CGER-REPORT

ISSN 1341-4356
CGER-I091-2009

Proceedings of the 7th Workshop on Greenhouse Gas Inventories in Asia (WGIA7)

Capacity building for measurability, reportability and verifiability under the Kobe Initiative

7-10 July 2009, Seoul, Republic of Korea

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

Center for Global Environmental Research

CGER

National Institute for Environmental Studies, Japan

CGER-REPORT

ISSN 1341-4356
CGER-I091-2009

Proceedings of the 7th Workshop on Greenhouse Gas Inventories in Asia

Capacity building for measurability, reportability and verifiability under the Kobe Initiative

7-10 July 2009, Seoul, Republic of Korea

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

Center for Global Environmental Research

CGER

National Institute for Environmental Studies, Japan

Proceedings of the 7th Workshop on Greenhouse Gas Inventories in Asia

Capacity building for measurability, reportability and verifiability under the Kobe Initiative

Prepared by:

Greenhouse Gas Inventory Office of Japan

Center for Global Environmental Research (CGER)
National Institute for Environmental Studies (NIES)
16-2 Onogawa, Tsukuba, Ibaraki 305-8506 Japan
Fax: +81-29-850-2219
E-mail: www-gio@nies.go.jp
http://www-gio.nies.go.jp

Copies available from:

Center for Global Environmental Research (CGER)
National Institute for Environmental Studies (NIES)
16-2 Onogawa, Tsukuba, Ibaraki 305-8506 Japan
Fax: +81-29-858-2645
E-mail: www-cger@nies.go.jp
http://www.cger.nies.go.jp

All copies in PDF format are available from: http://www-cger.nies.go.jp/cger-e/e_report/r_index-e.html

This publication is printed on paper manufactured entirely from recycled material (Rank A), in accordance with the Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities.

Contents

Foreword

Parties to the United Nations Framework Convention on Climate Change (UNFCCC) are required to develop, periodically update, and publish national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol (GHG inventories). GHG inventories play a critical role as a basis for decision makers to track trends of emissions and removals, and develop strategies to reduce the emissions and to enhance the removals.

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 purpose of WGIA is to assist countries in Asia in developing and improving their GHG inventories through the promotion of regional information exchange. Most of the WGIA-participating countries have been currently working on their second national communications (NC) with the exception of Myanmar, which is working on the first NC and Republic of Korea, which is working on the third NC.

Since its foundation in 1990, the Center for Global Environmental Research (CGER) has been engaged in global environmental issues, including climate change. CGER conducts environmental monitoring, maintains a global environment database, 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 7th WGIA, which was held on July 7-10, 2009, in Seoul, Republic of Korea. 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

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

As awareness in regards to Global Warming is increasing, the inventories are being more and more accepted as being worthwhile, since they provide the basis for evaluating the effectiveness of nationally appropriate mitigation actions taken within a country. Persistent efforts, therefore, need to be made in order to improve their quality and make them more reliable, since it is expected that such mitigation actions are implemented in a measurable, reportable and verifiable manner according to the Bali Action Plan.

This time, the 7th WGIA (WGIA7) was held from 7 to 10 July, 2009 in Seoul, Republic of Korea as again part of the Kobe Initiative: Capacity building support for developing countries on GHG inventories and data collection (measurability, reportability, and verifiability). The issues dealt with at this workshop were all essential for improvement of the inventories.

The outcomes of the WGIA7 are summarized in this Proceedings. We would be grateful, if this report is found to be useful and could contribute to further improvement of the GHG inventories in the WGIA-participating countries.

In conclusion, we would like to express our sincere appreciation to the local host organizations, the Ministry of Environment Republic of Korea (MOEK) and the Korea Environmental Management Corporation (EMC), for their excellent support and kind hospitality in hosting the WGIA7. We also would like to thank all the attendees for their participation and active contribution to the success of the workshop.

Yukihiro Nojiri

Manager
Greenhouse Gas Inventory Office
Center for Global Environmental Research
National Institute for Environmental Studies

Katsumasa Seimaru

Deputy Director
Climate Change Policy Division
Global Environment Bureau
Ministry of the Environment, Japan

List of Acronyms and Abbreviations

AD	Activity data
AIM	Asia-Pacific Integrated Model
APEC	Asia-Pacific Economic Cooperation
AWG-LCA	Ad Hoc Working Group on Long-term Cooperative Action under the Convention
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
EF	Emission factor
EFDB	Emission factor database
EMC	Korea Environmental Management Corporation
GEF	Global Environmental Facility
GHG	Greenhouse gas
GIO	Greenhouse Gas Inventory Office of Japan
GIS	Geographic information systems
GPG	Good practice guidance
HFCs	Hydrofluorocarbons
IEA	International Energy Agency
IGES	Institute for Global Environmental Strategies
IPCC	Intergovernmental Panel on Climate Change
IPCC-EFDB	IPCC Emission Factor Database
IRRI	International Rice Research Institute
JICA	Japan International Cooperation Agency
LULUCF	Land Use, Land Use Change and Forestry
MRV	Measurability, Reportability, and Verifiability
MSW	Municipal solid waste
NAI	Non Annex I
NIES	National Institute for Environmental Studies
MOEJ	Ministry of the Environment of Japan
MOEK	Ministry of Environment of the Republic of Korea
MSW	Municipal solid waste
NC	National Communication
N_2O	Nitrous oxide
NGGIP	National Greenhouse Gas Inventories Programme
PFCs	Perfluorocarbons
QA	Quality assurance
QC	Quality control
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
SNC	Second National Communication
SPM	Summary for policy makers
SWGA	Workshop on Improvement of Solid Waste Management and Reduction of GHG Emission in Asia
TSU	Technical Support Unit
UNFCCC	United Nations Framework Convention on Climate Change
WGIA	Workshop on Greenhouse Gas Inventories in Asia
WGIA-EFDB	WGIA Emission Factor Database
2006 IPCC Guidelines	2006 IPCC Guidelines for National Greenhouse Gas Inventories

Photos of the Workshop

Master of Ceremonies

Mr. Junheung Yi

Opening Address

Mr. Joon-seok Hong

Overall Chairperson

Mr. Takahiko Hiraishi

Welcome Address

Mr. Reo Kawamura

Mr. Ki-Jong Woo

Plenary Sessions

Working Groups

Energy

Agriculture

LULUCF

Waste

Closing Remarks

Mr. Chang-han Joo

Dr. Yukihiro Nojiri

1. Executive Summary of WGIA7

The Ministry of the Environment of Japan (MOEJ) and the National Institute for Environmental Studies (NIES), jointly with the Ministry of Environment of the Republic of Korea (MOEK) and the Korea Environmental Management Corporation (EMC), convened the 7th Workshop on Greenhouse Gas Inventories in Asia (WGIA7) on 7-10 July 2009 in Seoul, the Republic of Korea, as part of the "Kobe Initiative[1]" of G8 Environment Ministers Meeting. The workshop was attended by approximately 100 participants from eleven WGIA-member countries in Asia (Cambodia, Indonesia, Japan, the Republic of Korea (RoK), Lao P.D.R., Malaysia, Mongolia, Myanmar, Philippines, Thailand, and Viet Nam), as well as the United Nations Framework Convention on Climate Change (UNFCCC), the Intergovernmental Panel on Climate Change (IPCC), and the Regional Capacity Building Project for Sustainable National Greenhouse Gas Inventory Management Systems in Southeast Asia (SEA GHG Project). The Greenhouse Gas Inventory Office of Japan (GIO) under the NIES functioned as WGIA secretariat.

The objectives of the workshop were:

- to share information on the progress in inventory preparation by each country,
- to share experiences gained through the activities following the conclusions of WGIA6 (e.g., uncertainty assessment, development of time series estimates, awareness-raising),
- to discuss possible plans for activities in the future, particularly after completion of the latest national communications currently under preparation[2], by the individual countries as well as by WGIA, taking the "Kobe Initiative" into account,
- to discuss sector-specific issues and possible ways to solve them, and
- to discuss how we can accelerate the improvement of GHG Inventory as a key to mitigation actions in a measurable, reportable and verifiable (MRV) manner.

The workshop was opened with an opening address by Mr. Joon-Seok Hong, Deputy Minister of Environment, RoK, followed by welcome addresses delivered by Mr. Reo Kawamura, Deputy Director of Climate Change Policy Division, MOEJ and Mr. Ki-Jong Woo, Secretary-General of the Presidential Committee on Green Growth. The workshop was chaired by Mr. Takahiko Hiraishi, Senior Consultant of the Institute for Global Environmental Strategies (IGES) and Co-chair of the IPCC Task Force on National Greenhouse Gas Inventories.

The participants discussed various subjects of interest to Asian countries, including

---

[1] The Bali Action Plan adopted at the COP13 (December 2007) referred to nationally appropriate mitigation actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner. Since GHG inventories provided information on emissions and removals of GHGs, and enabled to track and manage the emissions, the importance of setting up and running the GHG inventories was noted in the Chair's Summary of the G8 Environment Ministers Meeting held in Kobe, Japan (May 2008). The Kobe Initiative launched at the same meeting aimed at holding meetings together with the outreach countries to discuss specific four items including "Capacity building support for developing countries on inventories and data collection (MRV: Measurability, Reportability, and Verifiability)". In response, WGIA has been held as part of Kobe Initiative since its 6th session (July 2008).

[2] When this workshop was held, the RoK was preparing its third national communication (NC), Myanmar was preparing its initial NC, and the other participating countries were preparing their second NCs.

uncertainty assessment, time series estimates and projection, awareness-raising about GHG inventory and mitigation, future WGIA activities, and sector-specific issues. The outcomes of the discussions about each subject are summarized below.

Through the discussions of these subjects, the participants reaffirmed the importance of GHG inventory as a key tool for promoting mitigation actions in a MRV manner. The participants agreed that each country should continue its efforts to improve its national GHG inventory, and that the continuous cooperation among Asian countries was essential.
The workshop was closed with closing remarks by Mr Chang-Han Joo, Executive Director of EMC, and by Mr. Yukihiro Nojiri, Manager of GIO.

Uncertainty Assessment

Following the conclusion on this subject from the previous meeting (WGIA6, July 2008), the participants shared their experiences with uncertainty assessment undertaken after WGIA6. Some countries reported they had conducted uncertainty assessment using the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (*2006 IPCC Guidelines*) and that they would include the results in their national communications currently under preparation. It was agreed upon that each country should continue its efforts to perform uncertainty assessment, and that information exchange and discussion via WGIA network (e.g., using the mailing list) should be promoted to find out solutions to the problems each country had encountered.

Time Series Estimates and Projection

As was the case about uncertainty assessment, the participants shared their experiences gained through their work on time series estimates and projection of GHG emissions/removals undertaken after WGIA6. Many countries reported that they had developed time series estimates for some sectors/categories to be included in their latest national communications currently under preparation. For example, Mongolia developed GHG inventories for 17 consecutive years from 1990 to 2006. The participants agreed to continue and enhance their efforts to develop and improve their time series estimates and projection. They also agreed to make use of the WGIA network to cooperate to overcome the problems that each country had encountered.

During this workshop, a lecture and hands-on training on techniques to fill data gaps were given by Mr. Simon Eggleston, Head of the Technical Support Unit for the IPCC Task Force on National Greenhouse Gas Inventories. They were welcomed and appreciated by the participants as it helped them further consider how to improve their time series estimates. The participants were encouraged to disseminate what they had learned from their colleagues after returning to their countries.

In addition, Mr. Shuichi Ashina of NIES explained projection of GHG emissions using the Asia-Pacific Integrated Model (AIM). Many participants expressed their great interest in the AIM.

Awareness-raising about GHG Inventory and Mitigation

In accordance with the conclusions from WGIA6, a draft template of “summary for policymakers” (SPM) on GHG inventory was presented by Mr. Leandro Buendia, Coordinator of the SEA GHG Project which was in close cooperation with WGIA. This draft had been prepared through discussion within the SEA GHG Project. The participants in this workshop were in general of the view that the draft was already fine, but agreed to consider further possible improvements to suggest to the SEA GHG Project. Also, the participants were encouraged to produce SPMs for their own countries using this draft template. Furthermore, some participants underlined the necessity of drawing attention of a wider range of stakeholders to the usefulness of GHG inventory for various purposes such as evaluation of mitigation options. It was therefore agreed upon that efforts for awareness-raising should be further enhanced, for example by incorporating the contents of the aforementioned SPM into the executive summary of national communications.

Future WGIA Activities after Completion of the Latest National Communications

Many WGIA-participating countries were in the last stage of preparation of their latest national communications under the UNFCCC. As an integral part of this work, many countries were making fairly good progress in GHG inventory compilation. The participants agreed upon the importance and necessity of keeping this momentum to further improve their GHG inventories continuously and efficiently, even after completion of the national communications currently under preparation. With this consensus, the participants discussed possible plans for WGIA activities in the future.

<u>WGIA Emission Factor Database and Roster of Regional Experts</u>

The WGIA secretariat reported that it was constructing a database of emission factors (EFs) used in the national communications of WGIA participating countries (WGIA-EFDB) as well as a roster of inventory-related experts in Asia in order to meet the demand expressed by participants in the previous WGIA meetings. The participants in this workshop welcomed this work being done by the WGIA secretariat. They recommended the WGIA secretariat to enrich the WGIA-EFDB with more data/information not only to make it more useful to WGIA participating countries but also to contribute with collected data to the IPCC Emission Factor Database (IPCC-EFDB). The WGIA secretariat encouraged the participants to make good use of the roster of regional experts to promote collaboration among countries.

<u>Financial Support to Ensure Continuity of Inventory Work</u>

Some participants pointed out that it was crucial for each country to secure funds to ensure the continuity of inventory-related work. In this context, the participants 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),[3] which allows non-Annex I Parties to submit project proposals to the Global Environmental Facility (GEF) for the funding of their subsequent national communications before completion of their current national communications. Some participants suggested that they should also look for other sources of funds (e.g., Japan International Cooperation Agency (JICA)).

<u>Improvement of Data Collection</u>

The participants also discussed how to overcome the lack of data, which was one of the most common and fundamental problems that all the WGIA participating countries experienced. It was agreed that relevant ministries and agencies, particularly statistical offices, should be urged to cooperate in inventory compilation. The participants also agreed that it would be

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

advisable to use the new guidance on data collection as well as updated default data contained in the *2006 IPCC Guidelines*.

Cooperative Actions among WGIA Participating Countries

The participants also discussed possible cooperative actions among WGIA participating countries. The RoK made a presentation in this context, on experiences gained through the mutual GHG inventory review between Korea and Japan in October 2008, which was voluntarily implemented focusing only on waste sector. This mutual inventory review was found to be very fruitful as it facilitated active and substantial discussions between experts from both countries and resulted in considerable improvements in Korea's GHG inventory. The participants in this workshop took interest in this new bilateral cooperative action taken by Korea and Japan, and agreed that similar activities should be promoted among other WGIA participating countries. It was suggested that the WGIA website should be used as a platform for this purpose.

Others

Many participants expressed their interest in expanding the WGIA activities to enhance the utility of the GHG inventory (e.g., activities to link GHG inventories to mitigation planning), by, for instance, awareness building for relevant government agencies. Many participants supported this suggestion.

Sector-specific Issues (Energy, Agriculture, LULUCF, and Waste Sectors)

In one of the sessions during the workshop, the participants split into four breakout groups to discuss issues on each of the following four inventory sectors: Energy, Agriculture, LULUCF, and Waste.

Energy Sector

This group discussed issues on activity data (AD) for calculation of emissions from fuel combustion, focusing on two types of key energy statistics, namely: energy balances that can be used for "Reference Approach" and detailed statistics on energy consumption by sector to be used for "Sectoral Approach".

As regards energy balances, the participants observed three stages of development in Asian countries, i.e., 1) no experience in developing energy balances, 2) some experiences but not available annually, and 3) available annually. The participants concluded that each country needed to decide on their priorities in developing energy statistics depending on which stage it was currently in. Countries with no experience may need to prioritize development of energy balances first while countries with energy balances available annually should switch their attention to detailed statistics.

The participants took note of the value of detailed statistics as they would allow of estimates of non-CO_2 emissions as well as understanding of potential co-benefits such as reduction of local air pollutants. The group recommended each country to develop and enhance official data collection as well as to make use of international energy statistics where national data were not available.

Agriculture Sector

This group discussed country-specific EFs for Agriculture Sector used in the GHG inventories as part of the national communications currently under preparation. From presentations and discussions, the participants found that many Asian countries had developed their own country-specific EFs, particularly for CH_4 emissions from rice cultivation. The participants welcomed it, and encouraged each country to input their data into the WGIA-EFDB to facilitate exchange of useful data and information in the region. It was also noted, however, that care should be taken about the applicability of country-specific EFs, as using such data might not always be the best choice depending on the conditions under which they were measured or modeled.

The participants also discussed and made recommendations for WGIA activities in the future, including: to share experiences in using software and other various tools that help move from simple tier 1 to tier 2 methods, to combine LULUCF and Agriculture sectors, to focus on improvement of emission estimates for agricultural soil and livestock, and to discuss mitigation options.

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

This group shared experiences and lessons learnt in applying data obtained from remote sensing (RS) and geographic information systems (GIS) for LULUCF inventory. The participants agreed that RS and GIS data could greatly help each country improve their LULUCF inventories, but they also noted that lack of relevant human resources within inventory compiler teams hampered utilization of such data in many Asian countries. The group stressed the necessity of training RS and GIS experts as well as engaging existing RS and GIS experts within each country in GHG inventory compilation. It was also recognized that many global datasets were available and could be accessed freely by developing countries to improve their inventory. The group recommended each country to access such datasets. The participants also agreed on the need to make efforts in obtaining more ground data required for verifying the use of RS and GIS data, in particular for estimating emission/removal factors or carbon stocks in five carbon pools.

The participants concluded that further discussions were necessary on the following subjects: identification of barriers to data collection and approaches to solve them; ways to acquire relevant data nationally and globally for LULUCF GHG inventories; and national systems to support the development of high quality inventory in subsequent national communications.

Waste Sector

This group discussed two main subjects. One of them was improvement of data collection scheme for the Waste sector, and the other was issues on wastewater handling. As regards the improvement of data collection scheme, experiences were shared by the Republic of Korea and Japan. Korea introduced their experiences gained through monitoring the change of composition of municipal solid waste (MSW) that was supposed to be driven by the Ban on Direct Landfill of Foodwaste. Japan reported their experiences highlighting the roles of prefectural governments and municipalities in charge of accumulating industrial data and municipal solid waste data under the law on waste management and public cleansing. As to the issues on wastewater handling, Japan shared their experiences in estimating GHG emissions from this source as well as findings from relevant studies, referring to the importance of operation-related GHG emissions (especially those associated with electricity used in wastewater handling facilities) in evaluation of mitigation options, etc.

The participants agreed on the importance of information sharing through WGIA about new waste management policy schemes introduced in each country. They also agreed on the necessity of providing waste managers or government officials in charge of waste management in each country with knowledge and data accumulated through WGIA with the aim of engaging them in GHG inventory work as well as in possible mitigation planning.

2. Introductory Notes[4]

2.1. Background

Under the UNFCCC, all parties are required to develop and report a national GHG inventory. These GHG inventories are extremely important as they provide information on trends in GHG emissions and removals, which allows policy makers to adopt measures to reduce emissions and increase removals more effectively and reliably.

The Workshop on Greenhouse Gas Inventories in Asia (WGIA), organized by the National Institute for Environmental Studies (NIES) and the Ministry of the Environment of Japan (MOEJ) together with host country organizations (in case of the 7th WGIA, Ministry of Environment Republic of Korea (MOEK) and Korea Environmental Management Corporation (EMC)), aims at assisting the countries in the Asia region in developing and improving their GHG inventories by providing opportunities to exchange information and share their own experience. The major participants of WGIA are government officials and researchers, who are involved in preparing GHG inventories. Since November 2003, six meetings have been held on an annual basis, through which the network of government officials and researchers in the Asian region has been enhanced. Countries that have participated in the WGIA meetings to date include: Cambodia, China, India, Indonesia, Japan, Republic of Korea, Lao P.D.R., Malaysia, Mongolia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam.

<WGIA meetings in the past>

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

In the Chair's summary of G8 Environmental Ministers Meeting held in Kobe, Japan, in May 2008, it was noted that setting up and running of GHG inventories in developing countries is of fundamental importance and G8 countries should consider supporting capacity building in developing countries for the collection and provision of data. There was wide support to follow up on the outcome of the Ministerial Meeting's so called "Kobe Initiative". The WGIA6 was held as part of "Kobe Initiative" and so is the upcoming WGIA7.

These introductory notes for the WGIA7 are intended to inform the prospective participants of the objectives and expected outcomes of the workshop as well as the details of each session. It is hoped that this will help participants prepare for the workshop. We would also like to encourage the participants to provide the Secretariat with suggestions and comments during the on-going preparation process for the workshop.

2.2. Major Themes of the WGIA7

The WGIA7 will address the following major themes. Through the discussion of these major

[4] The introductory notes were shared with participants prior to the workshop.

themes, the participants may also consider how we can accelerate the improvement of GHG Inventory as a key to mitigation actions in a MRV manner. In addition, the WGIA7 will provide an opportunity for participants to update each other on the state of inventories and other relevant information.

2.2.1. Review of Progress since WGIA6

Objectives: To share experiences gained through the activities to follow up the conclusions of the WGIA6.

Session Style: Plenary

Overview: The participating countries will be requested to provide the information and experiences gained through the activities to follow up the conclusions of the WGIA6, where possible, prior to the meeting. The topics will include:

- Uncertainty assessment exercise
- Time series estimates of GHG emissions and removals
- Awareness-raising

The WGIA secretariat will compile the information provided by each country for consideration at the meeting. Each participating country may be requested to deliver a short presentation at the meeting. The participants will also discuss the emission trends in the past as well as projections of emissions in the future.

2.2.2. Plan for Future Activities beyond NC

Objectives: To discuss possible plans for activities in the future, particularly after completion of NC, by their own countries as well as by WGIA taking the “Kobe Initiative” into account.

Session Style: Plenary

Overview: The participants will discuss and develop plans for activities in the future, particularly after completion of SNC, by their own countries as well as by WGIA (including promotion of cooperation with other regional programmes) taking the “Kobe Initiative” into account. Some of the participants (including the WGIA Secretariat) will be requested to deliver presentation on their experiences and/or their products to facilitate the discussion.

2.2.3. Techniques to fill Data Gaps

Objectives: To learn how to solve data gaps with a view to facilitating development of time series estimates of GHG emissions and removals.

Session Style: Plenary (Hands-on training)

Overview: A lecture using PowerPoint slides will be given, which will be followed by an exercise by each participant using MS-Excel. The participants will be familiarized with various techniques to solve data gaps such as those explained in Chapter 5 of Volume 1 of the *2006 IPCC Guidelines*.

2.2.4. Sector-specific Issues

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

Session Style: Separate working groups

Overview: The participants will split into four groups to discuss sector-specific issues. A WGIA Secretariat member in each group will give a brief guidance prior to the discussion. See details of discussion topics below.

1) Energy

Discussion topic: Available Energy Statistics in each country and their possible future improvements

Participants will look through statistics used in the "Fuel Combustion (1.A.)" in all WGIA participating countries and the relevant data published by APEC and the IEA. In order to make this discussion possible, all participating countries are requested to provide relevant information prior to the WGIA7. The WGIA Secretariat will then summarize the submitted information and give an introductory presentation. Through group discussion, participants could prioritize the improvement in their AD and see if the published data are applicable to their countries' GHG inventories.

2) Agriculture

Discussion topic: Country specific emission factors and mitigation measures

Participants will exchange information on EFs developed in their countries. In order to let other participants know if those EFs are also applicable to their countries, presentations should include not only experimental setup and procedure but also detailed background information (e.g., climate conditions, soil types, livestock management practices, costs for measurements, etc.). Participants will also discuss the mitigation measures applied to the Agricultural sector. The WGIA Secretariat will give an introductory presentation for both topics including the summary of "Challenges and opportunities for mitigation in the agricultural sector" (FCCC/TP/2008/8). Through group discussion, participants could find out the applicability of other country's EFs and mitigation measures to their own GHG inventories and mitigation efforts.

3) Land Use, Land Use Change and Forestry (LULUCF)

Discussion topic: Activity Data - Remote Sensing and GIS

Participants will exchange information and their experiences related to Remote Sensing and GIS in more detail than at the previous WGIA. This information includes: accessibility to those data and their properties, and how to make those raw data applicable to the GHG emission estimates (e.g., distinguishing the six land-use categories, identifying areas of deforestation and degradation). The WGIA Secretariat will give an introductory presentation. Some participating counties which have experiences with these techniques may be asked to give presentations. In this case, we will give an appropriate notice in advance. Through group discussion, participants could find out ways to overcome their AD deficit in the LULUCF Sector.

4) Waste

Discussion topic: Improvement of data collection scheme for the Waste Sector and information exchange on wastewater handling

Participants will look through each country's available relevant data for the Waste Sector and discuss how to improve data collection schemes in the WGIA countries in order to collect more data in an efficient manner. In order to make this discussion possible, participants are requested to provide relevant information prior to the WGIA7. This information will then be summarized by the WGIA Secretariat and presented as an introductory presentation. Through group discussion, participants could find out ways to improve their current data collection schemes and also to develop better approaches to collect data for the Waste Sector. Participants will furthermore exchange information on their experiences with the wastewater handling.

Details of the requests for information mentioned above will be sent to each participant in due time. The WGIA secretariat will be most grateful to every participant for the constructive cooperation that is essential to the success of the WGIA7.

3. Workshop Report

3.1. Opening Session

The opening session was chaired by the overall workshop chair, Mr. Takahiko Hiraishi, Senior Consultant of the IGES and Co-chair of the IPCC Task Force on National Greenhouse Gas Inventories, and the Master of Ceremonies for the session was Mr. Junheung Yi, Director of the EMC, RoK.

The workshop opened with an opening address from Mr. Byung-Wook Lee, Vice Minister of the MOEK. He thanked all relevant parties for their efforts in organizing the meeting, and pointed out the increasing importance of accurate and timely preparation of national inventories as basis for the post-2012 climate framework. He highlighted the role WGIA has played in knowledge-sharing and building a human resource network since its inception.

This was followed by a welcome address by Mr. Reo Kawamura, Deputy Director of the Climate Change Policy Division, MOEJ. He pointed out the urgent need to take action against human-induced climate change, and the importance of global cooperation in doing so. In discussions on the post-2012 regime, the necessity of MRV nationally appropriate mitigation actions has been recognized. He stressed that inventories were essential in taking MRV actions, and noted that WGIA was a part of this effort, and it was one of the key elements of capacity building under the “Kobe Initiative”.

Mr. Ki-Jong Woo, Secretary-General of the Presidential Committee on Green Growth, RoK welcomed everyone to the workshop, and pointed out the great opportunity that it presented in bringing experts together to share experience and know-how. He introduced the new Low Carbon, Green Growth five-year plan, which had just been announced a day before the workshop commenced. In this five-year plan, Korea commits itself to be a leading country in greening its industry, economy, and people's lifestyles. He stressed the need for concrete measures to reduce GHG emissions, and noted the importance of reliable inventories for the post-Kyoto framework.

Dr. Yukihiro Nojiri (GIO-CGER-NIES, Japan) gave an overview of WGIA and introduced the objectives, participants, and agenda of WGIA7. The objectives of the workshop were:

- to share information on the progress in inventory preparation by each participating country,
- to share experiences gained through the activities following the conclusions of WGIA6 (e.g., uncertainty assessment, development of time series estimates, awareness-raising),
- to discuss possible plans for activities in the future, particularly after completion of the latest NCs currently under preparation, by the individual countries as well as by WGIA, taking the “Kobe Initiative” into account,
- to discuss sector-specific issues and possible ways to solve them, and
- to discuss how WGIA can accelerate the improvement of GHG Inventories as a key to mitigation actions in a MRV manner. [Presentation 4.1.1 (p.35)]

Mr. Dominique Revet (UNFCCC) updated the participants on the latest debate at SBI30 on the topic of NCs of the non-Annex I Parties. He informed that the Consultative Group of Experts (CGE) on NCs from non-Annex I Parties would be reconstituted following final approval of a draft decision by the Conference of the Parties (COP) in December 2009, and that the agenda sub-item on information contained in NCs from non-Annex I countries was held in abeyance. In regard to financial and technical support, it was noted that project proposals to the GEF for funding of subsequent NCs could be made before completion of current NCs. [Presentation 4.1.2 (p.37)]

Mr. Reo Kawamura (MOEJ) made a presentation on Japan's climate change policies and MRV initiatives. He stressed the need for significant reduction in GHG emissions throughout the world, and introduced Japan’s various initiatives in international environmental cooperation, including the Kobe Initiative. He also gave an overview of Japan’s domestic policy on GHG reduction, against the backdrop of Japan’s commitments under the Kyoto Protocol, the cabinet decision on building a Low-Carbon Society, and the most recently announced mid-term target. [Presentation 4.1.3 (p.38)]

Mr. Rinsan Joung (Presidential Committee on Green Growth, RoK) talked about the Low Carbon, Green Growth Vision, announced by President Lee on the 60th Independence Day of the Republic, as the new national vision for the next 60 years. The Presidential Committee on Green Growth was established based on this vision, and although the legal framework is still underway, a total of 107 trillion KRW is planned for investment over the course of five years. [Presentation 4.1.4 (p.42)]

Mr. Jang-won Lee (MOEK) made a presentation on Korea's GHG inventory management. He gave an overview on the development of the National Inventory System of the RoK, and the GHG Clean Air Policy Support System (GHG-CAPSS) that was built on top of the preceding database system for estimation of air pollutants emissions. GHG-CAPSS now provides integrated emissions data on both air pollutants and GHGs. He also introduced the various efforts to establish inventories at the local levels. [Presentation 4.1.5 (p.45)]

3.2. Session I: Review of Progress since WGIA6

Session I was chaired by Mr. Dominique Revet (UNFCCC), and the Rapporteur was Dr. Damasa Magcale Macandog (University of the Philippines Los Banos).

Ms. Takako Ono (GIO-CGER-NIES, Japan) made an introductory presentation for the first half of Session I, where she looked back at the outcomes and recommendations from WGIA6 and the progresses made since, on uncertainty assessment and awareness-raising. She then laid out the points for discussion on the above topics during WGIA7. [Presentation 4.2.1 (p.50)]

Uncertainty Assessment

Dr. Savitri Garivait (King Mongkut's University of Technology Thonburi, Thailand) made a presentation on Thailand’s uncertainty assessment. Currently, uncertainty assessment for Thailand’s inventory is based on a simplified method of determining data source uncertainties. She noted that in many cases empirical data were not available and thus well-informed expert judgment, backed up with well-documented data, was necessary. She emphasized that the implementation of this assessment, even a simple approach 1, was useful for better understanding of key source/sink categories. [Presentation 4.2.2 (p.52)]

Following the conclusions of WGIA6 on this subject, the participants shared their experiences with uncertainty assessment undertaken after WGIA6. Some countries reported they had conducted uncertainty assessment using the *2006 IPCC Guidelines* and that they would include the results in their NCs currently under preparation (see [Presentation 4.5.1 (p.171)]). It was agreed upon that each country should continue its efforts to perform uncertainty assessment, and that information exchange and discussion via the WGIA network (e.g., using the mailing list) should be promoted to find out solutions to the problems each country had encountered.

Awareness-raising

Mr. Leandro Buendia (SEA GHG Project) talked about raising awareness on national GHG inventories in developing countries. He introduced the draft template of SPM for the GHG inventory chapter of the NCs, newly proposed under the SEA GHG Project that had been in close collaboration with WGIA. He stressed that it highlighted information that should be conveyed to policymakers (and GHG inventory managers) regarding the importance of GHG inventories and the information they provided, and allowed for adaptation according to national circumstances. [Presentation 4.2.3 (p.54)]

In the discussions following the presentations, the participants expressed their views that the SPM was generally already fine, but agreed to consider further possible improvements to suggest to the SEA GHG Project. Also, the participants were encouraged to produce SPMs for their own countries using this draft template. Furthermore, some participants underlined the necessity of drawing attention of a wider range of stakeholders to the usefulness of GHG inventory for various purposes such as evaluation of mitigation options. It was therefore agreed upon that efforts for awareness-raising should be further enhanced, for example by incorporating the contents of the aforementioned SPM into the executive summary of NCs.

Mr. Kohei Sakai (GIO-CGER-NIES, Japan) made an introductory presentation for the latter half of Session I, where he looked back at the outcomes and recommendations from WGIA6, and the progresses made since, on time series estimates and projection. He then laid out the points for discussion on these topics during WGIA7. [Presentation 4.2.4 (p.58)]

Time Series Estimates and Projections

Dr. Dorjpurev Jargal (Energy Conservation and Environment Research and Consulting Co. Ltd., Mongolia) gave a presentation on the GHG Inventory Preparation in Mongolia. He described how the national system for GHG inventory preparation was developed, and how GHG inventories were prepared for the Initial and Second NCs. He noted that the main difficulty was the lack of reliable data, but that the time series estimates over the course of 17 consecutive years from 1990 to 2006 had shown that the largest reductions were due to the socio-economic slowdown during the economic transition period. [Presentation 4.2.5 (p.59)]

Dr. Sirintornthep Towprayoon (King Mongkut's University of Technology Thonburi, Thailand) followed by talking about the time series estimates made for Thailand's GHG inventory included in the SNC. She introduced the national system for GHG inventory preparation, how the inventory was prepared, and the current state of emissions. Reliability of data varies by sector, and problems have been encountered with missing data, and/or the use of different/new data sets. [Presentation 4.2.6 (p.63)]

Dr. Rizaldi Boer (Centre for Climate Risk Opportunity and Management, Indonesia) made a presentation on time series estimates made for Indonesia's GHG inventory included in the SNC. He talked about the GHG emission trend of Indonesia, and process for collecting AD and developing EFs for rice cultivation. He presented the time series of emission for rice from the year 2000, which indicated that there was not much increase in CH_4 emission from rice cultivation. [Presentation 4.2.7 (p.68)]

As was the case for uncertainty assessment, the participants shared their experiences gained through their work on time series estimates and the projection of GHG emissions/removals undertaken after WGIA6. Many countries reported that they had developed time series estimates for some sectors/categories to be included in their latest NCs currently under preparation (see [Presentation 4.5.1 (p.171)]). The participants agreed to continue and enhance their efforts to develop and improve their time series estimates and projections. They also agreed to make use of the WGIA network to cooperate to overcome the problems that each country had encountered.

In addition, Dr. Shuichi Ashina (NIES, Japan) talked about projection of GHG emissions using the AIM. He described the top-down and bottom-up approaches for projection, and noted that inventory data was one of the important bases for bottom-up analysis. Many participants expressed their great interest in the AIM. [Presentation 4.2.8 (p.70)]

As part of Session I, a lecture and hands-on training on techniques to fill data gaps were given by Dr. Simon Eggleston, Head of the TSU-NGGIP-IPCC. Participants underwent exercises for the following techniques: splicing, interpolation, trend extrapolation, and surrogate data. These exercises were welcomed and appreciated by the participants as it helped them further consider how to improve their time series estimates. The participants were encouraged to disseminate what they had learned from their colleagues after returning to their countries. [Presentation 4.2.9 (p.77)]

3.3. Session II: Plan for Future Activities beyond SNC

Session II was chaired by Dr. Batimaa Punsalmaa (Ministry of Nature, Environment and Tourism, Mongolia), and the Rapporteur was Mr. Leandro Buendia (SEA GHG Project).

Mr. Kiyoto Tanabe (GIO-CGER-NIES, Japan) made an introduction for the session. He looked at the state of submissions of NCs from WGIA countries and pointed out that WGIA had entered a period of transition with the latest NCs being completed soon, and the next NCs yet to be required. He stressed the need for continuous efforts towards improvement, and proposed to discuss possible plans for activities in the future, particularly after completion of the latest NCs, by the individual countries as well as by WGIA, taking the "Kobe Initiative" into account. [Presentation 4.3.1 (p.80)]

Dr. Junko Akagi (GIO-CGER-NIES, Japan) talked about on-going WGIA activities on behalf of the WGIA Secretariat. She introduced the WGIA mailing list and website already available, and the WGIA-EFDB and the Roster of Regional Experts as new initiatives. She expressed that the Secretariat hoped to promote the use of the above tools, and to further the exchange of information/ideas among WGIA countries to improve the quality of their GHG inventories. [Presentation 4.3.2 (p.82)]

Dr. Masato Yamada (NIES, Japan) introduced the Workshop on “Improvement of Solid Waste Management and Reduction of GHG Emissions in Asia (SWGA)” as an example for collaboration of sectoral experts among countries. This Workshop’s objectives have been to understand the effects of the improvement of the waste management system on GHGs emissions and to discuss issues of sustainability in waste management. He has drawn fruitful conclusions for GHG emissions reductions as well. [Presentation 4.3.3 (p.85)]

Following the presentations, the participants in this workshop welcomed the work being done by the WGIA secretariat. They recommended the WGIA secretariat to enrich the WGIA-EFDB with more data/information not only to make it more useful to WGIA participating countries but also to contribute with collected data to the IPCC-EFDB. The WGIA secretariat encouraged the participants to make good use of the roster of regional experts to promote collaboration among countries.

Further Improvement in Data Collection

Dr. Simon Eggleston (TSU-NGGIP-IPCC) made a presentation on the *2006 IPCC Guidelines* & Data Collection. He talked about new developments, including guidance on data collection, in the *2006 IPCC guidelines*. These included: what methodological principles to use, what sources of data were available, what to keep in mind when generating new data/adapting existing data, and when and how to seek expert judgment. [Presentation 4.3.4 (p.89)]

Ms. Takako Ono (GIO-CGER-NIES, Japan) followed by offering information on statistical capacity building under the UN Framework for Development of Environment Statistics (UN-FDES). She offered background information on UN-FDES, and talked about its emerging agenda to develop climate change statistics. She also introduced capacity building projects for Environment Statistics implemented by the Asian Development Bank in line with the UN-FDES project. [Presentation 4.3.5 (p.92)]

The participants discussed how to overcome the lack of data, which was one of the most common and fundamental problems that all the WGIA participating countries experienced. It was agreed that relevant ministries and agencies, particularly statistical offices, should be urged to cooperate in inventory compilation. The participants also agreed that it would be advisable to use the new guidance on data collection as well as updated default data contained in the *2006 IPCC Guidelines*.

Proposals for New Cooperative Actions by WGIA Participating Countries

Mr. Kazuya Suzuki (JICA) made a presentation on what JICA did, its strategy for international cooperation on climate change, and JICA-supported activities related to climate change in Asia. He also introduced the currently proposed “Project for Capacity Building of GHGs National Inventory in Viet Nam” to be jointly implemented by the counterpart organization in Viet Nam, the MOEJ and the GIO. [Presentation 4.3.6 (p.96)]

Mr. Byong-bok Jin (EMC, RoK) followed by talking about experiences gained through the mutual GHG inventory review between Korea and Japan which was voluntarily implemented in October 2008. The peer review focused on the waste sector and consisted of an exchange of pre-questionnaire sheets and a cross-review meeting, followed by the development of an improvement plan. He explained how the results had been reflected in the Korean National

Inventory, with the recalculation of CH_4 recovery, and in the change of emission estimation method for landfills to the First Order Decay Method. [Presentation 4.3.7 (p.99)]

Following presentations, some participants pointed out that it was crucial for each country to secure funds to ensure the continuity of inventory-related work. In this context, the participants were strongly encouraged to take advantage of one of the conclusions made by the SBI30 which allowed non-Annex I Parties to submit project proposals to the GEF for the funding of their subsequent NCs before completion of their current NCs. Some participants suggested that they should also look for other sources of funds (e.g., JICA).

The participants in this workshop also took interest in the new bilateral cooperative action taken by Korea and Japan, and agreed that similar activities should be promoted among other WGIA participating countries. It was suggested that the WGIA website should be used as a platform for this purpose.

3.4. Session III: Group Discussion on Sector-specific Issues

The participants split into four WGs and discussed sector-specific issues. The points of discussions and the outcomes of the individual WG are summarized in the following sessions (3.4.1. - 3.4.4.).

3.4.1. Energy Sector Working Group

Introduction

For WGIA countries, which are experiencing rapid development, it is important to try to find ways to collect AD for calculation of emissions from fuel combustion, based on energy balances that can be used for the "Reference Approach", and detailed statistics on energy consumption within each sector to be used for the "Sectoral Approach." In the previous WG session held at the WGIA4 in 2007, it was recognized that energy balances could be used as basis for developing inventories for the energy sector. Therefore, discussions in the energy WG focused on statistics for the energy sector.

Major topics of the discussion in the WG were as follows:

- Problems identified and possible solutions in energy balance preparation,
- Utilizing data that are already available, and
- Strategies to improve reliability of energy data.

There were 22 participants with a mixture of experts in the field, and others who joined this WG in order to learn more about statistics in the energy sector. The WG was attended by representatives of five countries (Cambodia, Japan, Mongolia, RoK and Viet Nam), and members of the UNFCCC Secretariat and the TSU-NGGIP-IPCC. The energy WG discussion was chaired by Mr. Kiyoto Tanabe (GIO-CGER-NIES, Japan), and the rapporteur was Dr. Simon Eggleston (TSU-NGGIP-IPCC).

Presentations

Dr. Yuriko Hayabuchi (GIO-CGER-NIES, Japan) made a brief introductory presentation. She summarized the outcomes of the previous energy WG session held at the WGIA4, and proposed topics for discussions to follow the successive five presentations. [Presentation 4.4.1.1 (p.104)]

Mr. Vuth Chanmakara Va (Ministry of Industry, Mines and Energy, Cambodia) made a presentation on Cambodia's state of emissions from the energy sector in the year 2000. Most of the fossil fuel consumed inside Cambodia is supplied through imports. Since imports are overseen by the Cambodia Import/Export Inspection & Fraud Repression Department, annual statistics on imports are readily available for use in the preparation of the national inventory. Although Cambodia has yet to prepare an official energy balance, the aforementioned data indicate that total emissions from fuel combustion amounted to 2,050 Gg (CO_2 eq.). Within the energy sector, 38% of the emissions were from transport; 27% were from energy industries; and 10% were from agriculture/forestry/fisheries. [Presentation 4.4.1.2 (p.105)]

Ms. Nguyen Thi Xuan Thang (Ministry of Industry and Trade, Viet Nam) made a presentation on energy consumption and GHGs inventory-related issues in Viet Nam. Half of Viet Nam's energy supply comes from oil, while the rest is from hydropower (20%), coal (18%), and natural gas (12%). Energy consumption has increased as a result of rapid economic growth. Viet Nam's GHG emissions in 2000 were 130.5 Gg (CO_2 eq.), which has increased by 25.7% since 1994. Based on projection, emissions from the energy sector are expected to increase significantly among all the other sectors. She also stated that Viet Nam had prepared an energy balance in the past, however, this was not practiced on an annual basis. [Presentation 4.4.1.3 (p.108)]

Dr. Dorjpurev Jargal (Energy Conservation and Environment Research and Consulting Co. Ltd., Mongolia) made a presentation on energy statistics in Mongolia. He introduced the *Mongolian Statistical Yearbook* (prepared by the National Statistical Office) as the main sources of energy statistics, and pointed out that coal was the main source for Mongolia's electricity and heat demands. A balance sheet for coal is prepared for use in the national inventory preparation for both the reference and sectoral approaches, and includes coal production and consumption data from all mines. [Presentation 4.4.1.4 (p.112)]

Mr. Tae-sik Park (Korea Energy Economics Institute, RoK) made a presentation on energy statistics and the national energy balance of Korea. In Korea, general energy data are available from the 1980s and onwards in the *Yearbook of Energy Statistics*, which enables the annual preparation of the Energy Balance. He explained that the gaps between Korea's national energy balance and the data from the International Energy Agency (IEA) resulted from the difference in coverage of energy sources and transformation, calorific values, and definition. [Presentation 4.4.1.5 (p.114)]

Mr. Ken Imai (Suuri Keikaku Co. Ltd., Japan) made a presentation on calculation methodologies for CH_4 and N_2O emissions from stationary combustion sources in Japan. AD are estimated by using the amount of fuel consumption by sector, type of fuel, and type of furnace provided by the *Research of Air Pollutant Emissions from Stationary Sources*. This Research was originally conducted under the Japanese Air Pollution Control Law to evaluate the state of air pollutant emissions from stationary sources; however, it has now been utilized for estimating GHG emissions. He pointed out how environmental pollution control efforts could contribute to addressing climate change issues as well. [Presentation 4.4.1.6 (p.118)]

Summary of Discussions

Discussions followed the presentations. In some countries such as RoK and Mongolia, there are enough AD available to make estimates for the energy sector. However, data collection in some countries is not yet adequate. It is difficult for some countries to develop time series with data not always available annually. The group mainly focused on strategies to improve energy balance preparation, and in regards to energy balances, the participants observed three stages of development in the WGIA countries: 1) no experience in developing energy balances, 2) some experiences but not available annually, and 3) available annually. There is room for improvement at each stage.

Since, in many cases, data collection is not yet adequate, Dr. Hayabuchi provided some data/information from the IEA and the APEC Energy Statistics as AD that might be utilized. It was noted that although the IEA energy balances or the APEC statistics were available for many countries, the figures might differ among these international statistics, as well as those from domestic statistics in some cases.

Furthermore, considering the situation in Japan, additional benefits of GHGs estimates were pointed out, especially with regard to the role it could play in contributing to air quality management. The collection of data on air pollutant emissions has resulted in co-benefits in that collected data can be used for inventory preparation as well.

Conclusions & Recommendations from the Working Group

The participants recommended that each country continued to improve their energy balances if possible and if it was suitable with the use of international energy statistics. The participants also concluded that each country needed to decide on their priorities in developing energy statistics, depending on which stage of development it was currently at. Countries with no experience may need to prioritize development of energy balances first while countries with energy balances available annually should start to focus their attention to detailed statistics. The participants took note of the value of detailed statistics as they would allow for estimates of non-CO_2 emissions as well as for the development of potential co-benefits such as reduction of local air pollutants.

In addition, since AD is often drawn from national energy agency statistics, the agency in charge of preparation of the national inventory needs to be in close collaboration with energy agencies in each country.

Annex

Participants:	Vuth Chanmakara VA	(Cambodia)
	Mayuko HATTORI	(Japan)
	Elsa HATANAKA	(Japan)
	Yuriko HAYABUCHI	(Japan)
	Ken IMAI	(Japan)
	Takashi MORIMOTO	(Japan)
	Yukihiro NOJIRI	(Japan)
	Kiyoto TANABE	(Japan)

Dorjpurev JARGAL	(Mongolia)
Namkhainyam BUSJAV	(Mongolia)
Sang Zin JEON	(RoK)
Eun Jung KIM	(RoK)
Dongmin LEE	(RoK)
Hyunsoo LEE	(RoK)
Sang-ho LEE	(RoK)
Joonho LIM	(RoK)
Yun-sum LIM	(RoK)
Tae-sik PARK	(RoK)
Kwang-Seol SEOK	(RoK)
Nguyen Thi Xuan THANG	(Viet Nam)
Simon EGGLESTON	(TSU-NGGIP-IPCC)
Dominique REVET	(UNFCCC)

Handouts:
- IEA energy balances for the WGIA countries
- Cambodia 2000 Energy Balance sheet
- Questionnaires regarding the statistics for the Fuel Combustion Activities in Energy Sector

3.4.2. Agriculture Sector Working Group

Introduction

The Agriculture Sector WG held in WGIA6 focused mainly on strategies to improve the reliability of agricultural data, on current status, and on challenges in the agriculture inventory. It was concluded that reliability of data was a major challenge for the agriculture inventory, and this could be addressed by developing CS-EFs, estimating EFs based on literature data, and enhancing information exchange. The participants stressed the necessity of a framework, which included both international and domestic collaboration, for using the shared information in identification of challenges and solutions to the problems. Finally, the participants of the WG recommended each country to present CS-EFs developments and to exchange agriculture-related information at the next WGIA. Besides, soil carbon, sustainable agriculture production and enhanced international collaboration were also recommended as subjects to be discussed at future WGIA meetings.

In response to this, the agriculture WG of WGIA7 focused on the “Emission Factors utilized for the NCs”. The following points were discussed in the WG:

- Understanding of CS-EFs development and reporting progress of NCs,
- Availability of CS-EFs to the other countries, and possibility of joint research,
- Exchange of agricultural information including mitigation potential.

A handout presenting agricultural EFs that were submitted by each member country and were integrated in the WGIA-EFDB was also distributed as a source material for the discussions.

The agriculture WG was attended by 11 participants from 7 WGIA-member countries

(Mongolia, Indonesia, Myanmar, Viet Nam, Lao PDR, Cambodia, and Japan) and also from the SEA GHG Project. The chairperson of this session was Dr. Kazuyuki Yagi (National Institute for Agro-Environmental Sciences, Japan) and the rapporteur was Dr. Batimaa Punsalmaa (Ministry of Nature, Environment and Tourism, Mongolia).

Presentations

Mr. Kohei Sakai (GIO-CGER-NIES, Japan) made an introductory presentation. He introduced the background information and the theme of the WG, the WGIA-EFDB and the points of discussions. [Presentation 4.4.2.1 (p.121)]

Mr. Koki Maeda (National Agriculture and Food Research Organization, Japan) made a presentation on GHG emissions from livestock waste management in Japan. He mentioned that manure management such as pit storage, deposition, composting, and wastewater management were widely practiced in Japan. He focused on the estimation of EFs for cattle manure composting process and introduced gas sampling methods and measuring equipment. [Presentation 4.4.2.2 (p.123)]

Dr. Kazuyuki Yagi made a presentation on CS-EFs for agricultural soils and rice cultivation in Japan. He explained that there were three EFs, which had been developed based on seasonal field monitoring at 36 sites in Japan, and that they were utilized for Japan's GHG inventory for the estimation of N_2O emissions from agricultural soils in Japan. In addition, he proposed the introduction of prolonged mid-season drainage in paddy fields, since this water management reduced GHG emissions without reducing the yield of rice. As a future prospect, there is a consideration of the application of DeNitrification-DeComposition (DNDC) model to the estimations of CH_4 emissions from rice cultivation and N_2O emissions from agricultural soils in Japan. [Presentation 4.4.2.3 (p.126)]

Mr. Leandro Buendia (SEA GHG Project) made a presentation on CS-EFs for rice cultivation in the Philippines. He also introduced the IRRI international research program on CH_4 emissions from rice fields in Asia. In the Philippines, EFs are set for 4 different types of practices: 1) irrigated–continuously flooded–dry season, 2) irrigated–continuously flooded–wet season, 3) rainfed–dry season, and 4) rainfed–wet season. He concluded that other countries could benefit from using the IRRI findings in developing CS-EFs and improving their estimates of CH_4 emissions from paddy fields. [Presentation 4.4.2.4 (p.130)]

Dr. Prihasto Setyanto (Indonesian Agricultural Environment Research Institute, Indonesia) made a presentation on Indonesia's experience in determining the CS-EFs for the agricultural sector. He explained that EFs for rice fields were classified according to emission types that were controlled by water regime and soil types in Indonesia. He explained about his future work, i.e., the development of various scaling factors that were multiplied by EFs. [Presentation 4.4.2.5 (p.133)]

Mr. Kohei Sakai introduced a technical paper for mitigation in the agricultural sector published by the UNFCCC (FCCC/TP/2008/8), as well as information on the workshop on the mitigation within the agricultural sector held during the 5th session of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA) in April, 2009. He explained that high mitigation potential was seen in soil carbon sequestration on a global scale, while CH_4 emissions from rice cultivation had a high mitigation potential in Asia, in particular China, Southeast Asia and South Asia. [Presentation 4.4.2.6 (p.137)]

Summary of Discussions

There were some questions and clarifications following the individual presentations. By referring to Mr. Maeda's presentation, composting by mixing rice straw and manure was said to be widely practiced in Japan. Since this mixing practice reduces manure moisture, CH_4 emissions through the composting process are reduced by aerobic condition. In Japan, cattle are farmed mostly in sheds and barns except in Hokkaido prefecture. In the presentation of Dr. Yagi, it was confirmed that a trade-off by aeration of paddy fields occurred between CH_4 and N_2O. Mr. Buendia emphasized, as an author of a technical paper for the mitigation potential document, that the UNFCCC document and workshop introduced by Mr. Sakai were important to decide policy and measurement for mitigation in each country. For N_2O emissions from soils, participants noted that proper management of nitrogen, such as amount and application timing of fertilizers, was important to reduce GHG emissions.

Besides the presentations above, Mongolia, Myanmar and Viet Nam presented their own country's situation. Dr. Khin Lay Swe (Yezin Agricultural University, Myanmar) explained estimation methodologies applied to Myanmar's agriculture sector in their First NC. She reported that the inventory was prepared by referring to the *2006 IPCC Guidelines*. Dr. Punsalmaa presented CS-EFs for enteric fermentation in cattle in Mongolia. The EFs were developed based on the formula given in the *revised 1996 IPCC Guidelines* and on the data available for cattle within her country such as weight and milk production. Mr. Mong Cuong Nguyen (Research Center for Climate Change and Sustainable Development, Viet Nam) talked about the CS-EFs for rice cultivation in Viet Nam, which were classified according to locations, namely, Northern, Middle and Southern parts of the country.

The participants shared the view that it might not always be necessary to develop CS-EFs with respect to each individual category of each country. An EF developed in one country could be applicable to neighboring countries. This should result in improving the inventory quality of those countries in a cost- effective manner.

The participants, who attended the agriculture WG for the first time, made a comment that it was difficult for them to obtain background information on this WG in advance. Therefore, they requested the WGIA secretariat to prepare a background paper for the WG. The WGIA secretariat will meet their request. In addition, since WGIA participants, as well as the agriculture WG members differed in each WGIA, it was suggested that fixed members participated in WGIA and in the agriculture WG.

Conclusions & Recommendations from the Working Group

Since rice cultivation is the major GHG emission source for the member countries, CS-EFs were found to be well developed in many of them. However, it was revealed that only a few countries had developed CS-EFs for enteric fermentation, livestock manure management and agricultural soils. For these categories, however, participants shared the view that it was not always necessary to develop CS-EFs, since some EFs developed in one country could be shared with neighboring countries.

In addition, the participants discussed briefly the WGIA-EFDB. Data were not collected at a

useful level at present. Participants encouraged each country to input their data into the DB to facilitate exchanging useful data and information among the member countries.
The participants also discussed WGIA activities in the future and produced some recommendations: (1) to share experiences in using software and other tools that help improve methodologies from simple tier 1 to tier 2, (2) to consider models (e.g., the ALU and the DNDC model), (3) to organize a joint WG of the LULUCF and Agriculture sectors, (4) to focus on improvement of emission estimates for agricultural soil and livestock, and (5) to discuss mitigation options.

Annex

Participants:	Prihasto SETYANTO	(Indonesia)
	Kazumasa KAWASHIMA	(Japan)
	Kouki MAEDA	(Japan)
	Kohei SAKAI	(Japan)
	Kazuyuki YAGI	(Japan)
	Thounheuang BUITHAVONG	(Lao, P.D.R.)
	Batimaa PUNSALMA	(Mongolia)
	Khin Lay SWE	(Myanmar)
	Mong Cuong NGUYEN	(Viet Nam)
	Leandro BUENDIA	(SEA GHG Project)
Handouts:	- CS-EFs in the WGIA-EFDB (Agriculture sector)	

3.4.3. Land Use, Land-use Change and Forestry (LULUCF) Sector Working Group

Introduction

The LULUCF sector WG session was held for discussing how to utilize remote sensing (RS) and Geographic Information System (GIS) data as AD for LULUCF inventories. The previous LULUCF WG session in WGIA6 had recommended to hold a training session for Tier 3 modeling and to share country experiences on uncertainty assessment and data collection. As a result of examining the possibility of holding the training session, however, it was revealed that a half-day session was too short to understand Tier 3 modeling. With respect to sharing country experiences on uncertainty assessment, the topic was determined to be discussed in a plenary session. Therefore, the WGIA secretariat decided to discuss in this WG session how to utilize RS and GIS data for LULUCF inventories. The objectives and points of discussion in this session were as follows:

- Objectives:
  - To share information on how to concretely apply RS and GIS data as AD of LULUCF inventories,
  - To discuss how to ensure actual application of RS and GIS data to LULUCF inventories.
- Points of discussions:
  - How do we identify or estimate concrete data by applying RS and GIS data?

- How do we verify RS and GIS data?
- What kinds of resources are necessary for utilizing RS and GIS data?
- What type of institutional arrangement is effective for applying RS and GIS data to LULUCF inventories?

The LULUCF WG was attended by 11 participants from 6 countries (Indonesia, Japan, Korea, Malaysia, Myanmar and Thailand). The chairperson of this session was Dr. Abdul Rahim Nik (Forest Research Institute Malaysia), and the rapporteur was Dr. Rizaldi Boer (Centre for Climate Risk Opportunity and Management, Indonesia).

Presentations

Ms. Takako Ono (GIO-CGER-NIES, Japan) gave an introductory presentation and explained the topic and objectives of this session, results and recommendations from WGIA6, progresses after WGIA6, the current state of countries' applying RS and GIS data to LULUCF inventories, presentations in this session and points of discussion. She mentioned that two Annex I countries developed LULUCF inventories by using only RS data as their AD, and that Brazil, India and Thailand utilized RS and GIS data for their inventories. [Presentation 4.4.3.1 (p.139)]

Ms. Noriko Kishimoto (Geographical Survey Institute, Japan) presented information on the Global Map for addressing climate change. She explained that the Global Map was a digital geographic dataset covering the whole land area of the globe with unified specifications, and it was freely downloadable for non-commercial use. The Global Map included land-use data, which could be divided into categories of the LULUCF sector; therefore, it could be used as AD for LULUCF inventories. She mentioned that prerequisites to utilize the Global Map for calculating land-use areas were the Global Map data, GIS software and fundamental GIS skills. In addition, she mentioned that capacity building programs for utilizing the Global Map were implemented, and that some Asian countries had already had experts of the Global Map although they were not familiarized with LULUCF inventories. [Presentation 4.4.3.2 (p.141)]

Dr. Yasumasa Hirata (Forestry and Forest Products Research Institute, Japan) delivered a presentation on application of RS to forest inventories for identifying deforestation and forest degradation. He introduced several techniques for interpreting and classifying satellite RS data, identifying areas of deforestation and forest degradation, and applying new RS technologies such as ALOS, Japan's new satellite. He also mentioned that RS and GIS data were not almighty for estimating GHG emissions and removals although they were very useful. He emphasized that consistency of satellite data and results of interpretation was important; determination of methodologies for data acquisition should be considered; consideration of definition issues between land cover and land use was necessary; and implementation of field surveys was indispensable. Specifically, he stressed the importance of field surveys, because field surveys with geo-references were important not only for verifying RS data but also for obtaining emission and removal factors. [Presentation 4.4.3.3 (p.147)]

Dr. Savitri Garivait (King Mongkut's University of Technology Thonburi, Thailand) made a presentation on Thailand's experience with RS and GIS for identifying biomass open burning in the Mekong river basin sub-region and in Thailand. She explained that Thailand developed its national land-use map and fire hot spots map by utilizing RS data and GIS. She mentioned that utilization of coarse-resolution satellite data from radiometers named MODIS was beneficial, but also indicated that the data provided by MODIS were highly underestimated for agricultural biomass burning in terms of number of hot spots, and that a coarse resolution (1x1 km) was too large to identify biomass burning sites comprehensively because the satellite had already passed over the burnt sites when the fire occurred. Hence, she concluded that cross check with data from other international institutes, national forest fire statistics and ground-based surveys were necessary for supplementing a RS dataset. [Presentation 4.4.3.4 (p.153)]

Summary of Discussions

In this session, participants discussed about data collection, experts engagement and institutional arrangement. First, the participants agreed that RS and GIS data could greatly help each country improve their LULUCF inventories. They also indicated that it was necessary to identify what kinds of global datasets existed in order to enhance their AD collection. Many global RS and GIS datasets were available and able to be accessed freely by developing countries. These datasets would provide data necessary for improving the quality of AD on LULUCF inventories. However, it was less well-known what kinds of datasets existed in which institutes. Therefore, the participants agreed on the necessity of exploring existing datasets.

It was also indicated that RS and GIS data were not almighty for developing LULUCF inventories as a whole. RS and GIS data did not provide complete datasets necessary for compiling LULUCF inventories. Specifically, areas of peat fire, combustion factors for biomass burning, carbon stocks in soils, and degrees of degradation status in Forest land remaining Forest land were difficult to be identified only by RS. For example, carbon stock changes between two periods in soil in open peatland have recently become identifiable by means of data from ALOS; however, identification of soil carbon stock changes in peatland under forests had different problems to be solved. Therefore, while their advantages were utilized, capacity limitation of RS and GIS data should be understood as well.

Moreover, the participants indicated that ground-based data were indispensable for verifying RS and GIS data and acquiring emission and removal factors such as carbon stocks in five carbon pools[5]. Nonetheless, the status of collecting ground-based data was insufficient. For instance, capacity of identifying tree species by means of RS with high resolution depended on forest types and ground information. Hence, sufficient ground information on tree species was necessary for identifying groups of tree species by means of RS. The participants, therefore, agreed on the need to make efforts to obtain more ground-based data required for verifying RS and GIS data and acquiring the emission and removal factors. Specifically, development of a national forest inventory system by utilizing both RS and ground-based data was recommended in order to improve the accuracy and precision of emission and removal estimation.

Second, with respect to expert training and engagement, many experts in RS and GIS in developing countries have not experienced application of these data to estimation of GHG emissions and removals. Therefore, training these experts in the application of RS and GIS data to estimation of GHG emissions and removals was necessary. Moreover, it was necessary

[5] Five carbon pools are above-ground biomass, below ground biomass, dead wood, litter, and soil organic carbon. See paragraph 21 in Decision 16/CMP.1 [FCCC/KP/CMP/2005/8/Add.3].

to engage the national experts in RS and GIS in developing GHG inventories in order to effectively utilize RS and GIS data.

Finally, institutional arrangement was identified as a necessary item for improving the quality of LULUCF inventories. While there were freely available RS and GIS data, high-resolution RS data, which would be effective to improve the quality, were expensive. If proper institutional arrangement was developed for enhancing multipurpose utilization of datasets including utilization for LULUCF inventories, the total cost burden of national governments would be reduced. Specifically, institutional arrangement for sharing data with the agriculture sector was identified as important, because the agriculture and LULUCF sectors had mutually necessary data, and these two sectors would be integrated in the future. Meanwhile, effective institutional arrangement differed for each country. For example, Indonesia set up an alliance of 18 institutions that had RS and GIS data in order to apply their data to its GHG inventory, while Korea set up a team for developing its LULUCF inventory in a single institution. Therefore, it is necessary to consider national circumstances in order to coordinate effective national institutional arrangement.

Conclusions & Recommendations from the Working Group

The participants concluded that

- Exploring what kinds of datasets existed globally, regionally or nationally as accessible data and how they could be acquired should be examined in order to understand their characteristics, usability and accessibility;
- Enhancing collection of ground-based data was necessary for verifying the datasets provided from RS and GIS and for obtaining emission and removal factors;
- Training of experts in RS and GIS and their engagement in GHG inventories were important for applying RS and GIS data to the LULUCF inventories;
- Exploring the use of RS technology for estimating peatland carbon stocks should be considered with reasonable accuracy;
- Institutional arrangement for enhancing national inventory systems should be considered in accordance with national circumstances;
- Sharing experiences of Annex-I countries in regard to data collection and verification would be beneficial for considering how non-Annex I countries could improve their LULUCF inventories.

The recommendations for the next LULUCF session were as follows:

- Considering how to resolve remaining problems before submitting the latest NCs would be a good topic for the next LULUCF group session because the next session would be the final chance to examine these problems before submission;
- In order to produce a high-quality inventory in subsequent NCs, reviewing the development process of the latest NCs, identifying gaps and problems necessary to be improved, and considering how to develop national inventory systems for the next NCs were necessary;
- How to acquire relevant data nationally and globally for LULUCF inventories, including training GIS experts in deriving AD and EFs from global data, should be discussed;
- Enhancing cooperation among experts in Agriculture and LULUCF sectors and those in RS and GIS in the application of RS and GIS data needed to be considered for adopting

the *2006 IPCC Guidelines* and replacing the Agriculture and LULUCF sectors with the Agriculture, Forestry and Other Land Use sector.

Annex

Participants:	Rizaldi BOER	(Indonesia)
	Junko AKAGI	(Japan)
	Takahiko HIRAISHI	(Japan)
	Yasumasa HIRATA	(Japan)
	Noriko KISHIMOTO	(Japan)
	Takako ONO	(Japan)
	Kyeong-hak LEE	(RoK)
	Hyun Kook CHO	(RoK)
	Abdul Rahim NIK	(Malaysia)
	U Than Naing WIN	(Myanmar)
	Savitri GARIVAIT	(Thailand)

Questionnaire: - Questions regarding the use of RS and GIS for inventories

3.4.4. Waste Sector Working Group

Introduction

In the previous WGIA6, participants at the Waste Sector WG had shared the view that it was difficult to apply the IPCC waste model to the GHG emissions estimation in Asian countries, since they had problems with their data collection systems. In order to facilitate the data collection, they recognized the importance of establishing a common data collection format for Asian countries, the necessity of identifying a country specific waste stream and the importance of guidelines for separate stepwise levels of data collection systems. Besides, discussions on the GHG emissions from wastewater handling were desired, as this issue had not been dealt with at the WGIA. The Waste WG, therefore, set the following two discussion themes:

- Theme 1: Improvement of the data collection scheme for the waste sector, and
- Theme 2: Information exchange on waste water handling.

The first half of the WG (session I) focused on theme 1 in order to know the data collection status in each country and to confirm the establishment of the newly developed data collection format of the waste sector in Asian countries. The latter half (session II) was for theme 2 in order to identify problems with estimating GHG emissions from wastewater handling. Prior to the WGIA7, questionnaires were filled out by the member countries in order to identify the country specific waste management by using a newly established data collection format. Information was provided by Malaysia, Mongolia, RoK, Philippines and Japan.

The waste WG was attended by 16 participants from 7 WGIA-member countries (Indonesia, Japan, RoK, Lao R.P.D. Malaysia, Philippines and Thailand). Session I was chaired by Dr. Seoungdo Kim (Research Center for Climate Change, RoK) and the rapporteur was Mr.

Byong-Bog Jin (EMC, RoK); while session II was chaired by Dr. Sirintornthep Towprayoon (King Mongkut's University of Technology Thonburi, Thailand) and the rapporteur was Dr. Takefumi Oda (GIO-CGER-NIES, Japan).

Presentations

Session I

Dr. Takefumi Oda (GIO-CGER-NIES, Japan) made an introductory presentation of the Waste WG. He introduced two themes set out for this WG: the data collection system and GHG emissions from wastewater handling. He also presented the list of participants, the schedule and the results of the questionnaire survey that had been conducted prior to the WGIA7. [Presentation 4.4.4.1 (p.156)]

Mr. Wonseok Baek (EMC, RoK) made a presentation on the change of municipal solid waste composition attributed by the Ban on Direct Landfill of Food waste in Korea. Since its enforcement in 2005, the rate of food waste disposal methods has changed: direct food waste disposal has decreased from 84% to 2%; while recycling of the food waste through composting has increased from 10% to 92%. As a result, CH_4 emissions from landfills have decreased. Furthermore, GHG emissions from food waste relative to the total waste have decreased from 20% to 5%. [Presentation 4.4.4.2 (p.158)]

Dr. Kosuke Kawai (NIES, Japan) made a presentation on the data collection scheme in Japan. It is a centralized system: data are reported to the national government from the prefectural governments and the municipalities. The former are in charge of collecting and estimating industrial waste data from businesses, while the latter are in charge of collecting municipal solid waste data in their municipal areas. He stressed that the cooperation between municipalities and governments are vital for data collection. [Presentation 4.4.4.3 (p.162)]

Session II

Mr. Hiroyuki Ueda (Suuri Keikaku, Co. Ltd., Japan) made a presentation on GHG emissions from wastewater treatment and discharge in Japan. GHG emissions of "6.B. Wastewater Handling" accounted for 10.5% of the waste sector in 2007 and were 25.9% lower compared with the base year. This category has some specific problems, which are not observed in the other waste categories (e.g., only a few or no statistics at all, not so well-established country specific methodology, diverse and unidentified emission sources). As many countries need to improve their 6.B. inventory, he shared information gained though his experiences with improving Japan's inventory. [Presentation 4.4.4.4 (p.164)]

Dr. Tomonori Ishigaki (Ryukoku University, Japan) made a presentation on the evaluation of GHG emissions from advanced wastewater treatment. He introduced various advanced treatment processes and evaluated their benefits and drawbacks with a Life-cycle Impact Assessment Method based on Endpoint Modeling (LIME). A negative correlation was found between the degree of eutrophication and CO_2 emitted through the nutrient removal processes. The step-feed nitrification-denitrification process appears to be the only co-benefit process among those methodologies. [Presentation 4.4.4.5 (p.168)]

Summary of Discussions

Session I focused on data collection. Japan's data collection scheme was presented as a well-established example. This scheme was established in line with the “Waste Management and Public Cleansing Law”. In order to assure the reliability of data, there is a set of guidelines “KANSEI VOL.95” as well as capacity training for municipalities to teach them how reports should be made. The effectiveness of the law enforcement (“Ban on Direct Landfill of Foodwaste”) on GHG emission mitigation was also recognized as it affected the waste composition at landfill sites. Based on the presentations given by Japan and RoK, the participants shared the view that the laws on waste management were important for both waste data collection and mitigation.

Session II focused on wastewater handling. Japan’s GHG emission status of wastewater handling was reported and the reduction of emissions since 1990 was a result of the conversion of vault toilet, the waste of which is not treated by the sewage plants, to the other toilet systems. In order to efficiently improve the 6.B. inventory, the importance of early and well-planned preparation as well as the importance of prioritization of targets was stressed, since a long time is required to make an accurate inventory, and because many countries often have limited human, institutional and financial resources. The analysis introduced by Dr. Ishigaki revealed that the step-feed nitrification-denitrification process was the best one among various advanced treatment processes, since it mitigated eutrophication without emitting as much CO_2 as the other processes did.

Besides the discussions of presentations, each country’s data collection status of wastewater handling was shared: Dr. Towprayoon (Thailand) stated that the lack of data from industrial wastewater treatment was a significant problem in Thailand. Data collection has just been started. She suggested that the best way of collecting data was to follow the *2006 IPCC Guidelines*. Ms. Othman (Malaysia) stated that in Malaysia there were no data of industrial waste, only of households. Mr. Mulyanto (Indonesia) indicated that in his country there were some data from pipe, pump, and oil companies, but only spot data and series data. Data from households and other industries have not been estimated yet. Mr. Keodalavong (Lao, P.D.R.) stated that in Laos there was funding to support the industrial database, especially for solid waste. Also, there are some environmental protection laws, especially for waste water. However, there is a lack of funds to support waste treatment. Dr. Macandog (Philippines) stated that in her country industrial wastewater was treated; while the household wastewater might or might not be. Dr. Kim (RoK) indicated that the central government of RoK had close relationships with local governments and, therefore, there were good statistics. However, setting up a system and guidelines has to be done first, and then this can be combined with the policy. The development of EFs for the wastewater handling has just started.

Dr. Towprayoon stressed that data collection was the largest issue, both for industrial and domestic wastewater, as most member countries did not have sufficient data. Although Japan has a well-established data collection flow, each country should establish something similar by taking their countries’ situation into consideration. The importance of laws and regulations to control wastewater treatment and discharge were also mentioned. Some participants stated that the implementation of laws was even more important, since some existing laws in their countries were not working in an effective manner.

Conclusions & Recommendations from the Working Group

Based on the presentations and the discussions, the participants recognized the importance and the effectiveness of laws, regulations, and guidelines for data collection as well as for the

GHG emissions mitigation. Therefore, participants, as inventory experts, agreed to promote information sharing with waste management officers in their countries, since collecting waste data was needed not only for better waste management but also for evaluating environmental impacts, which now, of course, includes global warming. In order to improve the 6.B. inventory, data collection was essential, since many countries did not have sufficient data. The necessity of the establishment of data flux, which was suited for each individual country, was confirmed.

The following themes were recommended for discussion at the next WGIA:

1) Information sharing among us about new waste management policy schemes, introduced in the individual countries, and
2) Provision of our knowledge and data to waste managers, which would make them know more about GHG emissions and climate change.

The latter point was recommended to be implemented without waiting for the next meeting.

Annex

Participants:	Haneda Sri MULYANTO	(Indonesia)
	Tomonori ISHIGAKI	(Japan)
	Kosuke KAWAI	(Japan)
	Edit NAGY-TANAKA	(Japan)
	Takefumi ODA	(Japan)
	Hiroyuki UEDA	(Japan)
	Masato YAMADA	(Japan)
	Khamphone KEODALAVON	(Lao, P.D.R.)
	Azlina OTHMAN	(Malaysia)
	Damasa M. MACANDOG	(Philippines)
	Wonseok BAEK	(RoK)
	CheonHee BANG	(RoK)
	Byong-bok JIN	(RoK)
	Seungdo KIM	(RoK)
	Byong-Ok YOO	(RoK)
	Sirintornthep TOWPRAYOON	(Thailand)

Handouts:

- Japan’s data collection system for statistics of waste disposal
- How to estimate time-series data in Japan
- Questionnaire regarding the municipal solid waste management
  (For National Governments) – Japan, RoK,
  (For Municipal Governments) – Malaysia, Mongolia, RoK
- Country report on waste management in Laos

3.5. Wrap-up Session

This session was chaired by Mr. Takahiko Hiraishi (IGES/IPCC). In this session, the rapporteurs from plenary sessions and WGs provided summaries of the discussions including the findings and recommendations, which were followed by the final discussion to conclude the workshop. The following are the major conclusions of this workshop.

Summary of Session I [Presentation 4.5.1 (p.171)]

Many parties are in the process of concluding their SNCs, and through preparation, they have conducted uncertainty assessment and time series estimates in many cases.

With regard to uncertainty assessment, participants confirmed that the lack of data was a major problem, and emphasized the necessity of CS-EFs. Dr. Garivait emphasized that the implementation of uncertainty assessment, even a simple approach 1, was useful for better understanding of key source/sink categories, and that the implementation of QA/QC could reduce uncertainty. Since the implementation of uncertainty assessment increases the confidence level of inventories, continuous efforts in all sectors was also encouraged.

With regard to time-series estimates, the lack of AD and CS-EFs was confirmed as major obstacles for their development. Referring to the presentations given by Mongolia, Indonesia and Thailand, the following information was shared: 1) actual emissions rather than the potential ones should be estimated in order to avoid over-estimation, 2) recalculations should be conducted when a new CS-EF was applied, in order to assure the time-series consistency, 3) GIS and RS are useful for determining rice areas based on certain factors, and for developing scaling factors, and 4) a database from various research studies is needed to develop scaling factors. The hands-on training focusing on techniques to fill data gaps was welcomed by the participants. Continuous efforts to be made for further development of the time-series data were encouraged.

With regard to the projection, Dr. Ashina gave an overview of the AIM model. For those who are interested in learning more about this model, an annual training course organized by his group was offered.

Mr. Hiraishi suggested that both uncertainty and time-series estimates might be good topics for mutual GHG inventory reviews in the future. Mr. Tanabe followed with a suggestion that parties, when faced with difficulties in conducting uncertainty assessment and time series estimates, should share these difficulties within the WGIA network by the WGIA-ML for possible problem-solving.

Mr. Hiraishi reminded the attendants that the SPM template for the GHG Inventory Chapter of the SNCs was currently open for comment, and countries were encouraged to prepare a SPM if possible. Some participants proposed that upon the completion of the SPMs from each country, it might be useful to summarize them into one SPM for the total region. Mr. Hiraishi commented that GIO might consider taking on the task of synthesizing the SPMs.

It was noted that it was essential to make others, aside of inventory experts, aware of the importance of inventories, and it was therefore agreed upon that efforts for awareness-raising should be further enhanced, for example by incorporating the contents of the aforementioned SPM into the executive summary of NCs.

Summary of Session II [Presentation 4.5.2 (p.173)]

Many WGIA-participating countries were in the last stage of preparation of their latest NCs. As an integral part of this work, many countries were making fairly good progress in GHG inventory compilation. The participants agreed upon the importance and necessity of keeping this momentum to further improve their GHG inventories continuously and efficiently, even after completion of the NCs currently under preparation.

Discussions in this session therefore mainly focused on what kind of activities were necessary in order to improve inventories and how to realize them, how the WGIA could further support each country's activities, and what we should do by the next WGIA.

Regarding the WGIA and the SWGA on-going activities, more contribution from participating countries was encouraged (e.g., information sharing on CS-EFs, contacts of inventory experts, solid waste management). As a new activity, participants were encouraged to submit a proposal for GEF funding prior to the completion of their NCs currently under preparation, in order to ensure their continuous inventory improvement. The exploration of new funding sources such as JICA was also encouraged.

With regard to methods of improving inventory quality, the following activities were suggested: 1) collection of AD using the guidance from the *2006 IPCC Guidelines*, 2) application of new (updated) EFs developed in each country, in the *2006 IPCC Guidelines* and in the WGIA-EFDB, and 3) the trial of the mutual inventory review. It was also noted that the WGIA-EFDB should feed into the IPCC-EFDB.

Many participants expressed their interest in expanding the WGIA activities to enhance the utility of the GHG inventory (e.g., activities to link GHG inventories to mitigation planning), by, for instance, awareness building for relevant government agencies. Many participants supported this suggestion.

Mr. Hiraishi proposed that potential agenda items for future sessions could be: review of inter-sessional activities (e.g., uncertainty assessment, time-series estimates, mutual review of a draft communication), and new tasks that may emerge from COP15.

Summary of Session III

<u>Energy WG [Presentation 4.5.3 (p.174)]</u>

Participants of the Energy WG reviewed available energy statistics and the applied approaches (reference and/or sectoral) in each country. The status of each country was found to be different and their situation could be further improved. The prioritization of improvement approaches and comparisons between national and international statistics were suggested. It was also noted that detailed energy statistics allowed understanding of potential co-benefits.

Interest was shown in dealing with transportation data, as a good starting point for mitigation, and Mr. Hiraishi noted that this issue of transport might be a potential agenda item for the next session. He also commented that the need for collaboration with national statistics offices/officers was observed, and that this might be done inter-sessionally.

Agriculture WG [Presentation 4.5.4 (p.176)]

Participants of the Agriculture WG reviewed the CS-EFs developed in different countries and shared agricultural information including mitigation potential.

With regard to CS-EFs, participants of the Agriculture WG emphasized that these were sometimes obtained from a small number of measurements, and therefore use of default values might be better in some cases. Mr. Hiraishi agreed, noting that in agriculture or forest sectors it might take a long time to obtain large numbers of measurements. He also noted that new EFs were emerging, and WGIA-EFDB and IPCC-EFDB collaboration should be considered.

LULUCF WG [Presentation 4.5.5 (p.180)]

Participants of the LULUCF WG shared their experiences and lessons learnt in applying GIS and RS for inventory and the institutional arrangement of each country for the LULUCF sector.

Participants from the LULUCF WG proposed to bring the agriculture and LULUCF sectors together when using RS and GIS data, similar to what was proposed by the Agriculture WG. Another WG participant emphasized the importance of this especially in terms of developing the co-benefits of mitigation options, such as improvement in soil fertility, increase in crop-yield, and productivity enhancement of forests as a result of increase in soil carbon sequestration. Mr. Hiraishi commented that sharing information with RS and GIS experts was important and probably useful in this sector. He suggested that technology such as RS and GIS be taken up as an agenda item for discussion in the future.

Waste WG [Presentation 4.5.6 (p.183)]

Participants of the Waste WG reviewed the status of each country for data collection for the waste sector, the methods for estimation of waste generation, and exchanged general information regarding wastewater handling. Through discussions, they found several problems: data is insufficient or not available, funds to support wastewater treatment are insufficient, the national system and database are yet to be consolidated, and more regulations/laws are needed for environmental protection and waste management.

It was noted that sharing information on waste management policy schemes among members and transferring such information to the waste experts in their home countries could improve this situation.

They added that the sharing of data collection format for wastewater treatment should be added to the recommendations. Mr. Hiraishi commented that the proposed data collection format might be useful for both solid waste and waste water.

Overall

Through the discussions of the above subjects, the participants reaffirmed the importance of the GHG inventory as a key tool for promoting mitigation actions in a MRV manner. The participants agreed that each country should continue its efforts to improve its national GHG inventory, and that continuous cooperation among Asian countries was essential.
Mr. Tanabe, in his concluding remarks, re-stated that WGIA was entering a transition period,

and posed a question to the group about whether they wanted to continue the workshop in the current format. He mentioned the possibility of a sector-specific workshop as one option of a new format, and urged the group to share their thoughts on this issue through the mailing list.

He also stressed the importance of continuity, and asked that participants kindly delegated someone else if they could not be present at the next WGIA. Participants proposed that the number of attendants/working groups be increased, provided that financing was available. The participants agreed upon the proposal to form a steering committee, which might be useful for designing the format of the next WGIA meeting.

Closing remarks were delivered by Mr. Chang-han Joo, Executive Director of EMC, RoK, 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. Presentations

Presentation 4.1.1

Overview of WGIA7

Yukihiro Nojiri
Greenhouse Gas Inventory Office of Japan (GIO)
National Institute for Environmental Studies (NIES)

7th Workshop on Greenhouse Gas Inventories in Asia
Seoul, Republic of Korea
July 7-10, 2009

Workshop on Greenhouse Gas Inventories in Asia (WGIA)

Objective	To support countries in Asia to improve the quality of inventories via regional information exchange
Style	Annual workshop since 2003
Participants	[One researcher + One government official] from 14 countries + UNFCCC Secretariat, etc.
Funds	Ministry of the Environment of Japan

WGIA7

- 3-Day Workshop + 1-Day Excursion (July 7-10, 2009)
- Objectives:
  - Share experiences gained through the activities to follow up the conclusions of the 6th WGIA
    - Uncertainty assessment exercise
    - Awareness-raising
    - Time series estimates and projections of GHG emissions and removals
  - Discuss possible plans for future activities of participating countries as well as WGIA after completion of their second National Communication (SNC) by taking the "Kobe Initiative" into account.
  - Learn how to solve data gaps with a view to facilitating development of time series estimates of GHG emissions and removals.
  - Discuss sector-specific issues and possible ways to solve them
    - Energy Sector / Agriculture Sector / LULUCF Sector / Waste Sector

Welcome Participants!

- 100 Participants from 11 countries in Asia, international organizations and projects:

Participating countries:
Cambodia, Indonesia, Japan, Republic of Korea, Lao P.D.R., Malaysia, Mongolia, Myanmar, Philippines, Thailand, Vietnam.

Welcome Participants!

Participating international organizations and a project:
- United Nations Framework Convention on Climate Change (UNFCCC) Secretariat
- Intergovernmental Panel on Climate Change (IPCC)
- Regional Capacity Building Project for Sustainable National GHG Inventory Management Systems in Southeast Asia (SEA GHG Project)

Workshop Flow

Day 1

Session I: Review of Progress since WGIA6
- Uncertainty Assessment / Awareness Rising
- Time-series estimates / Projection of GHG emissions

Day 2

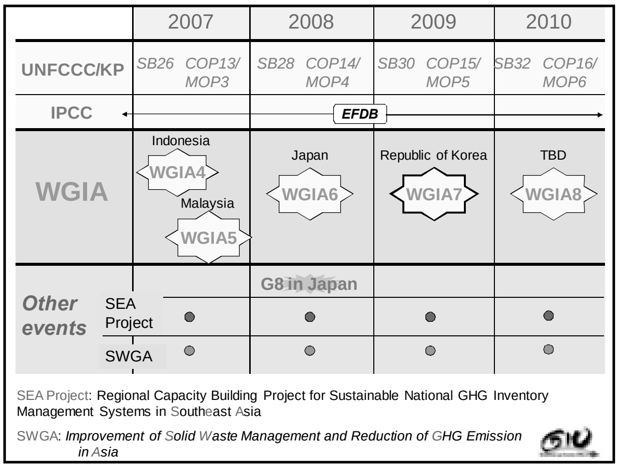
Session II: Plan for Future Activities beyond SNC
- Further improvement in data collection
- Proposals for new cooperative actions by WGIA participating countries

Hands-on Training Session: Techniques how to fill data gaps

Day 3

Session III: Working Group Discussion
- Working Groups: Energy, Agriculture, LULUCF and Waste

Wrap-up Session
- Summary reports of Session I and II
- Summary reports from Working Group 1, 2, 3 and 4
- Discussion on future activities and wrap-up


2007
2008
2009
2010
UNFCCC/KP
SB26 COP13/ MOP3
SB28 COP14/ MOP4
SB30 COP15/ MOP5
SB32 COP16/ MOP6
IPCC
EFDB
WGIA
Indonesia
WGIA4
Malaysia
WGIA5
Japan
WGIA6
Republic of Korea
WGIA7
TBD
WGIA8
G8 in Japan
Other events
SEA Project
SWGA
SEA Project: Regional Capacity Building Project for Sustainable National GHG Inventory Management Systems in Southeast Asia
SWGA: Improvement of Solid Waste Management and Reduction of GHG Emission in Asia


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

Presentation 4.1.2

Update on non-Annex I National Communications

7th WGIA

Seoul, 7-10 July 2009

Dominique Revet
UNFCCC
Financial and Technical Support (FTS) Programme
DRevet@unfccc.int

UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE 1

SBI 30 (June 2009, Bonn)

- **4(a)**. The SBI resumed discussions on the **mandate and terms of reference of the CGE** (**Decision 3/CP.8**); and agreed on a draft decision**,** to be forwarded to **COP 15** for adoption, that **reconstitute** the CGE.

Full text available at:
http://unfccc.int/resource/docs/2009/sbi/eng/l03r01.pdf

- **3** year mandate (**2010-2012**), with revision of the mandate at COP 17
- Same **membership** as in **Decision 3/CP.8**
- **Mandate**: technical assistance on components of NCs; recommendations on future guidelines for NCs; technical advice for long term sustainability of processes; technical advice and support on steps to integrate CC into policies and actions (**Art. 4.1(f)**); provision of information on activities and programmes to facilitate and support the preparation of NCs; provision of technical support through workshops and hands-on training workshops.

UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE 2

SBI 30 (*Cont.*)

- **4(b).** Consideration of **information contained in national communications from NAI Parties** (continued to be held in abeyance).
- **4(c). Provision of Financial and Technical (F&T) Support**: GEF to present a complete and detailed information on funding provided for NCs at **SBI 31**.

Full text available at:
http://unfccc.int/resource/docs/2009/sbi/eng/l12.pdf

- Non-Annex I Parties **encouraged** to make all effort to submit their NCs in accordance with **Decision 8/CP.11, paragraph 3**
- GEF to **assist** non-Annex I Parties (**Decisions 7/CP.13** and **4/CP.14**) in formulating and developing project proposals identified in their NCs
- GEF **urged** (**Decision 4/CP.14**) to ensure, as a top priority, that sufficient financial resources are provided to non-Annex I Parties to comply with their obligations under **Article 12, paragraph 1** of the Convention
- Non-Annex I Parties **encouraged** to submit project proposals for funding of their subsequent NCs before completion completion of their currents NCs, in order to avoid a lack of continuity in project financing

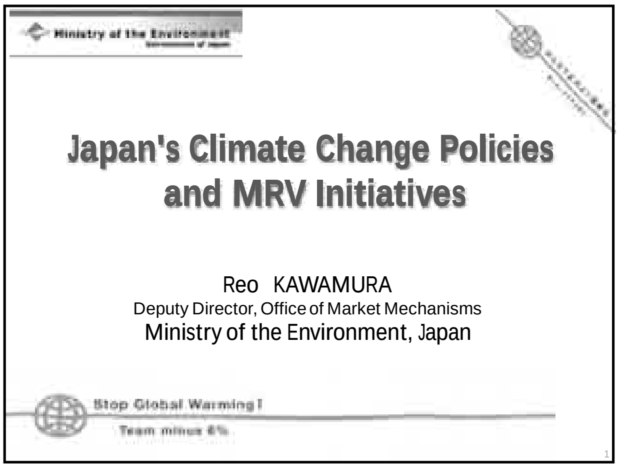
UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE 3

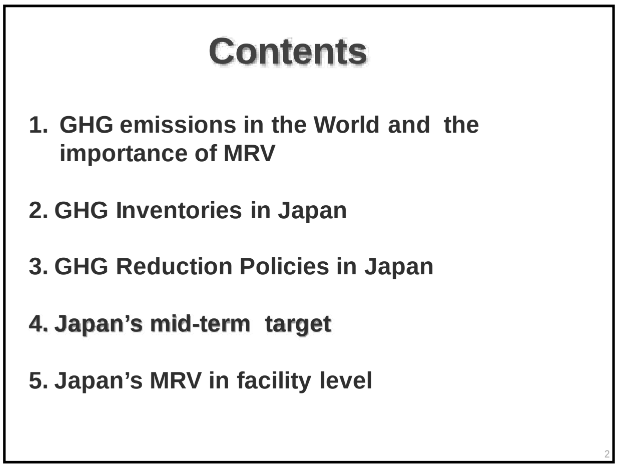
SBI 31 (December 2009)

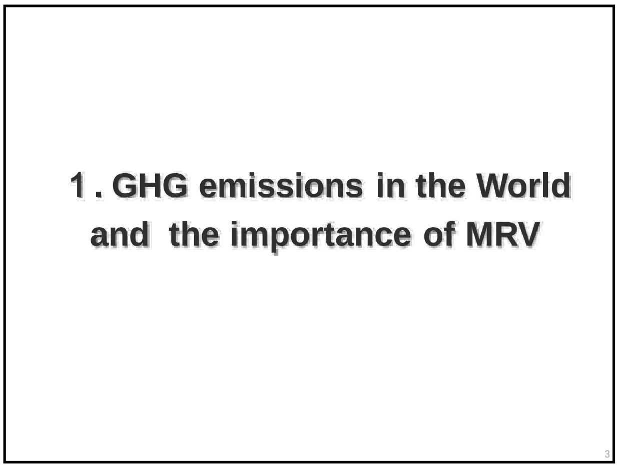
- Certain: Discussions on the further implementation of Article 12, paragraph 5 (i.e. "*frequency*") of submission of NCs from non-Annex I Parties will take place at SBI 31/COP 15.
- Possible: Replacement of current item 4(b) as it stands with "Compilation and Synthesis" of second national communications.

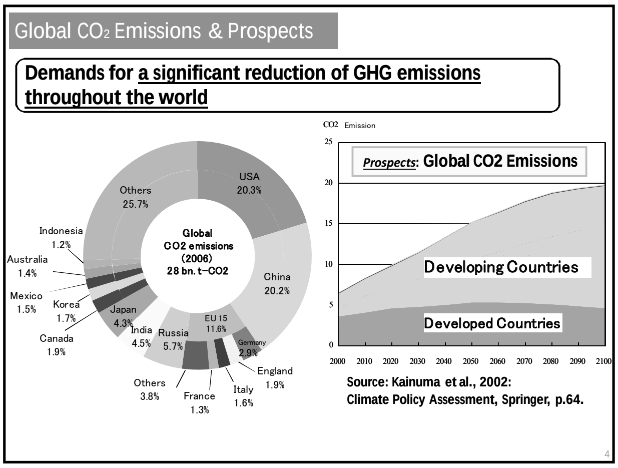
UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE 4

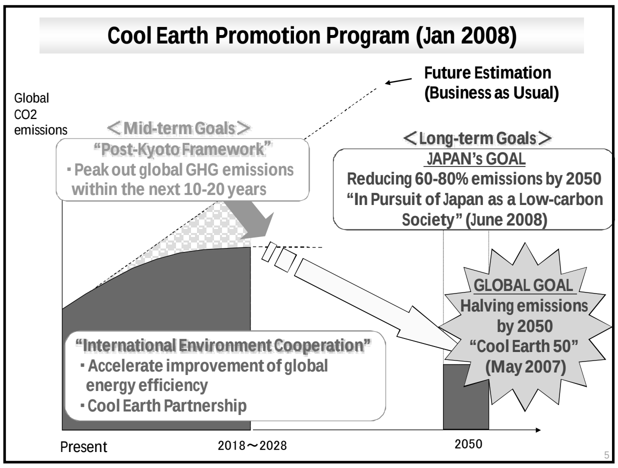
Presentation 4.1.3

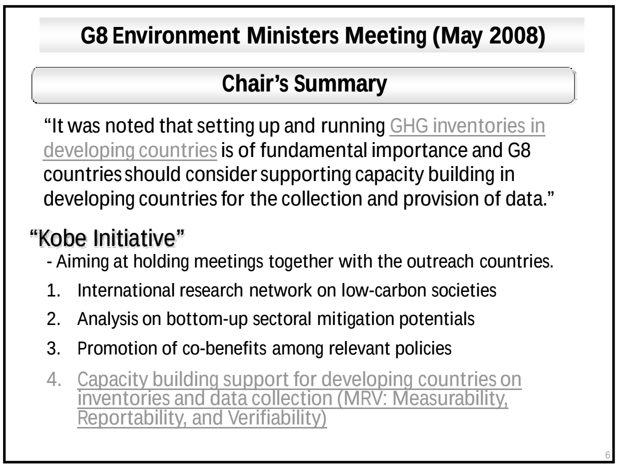












Japan's initiative for supporting developing countries in GHG inventories

- **WGIA:** Workshop on GHG Inventories in Asia
  - Improve the quality of GHG inventories via regional information exchange
  - Annual workshop in 14 Countries (2003-)
- **SWGA:** Improvement of Solid Waste Management and Reduction of GHG Emission in Asia (SWGA)
  - Improve GHG inventories for the waste sector
  - Annual workshop in 8 Countries (2007-2010)
- **SEA GHG Project:** Regional capacity building for sustainable national greenhouse gas Inventory management systems in Southeast Asia
  - Improve the quality of GHG inventories to develop the sustainable inventory management systems
  - Support and Training in 8 Countries (2007-2010)

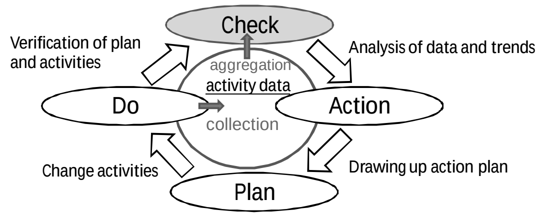
7

GHG Inventories and Data Collection

Data collection is key

Why? → Establishment of PDCA Cycle

Understanding of the current situation



→Clear Understanding of Current Situation is a first step !!

8

GHG Inventories and Data Collection

Both "macro" and "micro" levels of data collection are key

Macro: GHG inventories in national level

- National communication for UNFCCC
- Main theme for today's workshop

Micro: Emission data in facility level

- IEA (Indicator setting)
- APP Task Force (Reduction potential, indicator)

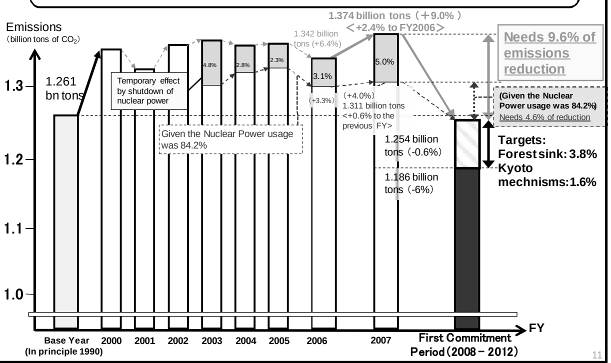
9

2. GHG Inventories in Japan

10

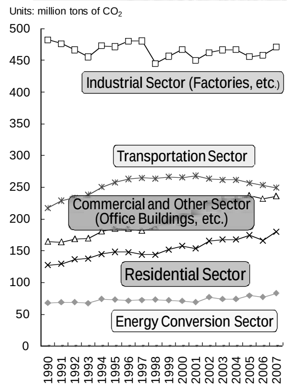
Greenhouse Gas Emissions in Japan

Japan's emissions for 2007 were 9.0% more than those for the base year, which means that reductions of 9.6% are needed to achieve the 6% reduction commitment under the Kyoto Protocol.



11

Trends in CO_2 Emissions from Energy by Sectors and the Targets for 2010



Base year	Change form 1990	2007	Reduction Rate to meet Target	Targets for 2010
482	- 2.3%	471	−9.2%～−10.0%	424～428
217	+14.6 %	249	−2.4%～−3.8%	240～243
164	+43.8 %	236	−11.1%～−12.0%	208～210
127	+41.2 %	180	−21.5%～−23.[illegible]%	138～141
68	+22.2 %	83	−20.1%	66

12

3 . GHG Reduction Policies in Japan

13

Framework of the Kyoto Protocol Target Achievement Plan

Measures and Policies for Achieving Targets

1. Measures and Policies relating to Greenhouse Gas Emissions Reduction, Removal, etc.
(1) Measures and Policies relating to Greenhouse Gas Emissions Reduction
[Examples of Primary Additional Measures]
○Promotion of Voluntary Action Plans
○Improvement of energy efficiency of equipment that meets Top-runner Standards, etc.
○Improvement of automobile fuel efficiency
○Promotion introduction of new energy sources
(2) Greenhouse Gas Sink Measures
○Forest management such as tree thinning, promotion of the "Beautiful Forest Building National Campaign"
2. Cross-sector Policies
○Mandatory Greenhouse Gas Accounting and Reporting System
○Development of national campaigns

※Issues needing to be addressed promptly
○Domestic Emissions Trading System
○Environment tax
○Departure from late-night work and lifestyles
○Introduction of daylight savings

Targets of GHG Emissions and Removals

	Emissions Targets for 2010	
	Million tons of CO_2	Base Year Total Emissions Comparison
CO_2 from Energy	1,076~1,089	+1.3%~+2.3%
Industry	424~428	-4.6%~-4.3%
Commercial and Other	208~210	+3.4%~+3.6%
Residential	138~141	+0.9%~+1.1%
Transportation	240~243	+1.8%~+2.0%
Energy Conversion	66	-0.1%
CO_2 from non-Energy, CH_4, N_2O	132	-1.5%
HFCs, PFCs SF6	31	-1.6%
Greenhouse Gas Emissions	1,239~1,252	-1.8%~-0.8%

For definite progress towards 6% reduction commitment under the Kyoto Protocol, all measures, including sink measures and Kyoto mechanisms, will be implemented.

14

Points of "Action Plan for Achieving a Low-Carbon Society"
(Cabinet decision, July 29, 2008)

1. Japan's Targets

○**Reduce 60–80 % of the current level of emissions by 2050**
○**Announce quantified national target (mid-term target) at an appropriate time next year**
○**Support for other countries' efforts**

2. Technology Development and Diffusion

○ Promote **innovative technology development**, e.g., CCS technology.
○ Aim at becoming once again the world leader in **solar power generation**: installations be 10 times in 2020, 40 times in 2030,
○ Increase **next-generation vehicle** proportion to 1/2 of new car sales by 2020.
○ Aim for all newly built **houses and buildings** to be energy-efficient

3. Framework to move towards a Low Carbon Society

○ Start trial phase of **domestic emissions trading** by around October
○ Generally review taxation system including **environmental tax** introduction; promote **taxation greening**

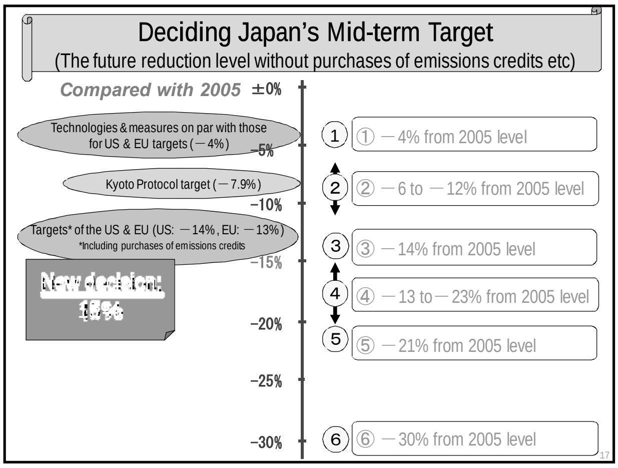
4. Support for regional and citizens' initiative

○ Reduce carbon using the functions of agriculture, forestry and fisheries Ex: **promoting biofuels**
○ Further promote ***national campaigns*** such as "Team Minus 6%".

15

4 .Japan's mid-term target

16



Mid-term Targets in Various Countries and Regions

	Comparison with 2005 emissions	Purchases of emissions credits from other countries	Base year
Japan	**－15%**	Not included in target	2005
EU (27)	**－13%**	Included in target	1990 (－20%)
USA	**－14%**	Included in target?	2005

・The announcement on the mid-term target is, so to speak, a first step towards full-fledged international negotiations.
・Japan will decide on such additional reductions under the forthcoming (post-2012) framework after discerning the course of future international negotiations.

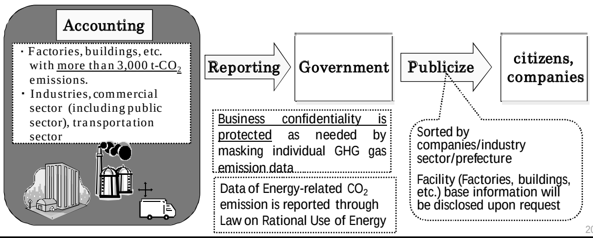
18

5. Japan's MRV in facility level

19

Mandatory Greenhouse Gas Accounting and Reporting System

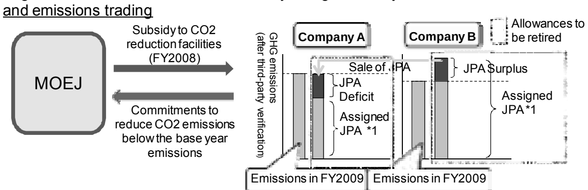
- Provided in the Law on Global Warming Countermeasure
- Mandates entities to account and report their emissions every year to the government, which publicizes the data. (Available: FY2006 and FY2007)
- Encourage businesses to voluntarily reduce GHGs by promoting awareness .
- Covers 15,000 factories and office buildings, etc and 1,400 transportation companies (About 0.2% of business entities in terms of the number)
- Total amount of reported GHG emissions was 650 million t-CO2 (About 50% of Japan's GHG emissions.)



20

JVETS overview

(1) Scheme outline
- Launched by MOEJ in 2005
- Supports voluntary CO2 reduction activities by business operators and ensures their target achievement in a cost-effective way using a subsidy to CO2 reduction facilities and emissions trading



*1 : Assigned JPA = Base year emissions (an average for the past 3 years) – Commitments of CO2 reduction

(2) Achievements
- Total participants: 232 companies
- Emissions reduction in FY2007 by 2nd phase (FY 2006) participants: 280,192t-CO2 (25% of the total emissions in the base year emissions) cf. their original emissions reduction plan: 19% of the total emissions in the base year emissions
- Total transactions in the 2nd phase: 51 transactions (54,643t-CO2 in total) with the average price of ¥1,250/t-CO2.

21

MRV in JVETS

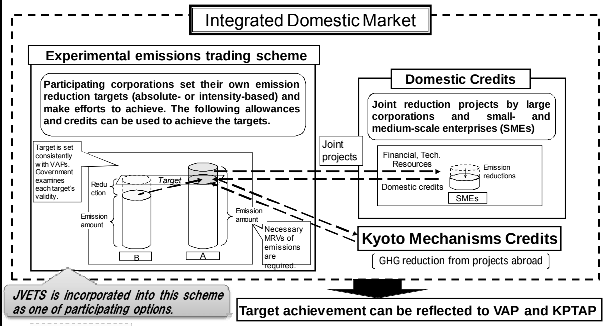
Monitoring and reporting guidelines
- Equivalent to EU-ETS Monitoring and Reporting Guidelines
- Suggest appropriate CO2 emissions monitoring and reporting by participants

Emission verification guidelines
- Encourage appropriate emissions verification for the third-party verifiers

- **Ensure consistency with International standards such as ISO 14064 series and ISO 14065**
- **Secure high accuracy in emissions calculation and verification**
- **Achieve cost-effective verification which contributes to total cost cut of emissions reduction for participants**

22

Experimental Introduction of an Integrated Domestic Market for Emissions Trading



Key points
- This scheme prepares various options for **substantial emissions reduction** by various entities including large corporations and SMEs in every sector.
- In the **integrated domestic market**, various allowances and credits are available for target achievement.
- Follow-up is scheduled at the beginning of 2009 and in the fall 2009.

23

Key Features of the Experimental Introduction of an Integrated Domestic Market for Emissions Trading

- Voluntary cap settings
  - Participants set their own targets and submit them to the Government.
  - The Government examines the validity of targets and allocates allowances.
  - Interim review and annual follow-up are implemented in Government Councils
- Target setting methods
  - Members of Voluntary Action Plan (VAP) adopt their VAP targets.
  - Both quantity and intensity targets are allowed for the VAP members.
  - Non-VAP-members set their targets following JVETS-like methodology
- Categorized MRVs
  - VAP members' MRV is in accordance with each VAP's procedure.
  - Those who want allowance transactions must have third-party verification.
  - Non-VAP-members' MRV is in accordance with JVETS-like procedure.

24

Presentation 4.1.4

Low Carbon, Green Growth in Korea

July, 2009

Rinsan Joung, Expert Commissioner
Presidential Committee on Green Growth
Republic of Korea

Why Korea needs green growth?

- ◆ **In Korea 2 times rapid climate change than Global warming**
  - **Summer** Period : 16 days **increase**
    : Jun. 3 ~ Sep. 21 (1920s) → May. 24 ~ Sep. 27 (1990s)
  - **Winter** Period : 19 days **decrease**
    : Nov. 21 ~ Mar. 18 (1920s) → Nov. 29 ~ Mar. 8 (1990s)

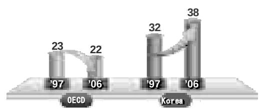
- ◆ **Increasing Damages due to disasters**

Why Korea needs green growth?

- ◆ **High dependence on energy import**
  - One of the world's top 10 energy consumers: 97% imported
    - Annual average increase rate : 1.1%
- ◆ **Ranking 9th GHG emission (594 million tCO_2/year'05)**

High energy consumption industries

* 38% of total energy consumption, 80% of energy consumption in manufacturing



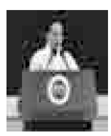
Definition of Green Growth

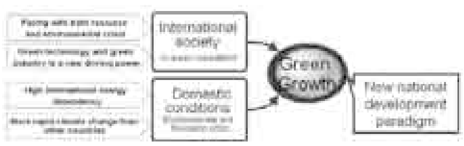
- ◆ **What is green growth?**
  - "sustainable development" that can be defined by the following 3 elements
    - Positive Cycle between Environment and Economy
    - Meet International Climate Change Expectations
    - Improve Quality of Life & Revolutionize Green Living

Strong Political commitment by the President

(2008, independency day's congratulatory address)

- ◆ President LEE committed **'**Low Carbon Green Growth through green technology and clean energy **as the new national vision for the next 60 years'**
- ◆ **"Green growth is not a choice, but the only option"**





Launching of Presidential Committee on Green Growth

◆ **established "presidential committee on green growth" as the top-level organization**

GREEN GROWTH KOREA

◆ **Legal frame: Basic Act on Low Carbon, Green Growth**

- Under review in National Assembly since Feb. 2009

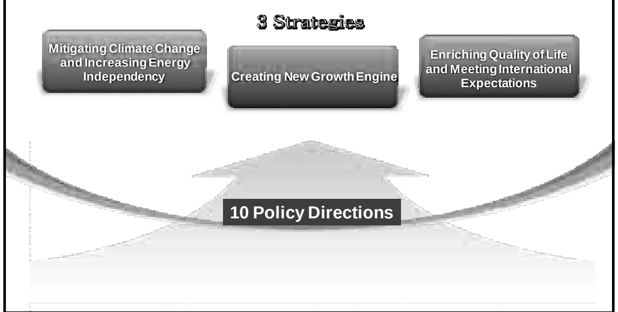
1. Background of Green Growth

2. Policy Directions of Green Growth

3. Progress of 3rd National Communication

Vision and Strategies

◆ **Vision : "become a global leading Green Country"**



10 Policy Directions

1. Effective Reduction of Greenhouse Gases
- Society with Carbon Visibility
- Carbon-3R Society (**R**educe-**R**euse-**R**ecycle of Carbon)

2. Reducing Fossil Fuel Consumption and Strengthening Energy Independency
- High Efficiency & Low-Energy Consumption
- New and Renewable Energy
- Nuclear Energy and Energy Resources Development

3. Strengthening Climate Change Adaptation Abilities
- Climate Change Adaptation
- Water Management

10 Policy Directions

4. Developing Green Technology and Green Industry
- Strategic Expansion of Green Technology
- Efficient Green R&D System

5. "Greening" Existing Industries and Fostering New Green Industries
- Resource Circulating Economics and Industry Structures
- "Doing More with Less"
- Green Small-Medium Companies (SMC's) & Green Cluster

6. Development of Low-Carbon Industrial Structure
- Foster High-Tech Fusion Industries
- Foster High-Value-Added Service Industries

10 Policy Directions

7. Establishment of Supportive Systems for Green Economy
- Building Carbon Market and Green Financial Infrastructure
- Reform in Tax System, Energy Welfare & Create Green Jobs

8. Building Green Land and Green Transportation
- Greening of Personal Living Spaces & Expanding Eco-Friendly Space
- Constructing Green Buildings & Building Green Transportation System

9. Green Revolution in Daily Lives
- Preparing basis for Green Citizen Cultivation
- Creating 'Green Life'
- Building Green Village and Revitalizing Eco-Sightseeing

10 Policy Directions

10. Contributing as a Global Role Model of Green Growth
- Cooperation to Realize Global Green Growth
- Green Growth Role-Model
- Support Developing Countries in Green Growth
- Green Hub Korea

◆ **Green Growth Investment Plans**
- Estimated that the total of **KRW 107 trillion** for 5 years

---

1. Background of Green Growth

2. Policy Directions of Green Growth

3. Progress of 3rd National Communication

Korea is preparing to submit 3rd NC

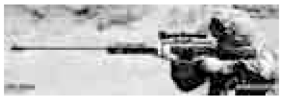
◆ **As one of the parties of UNFCCC, Korea submitted the 1st and 2nd NC in 1998 and 2002**

◆ **We are preparing the NC with the collection of the related information and the in-depth analysis and research**
- The NC will contain information on national inventories and Baseline of GHG, Policy and measures to mitigate GHG, reflecting the reduction target and sectoral strategy that will be announced this year

---

What goes around, Comes around

◆ **Advertising Poster for an antiwar campaign**

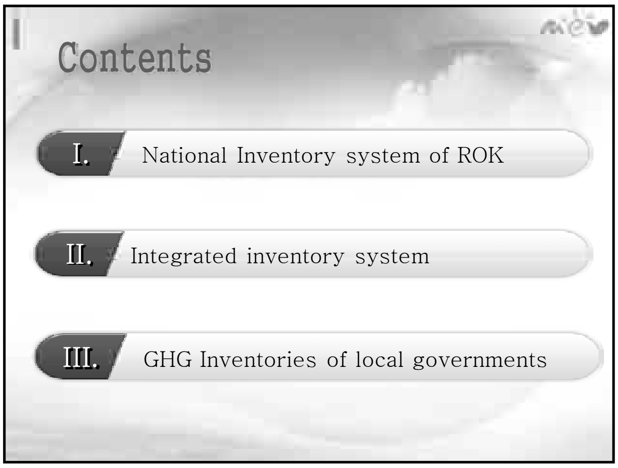


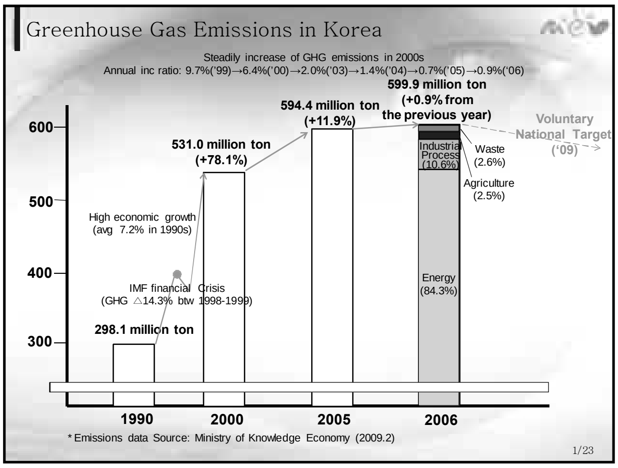
What goes around, Comes around

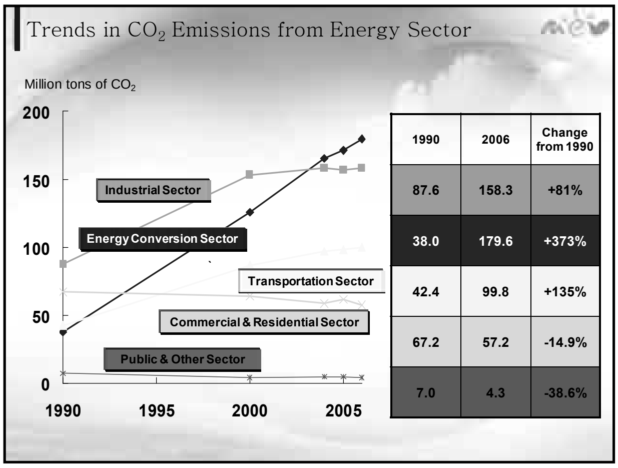
"Low Carbon goes around,
Green Growth comes around"

" Have a nice day! "

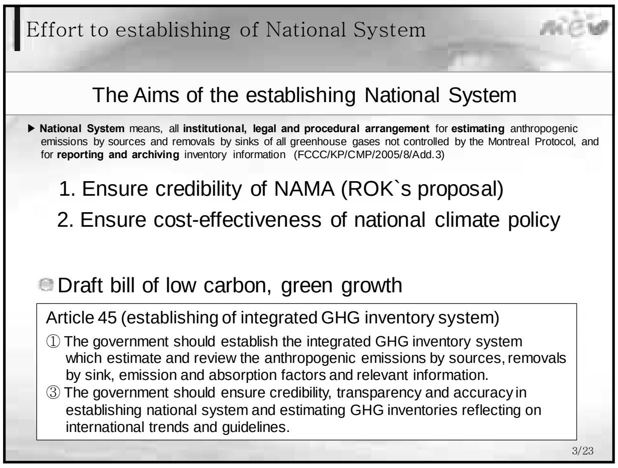
Presentation 4.1.5







1990	2006	Change from 1990
87.6	158.3	+81%
38.0	179.6	+373%
42.4	99.8	+135%
67.2	57.2	-14.9%
7.0	4.3	-38.6%



Korea``s Institutional Arrangement

Phase 1('99~'08)

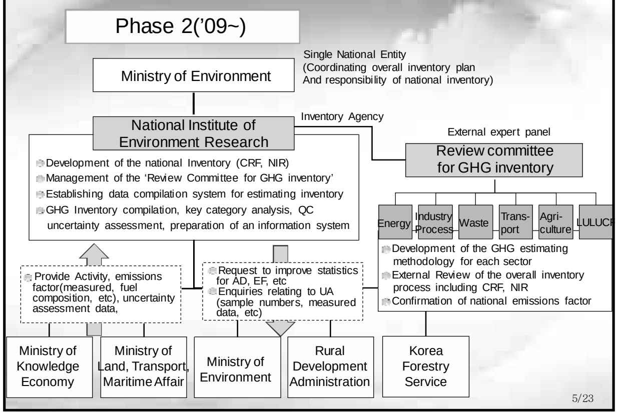
- Coordinate by MKE by the 'Fundamental Energy Act'('99~)
  - National inventory prepared by KEEI as an political research subject and reported to UNFCCC included in National Communication
    * 1st NC (1998), 2nd NC (2003), 3rd NC(2009)
  - Each ministry(institution) estimated sectoral GHG emissions and periodically reported to MKE(KEEI)
    * Energy(KEEI), Industrial process(KEMCO), Waste(EMC), Agriculture(RDA), Sink(KFS)

Transition Phase ('08~'09)

- Inter-ministrial discussions for improvement of National System ('08)
  - Need for review process, QA, Uncertainty Assessment of national inventory to ensure credibility, transparency, accuracy and consistency
- 'Presidential Committee of green growth' set to make an strategy of improvement of national system including institutional arrangement('09)

4/23

Proposed National systems (draft by MOE)



5/23

Strength and Weakness of National systems of Korea (draft by MOE)

Strength

- Cost-effectiveness of GHG inventory compilation by using an Integrated Air pollutant and GHG management system (GHG-CAPSS, NIER 2008)
  - Feasibility of integrated inventory planning, preparation, reporting and inventory data archive
  - Estimate GHG inventory both Top-down approach(national inventory) and Bottom-up approach(Local govnt` GHG inventory)
- Inventory improvement process by "Review Committee for GHG inventory"
  - External reviewer from academy, research institute and industry, etc (31members)
  - Overall review of inventory planning and national inventories (NIR, CRF), development of country-specific methodology, confirmation of country-specific emission factors

Weakness

- Need close linkage between ministries/agencies in overall inventory compilation process
  - providing of AD, EF and other related measured data to NIER
  - improvement of statistics for activity data in order to ensure accuracy, credibility of inventory
  - GHG inventory data are fed back to, and utilized by, ministries/agencies for their policy-making
- Lack of experiences of National Inventory Report, external review process,
  - voluntary peer-review, consultant, cooperation with Annex 1

6/23

II. Integrated inventory system (GHG-CAPSS)

7/23

GHG-CAPSS (NIER)

GHG Clean Air Policy Support System (GHG-CAPSS)

- CAPSS: The yearly national air pollutants emission data has been estimated by database system based on Emission Inventories (point, area, mobile) since 1999
- GHG-CAPSS: National air pollutants and GHGs integrated emissions DB system in order to support for planning reduction strategies, effect analysis of Air quality control policy and Climate Change policy (2007~2008.4)
  - link between SCC(source Classification Code) in CAPSS and CRF(Common Report Format) in IPCC

Key features of GHG-CAPSS

- Provide integrated emissions data
  - air pollutants (SOx, NOx, PM10, NH3, CO, VOC, TSP) and GHGs (CO_2, CH_4, N_2O)
    * estimation of F-gases(HFCs, PFCs, SF6) is developing by NIER at 2009
- Bottom-up approach
  - provide GHGs and air pollutants emissions map (1kmx1km)
  - provide emissions by each corporation(entity) - SEMS

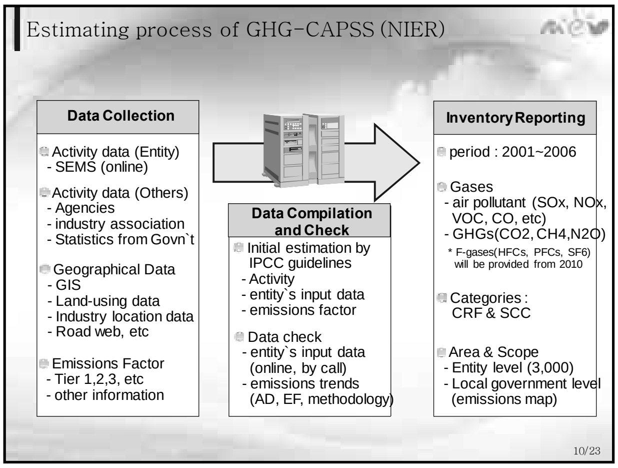
8/23

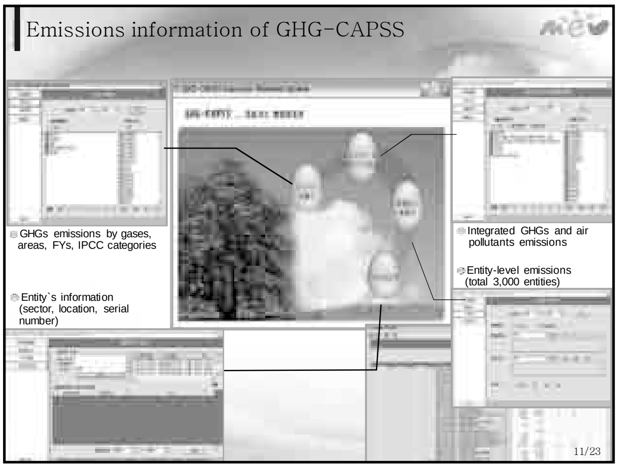
Link between IPCC & CORINAIR

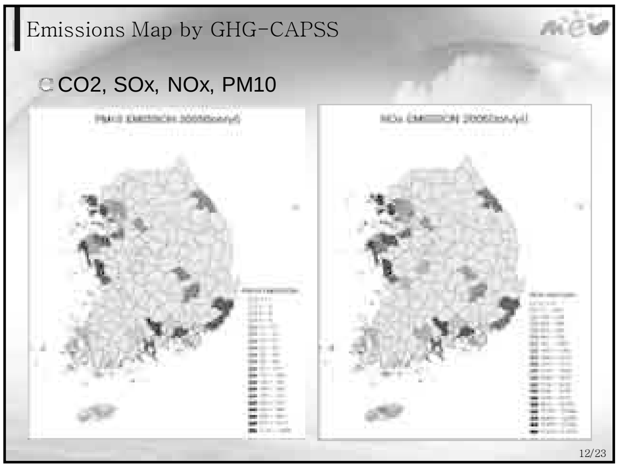
- Linkage categories in CAPSS and GHG-CAPSS based on IPCC 2006 G/L which provide this link between CRF in IPCC and SNAP in CORINAIR

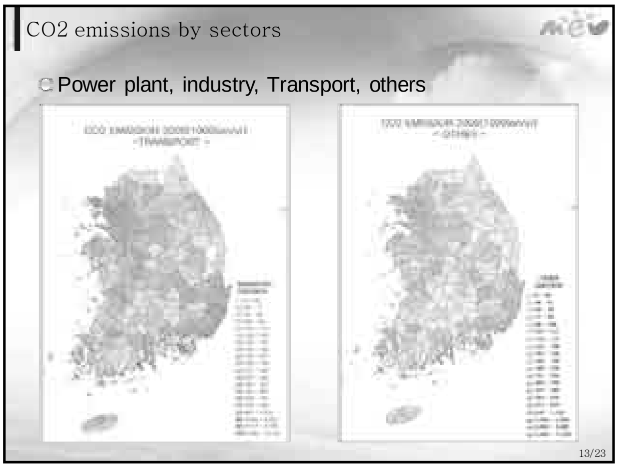
REPORTING CATEGORY				Source Sector	ENEP/CORINAIR Inventory Guidebook Chapter
IPCC category		CRF	NFR		
1. ENERGY					
1A1 Energy Industries	1A1a	1A1a	1A1a	Main Activity Electricity and Heat Production	B111 and B112
	1A1b	1A1b	1A1b	Petroleum	B132 and B136
	1A1c	1A1c	1A1c	Manufacture of Solid Fuels and Other Energy Industries	B142, B146 and B152
1A2 Manufacturing Industries and Construction	1A2a	1A2a	1A2a	Iron and Steel	B111,B112,B323,B324, B325,B331,B332,B333
	1A2b	1A2b	1A2b	Non-ferrous Metals	B336,B337,B338,B339, B3310,B3322,B3323
	1A2c	1A2c	1A2c	Chemicals	B111 and B112
	1A2d	1A2d	1A2d	Pulp, Paper and Print	B3321
	1A2e	1A2e	1A2e	Food Processing, Beverages and Tobacco	B111 and B112
	1A2f	1A2f	1A2f	Non-Metallic Minerals	B3311,B3312,B3313,B3314, B3318,B3319,B3320,B3323
	1A2g			Transport Equipment	B111 and B112
	1A2h			Machinery	B111 and B112
	1A2i			Mining and Quarrying	B111 and B112
	1A2j			Wood and Wood Products	B111 and B112
	1A2k			Construction	B111 and B112
	1A2l			Textile and Leather	B111 and B112
	1A2m			Non-specified Industry	B111 and B112

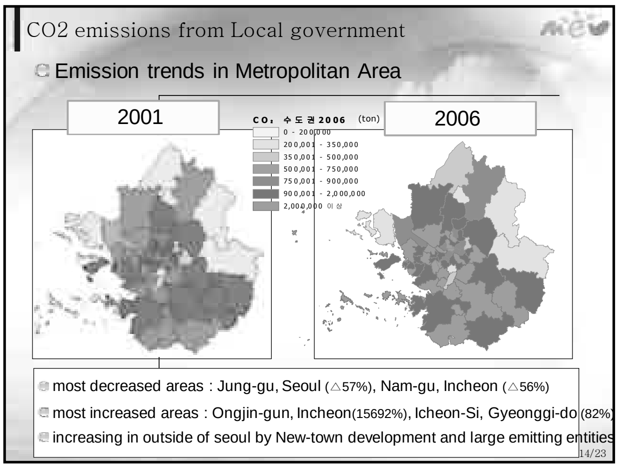
9/23


Estimating process of GHG-CAPSS (NIER)
Data Collection
Activity data (Entity)
- SEMS (online)
Activity data (Others)
- Agencies
- industry association
- Statistics from Govn`t
Geographical Data
- GIS
- Land-using data
- Industry location data
- Road web, etc
Emissions Factor
- Tier 1,2,3, etc
- other information
Data Compilation and Check
Initial estimation by IPCC guidelines
- Activity
- entity`s input data
- emissions factor
Data check
- entity`s input data (online, by call)
- emissions trends (AD, EF, methodology)
Inventory Reporting
period : 2001~2006
Gases
- air pollutant (SOx, NOx, VOC, CO, etc)
- GHGs(CO2, CH4,N2O)
* F-gases(HFCs, PFCs, SF6) will be provided from 2010
Categories : CRF & SCC
Area & Scope
- Entity level (3,000)
- Local government level (emissions map)
10/23


Emissions information of GHG-CAPSS
GHGs emissions by gases, areas, FYs, IPCC categories
Entity`s information (sector, location, serial number)
Integrated GHGs and air pollutants emissions
Entity-level emissions (total 3,000 entities)
11/23


Emissions Map by GHG-CAPSS
CO2, SOx, NOx, PM10
12/23


CO2 emissions by sectors
Power plant, industry, Transport, others
13/23


CO2 emissions from Local government
Emission trends in Metropolitan Area
2001
2006
(ton)
0 - 200,000
200,001 - 350,000
350,001 - 500,000
500,001 - 750,000
750,001 - 900,000
900,001 - 2,000,000
most decreased areas : Jung-gu, Seoul (△57%), Nam-gu, Incheon (△56%)
most increased areas : Ongjin-gun, Incheon(15692%), Icheon-Si, Gyeonggi-do (82%)
increasing in outside of seoul by New-town development and large emitting entities
14/23


III. GHG inventories of local governments
15/23

Effort to establishing of Local Govn`t Inventory

The Aims of the Local Government`s Inventory

1. Supporting implementation of Local govnt` Climate policy
2. Fostering Local climate change & inventory experts

Draft bill of low carbon, green growth

Article 11 (implementation of local govnt`s green growth policy)

① The Local government should prepare 'local government`s green growth plan' in order to implement local government level - 'low carbon, green growth' harmonizing with 'National green growth strategy'

Comprehensive plan of Climate Change ('08.9)

Establishing of local government`s GHG inventories (By MOE)
- Prepare for local govnt` level - inventory guidelines
- establishment inventory DB for estimating BAU, abatement potential

16/23

Features of local government` s` GHG inventory

Considering factors for estimating local inventory

- Unlimited movement(migration) of products, waste, mobile vehicles between local governments
  - ▶ Need to identify the emissions boundaries based on emissions sources and mobility
- Discrepancy in policy ability by local government for each emission sources
  - (ex) Direct GHG reduction of emissions by private facilities and entities is limited at local government level climate change policy
  - ▶ Need to distinguish emissions scope based on control approach of local government`s policy options
- Demand side GHG management is an important policy options at local government`s climate change policy
  - (ex) facilitating low carbon lifestyle (Green start, purchasing carbon labelled product) Energy efficiency investment (Renewables on building LED roadlamp)
  - ▶ Need to compile inventory based on indirect emissions(electricity, etc) and considering of energy demand(consumptions)

17/23

Establishing of local govnt inventories

Ministry of Environment — Inventory plan, Financial support (budget: 1.8 billion won(2009)

Environment Management Corporation (EMC) — Coordinating Agency
- Development of 'Local Government Inventory Protocol' ('09)
  - base on IPCC 2006 G/L and Protocol by ICLEI
  - Reporting formats and data archiving methodologies
- Provide technical support to each local government`s study group (Regional Environmental Centers)
- Operating and education of Internship program (total 68)
- Inventory review(QA/QC,UA) of local government`s inventories

Council of Local govnt` Inventory — Public officers, Research team, etc

16 Regional Environmental Centers (REC)
- Data collection (Activity, EF, statistics, measured data)
  - utilizing a sample investigation (entity, buildings) if needed
- Inventory compilation (based on protocol by EMC)
- Research of Case Study
  - improvement plan (AD collection
  - apply to high tier methodologies which reflect the regional emissions features

Internship (68 students from each region) — Supporting Inventory research Data collections

18/23

Establishing of local govnt` inventories

Timetable

		2009. MAR	JUN	OCT	DEC	2010 FEB	MAY	2011 FEB
EMC	Inventory Protocol	→	→					
	Internship program	(Seoul) →	←	(Each	Region) →			
	Technical support to REC							
	Inventory QA, UA							
16 REC (Regional Environmental Center)	16 Large Local government	→	→	→	→			
	10 Small local government (pilot)	→	→	→	→			
	230 Small local government					→	→	→
Inventory Council	Council (total 6th in 2009)	Initial	Mid-term		Final			

Key features

- Ensure cost-effectiveness, consistency, comparability of Local govnt` inventories
- Feasibility of peer-review of Top Down(national inventory) and Bottom Up inventory
  - need additional measures to decrease numerical deviation
  - peer-review with local inventories by GHG-CAPSS and provide to each local government (end of 2009)
- Ensure local areas` expertise by utilizing of '16 Regional Environmental Centers' and operating of Internship program from local universities

19/23

Inventory Reporting Format

Inventory Protocol (by EMC)

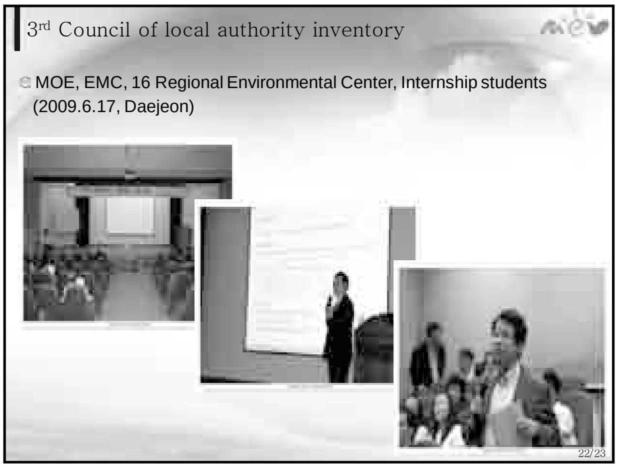
Scope			Contents
Scope1			Direct emission sources(sinks) in local government`s boundary
			Direct emission sources(sinks) under Local government`s operational control
	Scope 1-A	Scope 1-A-a	Having an Operational / Financial control *Environmental facility, public institute of local authority
		Scope 1-A-b	Not having an Operational / Financial control * Private facilities (Corporations. Buildings etc.)
	Scope 1-B		Direct emission sources(sinks) out of Local government`s operational control * Airport, harbor, etc (national infrastructures)
Scope2			Indirect emission sources(sinks) in local government`s boundary
			Indirect emission sources(sinks) under Local government`s operational Control
	Scope 2-A	Scope 2-A-a	Having an Operational / Financial control
		Scope 2-A-b	Not having an Operational / Financial control
	Scope 2-B		Indirect emission sources(sinks) out of Local government`s operational Control
Scope3			Emission sources(sinks) under local government`s operational control, but outside of local government`s boundary
	Scope3-A		Direct emission sources(sinks)
	Scope3-B		Indirect emission sources(sinks)

20/23

Internship program (2009.3~)

Education program : Climate Change, GHG inventories

- 68 graduates from each regional university, (2009.3.3~4.2, Seoul)


3rd Council of local authority inventory
MOE, EMC, 16 Regional Environmental Center, Internship students
(2009.6.17, Daejeon)
22/23


감사합니다

Presentation 4.2.1

Greenhouse gas Inventory Office of Japan

Session I: Review of Progress since WGIA6

Introduction

7 July 2009, Seoul, Korea
7th Workshop on GHG Inventories in Asia

Takako Ono
Greenhouse Gas Inventory Office of Japan (GIO)
National Institute for Environmental Studies (NIES)

0

Topics of Session I

- July 7th (First Half):
  - Uncertainty assessment,
  - Awareness raising for policy makers,
- July 8th (Second Half):
  - Time-series estimates in SNCs.

Objectives of the first half of this session

- **To review the following activities that have taken place since WGIA6:**
  - Countries' uncertainty assessment activities,
  - Preparation of awareness raising for policy makers,
- **To discuss how to improve and enhance these activities after WGIA7**

Outcomes from WGIA6

- Uncertainty Assessment (UA)
  - UA is important for improving accuracy and precision of GHG inventories.
- Awareness Raising
  - GHG inventories are indispensable for figuring out GHG emissions and removals.
  - It is necessary for making policy makers and stakeholders understand the importance and usefulness of the inventories.

Recommendations from WGIA6

- Uncertainty Assessment:
  - Performing UA is encouraged to the countries that have not yet performed it by WGIA7.
- Awareness Raising:
  - WGIA members and the SEA project will develop a template for communicating with policy makers, such as a summary for policy makers (SPM), and consider how to raise awareness of policy makers.

Progresses after WGIA6

- **Uncertainty Assessment:**
  - A spreadsheet for UA was distributed to participants of WGIA6.
- **Awareness Raising:**
  - The SEA project secretariat prepared a draft SPM.
  - At the SEA project meeting held in Cambodia, 6th to 9th May, participants of the meeting discussed the structure and contents of the draft SPM.
  - The SEA project secretariat revised the draft SPM and prepare the final draft.

Presentations in the first half of this session

- Uncertainty Assessment
  - Thailand, on the country's experience of UA
- Awareness Raising
  - SEA Project, on raising awareness on national GHG inventories, as a proposal for developing countries

Points of Discussion (1)

- **Uncertainty Assessment:**
  - What are the progresses on implementing UA?
  - What are major problems and solutions in implementing uncertainty assessment? Have there been any new findings?
  - Apparently the spreadsheet for UA provided through the WGIA secretariat has not been used by anyone. Any difficulty in using it? Shall we try again?
  - Are there any further discussion points on UA in the future WGIA?

Points of Discussion (2)

- **Awareness Raising:**
  - Is the information contained in the draft SPM sufficient for awareness raising?
  - Are there any points necessary to be added to or revised in the SPM?
  - Shall we produce country-specific SPMs utilizing the draft SPM for raising awareness of policy maker?

Greenhouse gas Inventory Office of Japan

Thank you
and
Let's start this session!!

Presentation 4.2.2

Thailand's Uncertainty Assessment

Savitri Garivait, *JGSEE*

WGIA 7

July 7-10, 2009
Mayfield Hotel
Seoul, Korea

1

What are we doing? How do we process? … (1)

- Conducting the GHGs emission inventory for the Second National Communication (SNC)
- Uncertainty assessment is based on a simplified method of determining data source of uncertainties.
  - Assumptions and methods
  - Input Data (Activity Data and Emission Factors)
  - Calculation errors
- Currently: uncertainty assessment for each key category included in the inventory
- Next step: uncertainty assessment for each sector and then for the entire inventory

2

What are we doing? How do we process? … (2)

- Source of data
  - National statistics agencies, international organizations publishing statistics (e.g. IEA, OECD, etc.)
  - Sectorial experts, stakeholder organizations, national experts, international experts
  - IPCC Database
  - Reference libraries (national and university libraries), scientific and technical books journals, articles in environmental books, and reports.
  - Web search for organizations & specialists
  - National Inventory Reports from Parties to the United Nations Framework Convention on Climate Change
  - Others

3

Preliminary lessons learnt … (1)

- In many cases empirical data are not available, and so need to use well-informed judgments from experts
- Possible biases: availability bias, representativeness bias, anchoring and adjustment bias, motivational bias, managerial bias…
- However, using formal expert elicitation protocols DID NOT ALWAYS solve the problem! => Solution: well-documented data in order to constrain expert judgments

4

Preliminary lessons learnt … (2)

- Example of using expert judgment for waste sector

Industrial Wastewater	Exp1	Unc. (%)	Exp2	Unc. (%)	Exp3	Unc. (%)	Exp4	Unc. (%)	Exp5	Unc. (%)	Exp6	Unc. (%)	Exp7	Unc. (%)	Exp8	Unc. (%)	Exp9	Unc. (%)	Ave MCF	SD (Unc. (%))
MCF for Anaerobic covered lagoon Technologies	0.8		0.8		0.6		0.75		0.6		0.7		0.6	50	0.8	70	1	100	**0.71**	11.51
MCF for Upflow Anaerobic Sludge Blanket (UASB) Technologies	0.9		0.8		0.6		0.85		0.8		0.85		0.8	50	0.8	80	0.9	100	**0.80**	12.48
MCF for Anaerobic Filter Technologies	0.8		0.8		0.6		0.85		0.6		0.75		0.8	50	0.8	80	0.9	100	**0.73**	12.45
MCF for Anaerobic Tank Technologies	0.8		0.8		0.5		0.7		0.6		0.7		0.7	50	0.8	80	0.9	100	**0.68**	12.41
MCF for Anaerobic Pond Technologies	0.6		0.6		0.5		0.65		0.4		0.6		0.3	50	0.3	70	0.8	100	**0.56**	11.34
MCF for Anaerobic digester Technologies	0.8		0.8		0.6		0.8		0.6		0.75		0.7	50	0.8	80	0.9	100	**0.73**	12.43
MCF for Septic Tank Technologies	0.4		0.6		0.4		0.5		0..3		0.7		0.4	50	0.5	80	0.9	100	**0.52**	13.44
MCF for Stabilization Pond Technologies	0.2		0.3		0.2		0.35		0.4		0.25		0.1	50	0.5	70	0.7	90	**0.28**	11.18
MCF for Polishing Pond Technologies	0		0.1		0		0		0.3		0.3		0	50	0.2	60	0.4	90	**0.12**	10.12
MCF for Aerated Lagoon	0		0.1		0		0		0.1		0.25		0	50	0.1	50	0.2	100	**0.08**	9.16
MCF forActivated Sludge	0		0.1		0		0		0		0.15		0	50	0	100	0.1	100	**0.04**	13.67
Oxidation Ditch Technologies	0		0.1		0		0		0.25		0.2		0.2	50	0.1	80	0.3	90	**0.09**	11.92
MCF for Constructed Wetland Technologies	0.4		0.2		0		0.1		0.25		0.2		0.1	50	0	100	0.2	90	**0.19**	13.77
MCF for Sequencing Batch Reactor (SBR) Technologies	0.1		0.3		0		0		0		0.2		0.1	50	0	80	0.1	90	**0.10**	11.89
MCF forDissolved air foatation					0		0				0.05		0	50	0	100	0	100	**0.02**	18.76
MCF forบ่อพักน้ำเสีย					0		0		0.3		0.1		0.1	50	0	80	0.4	90	**0.10**	14.54
MCF forบ่อเก็บน้ำเสีย					0.1		0.35		0.2		0.05		0.1	50	0.1	80	0.4	90	**0.18**	14.59
Domestic wastewater																				
MCF for Stabilization Pond Technologies	0.2		0.2		0		0.4		0.2		0.25		0.1	50	0.2	80	0.5	90	**0.21**	12.00
MCF for Oxidation Ditch,	0		0.1		0		0		0.1		0.2		0.1	50	0	100	0.1	90	**0.07**	13.69
MCF forAerated Lagoon	0		0.1		0		0		0.1		0.15		0	50	0	100	0.1	90	**0.06**	13.68
MCF forActivated Sludge Technologies	0		0.1		0		0		0		0.1		0	50	0	100	0	100	**0.03**	13.65
MCF for Contact Stabilization Activated Sludge (CSAS) Technologies	0		0.1		0		0		0		0.08		0	50	0	100	0	90	**0.03**	13.65
MCF for Two-Stage Activated Sludge Process Technologies	0		0.1		0				0		0.07		0..1	50	0	90	0	100	**0.03**	15.57
MCF for Combination of Fixed Activated Sludge(CFFAS) Technologies	0		0.1		0				0		0.075		0.1	50	0.1	80	0.1	90	**0.04**	13.05
MCF for Rotating Biological Contractor (RBC) Technologies	0.1		0.2		0		0.1		0.1		0.075		0.1	50	0.1	80	0.2	90	**0.10**	11.91
MCF for Constructed Wetland Technologies	0.4		0.2		0		0.1		0.2		0.15		0.2	50	0.2	80	0.2	90	**0.18**	11.97
MCF for Anaerobic filter (AF) Technologies	0.8		0.7		0.6		0.85		0.6		0.8		0.3	50	0.8	80	0.8	100	**0.73**	12.39
MCF forseptic Tank	0.4		0.6		0.5		0.5		0.4		0.85		0.4	50	0.6	80	0.8	100	**0.54**	12.28

Preliminary lessons learnt … (3)

- Even simple uncertainty estimates give useful information
- Good QA/QC and careful consideration of methods can improve representativeness of the data (reduce uncertainty)
- Assessment of uncertainty in the input parameters should be part of the standard data collection QA/QC
- For simple estimate: use of "Approach 1" is generally sufficient to get useful information for better understanding in source and sink

6

Next steps … (1)

- For uncertainty assessment of each sector and the entire inventory: use of error propagation method for combining uncertainty = choice for Tier 1
- Wherever possible Monte Carlo approach can be applied, i.e. PDF available, it will be tested and adopted if it enables a better understanding of source and sink and of the entire inventory uncertainty.

JGSEE

7

Presentation 4.2.3

Raising Awareness on National GHG Inventories in Developing Countries: A Proposal

The 7th Workshop on GHG Inventories in Asia (WGIA7)
7-10 July 2009, Seoul, Republic of Korea

Leandro Buendia
SEA GHG Project Coordinator

Outline

- What are the issues?
- What are the needs?
- What is being proposed?
- Conclusion and Recommendation

What are the issues?

- Data are not available
- High uncertainty associated with AD and EF
- Improving the quality of AD and to develop country-specific EF will require resources, strong coordination/ collaboration, research and planning
- In most cases, GHG Inventory is given low priority; less financial support; less resources!
- No permanent staff or inventory agency; no continuity
- **Consequences**: **the quality of national GHG inventory is poor and the system is not sustainable!**

What are the needs?

- Need to improve on data collection and reliability
- Need to develop country-specific EF (CSEF)
- Need to enhance support (funding, coordination) for GHG Inventory activities
- Need to have a sustainable and high quality GHG inventory
- **Challenges**: How to **increase awareness** on the importance of national GHG Inventories so that these needs can be addressed (funding, coordination and management, etc.).

What is being proposed?

- SEA GHG Project Meeting in May 2009 in Cambodia
  - Draft **Summary for Policymakers (SPM)** about the GHG Inventory Chapter of the SNC
  - **Facts**: An informed policymakers and Inventory Managers will help enhance inter-agency coordination and the needed resources.

Draft SPM Outline (Cambodia Meeting)

A. Background
B. National GHG Inventory
C. Building Sustainable National Inventory Management System
D. Conclusion and Recommendation

- **Feedback on draft SPM**: should be **clear on purpose**, **intended users**, and **contents**
- **Revise the SPM for future discussion**

Approach to SPM revision

- Points to consider in revising the SPM template:
  - What should be the purpose?
  - Who are the clienteles?
  - What format or medium?
  - What should be the structure?
  - What message to convey?

What is the purpose of SPM?

General:

- To highlight information that should be conveyed to policymakers (and GHG Inventory Managers) about the importance of GHG Inventory and the information it provides.

Specific:

- To inform policymakers of:
  - Why we do GHG Inventory?
  - the needs (gaps) for having a sustainable and high quality GHG inventory
  - the benefits of having a sustainable and high quality GHG inventory

Who are the clienteles?

General:

- **Policymakers and Inventory Managers:** To inform of the needed resources and coordination to develop a sustainable and high quality inventory

Specific:

- **Statistics Office and other relevant agencies**: To encourage to contribute in the improvement of AD quality
- **Researchers in relevant institutions and academes**: To encourage them to contribute in developing the needed country-specific EFs

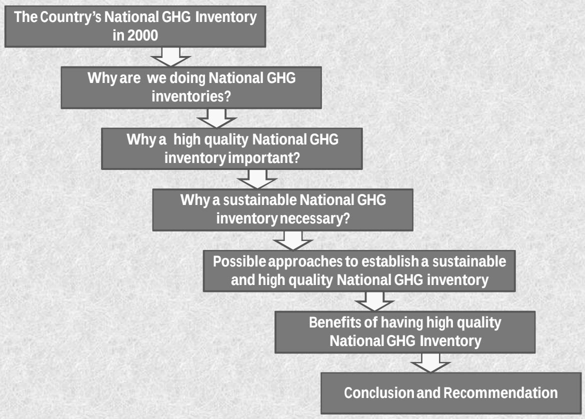
What format or medium?

- SPM should:
  - be simple, clear, concise and not overly technical
  - be no more than 2-4 pages of information
  - adapt the language to national circumstances (if possible)
- Information can be presented in several ways:
  - Using headlines with short paragraphs or bullets
  - Using key questions and answers
  - Combination of the above

What format or medium?

- The SPM template can be adapted to national circumstances by:
  - Adding information on mitigation opportunities
  - Adding information on public awareness and outreach plans
- The template can be used to complement an "agency/ministry" planning process to provide justification for a request for resources

What should be the SPM Structure?



Country X National GHG Inventory in 2000

- Total GHG emission in 2000 (use summary table and figure; by sector, by gas)
- Key sectors and sources
- Major greenhouse gases
- Trend in emissions; increase over 1994 estimate; projections

Example of Summary Tables

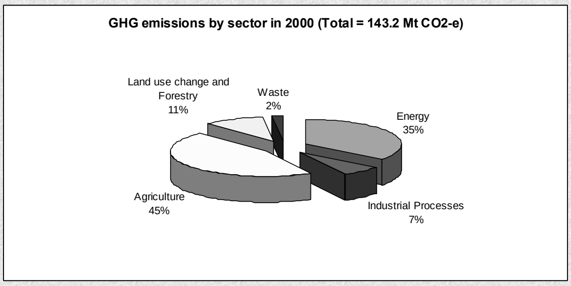
Table 1. Net GHG emissions and removals (Mt CO2-e) by sector, 1994 and 2000

Sector	1994	2000	Change (Mt CO2-e)
Energy	25.6	50.4	24.8
Industrial Processes	3.8	10.0	6.2
Agriculture	52.4	65.1	12.7
Land use change and Forestry	19.4	15.1	-4.3
Waste	2.6	2.6	0.0
Total net national emissions	**103.8**	**143.2**	**39.4**

Table 2. Net greenhouse gas emissions and changes (Mt CO2-e) by gas, 1994 and 2000

Greenhouse Gas	1994	2000	Change (Mt CO2-e)
Carbon dioxide (CO2)	40.6	68.7	28.1
Methane (CH4)	52.7	58.2	5.5
Nitrous Oxide (N2O)	10.6	16.3	5.7
Total CO2-e	**103.8**	**143.2**	**39.4**

Example of Summary Chart



Why are we doing national GHG Inventories?

- It is a component of the country's National Communication to fulfil its reporting obligation to UNFCCC
- The UNFCCC objective is to stabilise GHGs concentrations in the atmosphere at a level that would prevent dangerous human-induced interference with the climate system.
- The ability to achieve this objective is dependent on accurate knowledge of emissions and trends
- The key mechanism for reporting is the National Communication.

Why a high quality National GHG Inventory important?

- A high quality National GHG Inventory is critical to tracking GHG emissions (and removals) that contribute to climate change.
- National GHG inventory is the foundation for developing policies and measures to address climate change

Why a sustainable National GHG inventory necessary?

- It will help countries produce more accurate inventories
- It may enhance efficiency and ensure optimum use of scarce financial and human resources

Possible approaches to establish a sustainable and high quality National GHG inventory

- Important role of government in resource allocation and coordination (e.g. institutional, legal, and procedural arrangements for generating and collecting data, archiving, and reporting)
- There are available tools and techniques to assist countries such as:
  - IPCC Guidelines and Good Practice Guidance
  - Handbook on Managing National GHG Inventory Process (UNDP)
  - UNFCCC Software
  - USEPA Template Workbooks (and software) for Developing a National GHG Inventory System
- Importance of Regional Cooperation and Initiatives
  - SEA GHG Project
  - WGIA

Benefits of having high quality National GHG Inventory

- Provides information useful to economic development assessment and planning, such as information on the supply and utilization of natural resources (e.g., croplands, forests, energy resources) and information on industrial demand and production;
- Emissions trend information in combination with economic data can be used to develop emissions projections
- Provides information useful for addressing other environmental issues (e.g., air quality, land use, waste management, etc.);
- Clarifies national data gaps that, if filled, may be beneficial for other reasons (e.g., vehicle fleet data)
- Useful in evaluating GHG mitigation options and opportunities; and
- Provides the foundation for emissions trading schemes or other market-based programs.

Conclusion and Recommendation

- The government has an important role to play in building a sustainable and high quality National GHG Inventory System
- A high quality national GHG Inventory is important as a foundation for developing policies and measures to address climate change particularly on mitigation
- There are a number tools and techniques that can be used but will entail strong coordination and resources
- There are a number of other benefits that could be obtained in developing a sustainable and high quality National GHG Inventory

Thank you!

Presentation 4.2.4

Greenhouse gas Inventory Office of Japan

Session I: Review of Progress since WGIA6 (continuation)

Time Series Estimates and Projection

Introductory Presentation

8 July 2009, Seoul, Korea
7th Workshop on GHG Inventories in Asia

Kohei Sakai
Greenhouse Gas Inventory Office of Japan (GIO)
National Institute for Environmental Studies (NIES)

Background

- Under the UNFCCC, Non-Annex I Parties are not required time series estimates or projection.

However,

- Apparently, many WGIA colleagues are interested in "time series" and "projection" being taken up in WGIA.
- Some countries reported time series and/or projections of GHG emissions/removals already in their initial national communications.

Greenhouse gas Inventory Office of Japan

Background

Why?

- To analyze the impact of policies & measures on GHG emissions/removals
  - Development of time series estimates is essential.
- To formulate an appropriate mitigation plan
  - Projections of GHG emissions/removals are necessary.
- High quality time series estimates would lead to high quality projections.
  - Analysis of time series would help selection of appropriate drivers to be used for projections.

Greenhouse gas Inventory Office of Japan

WGIA6 Discussion and Results

Time series estimates and projection in WGIA6

- Participants discussed the importance and necessity of time-series estimates and projection.
- Agreed that time-series consistency and projection were important for developing an appropriate policy to reduce GHG emissions even though they were not mandates for NAI.
- Pointed out importance of documenting the data sets and methodologies used in developing time series.

Greenhouse gas Inventory Office of Japan

Presentation and hands on training

WGIA7

- Presentation for further deep discussion
  - ✓ Experiences in developing time-series estimates (data gaps encountered, methods to overcome) will be shared by:
    - Mongolia, Thailand, Indonesia
  - ✓ Projection using AIM model will be introduced by:
    - NIES AIM team
- Hands on training to make time series estimates (after Session II)
  - Techniques of how to fill in data gaps

Greenhouse gas Inventory Office of Japan

Discussion

Let's discuss and consider:

1) Costs and benefits of developing time series estimates and projection
   > Is it worth doing even after completion of SNC?
   > Is it feasible to do even after completion of SNC?

2) Actions that can/should be taken by each WGIA member country
   > For countries that have not developed time series: What is the first action that can/should be taken? What next?
   > For countries that have already developed time series: What is the further improvement actions that can/should be taken?

3) Expected WGIA activities to support each country's efforts
   > **Hands-on training** is given today.
   What else would be expected in the future?

Greenhouse gas Inventory Office of Japan

Presentation 4.2.5

The 7th Workshop on GHG Inventories in Asia (WGIA7)
7-10 July 2009,
Seoul, Republic of Korea

Review of GHG Inventory Preparation in Mongolia

Dr. DORJPUREV JARGAL
EEC Mongolia

Contents

- *Development of the National System for the GHG inventory preparation*
- *Preparation GHG Emissions for National Communications*
- *Difficulties with data gaps and uncertainty*
- *Development of time series Estimates*

Development of the National System for the GHG inventory preparation

- GHG inventory preparation is executed by Ministry of Nature, Environment and Tourism (MNET), which is responsible for climate change related issues, with the support of various related ministries as well as private sector, local communities and NGOs. The MNET is the operational focal point for multilateral environmental agreements.
- The National Climate Committee (NCC) established in 2000 is responsible to provide policy advice and guidance to the proposed project.
- A Project Management Team (PMT) and a National Study Team (NST) were reconstituted under the MNET. The NST consists of five Thematic Working Groups (TWG) including GHG Inventory and Mitigation Analysis.
- The Inventory working group is composed of a number of experts from both public and private sectors, academic institutions and NGOs.

Development of the National System for the GHG inventory preparation

- In order to prepare periodically GHG Inventories and to improve its quality, a National Manual of Procedures of preparation of GHG Inventories was developed to follow it in preparation of inventories.
- This *Manual* of Procedures of National GHG Inventory Preparation is the technical document to prepare National Greenhouse Gases Inventories for submission to the Conference of Parties to the United Nations Framework Convention on Climate Change (UNFCCC).

The main contents of the GHG Preparation manual are:

- Legal and Institutional Arrangements;
- Preparation of activity data;
- Choice of estimation methods suited to national circumstances;
- Quality assurance and quality control procedures
- Uncertainties at the source category level;
- Archiving, Reporting and Documentation.

Preparation GHG Emissions for National Communications

- The Initial National Communication included GHG emissions for the period 1990-1998 which was submitted to the COP/UNFCCC in 2001. During the calculation of GHG emissions there were difficulties with incomplete statistical information for source categories and lack of national emission factors.
- Since 2001, when INC has submitted, significant structural changes have occurred in the most important sectors of the national economy and the system of collection and processing of statistical information has been changed. Therefore, a more differentiated and detailed approach to inventory preparation was required within the framework of the SNC.
- The GHG Inventories for Second National Communication were prepared during the period of 2006-2008.
- For new inventories for SNC, it was updated all data and emission factors and recalculated GHG emissions for the period 1990-1998 and newly calculated GHG emissions for the period of 1999-2006.

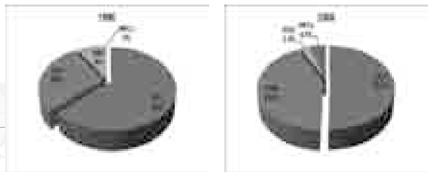
Preparation GHG Emissions for National Communications

GHG inventory preparation during the Initial and second National communications

Sectors	*Initial National Communication*	*Second National Communication*
All Sectors	- Calculation of GHG emissions for the period 1990-1998	- Recalculation of GHG emissions for the period 1990-1998 - New calculation of GHG emissions for the period 1999-2006
Energy	- CO2, CH4, N2O, NOX, CO emissions from fuel combustion by Reference Approach - Fugitive emissions from sold fuels	- CO2, CH4, N2O, NOX, CO, NMVOC and SO2 emissions from fuel combustion by Reference Approach - CO2, CH4, N2O, NOX, CO, NMVOC and SO2 emissions from fuel combustion by Sectoral Approach - Comparison of these 2 approaches - Fugitive emissions from sold fuels
Industry	- CO2 emissions from cement and lime	- Calculation of CO2 and SO2 emissions from cement and lime - NMVOC emissions from Food and drink production - Emissions from consumption of Halocarbons (HFCs)
Agriculture	- CH4 emissions from livestock - Default emission factors with some assumptions (Tier 1)	- CH4 emissions from livestock - Country specific emission factors for enteric fermentation of domestic animals (Tier 2) - CH_4, CO and NO_X emissions from the burning of agricultural residues - N2O emissions from Cultivation of soils
Land use change and forestry	- CO2 emissions from Changes in Forest and Other Woody Biomass Stocks - CO2 emissions from Forest and Grassland Conversion - CO2 removals from Abandonment of Managed Lands	- CO2 emissions from Changes in Forest and Other Woody Biomass Stocks - CO2 emissions from Forest and Grassland Conversion - CO2 removals from Abandonment of Managed Lands
Waste	- CH4 emissions from Solid Waste Disposal on Land	- CH4 emissions from Solid Waste Disposal on Land - CH4 emissions from Wastewater treatment - Country specific emission coefficients

Preparation GHG Emissions for National Communications

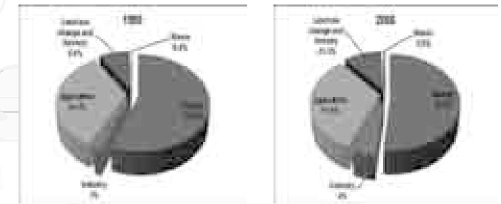
GHG Emissions in CO_2-eq by gases for the period 1990-2006



Carbon dioxide is the most important greenhouse gas in Mongolia's inventory with a share of 50.4 % of the total CO2-eq emissions in 2006 followed by methane, which comprises 41.8%. The remaining gases (N2O, HFCs) make up 7.8% of Mongolia's GHG Emissions.

Preparation GHG Emissions for National Communications

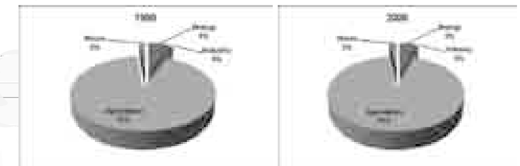
Contribution to total CO_2-eq emissions by sector for 1990 and 2006



In 2006, the energy sector (including stationary energy, transport and fugitive emissions) was the largest source of greenhouse gas emissions comprising 65.4% of total GHG emissions in CO2-equivalent. The second largest source of GHG emissions was agriculture sector (41.4%). For Land use change and forestry sector, the total CO2 removals were 13.3% due to increase of the area of abandoned lands and reduce of newly cultivated land. Other relatively minor sources currently include emissions from industrial process and waste sector.

Preparation GHG Emissions for National Communications

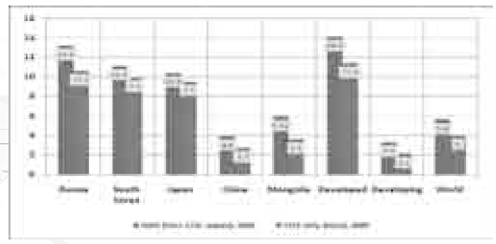
Contribution to methane emissions by sector for 1990 and 2006



The main contributor to the total methane emissions is the agriculture sector with about 92- 93% of the total methane emissions The second biggest contribution comes from the energy sector with about 5-6%, while all other sectors are contributing with less then 2% in total.

Preparation GHG Emissions for National Communications

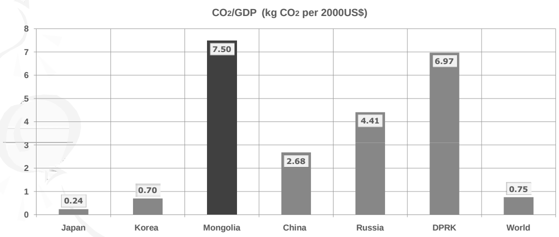
Per Capita Emissions



If compare with the other developed and developing countries, the total GHG emissions is small, but per capita and per GDP emissions is high. Mongolia's per capita emissions were 6.0 tons /person, which is almost 2 times more than developing countries average.

Preparation GHG Emissions for National Communications

CO2 Emissions per GDP



Per GDP CO_2 emissions are 10 times more than world average

Difficulties with data gaps and uncertainties

The Mongolian Greenhouse Gas (GHG) Inventory follows the methodologies recommended by the IPCC (IPCC, 1996).

The main obstacle was the lack of reliable data for the calculations. It was possible to obtain officially data from Statistical Yearbooks only general activity data, such as fuel and energy consumption and production, main industrial outputs, domestic animal population, area of cultivated land, etc.

Other required data could be found from different kind of courses. In some cases same data from different sources is different. In most cases, specialized data such as emission factors and country-specific emission data of gases have not been worked out for Mongolia. Therefore, the IPCC recommended default values were typically used in the GHG Inventory calculations.

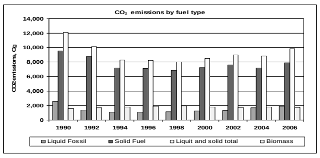
Difficulties with data gaps and uncertainties

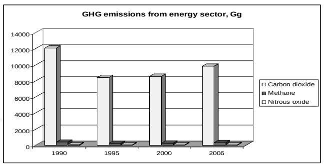
But the last GHG Inventory includes following improvements in order to reduce uncertainty.

- For energy sector, GHG emissions from fuel combustion were calculated using 2 approaches- Reference and Sectoral and made comparison analysis.
- For Agriculture sector, the GHG Inventory team is developed country specific emission factors for enteric fermentation of domestic animals. Methane emission from enteric fermentation of livestock depends on livestock type, its weight, productivity and quality of forage. However, most Mongolian livestock is an indigenous breed of animals, grazing trough out the year on natural pastures, with low productivity and small size compared to other breeds of animals in the world. Livestock stay in the pasture whole year and obtain forages from pasture where its quality varies season to season. Actually, cold season in Mongolia continues 7 to 8 months. Also there are no other countries similar to Mongolian nomadic husbandry are available. Therefore emission factors for enteric fermentation have been developed for Mongolian specific conditions using Tier 2 by working group on GHG Inventory.

Development of time series Estimates

Greenhouse gas emissions from Energy sector

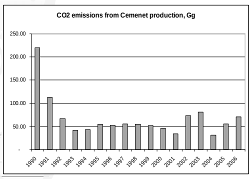


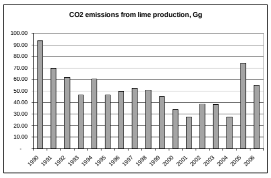


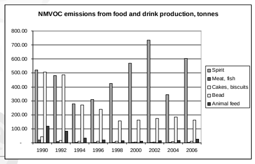
The decrease of Carbon dioxide emissions from fuel combustion between 1990 and 1995 is mostly due to socio-economic slowdown during the period of economic transition.

Development of time series Estimates

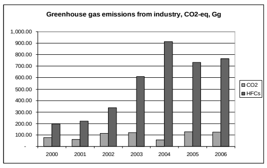
Greenhouse gas emissions from Industry







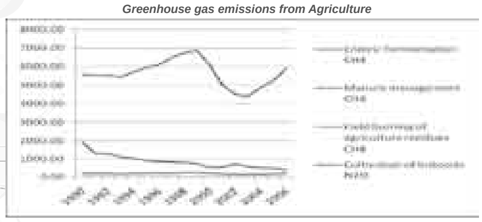
Non-Methane Volatile Organic Compounds (NMVOCs)



Fluorinated hydrocarbons (HFCs)

Development of time series Estimates

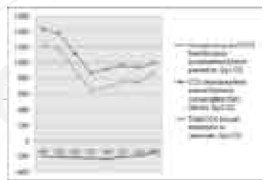
Greenhouse gas emissions from Agriculture

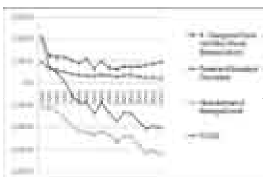


The most methane emissions for agriculture are from enteric fermentation of animals . The changes of methane emissions from enteric fermentation depend on livestock population

Development of time series Estimates

Greenhouse gas emissions from Land use Change and forestry

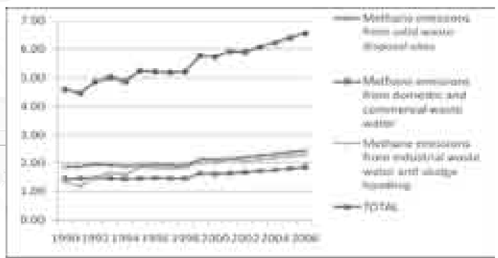


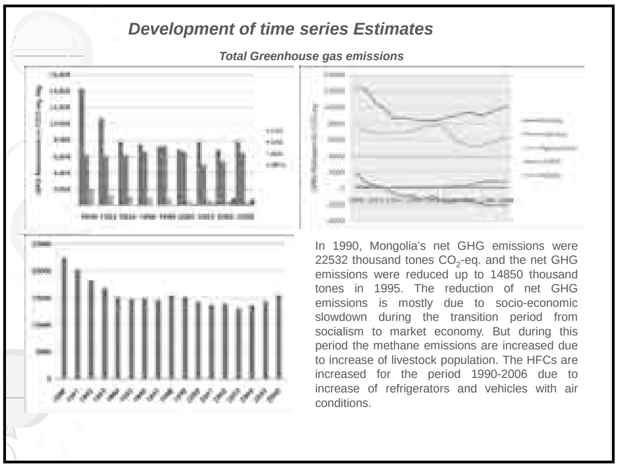


For land use change and forestry sector, CO2 removals were increased due to increase of the area of abandoned lands and reduce of newly cultivated land.

Development of time series Estimates

Greenhouse gas emissions from Waste




Development of time series Estimates
Total Greenhouse gas emissions
In 1990, Mongolia's net GHG emissions were 22532 thousand tones CO_2-eq. and the net GHG emissions were reduced up to 14850 thousand tones in 1995. The reduction of net GHG emissions is mostly due to socio-economic slowdown during the transition period from socialism to market economy. But during this period the methane emissions are increased due to increase of livestock population. The HFCs are increased for the period 1990-2006 due to increase of refrigerators and vehicles with air conditions.


Thank you for attention

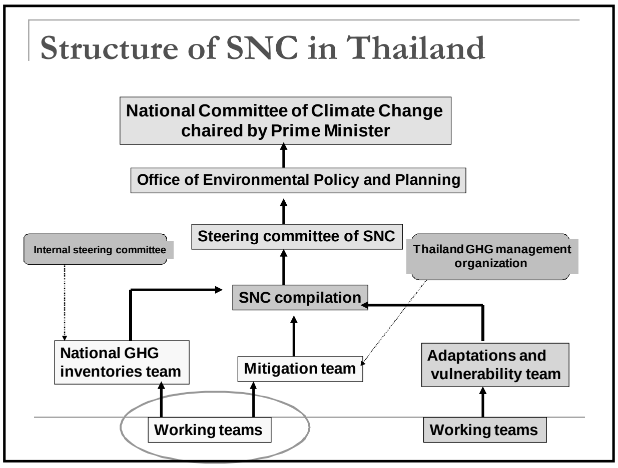
Presentation 4.2.6

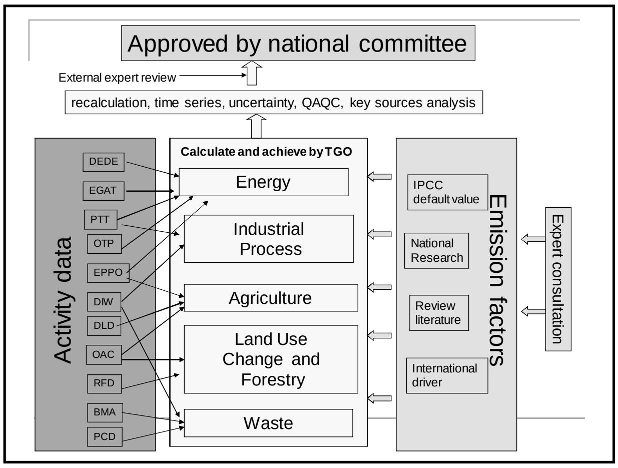
JGSEE

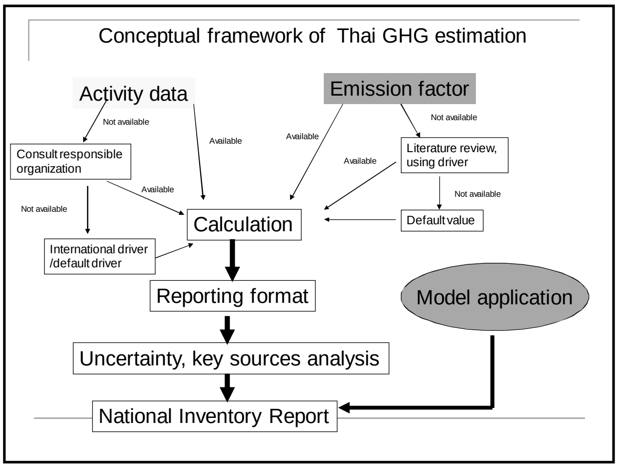
Time series estimates made for Thailand's GHG inventory included in the SNC

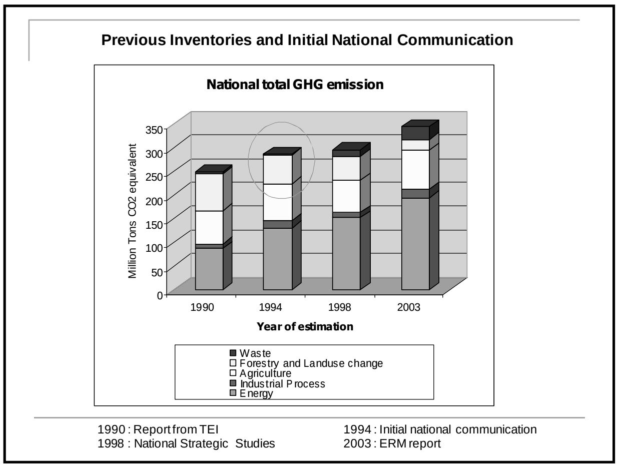
S. Towprayoon, A. Chidthaisong, S. Garivait, S. Pathumsawas, C Sorapipat, S. Jiarakorn, A. Nopparat, C Chiemchaisri, and A. Phongphiphat

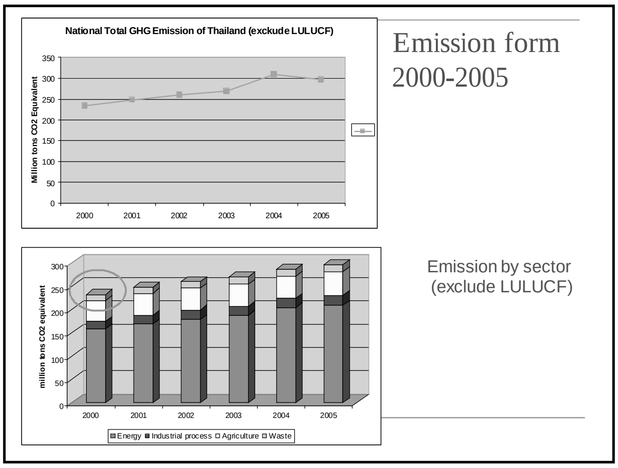
Present in 7th WGIA in Seoul 7-9 July 2009

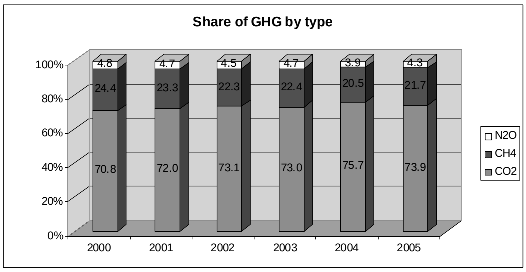




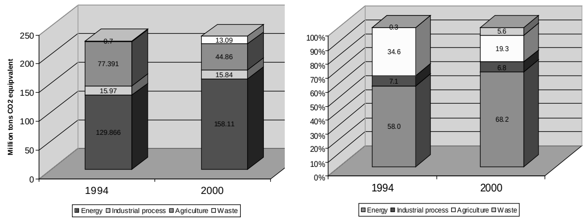




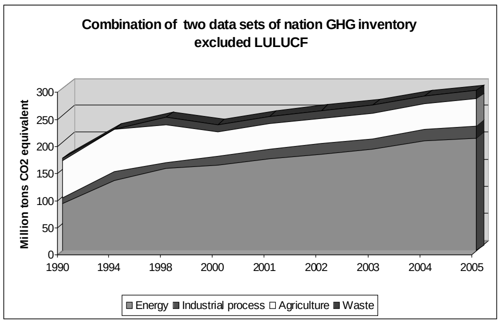




Comparison of 1994 and 2000



Emission form 1990-2005



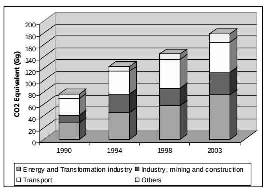
Problems in estimation: activity data

- Agriculture sector : rice field
- Agricultural sector : livestock – change in dataset
- Waste sector : domestic wastewater-population
- Waste sector : Industrial wastewater- detail of amount of effluent
- LULUCF : information of forest area

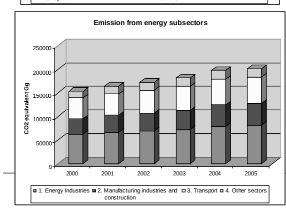
Subsector with good reliable data

- Energy sector : energy industry, energy manufacturing and transportation
- Agricultural sector : rice field

Emission from energy categories

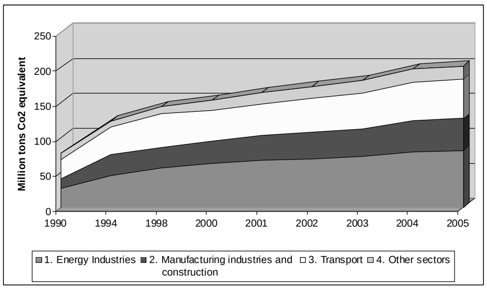


1990 : Report from TEI
1994 : Initial national communication
1998 : National Strategic Studies
2003 : ERM report

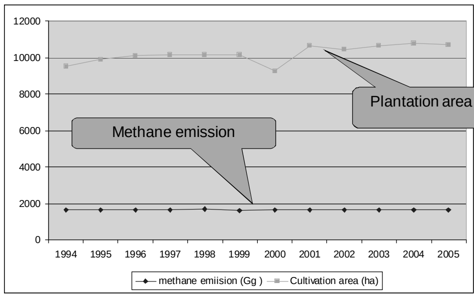


SNC estimation

Combination of the two data sets of inventory (1990,1994,1998 and 2000-2005)



Emission from rice field and plantation area



Subsector encounter inconsistency of data collection

- Waste Sector: Industrial waste water
- Waste Sector : Domestic wastewater
- LULUCF

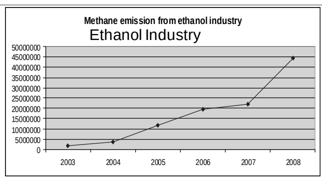
Example from industrial wastewater

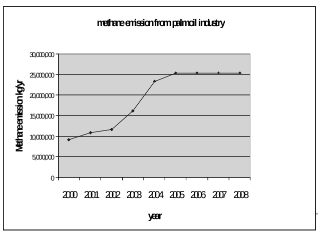
Literature data

In country expert judgment

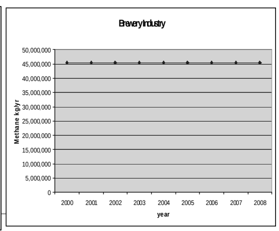
Number	Year	Name of factory	Treatment	FLOW(m3/day	COD(mg/l)	TOW(kgCOD/yr)	B0(kgCH4/kg	MCF	EF(kg CH4/kgCOD)	CH4 emission(kg/yr)
1	2003	บริษัท ไทยอะโกร เอ็	An.Digester+AL	1200	90000	39420000	0.25	0.8	0.2	7884000
2	2003	บริษัท เริ่มอุดม เอท	Anae F & Sta P	2800	85000	86870000	0.25	0.9	0.225	19545750
3	2004	บริษัท ไทยง้วน เอท	Anae	1200	85000	37230000	0.25	0.9	0.225	8376750
4	2005	บริษัท พรวิไล อินเต	Sta Pond	1200	85000	37230000	0.25	0.2	0.05	1861500
5	2005	บริษัท เพโทกรีน	Sta Pond	1200	80000	35040000	0.25	0.2	0.05	1752000
6	2006	ขอนแก่นเอทานอล	Sta Pond	300	85000	9307500	0.25	0.2	0.05	465375
7	2007	บริษัท ที พี เค เอทา	Sta Pond	1200	85000	37230000	0.25	0.2	0.05	1861500
8	2007	บริษัท เคไอ เอทานอ	Sta Pond	500	85000	15512500	0.25	0.2	0.05	775625
9	2008	บริษัท ไทยแอลกอฮ	Sta Pond	1200	85000	37230000	0.25	0.2	0.05	1861500

Complete literature data of ethanol factory with AD was in 2008
9 factories were account for emission in 2008



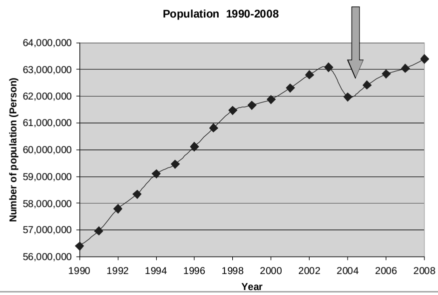


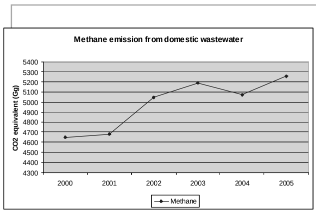
Palm Oil Industry



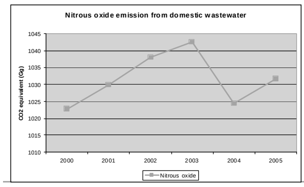
Brewery Industry

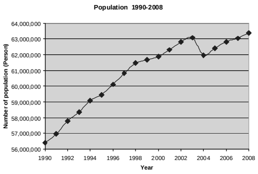
Domestic wastewater : data collection system change

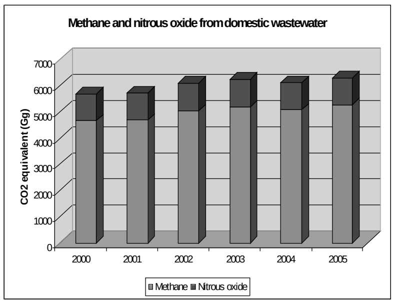




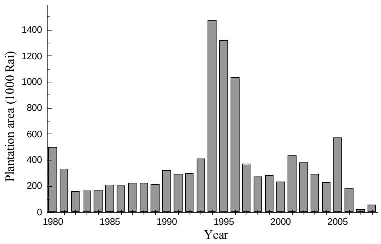
Effect of data collection system change







Problems in LULUCF



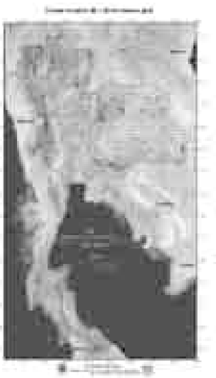
Plantation area from 1980-2007
data collected from three sources from Gov. department

ที่มา: 1) สำนักจัดการและฟื้นฟูพื้นที่อนุรักษ์ และสำนักอนุรักษ์และจัดการต้นน้ำ กรมอุทยานแห่งชาติ สัตว์ป่าและพันธุ์พืช (พ.ศ. 2523 - 2551), 2) ส่วนปลูกป่าภาครัฐ สำนักส่งเสริมการปลูกป่า กรมป่าไม้ (พ. ศ. 2536 - 2545) และ 3) สำนักอนุรักษ์ทรัพยากรป่าชายเลน กรมทรัพยากรทางชายฝั่ง (พ. ศ. 2546 - 2551**)**

Plantation Area from

- Plantation area from private sector was available only in 2000, 2004 and 2005. They are Eucalyptus and legume sp (Krathin thepa)
- Interpolation was done with simple calculation
- The nature of plantation for private sector is that there is a cycle of planting and cutting if looking through the area records. We thus estimate the area of plantation (mostly Eucalyptus) from the trends (slope estimate from regression).
- Degraded forest area change due to deforestation was also do the similar ways
- Regenerated forest, since only two data points are available (year 2000 and 2005), we just averaged this into change per year, and added it up the number into the missing years between 2000-2005.
- Area in 2001 = area in 2000+that average value,
- and area in 2002 = area in 2001+ the sameaverage value, and so on.

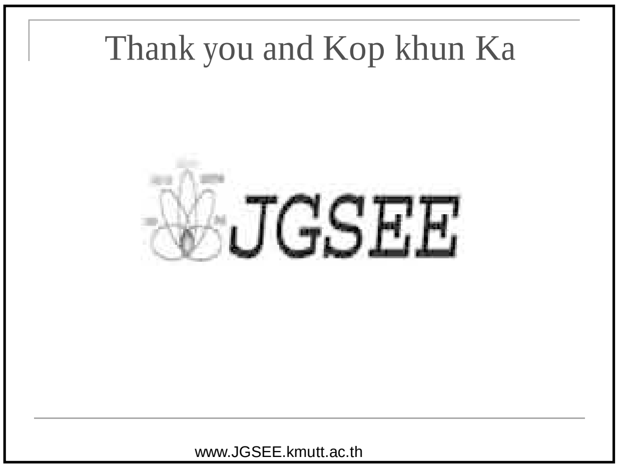
LULUCF : Data set change



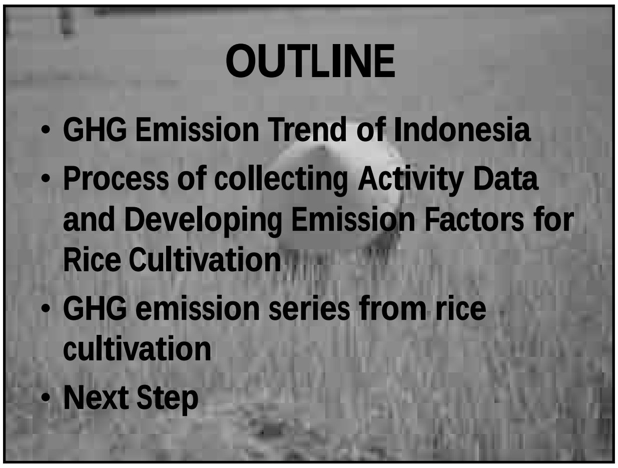
- Since 2005 Department of Natural Park. Wild life and Plant Conservation with International Tropical Timber Organization (ITTO) had set up the project of sampling design, plot establishment and estimation methods for national forest resources monitoring information sytem
- The project used Landsat TM and GIS data at 20x20 km with 425 sampling plot cover major plants in the forest of Thailand
- Project finish in 2007 and hope to be the good data source for LULUCF sector in Thailand
- Higher tier in LULUCF can also be possible.

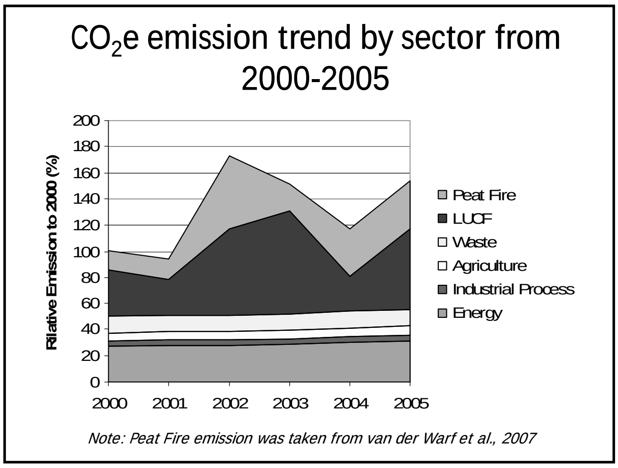
Problems encounter

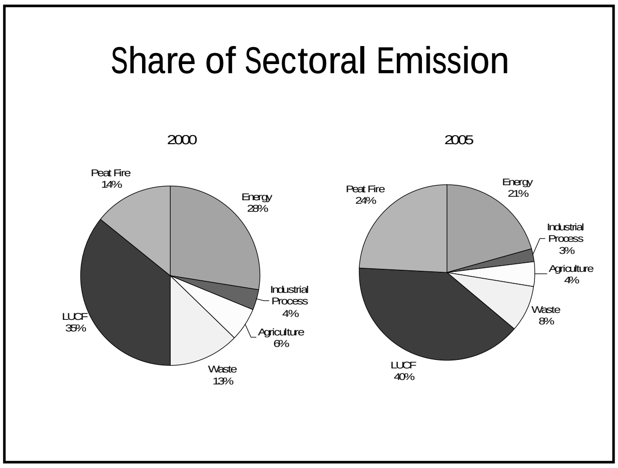
- Data missing
- Different data set
- New data set

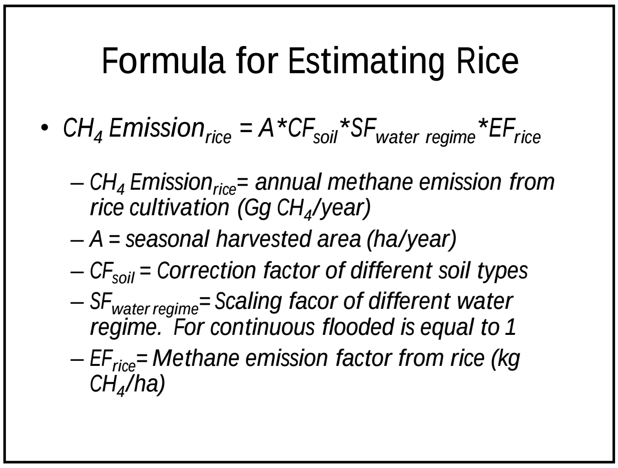

Thank you and Kop khun Ka
JGSEE
www.JGSEE.kmutt.ac.th

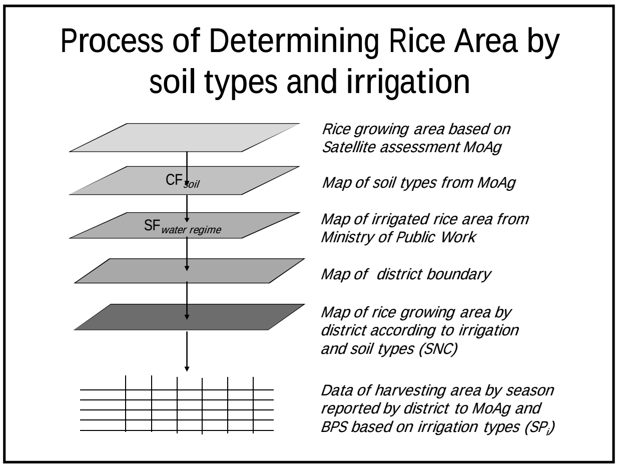
Presentation 4.2.7



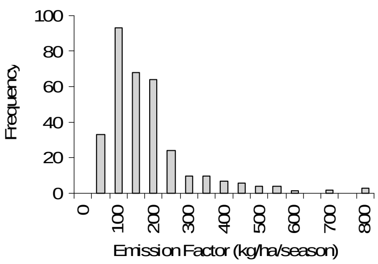






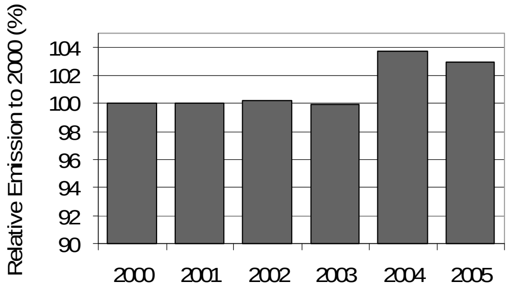


Rice Emission Factors



- Average of emission factor is 169.9 kg/ha/season based on 349 field experiments conducted in 10 different soil types and 3 different water management using 22 rice varieties (all in Java)

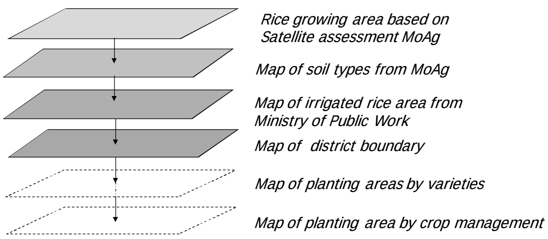
Emission Series from Rice



There is no much increase in CH_4 emission from rice cultivation

Next Step

- *Developing new scaling factor for variety (SF_v) and crop management (SF_{cm})*
- *CH_4 $Emission_{rice}$ = A*CFsoil*SFwr*SF_v*SF_{cm}*EF*



This approach can assist the sector to evaluate the effectiveness of mitigation technologies intervention by district

Presentation 4.2.8

Projection of GHG emissions

Make the inventory and AIM models will give the future pathways

Shuichi Ashina
National Institute for Environmental Studies

The 7th Workshop on GHG Inventories in Asia (WGIA7)
7-10 July 2009, Seoul, Republic of Korea

Agenda

1. Overview of AIM Project: *Who am I?*
2. Two approaches for Projection: *Top-down and Bottom-up*
3. Lead the way by setting an inventory: *Why is the WGIA important?*
4. Examples of Projection by using AIM/ESS: *How do we project?*
5. Make a step forward: *What's next?*

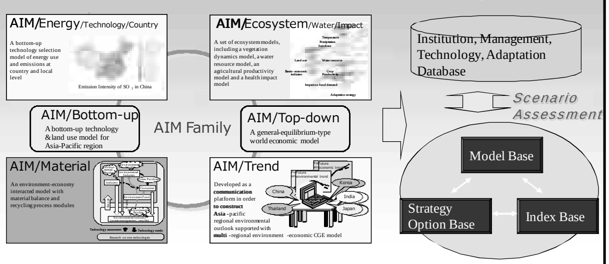
2

INTRODUCTION OF AIM

3

Overview of AIM Project (1/2)
AIM is Integrated Assessment Model

AIM: Asia-Pacific Integrated Model

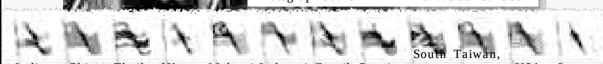


AIM Website: http://www-iam.nies.go.jp/aim/

4

Overview of AIM Project (2/2)
AIM is Team!

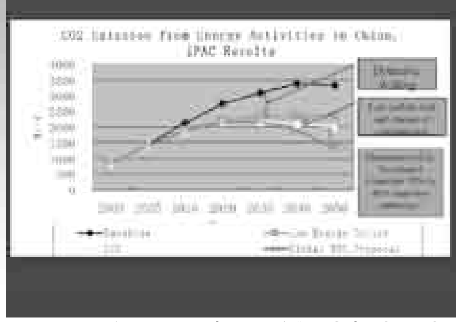
Photograph at the 14th AIM Int'l WS at Tsukuba



AIM Website: http://www-iam.nies.go.jp/aim/

5

AIM activities with Asian friends(1/3): CO_2 emission projection in China



Dr. Jiang Kejun (Energy Research Institute). "Low Carbon Society Scenario up to 2050 for China", The 14th AIM International WS, Tsukuba.

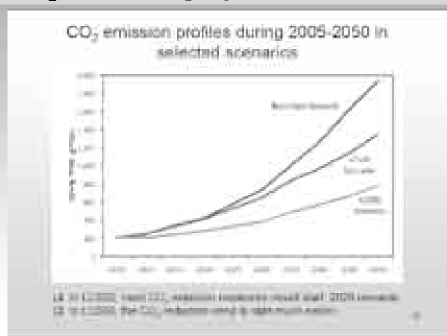
6

AIM activities with Asian friends (2/3): CO_2 emission projection in India

Prof. P.R. Shukla (Indian Institute of Management). "Low Carbon Scenarios for India", The 14th AIM International WS, Tsukuba.

7

AIM activities with Asian friends (3/3): CO_2 emission projection in Thailand



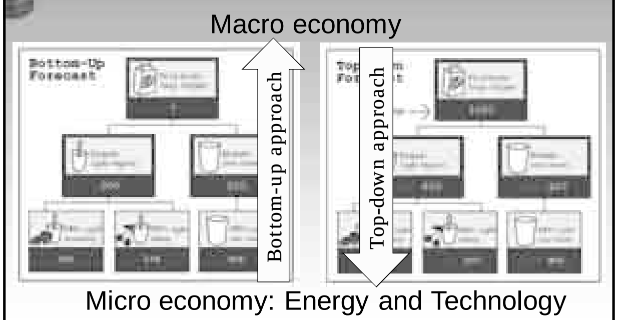
Prof. Ram M. Shrestha and Shreekar Pradhan (Asian Institute of Technology). "Low Carbon Scenarios: Case of Thailand", The 14th AIM International WS, Tsukuba.

8

WAY TO PROJECTION OF GHG EMISSIONS

9

Two approaches for Projection: Top-down and bottom-up



Source: http://www.demandplanning.net/forecast_reconciliation.htm

10

Comprehensive comparison of Top-down and Bottom-up approach

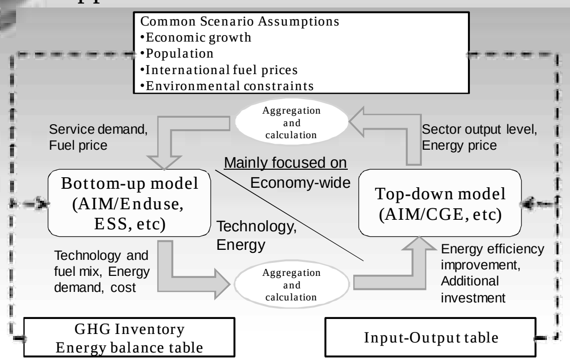
- Top-down approach
  - Computational General Equilibrium model of macro-economic relations inside a country and with other countries
  - Models in this type emphasize economy-wide
- Bottom-up approach
  - technology-rich description of energy system, options and costs (partial equilibria)
  - feature sectoral and technological details

⇨ This is just *"DICHOTOMY"* of the approaches!

There are a lot of Hybrid models which combines the two approach through coupling: part of the CGE economy is described by a bottom up model.

11

Overview of relationship between two approaches



Source: Based on Xu, Y., Jiang, K. and Masui, T. (2007). "CGE Linkage with AIM/Enduse: Assessing Energy Intensity Reduction Target in China", 13th AIM Int'l WS, Tsukuba.

12

AIM models for projection of GHG emissions from Top-down approach

AIM/CGE model:

- General Equilibrium model
- Draws the balanced macro economy, based on social conditions such as population, technology and preference, countermeasures
- Programming language: GAMS (The General Algebraic Modeling System)
- Skills required: Macroeconomics (esp. IO analysis), Mathematics (esp. partial differentiation)

13

AIM models for projection of GHG emissions from Bottom-up approach

AIM/Enduse model:

- Partial equilibrium model on energy
- Assess individual technologies under the detail technology selection framework
- Programming language: GAMS (The General Algebraic Modeling System)
- Skills required: Microeconomics, Mathematics (esp. Linear Optimization theory), and Energy and System Engineering.

AIM/Energy Snapshot Tool (ESS):

- Snapshot-type tool at a certain point (non-optimization)
- Assess energy balance and GHG emissions among sectors simultaneously
- Programming language: MS Excel (purely spreadsheet-based tool)
- Skills required: Basics of Energy Balance Table

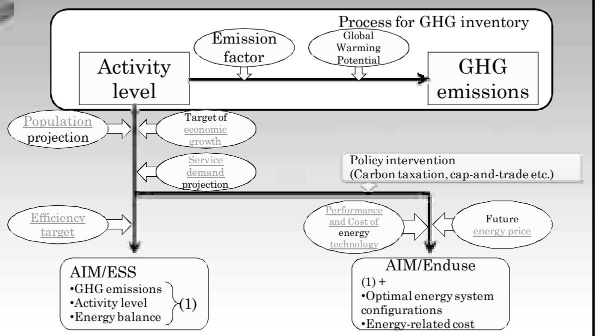
14

As the information, so the projection

	Top-down	Bottom-up
Activity information from Inventory		✓
Input-Output table of economy	✓	
Socio-economic assumptions		
Population projection	✓	✓
Economic growth	✓	✓
International Fuel Price	✓	✓
Performance and cost of Technology	✓	✓
Environmental constraint	✓	✓

15

Flow from Inventory to Projection with bottom-up models



Inventory data is one of important basis of bottom-up analysis!

16

Example (1/2): CO_2 emissions from fossil fuel burning

- CO_2 emissions are derived from energy consumption and emission factors.

CO_2 emissions [tCO_2] =
Energy consumption [MJ]
x Emission factor [tCO_2/MJ]
x Global Warming Potential (1)

Rearrangement of data as tabular form

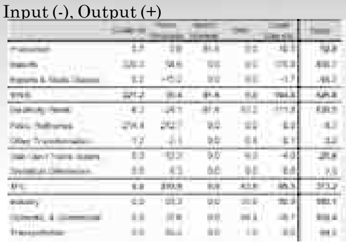
⇨ **Energy Balance Table!**

Projection by AIM/ESS is available

17

Supplement: What is Energy Balance Table (EBT)?

- Simple Table Format
- Illustrate general energy flow (production to end-use) of a region
- Flow (in row), Product in column)
  - Input (-), Output (+)



18

Example (2/2): Non-CO_2 emissions

- Non-CO_2 emissions are derived from activity level, emission factors and GWP.

GHG emissions [tCO_2] =
Activity level [MJ, t, ha, etc]
x Emission factor [[t/MJ, t/ha, etc]
x Global Warming Potential [tCO_2/t]

Rearrangement of data as tabular form

⇒ Non-CO_2 Balance Table

Projection by AIM/ESS is also available

19

EXAMPLE OF CO_2 PROJECTION IN JAPAN BY AIM/ESS

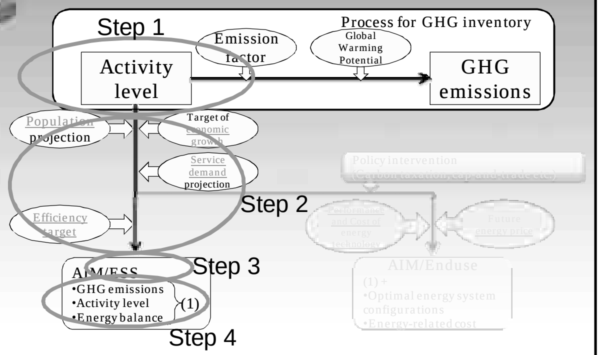
20

Four steps towards emission projection by AIM/ESS

1. Preparations of Energy Balance table in Japan
2. Setting future socio-economic conditions
3. Projection by AIM/ESS
4. Analyzing results

21

Four steps towards emission projection by AIM/ESS



22

Step 1: Preparation of Energy Balance Table

Source: Comprehensive Energy Statistics by METI (2007)

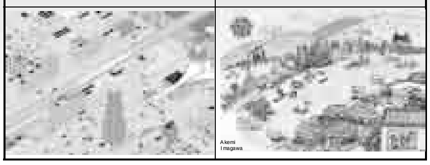
The Energy Balance table is also used for National GHGs Inventory Report of JAPAN

23

Step 2: Setting future socio-economic conditions (1/2)

- Target Yr: 2050

Vision A	Vision B
Vivid, Technology-driven	Slow, Natural-oriented
Urban/Personal	Decentralized/Community
Technology breakthrough Centralized production /recycle	Self-sufficient Produce locally, consume locally
Comfortable and Convenient	Social and Cultural Values
2%/yr GDP per capita growth	1%/yr GDP per capita growth



http://2050.nies.go.jp

24

Step 2: Setting future socio-economic conditions (2/2)

year	unit	2000	2050 A	2050 B
Population	Mil.	127	94(74%)	100(79%)
Household	Mil.	47	43(92%)	42(90%)
Average number of person per household		2.7	2.2	2.4
GDP	Tril.JPY	519	1,080(208%)	701(135%)
Share of production				
primary	%	2%	1%	2%
secondary	%	28%	18%	20%
tertiary	%	71%	80%	79%
Office floor space	Mil.m^2	1654	1,934(117%)	1,718(104%)
Travel Passenger volume	bill. p·km	1,297	1045(81%)	963(74%)
Private car	%	53%	32%	51%
Public transport	%	34%	52%	38%
Walk/bycycle	%	7%	7%	8%
Freight transport volume	bill. t·km	570	608(107%)	490(86%)
Industrial production index		100	126(126%)	90(90%)
Steel production	Mil.t	107	67(63%)	58(54%)
Etylen production	Mil.t	8	5(60%)	3(40%)
Cement production	Mil.t	82	51(62%)	47(57%)
Paper production	Mil.t	32	18(57%)	26(81%)

http://2050.nies.go.jp

25

Step 3: Projection by AIM/ESS (1/3)

Screenshot of AIM/ESS

26

Step 3: Projection by AIM/ESS (2/3)
Changes in energy demands in the residential sector

2000

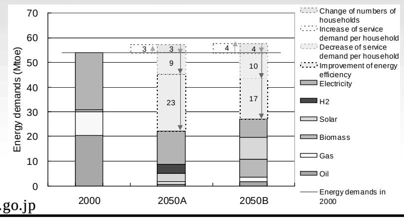
		COL	OIL	GAS	BMS	S/W	Heat	H2	ELE	Total
Cool	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2
Warm	Mtoe	0.0	10.9	2.8	0.0	0.0	0.0	0.0	1.2	14.9
Hot Water	Mtoe	0.0	8.4	5.0	0.0	0.8	0.0	0.0	1.0	15.2
Cooking (S)	Mtoe	0.0	1.2	1.6	0.0	0.0	0.0	0.0	0.0	2.8
Cooking (E)	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8
Lighting	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	3.4
Refrigerator	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	3.6
TV	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	2.1
Appliance	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.9	9.9
	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Generation	Mtoe									0.0
Cogeneration	Mtoe									0.0
	Mtoe									0.0
Total	Mtoe	0	21	9	0	1	0	0	23	54

2050 A (CM)

		COL	OIL	GAS	BMS	S/W	Heat	H2	ELE	Total
Cool	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5
Warm	Mtoe	0.0	0.5	0.5	0.0	0.0	0.9	0.0	0.9	2.8
Hot Water	Mtoe	0.0	0.3	0.3	0.0	0.6	0.6	0.0	0.7	2.4
Cooking (S)	Mtoe	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.7	0.8
Cooking (E)	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8
Lighting	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	1.9
Refrigerator	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	2.2
TV	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.5
Appliance	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0	9.0
	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Generation	Mtoe					7.6			-2.9	4.7
Cogeneration	Mtoe						-1.5	3.6	-1.6	0.5
	Mtoe									0.0
Total	Mtoe	0	1	1	0	8	0	4	14	27

2050 B (CM)

		COL	OIL	GAS	BMS	S/W	Heat	H2	ELE	Total
Cool	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3
Warm	Mtoe	0.0	0.5	0.5	4.5	0.0	0.0	0.0	0.4	5.9
Hot Water	Mtoe	0.0	1.0	1.0	2.0	2.9	0.0	0.0	0.5	7.3
Cooking (S)	Mtoe	0.0	0.3	0.4	0.7	0.0	0.0	0.0	0.4	1.8
Cooking (E)	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6
Lighting	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.3
Refrigerator	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	2.2
TV	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Appliance	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	6.5
	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Generation	Mtoe					15.5			-5.9	9.6
Cogeneration	Mtoe						0.0	0.0	0.0	0.0
	Mtoe									0.0
Total	Mtoe	0	2	2	7	18	0	0	7	37



http://2050.nies.go.jp

27

Step 3: Projection by AIM/ESS (3/3)
Future energy balance table and CO_2 emissions

Future energy balance table and CO_2 emissions

	COL	OIL	GAS	BMS	NUC	HYD	S/W	Heat	H2	ELE	Total
Energy Balances											
Power Gnr.	15	0	41	0	92	8	1			-66	90
CCS										3	3
Heat											0
Coal/Oil/Gas		2									2
Hydrogen			12				13		-14		11
Industrial	23	39	45	5			0	0	0	29	140
Residential	0	1	1	0			8	0	4	14	27
Commercial	0	1	1	0			3	0	5	18	28
Trans. Prv.	0	4	0	2			0	0	3	2	11
Trans. Frg.	0	3	0	9			0	0	3	1	17
Enduse	23	48	47	16			11	0	14	64	223
Total	38	50	100	16	92	8	25	0	0	-0	330
Feedstock in total		14									
Emission Factor (MtC/Mtoe)	1.05	0.80	0.55	0.00	0.00	0.00	0.00	(0.00)	(0.47)	(0.00)	
CO2 Gnr. (MtC)	40	29	55	0	0	0	0	-	-	-	124
CO2 CCS (MtC)	-16		-23					-	-	-	-39
											0
											0
CO2 Ems. (MtC)	24	28.6	33	0	0	0	0	-	-	-	85

http://2050.nies.go.jp

28

Step 4: Analyzing results (1/2)
Factor analysis of CO_2 reduction by Kaya-identity

$$C = D \times \frac{E}{D} \times \frac{C'}{E} \times \frac{C}{C'} \quad \text{(Extended Kaya-identity)}$$

$$\frac{\Delta C}{C} = \frac{\Delta D}{D} + \frac{\Delta(E/D)}{(E/D)} + \frac{\Delta(C'/E)}{(C'/E)} + \frac{\Delta(C/C')}{(C/C')} + \text{Cross term}$$

D: Driving forces (service demand)

E: Energy Consumption

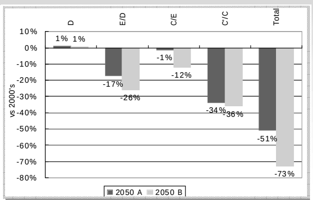
C': CO_2 emission without measures in transformation ector

C: CO_2 emission with measures in transformation sector

E/D: Energy Intensity

C'/E: CO_2 intensity in end-use sector (without measures in transformation sector)

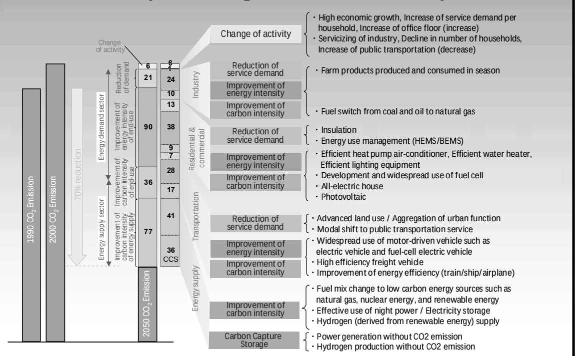
C/C': Change of CO_2 intensity by measures in transformation sector



http://2050.nies.go.jp

29

Step 4: Analyzing results (2/2)
Factor analysis of CO_2 reduction: Summary



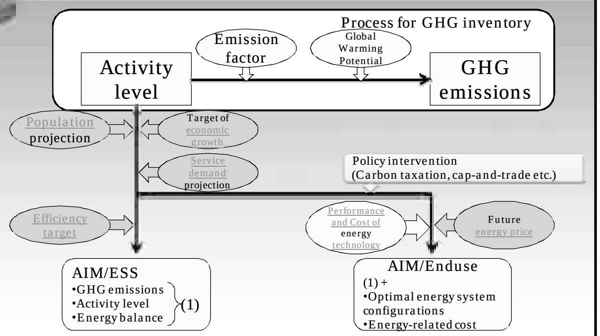
http://2050.nies.go.jp

30

FOR MORE DETAILED AND ROBUST PROJECTION

31

Model evaluation of Socio-economic conditions



32

Nine national/regional scale models for projecting energy services, energy consumption, their management etc. (*Element models*)

1. **AIM/Enduse[country]:** National level bottom-up engineering type model for energy supply/consumption
2. **Macro-economy model (EME):** Supply-side type mid-term econometric model
3. **Population/Household dynamics model (PHM):** to describe each country's demographic dynamics
4. **House and building dynamics model (BDM):** to describe transition and renovation dynamics towards modern and highly insulated buildings.
5. **Traffic demand model (TDM):** to describe passenger and freight transports coupled with economic activity and urban structure
6. **Material stocks and flow model (MSFM):** to describe material metabolism towards sustainable material societies
7. **Energy supply model (ESM):** to describe scenarios of renewables energy supply, power infrastructure development
8. **Household production and lifestyle model (HPLM):** to describe the transition of household consumption, lifestyle etc.
9. **AIM/Enduse[air]:** an atmospheric environment model to estimate co-benefits caused by environmental carbon policies.

33

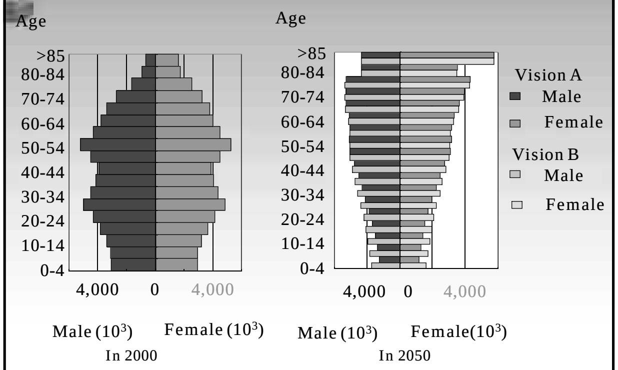
Population and Household Model

- A cohort component model for population, a household headship rate model for household types, with spatial resolution of provinces, land-use types and climate zones and five family types
- Analyzing effects of depopulation and changes in family composition on the future population projection.

Input	Output
Nation's and Province-wise: Base year's population Expected life table Expected fertility rate Expected migration rate Information on land-use types and climatic zones by province-wise resolution	Nation's and Province-wise: Future population by age and sex Number of households by family type Population and Households by climatic zone and land-use classification

2009/02/13 Japan (S.Ashina/NIES) 34

Demographic composition in Japan



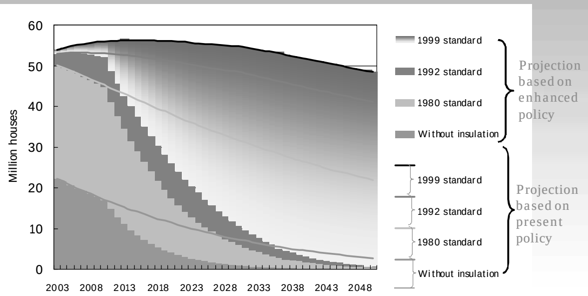
Building Dynamics Model

- A cohort model with a spatial resolution of climate zones, four heat insulation levels, four residential building types, and six commercial building types.

Input	Output
Dwelling stock in the base year Residual ratio Number of households Regional/Building type distribution of new dwellings Retrofit of existing dwelling stock Average floor space of new dwellings	Number and the floor space of future dwelling stock by Region Building type Construction period

2009/02/13 Japan (S.Ashina/NIES) 36

Projection of residential building stock by insulation level



2009/02/13 Comprehensive LCS Modeling and its Application to Japan (S.Ashina/NIES) 37

Passenger Transportation Demand Model

- Simulates transportation demand associated with changes in population distribution, social environment, personal activity patterns, modal share, and average trip distance.
- Based on the transportation model developed by Japan's Ministry of Land Infrastructure and Transport (MLIT).

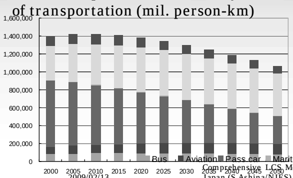
Input		Output
License holding ratio Trip generation coefficient Modal share Average trip distance Net total conversion ratio	⇨	Net transportation demand Total passenger transportation demand

2009/02/13 Comprehensive LCS Modeling and its Application to Japan (S.Ashina/NIES) 38

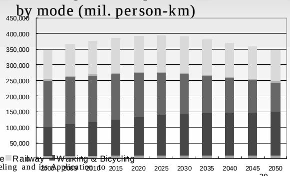
Passenger Transportation Demand Model: Application to Japan

Indices	Example of element
Personal attribute	Several groups depending on age, sex, employment, etc.
Day	Weekday, holiday
Land area	Urban, mountainous, agricultural, etc.
Mode	Car, bus, railway, aviation, maritime, walking & bicycling, etc.
Objective	Work, school, return, business, private & shopping, etc.
Simulation time	Every 5 years between 2000 and 2050

Total transportation demand by mode of transportation (mil. person-km)



Inter-region transportation demand by mode (mil. person-km)



2009/02/13 Comprehensive LCS Modeling and its Application to Japan (S.Ashina/NIES) 39

THANK YOU FOR YOUR ATTENTION!

ashina.shuichi@nies.go.jp

FURTHER INFORMATION

AIM Website:

http://www-iam.nies.go.jp/aim/

LCS Project Website:

http://2050.nies.go.jp/

40

Presentation 4.2.9

Time Series Consistency

7th Workshop on GHG Inventories in Asia (WGIA7), 7-10 July 2009, Seoul

Simon Eggleston, Head, Technical Support Unit,
Task Force on National Greenhouse Gas Inventories

ipcc INTERGOVERNMENTAL PANEL ON climate change

Time Series

- We need to know, not just the emissions/removals now but how they are changing.
  - (e.g. Kyoto targets are % changes)
- An Inventory is not just an estimate of a single year. It needs estimates for a number of years.
  - Ideally this is built up a year at a time
- How do we know the year-on-year changes are accurate?
  - Same methods used for all years, if possible
  - Methods should reflect drivers of change
  - Estimates for previous years may have been made in earlier years
    - Are these comparable?
  - Continuity needed
    - in methods and in inventory capacity

Time Series Consistency

- The general principal is to always calculate the emission/removal using the same method and data sources
- If a new inventory improves or changes a method then earlier years should be recalculated using the same method
  - Thus a new inventory may report a different emission/removal for an earlier year then an earlier inventory
- The new method may not be applicable for earlier years (e.g. lack of data)
  - But all the annual estimates should be comparable
  - Time series consistency guidance helps ensure this

Objectives

"As inventory methods improve and more relevant data become available, it is **good practice to apply this new information if it improves the reliability and accuracy of the inventory**"

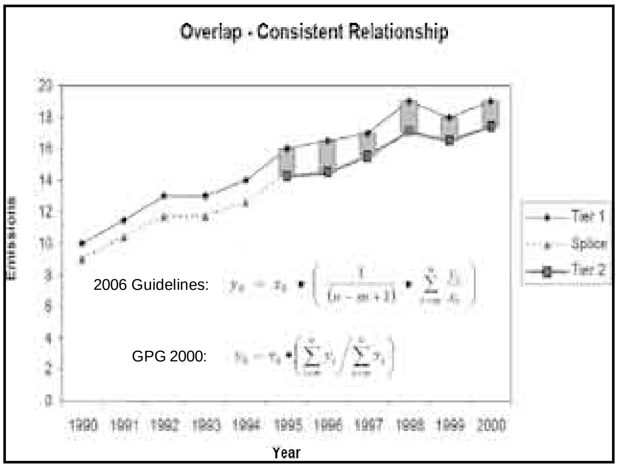
"It is good practice to recalculate historic emissions when methods are **changed** or **refined**, when new source categories are **included** in the national inventory, when **errors** in the estimates are identified and corrected."

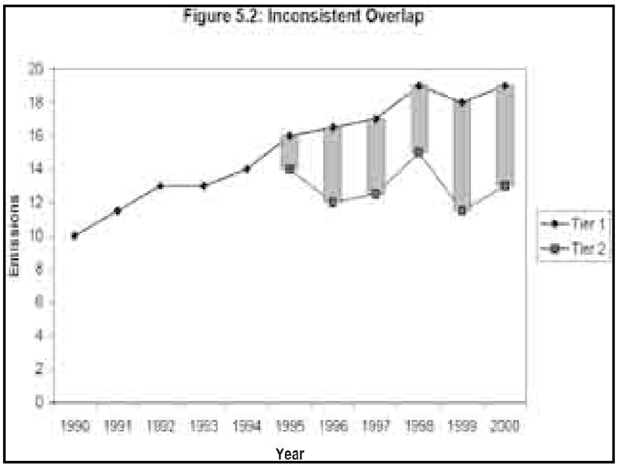
What to do?

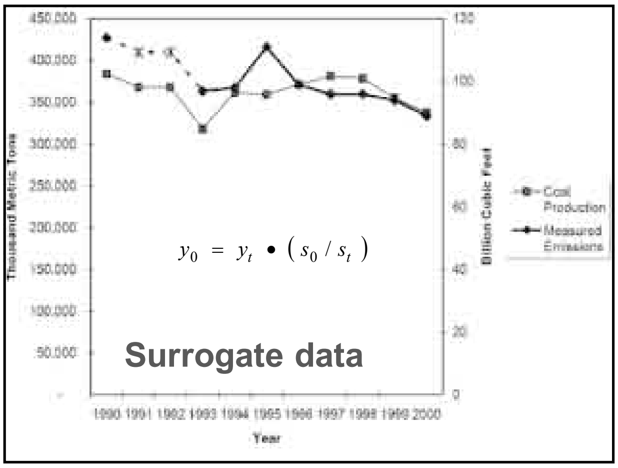
- Previous estimates should be recalculated using the new methods for all years in the time series.
- If it is not possible to use the same methods in all years, the GPGs and 2006 GLs give a number of techniques to ensure times series consistency
  - Splice
  - Surrogate
  - Interpolation/Extrapolation

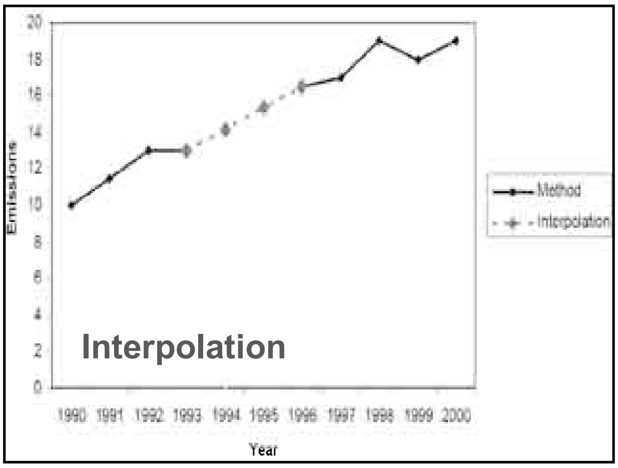
Periodic Data – Some Considerations

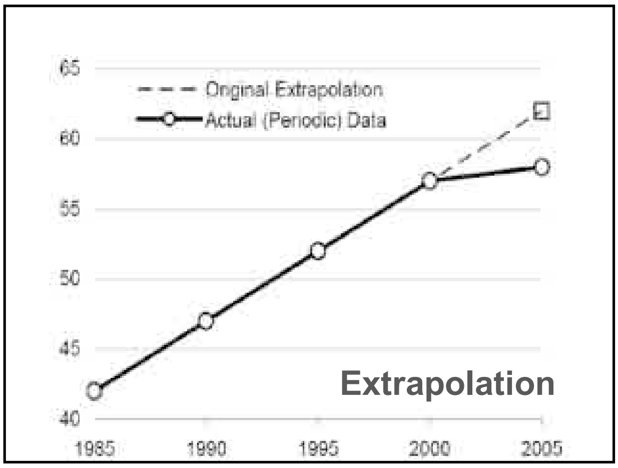
- When data is not available annually,
  - Estimates need to be updated each time new data become available
  - Before new data are available, new estimates should be extrapolated based on available data, and then recalculated when new data become available.
  - Alternative datasets that can be a proxy for missing data can be used for extrapolating the trend
- Extrapolate data not emissions



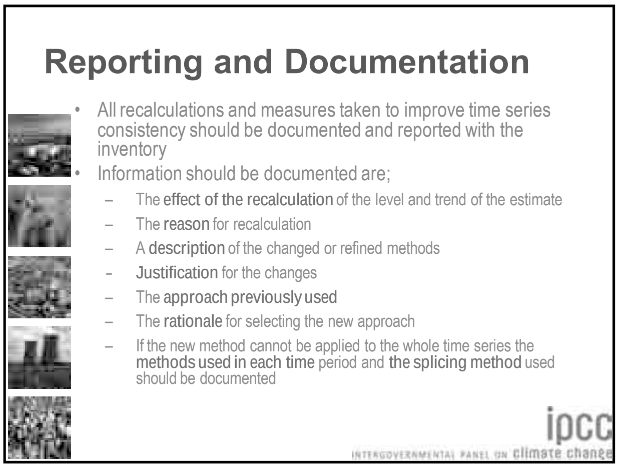


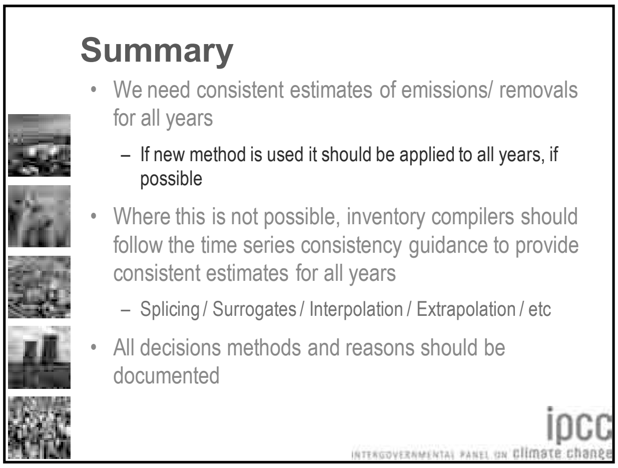






Approach	Applicability	Comments
Overlap	Data necessary to apply both the previously used and the new method must be available for at least one year, preferably more.	• Most reliable when the overlap between two or more sets of annual estimates can be assessed. • If the trends observed using the previously used and new methods are inconsistent, this approach is not *good practice*.
Surrogate Data	Emission factors, activity data or other estimation parameters used in the new method are strongly correlated with other well-known and more readily available indicative data.	• Multiple indicative data sets (singly or in combination) should be tested in order to determine the most strongly correlated. • Should not be done for long periods.
Interpolation	Data needed for recalculation using the new method are available for intermittent years during the time series.	• Estimates can be linearly interpolated for the periods when the new method cannot be applied. • The method is not applicable in the case of large annual fluctuations.
Trend Extrapolation	Data for the new method are not collected annually and are not available at the beginning or the end of the time series.	• Most reliable if the trend over time is constant. • Should not be used if the trend is changing (in this case, the surrogate method may be more appropriate). • Should not be done for long periods.
Other Techniques	The standard alternatives are not valid when technical conditions are changing throughout the time series (e.g., due to the introduction of mitigation technology).	• Document customised approaches thoroughly. • Compare results with standard techniques.


Reporting and Documentation
• All recalculations and measures taken to improve time series consistency should be documented and reported with the inventory
• Information should be documented are;
– The effect of the recalculation of the level and trend of the estimate
– The reason for recalculation
– A description of the changed or refined methods
– Justification for the changes
– The approach previously used
– The rationale for selecting the new approach
– If the new method cannot be applied to the whole time series the methods used in each time period and the splicing method used should be documented
ipcc
INTERGOVERNMENTAL PANEL ON climate change


Summary
• We need consistent estimates of emissions/ removals for all years
– If new method is used it should be applied to all years, if possible
• Where this is not possible, inventory compilers should follow the time series consistency guidance to provide consistent estimates for all years
– Splicing / Surrogates / Interpolation / Extrapolation / etc
• All decisions methods and reasons should be documented
ipcc
INTERGOVERNMENTAL PANEL ON climate change

Presentation 4.3.1

Greenhouse gas Inventory Office of Japan

Session II: Plan for Future Activities beyond SNC

"INC" for Myanmar
"TNC" for Korea

Guidance

8 July 2009, Seoul, Republic of Korea
7th Workshop on GHG Inventories in Asia

Kiyoto Tanabe
Greenhouse Gas Inventory Office of Japan (GIO)
National Institute for Environmental Studies (NIES)

Where are we?

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
						WGIA1						WGIA7				
Cambodia					INC							SNC				
China							INC								SNC	
India							INC							SNC		
Indonesia		INC										SNC				
Lao P.D.R.			INC											SNC		
Malaysia			INC									SNC				
Mongolia				INC								SNC				
Myanmar													INC			
Philippines			INC									SNC				
Republic of Korea	INC					SNC						TNC				
Thailand			INC									SNC				
Vietnam						INC						SNC				

[Based on information provided in FCCC/SBI/2008/INF.10, etc]

Greenhouse gas Inventory Office of Japan

We enter a transition period…

- WGIA has been aiming at contributing to development of GHG inventories for the post-2003/04 national communications (NCs).
- The latest NCs are being completed soon by WGIA countries – by 2012 at the latest.
- When will the next NCs need to be prepared?
  - No decision. Unlikely to be required very soon.
- Shall we just enjoy a good rest until the development of next NCs starts?

Greenhouse gas Inventory Office of Japan

Objective of this session

- Continuous efforts towards improvement need to be made. It will help:
  - ✓ maintain institutional memory and capacity
  - ✓ eventually enable you to produce a higher-quality GHG inventory for the next NCs in an efficient way.
- This session aims at discussing on possible plans for activities in the future, particularly after completion of the latest NCs, by their own countries as well as by WGIA, taking the "Kobe Initiative" into account.

Greenhouse gas Inventory Office of Japan

Topic 1: Ongoing activities

- Some ongoing activities may constitute a basis for, or serve as a good precedent for, future work by WGIA & its member countries.
  - Materials being prepared by WGIA secretariat
    - ✓ WGIA-EFDB (emission factor database)
    - ✓ Roster of experts in WGIA countries
    - → Presentation will be made by GIO.
  - Collaboration of sectoral experts among countries
    - ✓ Improvement of solid waste management and reduction of GHG emissions in Asia (SWGA)
    - → Presentation will be made by Dr. Masato Yamada.

Greenhouse gas Inventory Office of Japan

Topic 2: Improvement of data collection

- "Lack of data" – this has been one of the most common and fundamental problems. It needs to be resolved in time for the next NCs.
- We may be able to find a breakthrough by making use of the following.
  - 2006 IPCC Guidelines
    - ✓ Some new guidance available, e.g. on data collection
    - → Presentation will be made by Dr. Simon Eggleston.
  - Statistical capacity building under UN Framework for Development of Environment Statistics
    - → Presentation will be made by GIO.

Greenhouse gas Inventory Office of Japan

Topic 3: New cooperative actions

- Following the conclusions of WGIA6, new cooperative activities among WGIA countries (bilateral or multilateral) should be considered. Some projects have been already initiated.
  - ◆"JICA Project" on climate change
    - → Presentation will be made by Mr. Kazuya Suzuki.
  - ◆Group QA or cross-checking of inventories between countries as informal process
    - ✓ Mutual study of GHG inventories between Korea and Japan has been provisionally initiated.
    - → Presentation will be made by Dr. Byong-bok Jin.

Greenhouse gas Inventory Office of Japan

Let's discuss and consider together:

- What kind of (new) activities will be useful after completion of the latest NCs;
- How we will realize them;
- How the WGIA can support each country's activities; and
- What we should do by WGIA8.

Now, let's start this session!!

Greenhouse gas Inventory Office of Japan

Presentation 4.3.2

Greenhouse gas Inventory Office of Japan

On-going WGIA Activities

Junko Akagi
WGIA Secretariat
Greenhouse Gas Inventory Office of Japan (GIO)
akagi.junko@nies.go.jp

The 7th Workshop on GHG Inventories in Asia (WGIA7)
Seoul, Republic of Korea
7-10 July 2009

WGIA - What for?

Prime Objective of WGIA

Supporting countries in Asia to improve the quality of their GHG inventories through regional information exchange

Advantages of Information Exchange

- Learn good practices to improve inventory quality in a cost effective way (e.g., Share of EFs)
- Learn good mitigation and adaptation practices, which can be applicable to other countries

Greenhouse gas Inventory Office of Japan

Information Exchange - How?

- ☐ **Annual Workshop**
- ☐ **On-line Communication**

Greenhouse gas Inventory Office of Japan

Annual Workshop

Advantages

- Face-to-face communication
- Getting to know colleagues in Asia

Facilitated discussion!

Things to be considered…

- Continuation (human resources)
- Style
  - annual, biennial, …?
  - theme (sector) specific workshop?

If you have any suggestions, please share them with us!

Greenhouse gas Inventory Office of Japan

On-line Communication

Advantages

- Possible at anytime
- Cost effective

Info. exchange anytime you like!

How can we make it possible?

- Exchanging e-mails
  - General (to all)
  - Specific topics (to a specific expert)
- Uploading information on a Website

Tools are needed!

Greenhouse gas Inventory Office of Japan

Available Tools

- ☐ **Already there**
  - WGIA Mailing List
  - WGIA Website
- ☐ **New!**
  - WGIA-Emission Factor Database
  - WGIA-Roster of Regional Experts

Greenhouse gas Inventory Office of Japan

WGIA Mailing List

E-mail address: wgia@nies.go.jp

Members: WGIA participants (about 80 people)

This Mailing List can be used for …

- exchanging relevant information
- online discussion

Please feel free to share any GHG inventory related information with WGIA members with this mailing list.

Greenhouse gas Inventory Office of Japan

WGIA Website

Address:

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

Information of past WGIAs (1st – 6th) :

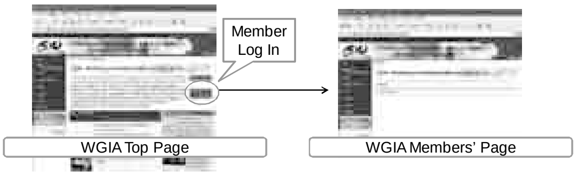
1. Workshop Proceedings
2. Workshop agendas and presentation materials
3. "Greenhouse Gas Inventory Development in Asia - Experiences from Workshops on Greenhouse Gas Inventories in Asia -" Report

Greenhouse gas Inventory Office of Japan

WGIA Website – New Aspect

WGIA Members' Page

ID and PW will be distributed in due course.



Documents listed: (as of July 1)

- WGIA-Roster of Regional Experts
- WGIA-EFDB
- Documents from the SEA GHG Project

※Special Thanks to Ms. Makiko Yamada

Greenhouse gas Inventory Office of Japan

WGIA-Emission Factor Database

WGIA-EFDB – New!

Country-Specific EFs provided by WGIA countries

- Please no IPCC default values, no direct emission data!

Countries, which have contributed :
Cambodia, China, India, Indonesia, Korea, Lao P.D.R., Malaysia, Mongolia, Thailand, Vietnam (10 countries)
- Please provide us background information on the CS-EFs!

Publication lists:
India, Malaysia, Thailand (3 countries)

This BD is now in the WGIA Members' Page

Greenhouse gas Inventory Office of Japan

WGIA-Emission Factor Database

Status as of July 1

Total: 244
Energy: 46 / IP: 7 / Agr: 44 / LULUCF: 77 / Waste: 70

		Energy	IP	Agr.	LUCF	Waste	Total	Default	Other
1	Cambodia			2	12	1	15	113	
2	China						0		9
3	India	11	7	20			38		
4	Indonesia			1			1	29	
5	Japan						0		
6	Rep. of Korea	23					23		
7	Lao PDR						0		14
8	Malaysia				49	7	56	50	
9	Mongolia			2			2		
10	Myanmar						0		
11	Philippines						0		
12	Singapore						0		
13	Thailand	12		10	12	60	94		
14	Vietnam			9	4	2	15	80	

Roster of Regional Experts in Asia

Roster of Regional Experts – New!

Information on inventory experts in WGIA countries

Countries, which have contributed :
Cambodia, Indonesia, Japan, Malaysia, Mongolia, Myanmar, Thailand, Vietnam (8 countries)

In addition, the following experts are listed in this Roster:

- Participants of WGIA7
- Participants of WGIA 1-6 (only Japanese experts)
- Participants of SEA Meeting (8 countries, status of 2009 May)

After the WGIA7, we are going to contact each one of you, who is currently listed in the Roster, as we would like to have your permission.

Greenhouse gas Inventory Office of Japan

Roster of Regional Experts in Asia

Status as of July 1

Total: 118
Note: One expert may be in charge of more than 1 sector.

		Energy	IP	Agr.	LUCF	Waste	Other	Total
1	Cambodia	3	-	2	3	2	4	13
2	China					2		2
3	India						1	1
4	Indonesia	2	2	4	2	2	1	9
5	Japan	11	8	11	9	8	3	35
6	Republic of Korea							
7	Lao PDR			1	1		3	5
8	Malaysia	3	3	1	3	2	1	10
9	Mongolia	2	1	-	-	1	1	3
10	Myanmar	1	1	2	3	1	1	9
11	Philippines	-	-	-	-	-	5	5
12	Singapore						1	1
13	Thailand	2	1	4	1	2	3	11
14	Vietnam	4	-	2	1	1	6	14

Cooperative Actions

Enhancement of cooperative actions was recommended at the previous WGIAs.

Other Projects

Good example of regional experts' cooperative action!

- Improvement of Solid Waste Management and Reduction of GHG Emission in Asia (SWGA)
- Regional Capacity Building Project for Sustainable National GHG Inventory Management Systems in Southeast Asia (SEA GHG Project)
- Livestock Emissions and Abatement Research Network Initiative (LEARN Initiative)

Greenhouse gas Inventory Office of Japan

Future Plans

- Improvement of the WGIA-EFDB' quality
- Improvement of the WGIA-Roster's quality
- Identifying Regionally-Significant Source/Sink Categories in Asia based on the WGIA countries' SNC Inventory data (2011～)
- Writing up a 2nd WGIA Activity Report (2011～)

- If you have any suggestions, please let us know!

Greenhouse gas Inventory Office of Japan

Summary

- We, the WGIA Secretariat, hope:
  - to use these tools more actively
  - to communicate with experts more freely
  - to share more CS-EFs (as new ones are developed)
  - to share your ideas to be discussed with WGIA members
  - to learn from you how we can make WGIA more meaningful for all of us
- We are willing to support any of your activities which can possibly result in improving your country's GHG inventory. Therefore, please feel free to contact us whenever you need any support from us!

Greenhouse gas Inventory Office of Japan

Thank you

WGIA: http://www-gio.nies.go.jp/wwd/wgia/wgiaindex-e.html
GIO Website: http://www-gio.nies.go.jp/index.html
NIR of Japan: http://www-gio.nies.go.jp/aboutghg/nir/nir-e.html

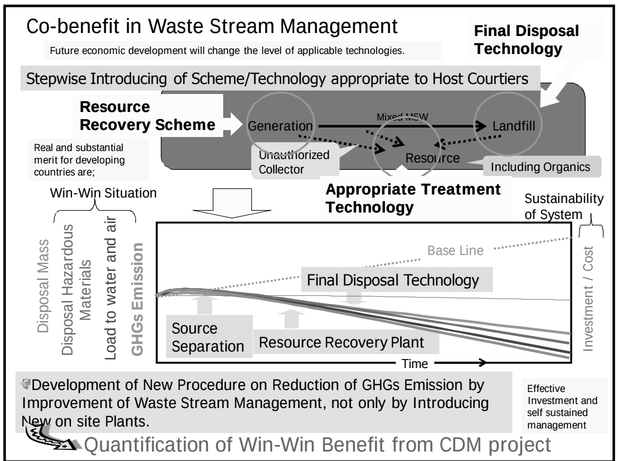
Presentation 4.3.3

Workshop on
"Improvement of solid waste management and reduction of GHG emissions in Asia (SWGA)"

Masato YAMADA, NIES, Japan

Objective

- To understand the effect of the improvement of waste management system on GHGs emission
- To discuss issues on sustainability on waste management
  - To share a common understanding of the current situation of waste management in Asian region
  - To improve the GHGs emission inventory for the waste sector
  - To draw the roadmap to both of the improvement of waste management and GHGs reduction



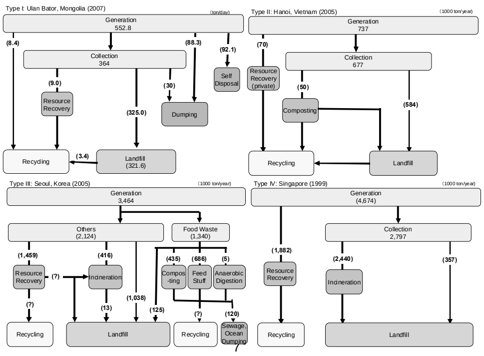
Participants

- **Vietnam**: Prof. Cao The Ha (Vietnam National Univ.)
- **Korea**: Prof. Lee, Dong-Hoon (The Univ. of Seoul)
- **China**: Prof. Wang Qi (CRAES), Dr. Huang Zechun (CRAES), Dr. Quan Hao (SJC), Dr. Wen Xuefng (SJC)
- **Thailand**：Prof. Sirintornthep TOWPRAYOON (KMUTT), Prof. Chart Chiemchaisri (Kasetsart Univ.)
- **Mongolia**：Dr. Bulgamaa Densambuu（Agricultural Univ. in Darkhan）：
- **Indonesia**：Ms. Upik S Aslia Kamil (MOE)
- **Malaysia**: Ms. Ellyza Mastura Aahmad Hanipiah (National Solid Waste Management Dept.)

Discussion

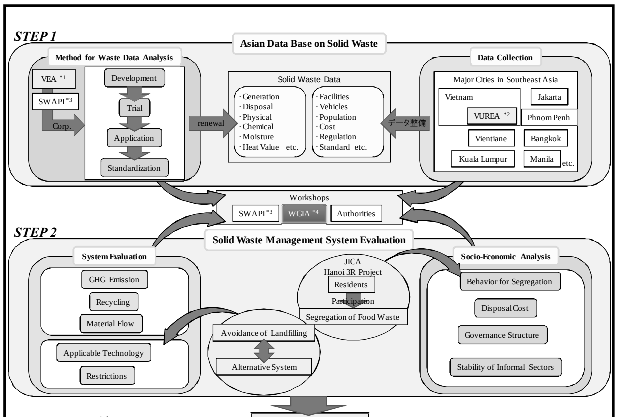
- **About Status of Waste Management in Asia**
  - Overall, waste is increasing in many countries, except BKK where waste decreased
  - Big cities vs. Other areas
    - Generation, composition, management of waste
  - Different status of waste management
    - Countries try to improve situations (e.g., New facilities in Beijing; Separation in Hanoi), but not so easy
    - 3R, materializing, etc. have considerable rooms for improvement
  - Open dumping, improper landfills
  - Waste pickers or recyclers as part of waste stream
  - CDM projects: a large number in China, a few in others (yet to be registered)
  - How to measure the amount of waste?
    - Not all types of waste is covered (e.g., informal collection not included).

Solid Waste Stream in Asia



Discussion

- **How to make reliable waste data?**
  - Procedure/ Manual/ Standard Methodology
  - Statistical reliability/ Accuracy: Money +time consuming
  - Not Best but Better Std Method (tolerable)
  - Optimize/ adjust to IPCC data platform
  - Difficulties on k-value (Asian country-specific)
    - Categorize technology on parameter
  - National base material flow analysis (MFA)



*1 Vietnam Environment Administration
*2 Vietnam Urban Environment Association
*3 Society of Solid Waste Management Experts in Asia and Pacific Islands
*4 Workshops on Greenhouse Gas (GHG) Inventories in Asia Region

Hanoi City

Respondent：Hanoi Urban Environment Limited Company (URENCO)
Population under Waste Collection：3,289,300 (Coverage 100%)

Year: 2007 **year**

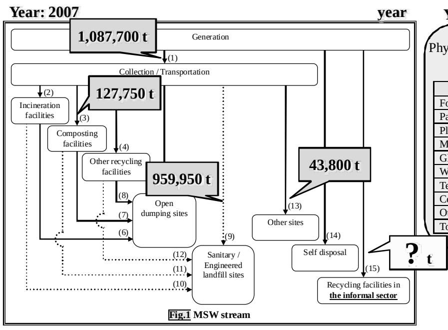


Fig.1 MSW stream

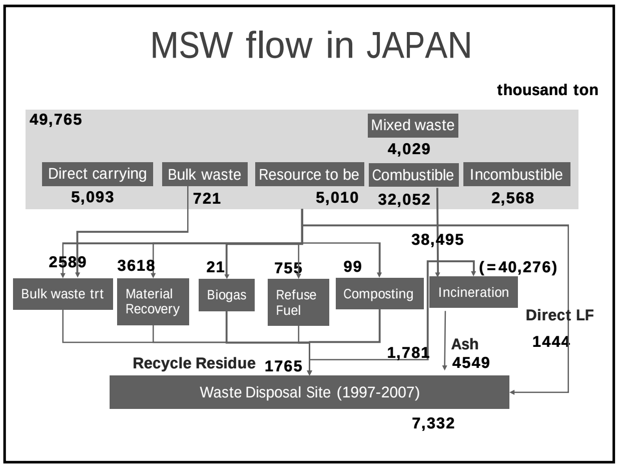
Year: 2005-2006

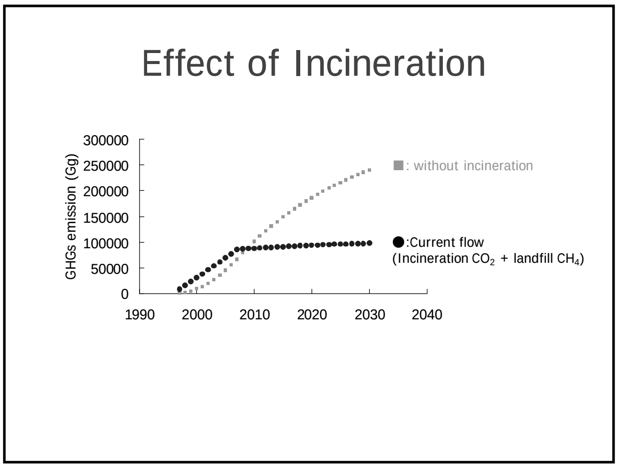
Physical Composition of MSW

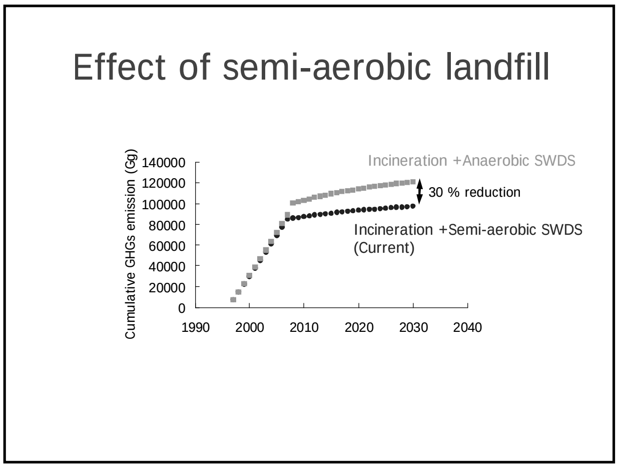
Item	Ratio (%)
Food	49.03
Paper and cardboard	2.9
Plastics, Rubber	8.50
Metals	1.00
Glass	0.79
Wood, Leather	2.05
Textile	2.15
Construction	7.36
Others (if any)	26.22
Total	100.00

Discussion

- **About "Appropriate tech."**
  - Rival (opposite?) technology
    - example. Semi-aerobic vs LFG to energy
    - Combination ; Go Together
    - Operating (active) or Closed LF, Scale (Size)
    - Appropriate combination/management
    - Order? Management definition?
    - Need of Asian strategy on landfill management
  - Reconsider to reduce GHGs, **Priority** ?







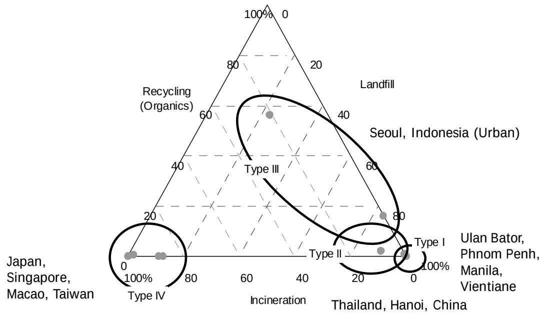
Discussion

- **About Upstream Solid Waste Management**
  - Importance of Education and Public awareness
  - Economical incentives
    - Charging system for food waste
    - Marketing value (& benefit) of source separation
    - special collection service, How collect, How transport
    - Business creation, involvement of municipality, Activity of informal picker, scavenger, resource buyer
  - Development of downstream
    - technology on treatment, transportation, storage should be needed with source separation
  - Effective measures in each country?
  - And How to Approach
    - Start from Local government under their own specific circumstances
    - 1st Education, participation, 2nd Incentives, 3rd punishment
    - Simultaneous development of education and punishment for encouraging people
    - Source separation would have educational effect
    - Education/ Advertisement with several channels

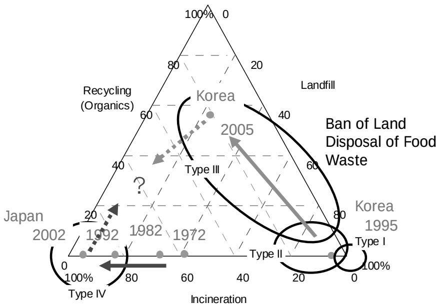
Discussion

- **About Sustainability of Waste Management**
  - Zero emission (ex.ZOL: zero organic to landfill, ZGE: zero greenhouse gas emission, ZDW: zero discharge waste water from waste)is one of the target for sustainable WM.
  - How to achieve the sustainability is different in each countries and regions.
  - Indicator for sustainable WM must be defined for Asian countries.
  - Barriers: economy, social, culture, technology
  - Important to realize the week point in each countries
  - WM could be include the part of sustainable society (economic)

Transition of Waste Management



Transition of Waste Management



Conclusion

- Reliable waste data is still the major issue both on waste management and GHG reduction in Asia.
- Waste management in each Asian country/city has been established in their circumstances.
- Understanding of similarity and difference of waste stream and disposal technology in Asian countries should be essential to improvement both of waste management and GHG reduction.
- Then collaboration between Asian countries will lead better waste management and GHG inventory.

Presentation 4.3.4

2006 IPCC Guidelines & Data Collection

7th Workshop on GHG Inventories in Asia (WGIA7), 7-10 July 2009, Seoul

Simon Eggleston, Head, Technical Support Unit,
Task Force on National Greenhouse Gas Inventories

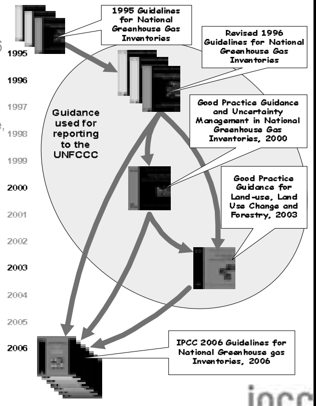
ipcc INTERGOVERNMENTAL PANEL ON climate change

INTRODUCTION

ipcc INTERGOVERNMENTAL PANEL ON climate change

Introduction

- Guidelines have evolved from 1996 to 2006
- Development of Good Practice Guidance (GPG) was a major step forward
  - Complete, consistent, comparable, transparent, and accurate inventories taking account of available resources
  - Major change was from 1996 LUCF to GPG LULUCF
- 2006 Guidelines [2.5 years work, 250 authors]
  - Have 4 sectors
  - Have improved methods and default data
  - Cover more gases and methods
  - Integrates GPG
  - Require similar resources
  - Do not pre-empt accounting choices
  - The best globally applicable methods



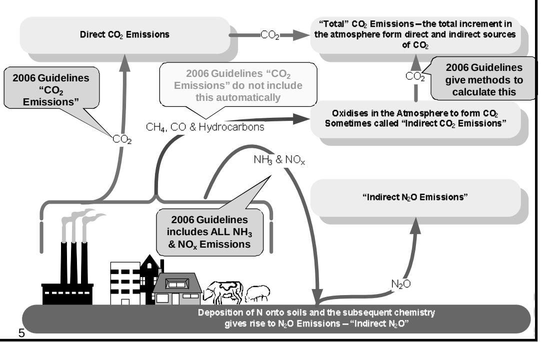
3

ipcc INTERGOVERNMENTAL PANEL ON climate change

20O6 IPCC GUIDELINES - DEFINITIONS

ipcc INTERGOVERNMENTAL PANEL ON climate change

Direct & Indirect: CO_2 and N_2O



5

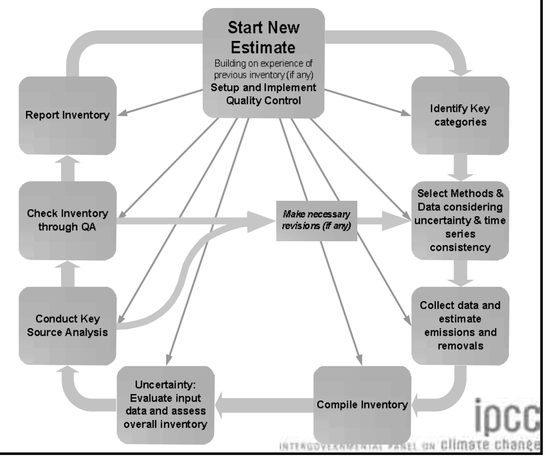
Estimation of Actual Annual Emissions

- In the 1996 Guidelines and Good Practice Guidance for a few sources, the simplest methodology estimates a "potential emission" rather than the actual annual emission.
  - *This "potential emission" assumes all the emissions from an activity occur in the current year, ignoring the fact they will occur over many years (e.g. methane emissions from waste in landfills occurs over decades as the decay processes take place).*
- In the 2006 Guidelines, simple default methods estimate emissions when they occur, thus removing the need for potential emissions.
- The removal of potential emission estimates also allows the emission reductions of abatement techniques to be properly estimated and ensures that the Tier 1 methods are compatible with higher tier methods. The areas where this occurred are:
  - *Actual emissions of fluorinated compounds*
  - *Methane from landfills*

6

ipcc INTERGOVERNMENTAL PANEL ON climate change

DATA COLLECTION



Methodological principles

- Focus on the collection of data needed to improve estimates of key categories
- Choose procedures that iteratively improve the quality of the inventory in line with the data quality objectives.
- Activities should lead to continuous improvement of the data
- Collect at a level of detail appropriate to the method
- Review data collection activities regularly
- Introduce agreements with data suppliers

Sources of Data

- National Statistics Agencies
- Experts, stakeholder organisations
- Other national experts
- IPCC Emission Factor Database
- Other international experts
- International organisations publishing statistics e.g., United Nations, Eurostat or the International Energy Agency, OECD and the IMF
- Reference libraries (National Libraries)
- Scientific and technical articles in environmental books, journals and reports.
- Universities
- Web search for organisations & specialists
- National Inventory Reports from Parties to the United Nations Framework Convention on Climate Change

Generating New Data

- Measurement Programme
  - Representative sample
  - Standardised methods (ISO, EN, USEPA, VDI etc.)
  - Document standards and quality management
  - Well-designed programme
    - Defined objectives
    - Suitable methods
    - Clear instruction
    - Defined data processing and reporting
    - Documentation

Adapting Existing Data

- Filling in gaps in periodic data (time series consistency)
- Time series revision
- Incorporating improved / Compensating for deteriorating data
- Incomplete coverage
- Combining data sets
- Multi-year averaging
- Non-calendar year data

Expert Judgment

- A last resort when all else fails!
- Expert judgment should be elicited using an appropriate protocol (e.g. Stanford/SRI)
  - Motivating explain background, reasons and biases
  - Structuring clearly define quantities needed
  - Conditioning expert defines data, models & theory used
  - Encoding quantify data and uncertainty
  - Verification feedback to test experts response
- Biases
  - Availability, Representativeness, Anchoring & Adjustment
  - Motivational, Expert, Managerial, Selection

ipcc INTERGOVERNMENTAL PANEL ON climate change

SOME NOTABLE IMPROVEMENTS IN 2006 GUIDELINES

ipcc INTERGOVERNMENTAL PANEL ON climate change

AFOLU

- Agriculture and Land Use, Land-use Change and Forestry (LULUCF) combined to form a new sector AFOLU – Agriculture, Forestry and Other Land Use
- However methods largely unchanged
  - Methodological change between revised 1996 GL and GPG LULUCF NOT from previous to 2006 GL
  - Small improvements/clarifications to methods.
- Many more improved default values

ipcc INTERGOVERNMENTAL PANEL ON climate change

Additional gases in 2006 Guidelines – Sources Identified in 2006 Guidelines

Only in IPPU Sector

By-product & fugitive emissions

	Electronics Industries	Magnesium production	Halogenated Compounds Production	GWP in TAR	GWP in AR4
nitrogen trifluoride (NF_3)	✓		✓	✓	✓
trifluoromethyl sulphur pentafluoride (SF_5CF_3)			✓	✓	✓
halogenated ethers (e.g. $C_4F_9OC_2H_5$, $CHF_2OCF_2OC_2F_4OCHF_2$, $CHF_2OCF_2OCHF_2$)	✓		✓	✓	✓
CF_3I, CH_2Br_2, $CHCl_3$			✓	✓	
CH_2Cl_2, CH_3Cl			✓	✓	✓
$C_3F_7C(O)C_2F_5$		✓	✓		
C_4F_6, C_5F_8, $c\text{-}C_4F_8O$	✓		✓		

Separate Guidance for categories included elsewhere in earlier guidelines

Fuel Combustion
- CO_2 -Transport and Storage
- Urea-based Catalysts (Road Transport)

Fugitive Emissions from Fuels
- Abandoned Underground Mines

Mineral Industry
- Glass Production
- Ceramics
- Non Metallurgical Magnesia Production

Chemical Industry
- Caprolactam, Glyoxal & Glyoxylic Acid
- Titanium Dioxide Production
- Petrochemical and Carbon Black Production

Metal Industry
- Lead Production
- Zinc Production

Electronics Industries
- Integrated Circuit or Semiconductor
- TFT Flat Panel Display
- Photovoltaics
- Heat Transfer Fluid

Other Product Manufacture and Use
- Electrical Equipment
- Military Applications
- Accelerators
- Medical Applications
- Propellant for Pressure and Aerosol Products

Substitutes for Ozone Depleting Substances

Land Use
- Complete, consistent treatment of fires
- Liming
- Settlements remaining Settlements
- Some wetlands categories
- Urea Application
- Indirect N_2O Emissions from Manure
- Harvested Wood Products

Waste
- Open Burning of Waste
- Biological Treatment of Solid Waste

Other
- Indirect N_2O Emissions from the Atmospheric Deposition of N (excluding agriculture)

17

Task Force on National Greenhouse Gas Inventories

Thank- you

Any questions?

ipcc INTERGOVERNMENTAL PANEL ON climate change

Presentation 4.3.5

Statistical capacity building under the UN Framework for Development of Environment Statistics (UN-FDES)

8 July 2009, Seoul, Korea
7th Workshop on GHG Inventories in Asia

Takako Ono
Greenhouse Gas Inventory Office of Japan (GIO)
National Institute for Environmental Studies (NIES)

Greenhouse gas Inventory Office of Japan 0

Outline

- Background Information of the UN-FDES
  – Emerging Agenda: Climate Change Statistics
- Issues of Developing Environment Statistics
- Capacity Building for Environment Statistics implemented by the Asian Development Bank

Greenhouse gas Inventory Office of Japan

Background Information of the UN-FDES

- The United Nations Framework for the Development of Environment Statistics (UN-FDES
  – Developed in 1984 as a joint project of the United Nations Secretariat and the United Nations Environment Programme (UNEP)
- Objective of the UN-FDES:
  – to assist in the development, coordination and organization of environment statistics at the national and international levels
- Institute in charge of implementation:
  – Environment Statistics Section
  United Nations Statistics Division

Greenhouse gas Inventory Office of Japan

Structure of the UN-FDES

- Pressure-state-response model
  – Developing a statistical system for measuring human activities that cause stresses on the environment, and measuring actual impacts that have become distinct over time.
    - Pressure: human activities that affect the environment
      – Ex: energy production, land use
    - State: results of human activities
      – Ex: quantity of air pollutant emissions, land area of deforestation
    - Response: Actual impacts to environment, which have become distinct over time and space
      – Ex: air pollution concentration, degree of soil erosion

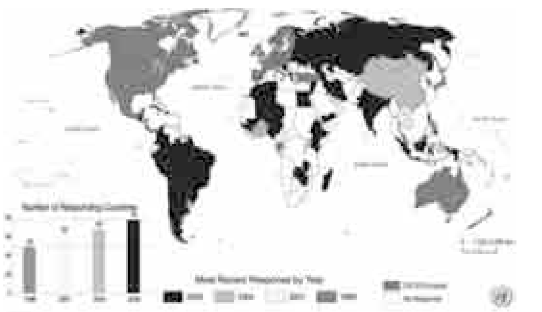
Greenhouse gas Inventory Office of Japan 3

Background Information of the UN-FDES
Data collection and dissemination

- Data collected in 2004, 2006 and 2008:
  – Water
    - water resources
    - water supply industry
    - waste water
  – Waste
    - Municipal waste collection
    - municipal waste treatment
    - hazardous waste
- Data collected in 2004:
  – Air
    - SO_2 emissions
    - NOx emissions
  – Land
    - Total surface areas
    - Forest area
    - Agricultural land

Greenhouse gas Inventory Office of Japan

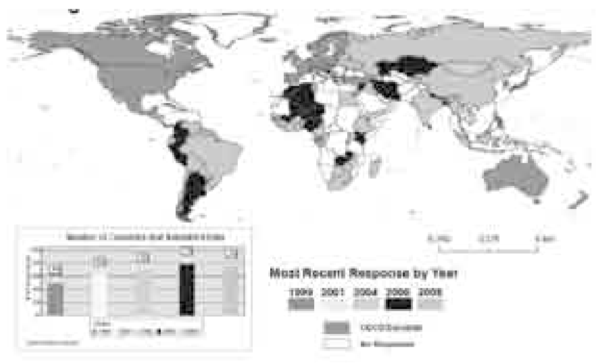
Coverage of UNSD Environment Statistics Data Collection (as of 2008)



Source: United Nations Statistical Commission, "Environment statistics", Brochure Environment (2007) <http://millenniumindicators.un.org/unsd/statcom/stacom_archive/brochures/for%20web/Brochure%20-%20Environment.pdf>.

Greenhouse gas Inventory Office of Japan

Coverage of UNSD Environment Statistics Data Collection (as of 16 Jan, 2009)



Source: United Nations Statistic Division, "Environment statistics", Brochure Environment (16 Jan 2009) <http://unstats.un.org/unsd/environment/envpdf/Brochures/BrochureEnvironment_16Jan2009.pdf>.

Emerging Agenda: Climate Change Statistics

- In the UN Statistical Commission (UNSC), Developing a framework and agenda for climate change statistics emerges as a new and important component of the methodological work of environment statistics.
  - Under the Two international conferences were held for discussing the climate change statistics:
    1. Conference on Climate Change and Official Statistics
       - held in Oslo, Norway (April 2008)
    2. Conference on Climate Change, Development and Official Statistics in the Asia-Pacific Region
       - held in Seoul, Korea (December 2008)
- As a result of these conference, a programme review on climate change and official statistics were submitted to the 40th session of the UNSC.

Greenhouse gas Inventory Office of Japan

Emerging Agenda: Climate Change Statistics

- At the 40th UNSC session, a decision on climate change statistics was adopted and brought to the attention of the UN Economic and Social Council.
- Abstract of the decision:
  - 40/101: Programme review: climate change and official statistics
    - "Recognized that climate change is an important global issue with social, economic and environmental impacts and that official statistics have an important role to contribute to closing data gaps",
    - "Noted the interest of some countries to develop a framework of environmental statistics at the national level to facilitate the understanding of the phenomenon of environmental and climate change",
    - Stressed the importance of training and capacity-building, in particular for the developing countries, and expressed the need for appropriate training material and the development of a knowledge base in this new area of official statistics".
  - This decision may enhance to provide Activity Data for GHG inventories.

Greenhouse gas Inventory Office of Japan

Issues of Developing Environment Statistics

- Environment statistics is still in an early stage of development in many countries, and data are often sparse.
- Not all countries submit requested data to the UNSD on biennial basis.
- One of the critical issues is institutional arrangement for collecting data, which requires comprehensive cooperation and collaboration among relevant governmental bodies.

Greenhouse gas Inventory Office of Japan

Capacity Building for Environment Statistics

- The Asian Development Bank (ADB) conducts statistical capacity building activities for the Asian region in accordance with the UN-FDES.
- The ADB implemented two capacity building projects for developing country-specific FDES.
  - Regional Technical Assistance (RETA) projects.
    - 1st phase: RETA 5555
    - 2nd phase: RETA 5860
- Division in charge of the capacity building:
  - Development Indicators and Policy Research Division
    Economics and Research Department
    Asian Development Bank

Greenhouse gas Inventory Office of Japan

RETAs for Developing Environment Statistics

- Name of the Project:
  - Regional Technical Assistance (RETA) for Institutional Strengthening and Collection of Environment Statistics
- Participating countries:
  - RETA 5555 (First Phase: 1995-1998):
    - Bangladesh, India, Indonesia, Malaysia, Nepal, Pakistan, Philippines, Samoa, Sri Lanka, Vanuatu, and Viet Nam.
  - RETA 5860 (Second Phase: 2000-2003?):
    - Kazakhstan, Kyrgyz Republic, Mongolia, Tajikistan and Uzbekistan.

(Red letters show WGIA participating countries.)

Greenhouse gas Inventory Office of Japan

RETA 5555

- Objectives of RETA 5555:
  - To establish institutional linkages and strengthen institutional capacity in environment statistics,
  - To formulate each participating countries' FDES, and
  - To prepare each participating countries' compendium of environment statistics based on the country-specific FDES by organizing environment statistics data that are already available from existing sources.

Greenhouse gas Inventory Office of Japan

Participating Agencies in RETA 5555

- India
  - Central Statistical Organization
  - Ministry of Environment and Forests
- Indonesia
  - Central Bureau of Statistics
  - Centre for Information Development and Environmental Compliance
- Malaysia
  - Department of Statistics, Environment Statistics Section
- Philippines
  - National Statistical Coordination Board
  - Department of Environment and Natural Resources
- Viet Nam
  - General Statistics Office

Greenhouse gas Inventory Office of Japan

Activities implemented under RETA 5555 (1)

- Four workshops:
  - Inception workshop (Manila, September 1995)
    - Reviewed the status of environment statistics,
    - Identified key issues,
    - Made an action plan to develop country-specific FDES.
  - Sub-regional workshops
    - 1st: in Nepal, 2nd: Indonesia
    - To review the progress of work in the preparation of FDES and CES
  - Concluding workshop (Manila, May 1998)
    - Reported each participating countries' achievements,
    - Assessed their performance,
    - Shared experiences in the process of developing environment statistics.

Greenhouse gas Inventory Office of Japan

Activities implemented under RETA 5555 (2)

- Training course on environment statistics
  - Conducted in India,
  - 23 participants from eight participating countries joined this course.
- Advisory assistance
  - Provided by fielding technical consultants to requesting countries for developing their country-specific FDES.
- Financial assistance
  - Provided for partly covering:
    - cost of national workshops,
    - local consultancy services and
    - Miscellaneous costs related to FDES and CES preparation.

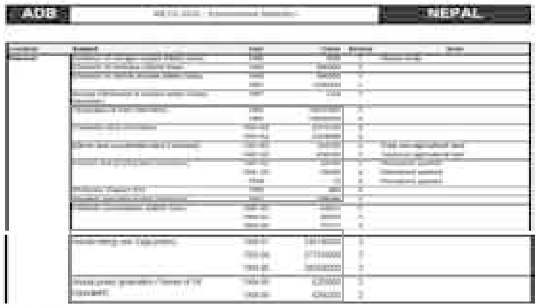
Greenhouse gas Inventory Office of Japan

Outputs from RETA 5555

- Publication of the final report of RETA 5555
  - Title: *Development of Environment Statistics in Developing Asian and Pacific Countries* (ADB: 1999)
  - http://www.adb.org/Documents/Books/dev_env_statistics/default.asp?p=statpub
- Country tables of environment statistics:
  - http://www.adb.org/Statistics/Environment/Ctry.asp
    - The ADB mentioned that the tables in this website may be updated regularly based on the publications of participating countries, which come out every two to three years, and available data from other sources.

Greenhouse gas Inventory Office of Japan 16

An Example of Outputs from RETA 5555: Part of Nepal's Country Table



Source: ADB, Country Table: Nepal <http://www.adb.org/Documents/EDRC/Statistics/Environment/nepal.pdf>.

Greenhouse gas Inventory Office of Japan

Summary

- Developing environment statistics has been promoted under the UN-FDES since 1984 for quantifying environmental degradation.
- Basic data for the environment statistics are similar to Activity Data (AD) for GHG inventories, so we can utilize the basic data as AD for GHG inventories.
- Climate change statistics emerges as a new field of the UN-FDES, which will help us to obtain the AD more sufficiently.
- Although the development of the UN-FDES has been promoted since 1984, the status of environment statistics have been still sparse and necessary for improvement.
- Capacity building activities implemented by the ADB support the development of environment statistics in the Asian region, which will also be helpful for developing data collection systems for GHG inventories.

Greenhouse gas Inventory Office of Japan

Thank you

Greenhouse gas Inventory Office of Japan

Presentation 4.3.6

7th Workshop in GHG Inventories in Asia (WGIA7)
7-10 July 2009, Seoul, Republic of Korea

JICA's support activities on Climate Change

Japan International Cooperation Agency (JICA)
Global Environment Department
Kazuya SUZUKI

8th July 2009

Today's Topics

1. What's JICA
2. JICA's strategy for international cooperation on Climate Change
3. JICA's supporting activities related to Climate Change in Asia

---

1. What's JICA

Tafaigata Landfill, Samoa

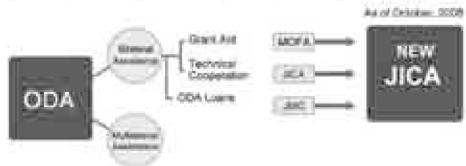
---

1. What's JICA? (1/2)

❶ Japan's ODA and New JICA

New JICA integrates the 3 schemes of Japan's Official Development Assistance (ODA): (a) technical assistance offered by "old JICA (Japan International Cooperation Agency)", (b) concessionary loans (Japanese ODA loans) etc. extended by "old JBIC (Japan Bank for International Cooperation)" Overseas Economic Cooperation Operations, and (c) part of the grant aid (with no obligation for repayment) provided by Japan's Ministry of Foreign Affairs (MOFA).

As of October, 2008



---

1. What's JICA? (2/2)

❷ Operation

[illegible]

❸ Budget

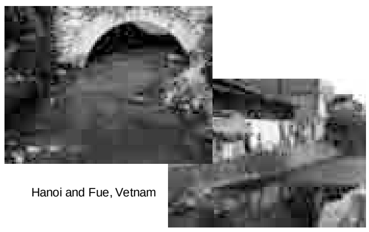
[illegible]

World Bank	Number of Staff	[illegible]
	Volume of Operations	[illegible]
Asian Development Bank	Number of Staff	[illegible]
	Volume of Operations	[illegible]
United States Agency for International Development	Number of Staff	[illegible]
	Volume of Operations	[illegible]
New JICA	Number of Staff	[illegible]
	Volume of Operations*	[illegible]

[illegible]

---

2. JICA's strategy for international cooperation on Climate Change



Hanoi and Fue, Vetnam

JICA's Strategy for International Cooperation on Climate Change (1)

- JICA,
  (1)in line with the Japanese government policy,
  (2)will proactively implement their support for developing countries' efforts to address climate change based on the following principles (on the follwoing slide)
  (3)by making the best use of JICA's experiences and achievements in international cooperation, and
  (4)Japan's experiences and technology.

7

JICA's Strategy for International Cooperation on Climate Change (2)

– To provide integrated cooperation from cross-sectoral perspectives based on the result of policy consultation between the Government of Japan and developing countries that will make efforts to reduce GHG emissions and achieve economic growth in a compatible way,

– To focus on a development assistance approach that realizes economic development, improvement of livelihoods and reduction of GHG emissions,

– To utilize Japan's cutting-edge technologies, including those of the private sector, effectively,

– To promote globally conducive research (e.g., basic research on the low-carbon society).

8

"Direction of JICA's Operation Addressing Climate Change" (October 1, 2008) (Summary)

Financial assistance | Technical assistance

Cross sector approach based on policy dialogue

<Mitigation Measures>
- Co-benefit
- Promotion of CDM
- Assisting in enhancing and promoting private sector initiatives
- Assisting in implementation of Policies
  - Improvement of legal systems
  - Capacity development
  - Monitoring, etc...

<Adaptation Measures>
- Supporting the formulation and implementation of adaptation measures based on the prediction of impacts in each country
- Strengthening the capacity for adaptation of countries and sectors where serious climate change impacts are expected
- Introducing and mainstreaming the concept of "Climate Risk"

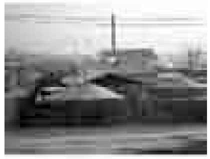
Utilize Japan's private cutting-edge technologies effectively

Promote globally conducive research

* "Co-benefit" approach・・・Project or program which realize both developmental benefits for developing country and GHG emission reductions.

9

3. JICA's supporting activities related to Climate Change in Asia



Ulaanbaatar, Mongolia

重慶 Chongqing, China

10

Existing Activities (1)

JICA conduct various activities in developing countries, focusing on sustainable development and on the measures needed to address climate change

JICA's major assistance experience in Climate Change related fields

Existing Activities (2)

JICA has conducted a variety of training courses over the years. 8 training courses were held in JFY 2008 utilizing Japan's experiences and advantages.

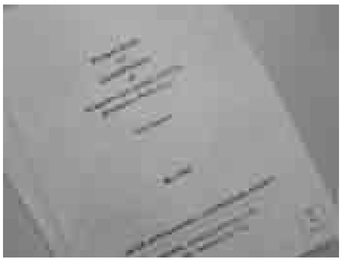
Case 1: CD for Adaptation to Climate Change - Climate Modeling and Analysis (Nov. – Dec. 2008)

In this training, by utilizing the 20-km mesh and 60-km mesh atmospheric general circulation model (MRI/JMA AGCM) results as well as the experience, knowledge and technology of Japan to analyze the current issues of climate change projections in each participant's country. Based on the fruits from this training, we will challenge to plan and implement the suitable adaptive policy for environmental impact evaluation and adaptive development plans.

Case 2: Development of Strategies on Climate Change (Jan. – Mar. 2009)

This training covers a wide range of topics from policymaking to more technical aspects. Participants learn the concepto of mainstreaming climate change policy intu sustainable development as well as methodology such as developing intentries of GHG emissions and sinks.

Quantification of GHGs Emission Reduction in JICA Projects



JICA is not only be required to actively provide climate change mitigation strategy support to developing countries, but will also be required to elucidate the effectiveness of such support in a more objective and quantitative mannar.

http://lvzopac.jica.go.jp/external/library?func=function.opacsch.toshoshozodsp&view=view.opacsch.newschdsp&shoshisbt=1&shoshino=0000248043

JICA's activities focused on specific country

Completed
Philippine Capacity development for the CDM project promotion

On-going
China Training course on CDM capacity building
Indonesia Climate Change Program Loan (CCPL)
Thailand Project for Capacity Building on Climate Change Adaptation and Mitigation for Implementation in Bangkok

Waiting to start
Thailand Project for Capacity Development and Institutional Strengthening for GHG Mitigation
Vietnam Project for Capacity Building of GHGs National Inventory

Planning Activities

Project for Capacity Building of GHGs National Inventory in Vietnam (draft)

Objective(draft)
- **To establish system necessary to improve GHG national inventory continuously.**

Outputs(draft)
- **To Strengthened capacity necessary to prepare accurate and reliable GHG national inventory**
- **To improve methodologies of GHG national inventory**

Duration Three(3) years(draft)

Counterpart Organ. : MONRE

Collaboration Organ. in Japan: Ministry of Environment GIO of NIES

Thank you for your attention!!

JICA proactively supports your efforts to address climate change!

Presentation 4.3.7

Experience Gained through the Mutual GHG Inventory Review between Korea and Japan

Environmental Management Corporation
Department of Climate Environment
Byong-bok JIN

1

1. Korea and Japan GHG Inventory Management Workshop

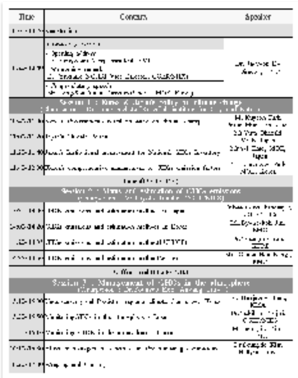
2

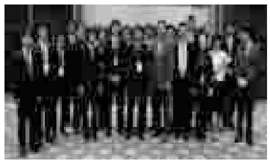
Introduction

- Korea and Japan GHG Inventory Management Workshop
- Date: 2008. 10. 22 (Wed) 10:00~17:00
- Host: Environmental Management Corporation (KOR), CGER/NIES (JPN)
- Participants : **Corporate, local governments**, total of **120** people
- Main Theme

- The introduction of ' Korea and Japan' s Climate Policy announced in ' 08
- **The GHG emissions and management system of Korea and Japan**
- **Sector specific GHG emissions and calculating methods**
- The impacts of Climate Change in Korea and GHG monitoring between Korea and Japan

3





4

Agreement Achieved

- ❖ Understanding Korea and Japan' s climate policies announced in 2008
- ❖ **Established collaborative relationships between Korea and Japan on sector specific GHG inventories**
- ❖ **Diffusion of awareness and concern on the importance of inventory management and reliability improvement**
- ❖ Confirmation of cooperation for the 7th Workshop on GHG inventories in Asia

5

2. The Peer Review on GHG Inventory of Waste Sector between Korea and Japan

6

The Peer Review on GHG Inventory of Waste Sector between Korea and Japan

- **Date**: 2008. 10. 23 (Thu) 10:00~13:00
- **Venue**: Environmental Management Corporation, Seoul office
- **Participants**: total of 14 people including experts on GHG Inventory from Japan, person in charge of Waste sector GHG Inventory from Korea
- **Objective**: Strengthening the cooperation and network between both countries in GHG inventory and guarantee reliability by mutual verification
- **Reviewed sector**: Waste Sector (landfill, incineration, waste water, biological treatment of solid waste)

7

- Korea (7) :

Mr. Byongbok JIN
Ms. Eunhwa Choi.
Mr. Wonseok Baek
Mr. Chunhee Bang
Ms. Sunghee Eun
Mr. Youngsung Kwon
Mr. Seungjin Hyun

- Japan (7) :

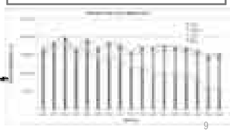
Mr. Sei Kato(MoEJ)
Dr.Baasansuren JAMSRANJAV(NIES)
Mr. Kiyoto Tanabe(NIES)
Mr. Takashi MORIMOTO (MURC)
Mr. Atsushi SATO (MURC)
Mr. Takeshi ENOKI(MURC)
Mr. Hiroyuki UEDA (Suuri-Keikaku Co.Ltd.

8

Review Process

1. **Development** of GHG Inventory Report (English)
2. Exchange and **preview** of GHG Inventory Reports
3. Exchange pre-questionnaire sheet
4. **Cross-review meeting**
5. Check the **feasibility of appliance** on GHG Inventory/Share additional info.
6. **Apply on GHG Inventory Report and develop improvement plan**

- Answers to Questions
- Comments
- Additional Inquiry



9

Reviewed Issues

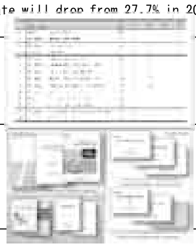
Waste Sector

- Landfill (CH_4)
- Incineration (CO_2, N_2O, CH_4)
- Waste Water (N_2O, CH_4)
- Biological Treatment of Solid Waste (N_2O, CH_4)

✓ The qualification of sector specific **estimation method**
✓ The suitableness of sector specific **category classification**
✓ The reliability of sector specific **activity data**
✓ The applicability of sector specific **emission factor**
✓ The reliability of sector specific emissions
✓ **Uncertainty Analysis**, Category Analysis, **QA/QC** etc.

10

Main Issues in Korea GHG Inventory (reviewed by Japan)

Part	Main Issue	Related Material and Conclusion
All	-**Changes in waste policies (decrease of landfill, increase of incineration)**	-According to the revised 2nd National Waste Management Plan, in case of municipal waste * incineration rate will raise from 16.0% in 2005 to 23.0% in 2011 * landfill rate will drop from 27.7% in 2005 to 17.0% in 2011
	-Key category of emission sources in waste sector	
	-**Collection of activity data** in waste sector	

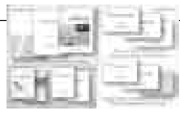
11

Main Issues in Korea GHG Inventory (reviewed by Japan)

Part	Main Issue	Related Material and Conclusion
All	- CRF in Waste Sector	
	- **Review process and methodology** used by the 3rd party experts	

12

Main Issues in Korea GHG Inventory (reviewed by Japan)

Part	Main Issue	Related Material and Conclusion
Landfill	- **FOD method should be applied** when landfill is the key category	- The results of key category analysis points out that the application of FOD method is required, while currently in process
	- Explanation on qualification of Korea's landfills than to the landfill defined for management in IPCC	- In 2006, Korea has designed and operated 227 landfills equipped with liner system
	- Explanation of methods used for annual collection of weight ratio data and related information	
	- **Possibility of overestimation on methane recovery**	- The data reflected in 2007 Inventory are results from investigation of landfill gas from resource recovery facilities

Main Issues in Korea GHG Inventory (reviewed by Japan)

Part	Main Issue	Related Material and Conclusion
Incineration	- Estimation and reporting of "Memo Item"	- Searching for methods using TMS
	- **Reporting of emissions from energy recovery facilities** (always report in energy sector)	- Needs discussion with energy sector authority
	- Reason of increase of non-biogenic waste incineration	- Increase of industrial waste incineration and change of policies (landfill -> incineration)
	- Difficulties of **distinguishing biogenic and non-biogenic** appeared in some cases, and there solutions	- In case there are no options, default value from IPCC is used, while enhancement of accuracy is required

14

Main Issues in Korea GHG Inventory (reviewed by Japan)

Part	Main Issue	Related Material and Conclusion
Wastewater	- **Methane recovery method and usage**	- explanation of methane gas produced in anaerobic digester system which are in airtight conditions
	- Request of wastewater **emission factor background information**	- Ministry of Environment, Korea developed CH4 emission factors in 2000 and 2002 for 11 iindustries - In 2010, additional development required will be conducted

15

Main Issues in Japan GHG Inventory (reviewed by Korea)

Part	Main Issue	Related Material and Conclusion
All	- Future improvement plans of Japan GHG Inventory	- Until Phase 2 ends(2012), there are 30~40 issues to enhance but difficult to solve
Landfill	- Method used to calculate **recovery from electricity production**	- Use of simple formula is possible (electricity production->calorific value->methane gas) and the data of electricity production and efficiency is suitable for reliable basis
	- Request for information of **process on developing country specific values** and related sources	- Half-life of specific compositions(except sludge) is solely developed and used (related thesis provided) - Country specific value of content of carbon is used from composition analysis conducted in 2004 - MCF value of aerobic landfill is 0.5, anaerobic 1.0
	- Explanation of estimation method used for inventory years consist of unavailable	- Activity data of 1954 to 1979 is applied from 1980 (in this period of time, uncertainty of population and GDP is

Main Issues in Japan GHG Inventory (reviewed by Korea)

Part	Main Issue	Related Material and Conclusion
Incineration	- Possibility of **double-counting** of waste used for **heat recovery and electricity production**	- In Japan, regardless of energy recovery, all reported in waste sector incineration thus no possibility of double-counting
	- Reason of not estimating other (except waste oil) hazardous waste	- Definition of waste oil includes waste organic solvent etc.
	- **Estimation of emissions from pyrolysis and plasma type incineration**	- Amount of pyrolysis and plasma type incineration and furnace are insufficient to apply an emission factor separately
	- Reference used for emission estimation	- In Japan, the authority in charge of waste statistics compile the data suitable for emission statistics

17

Main Issues in Japan GHG Inventory (reviewed by Korea)

Part	Main Issue	Related Material and Conclusion
Wastewater	- **Method of estimating organic removal by sludge**	- In Japan, organic removal by sludge is not applied
	- Inclusion of methane recovery in total methane emission	- Methane recovery is estimated for reference but not included in total methane emission
	- **Development** of sector specific industrial waste **emission factors**	- In Japan, the development of sector specific emission factors for industrial wastewater is not active

18

Reflect of Results

① Recalculation of Methane Recovery (R)

Before

- ○ Recovery rate (R=13%) developed regarding characteristics of landfill in 1997 were applied unconditionally on every inventory year
- ○ Necessity of reflecting increase of resource recovery facility and technology advance of methane gas
- ○ Accurate translation and application of 2006 IPCC G/L are required
  - -default value : 0
  - -Application relying on written reference

After

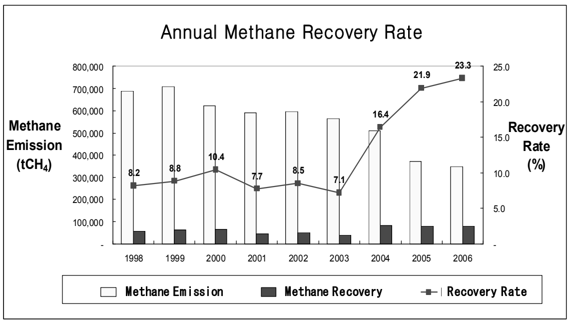
- ■ Total investigation of methane gas recovery from landfill resource recovery facility operating in Korea
  - - Facility : 15 (Electricity production: 11, Gas production: 4)
  - - Review data : LFG flux, CH4 concentration, monitored data
- ■ Recalculation of annual methane recovery and recovery rate
- ■ Update plan of methane recovery will be conducted annually

Methane Recovery(R)

Year	Methane Emission (tCH_4/yr)	Methane Recovery (tCH_4/yr)	Recovery Rate (%)	Notes
1998	686,873	56,305	8.2	CH4 Emission: IPCC GPG 2000 applied
1999	709,393	62,490	8.8	
2000	621,787	64,511	10.4	
2001	589,249	45,547	7.7	
2002	595,965	50,789	8.5	
2003	566,256	40,346	7.1	
2004	510,086	83,584	16.4	Recovery increase occurred by completion of stabilization construction of Sudokwon Landfill
2005	370,809	81,319	21.9	Landfill gas decrease occurred by ban on direct disposal of landfill of food waste
2006	345,453	80,626	23.3	

20

Methane Recovery (R)



** Methane Emission : Mass Balance method used

21

② Other Issue

➢ Change of method of emission estimation in landfill

Mass Balance Method	First Order Decay Method
● 2000 IPCC GPG ● Final gasification occurred on current year	● 2006 IPCC G/L ● Long-term process of gasification ● Application of time function (First-order-decay)

➢ Estimation of past landfill of waste for FOD Method application

22

Internal Improvements

① Investigation on characteristics of past landfills for recalculation of annual MCF factor

② Improvement of Degradable Organic Carbon(DOC)

Issue

- ○ DOC factor applied in current Inventory Report
  - -Need to reflect composition change of waste statistics

Method

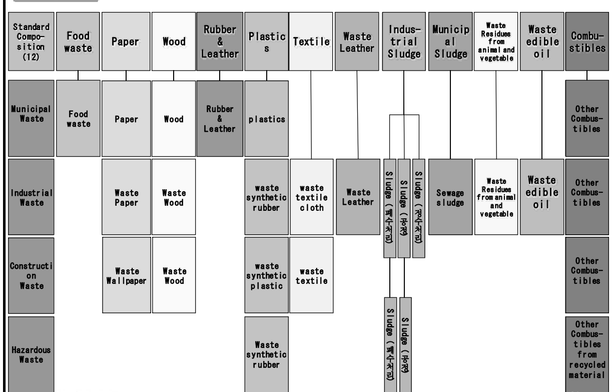
- ○ Development of country specific emission factors
  - - Results from 3 major authorities in charge of waste : MOEK, EMC, SLC
  - - 2006 IPCC GLs default value
  - - Factor used in former National Inventory Reports

Results

- ○ Recalculate and determine reliable data by establishing DOC waste material standard
- ○ Divide the standard material into 12 types
  - - Priority : MOEK > EMC > IPCC or factors used in former National Inventory Reports

23

DOC : Standard Material of DOC Landfill Waste for recalculation



24

DOC : Rearrangement of DOC Reference by Standard Material

Standard Material		Total carbon content (dry, %)	Fossil carbon rate[1] (dry, %)	DOC		Water content (%)	Reference
				dry (%)	wet (%)		
Combustibles	Food waste	43 (36~47)	–	43 (36~47)	12 (10~16)	71 (62~80)	MOEK
	Paper	42 (41~44)	1	41 (40~43)	32 (30~35)	22 (18~25)	MOEK
	Wood	47 (46~49)	–	47 (46~49)	37 (32~41)	22 (14~32)	MOEK
	Rubber & Leather	59 (51~72)	20	39 (31~52)	37 (29~49)	3 (2~5)	EMC
	Plastics	75 (73~76)	100	–	–	16 (6~30)	MOEK
	Textile	51 (50~51)	20	31 (30~31)	25 (14~27)	21 (8~34)	MOEK
	Waste Leather	51 (50~52)	–	51 (50~52)	48 (47~50)	6 (5~7)	MOEK
	Industrial Sludge	–	–	–	9	–	IPCC
	Municipal Sludge	–	–	–	5	–	IPCC
	Waste Residue	41	–	–	11	72	Default value
	Waste edible oil	67	–	–	67	–	Default value
	Others	40 (38~43)	–	40 (38~43)	23 (17~27)	43 (31~55)	EMC
Incombustibles	- Municipal Waste : briquet ashes, metal & glass, sand & soil, etc. - Industrial Waste : fly ash, bottom ash, dust, waste sand, waste metal, waste plaster, waste catalysts, waste absorbent, glass & ceramics, inorganic sludge, etc. - Construction Waste : construction sludge, waste metals, waste glass						

※ Reference 1 : 2006 IPCC GLs

25

Assessment of Cross-review Meeting

- ❖ Comprehensive review conducted in collection of activity data from both countries, category classification, development of EFs, estimation methods and process
- ❖ Critics appeared on overall issues considered internally
- ❖ Deep discussion held by experts of inventory on waste sector, which leads to establish future plans efficiently
- ❖ Results achieved will be reflected in 2009 Inventory

26

Presentation 4.4.1.1

Greenhouse gas Inventory Office of Japan

Session III: Group Discussion

Group 1 : Energy

9 July 2009, Seoul, Republic of Korea
7th Workshop on GHG Inventories in Asia

Yuriko Hayabuchi
Greenhouse Gas Inventory Office of Japan (GIO)
National Institute for Environmental Studies (NIES)

0

Background

- Previous Summaries -*WGIA4 Energy Working Group*
  - Energy Balances can be used as a basis for developing inventories for the energy sector.
    - Important to try to find ways to collect the data for the inventories using whatever means possible, for example, basing estimates on supply side statistics.
  - In order to gain support for inventory development in each country, it is important to recognize that the data used in the inventories can serve as valuable input for other analyses.
  - Need to pay attention to new technologies that can enhance efficiency and decrease emissions.

Greenhouse gas Inventory Office of Japan

WGIA7 Group 1: Energy

- Theme: **Statistics for the Energy Sector**
- Suggested topics from secretariat
  - Strategies to improve reliability of energy data
  - Issues identified and possible solutions in Energy Balance Table preparation
  - Utilizing data that is already available
  - What kind of co-benefits can be pursued from inventory work and results?
  - Recommendation on activities to be carried out within the WGIA framework
    - *What to be done by WGIA8?*

Greenhouse gas Inventory Office of Japan

Today's Schedule

Day 3 (Thursday, 9 July)

9:30- 9:35	Introductory presentation
9:35- 9:50	Presentation (Cambodia)
9:50- 10:05	Presentation (Viet Nam)
10:05- 10:20	Presentation (Mongolia)
10:20- 10:35	Presentation (Korea)
10:35- 10:50	Presentation (Japan)
10:50- 11:00	*Coffee Break – Do not miss it!!*
11:00- 12:20	Discussion & preparation of summary report

Greenhouse gas Inventory Office of Japan

Now, let's start this session!!

Greenhouse gas Inventory Office of Japan

Presentation 4.4.1.2

The 7th Workshop on
GHG Inventories in Asia (WGIA7)

Emissions in Energy in Cambodia 2000

7-10 July 2009
Seoul, Republic of Korea

Va Canmakaravuth

Methodology

- **Tier 1** methodologies are used for Fuel Combustion. The IPCC Guidelines describes two approaches:
  - Reference Approach where emissions are estimated from the carbon content of fuels supplied to the country as a whole.
  - Source Categories Approach where emissions are estimated from the carbon content of fuels supplied to the main fuel combustion activities.

Methodology

- **Reference Approach**
  - Estimate of Apparent Fuel Consumption
  - Annual imports of all fuels to Cambodia are recorded by CAMCONTROL Department.
  - In the year 2000, the following petroleum products were imported (statistics in tons): jet A1, gasoline, diesel oil, fuel oil, kerosene oil, lubricant oil, gas, and bitumen.
  - It is assumed that all imports are consumed the same year, and that no fuels are exported.

Methodology

Imports of petroleum products for Year 2000 (Tons)

Petroleum products	Amount (t)
Jet A1	17,607
Gasoline	101,572
Diesel Oil	366,956
Fuel Oil	96,200
Kerosene Oil	28,782
Lube Oil	4,490
Gas	13,237
Bitumen	1,033

Source: Ministry of Commerce, CAMCONTROL

Methodology

- Conversion to A Common Energy Unit (TJ)
  - The IPCC default values for conversion factors are used to estimate apparent consumption in terajoules:
    - 44.80 TJ/10^3 tonnes for gasoline,
    - 44.59 TJ/10^3 tonnes for jet kerosene,
    - 44.75 TJ/10^3 tonnes for other kerosene,
    - 43.33 TJ/10^3 tonnes for gas / diesel oil,
    - 40.19 TJ/10^3 tonnes for residual fuel oil,
    - 47.31 TJ/10^3 tonnes for LPG,
    - 40.19 TJ/10^3 tonnes for bitumen and lubricants.

Methodology

- Multiplication by Carbon Emission Factors
  - The following IPCC default values are used for Carbon Emission Factors (CEF):
    - 18.9 tC/TJ for gasoline,
    - 19.5 tC/TJ for jet kerosene,
    - 19.6 tC/TJ for other kerosene,
    - 20.2 tC/TJ for gas / diesel oil,
    - 21.1 tC/TJ for residual fuel oil,
    - 17.2 tC/TJ for LPG,
    - 22.0 tC/TJ for bitumen, and
    - 20.0 tC/TJ for lubricants.

Methodology

- Converting to CO_2 Emissions
  - Multiply the Actual Carbon Emissions by 44/12 to find the total CO_2 emission from fuel combustion
- Summary of results
  - In the year 2000, 630 kilotons of petroleum products with a value of US $162 million were imported (CAMCONTROL, MOC).
  - Total national emissions from fuel combustion amounted to **2050 Gg CO_2 in the year 2000**.

Methodology

- **Source Categories Approach**
  - In the Source Categories Approach, emissions are estimated from the carbon content of fuels supplied to the main fuel combustion activities.
    - Energy Industries
    - Manufacturing Industry and Construction
    - Transport
      - Road transportation
      - Railways
    - Others
      - Commercial/Institutional
      - Residential
      - Agriculture/Forestry/Fishing sector

Methodology

- **Source Categories Approach**
  - This approach requires data that are not currently available in Cambodia.
  - Gaps persist in estimating emissions from manufacturing industries and construction, transport, the commercial and institutional sector, the residential sector, and agriculture/forestry/fishing.
  - In energies industries, fuel consumption data is only available from the State electric utility, and large Independent Power Producers (IPP).

Methodology

- **Energy Industry**
  - Electricité du Cambodge (EDC), the state-owned electric utility, reports fuel consumption for the year 2000 as follow: 24.9 kt of diesel oil and 85.7 kt of fuel oil (EDC 2007).
  - In rural areas, households have access to electricity through Rural Electricity Enterprises (REEs) and battery charging services.
  - Energy Industries - 2000 GHG Emissions: **546 Gg CO_2 eq**

Methodology

- Manufacturing Industries
  - Because of the unavailability or the lack of reliability of grid electricity, a large number of businesses and industries operate their own electric generators.
  - The installed autogeneration capacity amounted to some 87 MW in the year 2000, of which 32 MW in the manufacturing industries. Manufacturing industries produced and autoconsumed 90 GWh of electricity (NEDO 2001).
  - The diesel fuel consumption in the manufacturing industries is estimated at 24.3 kt for the year 2000.
  - Manufacturing Industries and Construction - 2000 GHG Emissions: **78 Gg CO_2 eq**

Methodology

- Transport Sector
  - The consumption for domestic railroad transport amounted to 2.1 kt of fuel oil and 0.6 kt of gasoline in the year 2000 (RRC 2008).
  - Statistics for domestic aviation and national navigation are not available for the year 2000.
  - However, emissions from domestic aviation (Phnom Penh to Siem Reap) are assumed to be insignificant when compared to international aviation to neighbouring countries.
  - Thus the total imports of 17.6 kt of jet kerosene to Cambodia in the year 2000 are attributed to international bunkers.

Methodology

- Transport Sector
  - The transport sector consumption accounted for 92% of gasoline imported to Cambodia in 2005, 41% of diesel and 1% of residual fuel oil (IEA 2005).
  - Assuming the same proportions for the year 2000, a total of 93.5 kt of gasoline and 150.5 kt of diesel fuel were consumed in road transport.
  - Transport - 2000 GHG Emissions: **774 Gg CO2 eq**

Methodology

- Other Sector
  - The installed autogeneration capacity was estimated at 55 MW in the commercial/institutional sector in the year 2000 (NEDO 2001).
  - Total power generated and autoconsumed amounted to 72 GWh for a consumption of 19.4 kt of diesel fuel.
  - The residential sector is assumed to have accounted for the totality of Liquefied Petroleum Gases and other kerosene imported and 5% of diesel fuel.
  - The agriculture/forestry/fishing sector consumed 8% of motor gasoline and 16% of diesel oil imported (IEA 2007).
  - Other sectors - 2000 GHG Emissions: **464 Gg CO2 eq**

Summary of Results

- In the IPCC Source Categories Approach, emissions are estimated from the carbon content of fuels supplied to the main fuel combustion activities.
- This approach requires data that are not currently available in Cambodia.
- A number of gaps persist in estimating sectoral emissions with an estimated **188 Gg CO2** unallocated to specific sectors.
- In the year 2000, transport was the largest net contributor to national emissions from fuel combustion with 38%, followed by energy industries with 27%.

Summary of Results

Greenhouse Gas Emission from Energy Sector in 2000 (Gg)

ENERGY Fuel Combustion Greenhouse Gas Source Categories	CO2 Emissions (Gg)	CO2 Emissions (%)
Energy industries	546	27
Manufacturing industries and construction	78	4
Transport	774	38
Commercial/Institutional	62	3
Residential	189	9
Agriculture/Forestry/Fishery	212	10
Other	188	9
Total	2050	100

Thank you!

Presentation 4.4.1.3

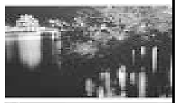
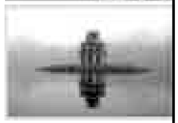
Seoul, Korea

7 – 10 July 2009

VIETNAM's ENERGY CONSUMPTION AND GHGs INVENTORY ISSUE.

Industrial Safety Techniques and Environment Agency
Ministry of Industry and Trade of Vietnam

General Information

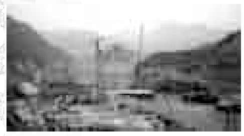
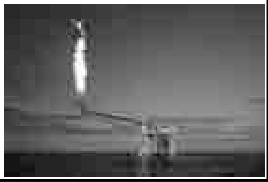



- The Capital: Hanoi
- Population:
  - ✓ 86.5 million in the year 2008
  - ✓ 98.6 million people by the year to 2020
- GDP (Gross Domestic Product)
  - ✓ 7.3 percent over the last ten years.
  - ✓ 6.23% specifically in 2008
  - ✓ 3.9% in the first 6 months of 2009
- Ratio of Urbanisation and industrialization
  - ✓ Cities: 500 (in 1990); 649 (2000); 656 (2003); 743 (2008)
  - ✓ Industrial Zones: 01 (in 1991); 82 (2003); 188 (2008)

CONTENTS

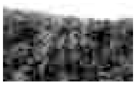
- *Part I: **About Energy Consumption and Combustion activities***
- *Part II: **GHGs emission issues***

About Energy Consumption and Combustion

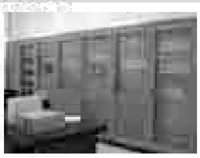
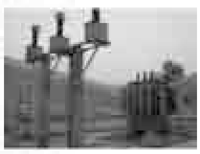



State of resources consumption

- **Water power consumption: 65,000 million m3 (in 1990); 92,000 (2000); 121,000 (estimate by the year to 2010) and 260,000 by 2040.**
- **Energy consumption:**
  - ✓ **Primary: mainly coal, oil and natural gas**


About Primary fuel

Primary Fuel	Coal	Oil	Gas
Potential	5.88 billion ton	1.98 Billion m3OE	2.42 Billion m3OE
Production 2008	39.8 million ton (40%)	14.94 million ton (37%)	7.4 Billion m^3 (15%)
Import 2008		12.66 million ton	
Export 2008	19.7 million ton	13.91 million ton	

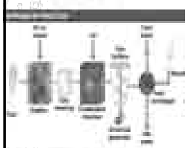
New and renewable energy

- Small hydro resource (≤ 30 MW):
  - ✓ The potential of is 20,560 MW,
  - ✓ In which for exploitation: 3,345 MW
  - ✓ Production: estimated round 11.7% o primary fuel produced.
- Solar energy:
  - ✓ Potential: 10 MW- 43.0 billion TOE per year (with 2,000-2,500 sunlight-hours/year, 150 kCal/cm2/year of total radiation energy on average)

New and renewable energy

- Wind Energy
  - ✓ Potential: 500 – 1,400 kWh/m2/year (location along the coastal zones)
- Geo-thermal Energy:
  - ✓ Potential: 661- 200 MW developed by the year to 2020 (more than 300 hot-temperature mineral water sites (30 -105oC) located in the North-West and Central of Vietnam
  - ✓ Power Generated: reached 72% and 476 MW

New and renewable energy



- Biomass Energy
  - ✓ Potential: 450 MW (43- 46 million TOE per year)
  - ✓ 60% from woodfires, 40% heat from rice straw and agricutural waste…
  - ✓ Power generated: approximate 3% as 380 KTOE
  - ✓ Heat supply: mostly 97% with 13,620 KTOE
- Biogas Energy
  - ✓ Potential in theory about 0.4 million TOE/year (10 billion m3/year), but we can exploit only 10% of it.

energy consumption in industry sector from 1995 to 2000

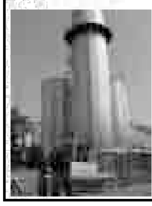
	1995	1996	1997	1998	1999	2000	Growth 95-2000	Flexible index energy/GDP
GDP (Billion VND 1994)	56.237	63.572	74.178	79.473	88.400	100.520	12,3%	
Energy consumption, KTOE								
Coal Antracite	1.938	1.948	2.472	2.453	2.314	2.339	3,8%	0.31
Electricity	397	473	530	583	651	782	14,5%	1.18
DO	284	355	416	426	477	591	15,8%	1.28
LPG	7	11	9	34	33	92	67,4%	5.47
Natural Gas	22	21	20	19	19	19	-2,9%	-0.24
Oil	6	8	4	5	5	9	8,4%	0.68
FO	446	549	505	659	803	823	13,0%	1.06
Sinh khối	2.896	2.910	3.000	3.090	3.147	3.209	2,1%	0.17

Source: IEA, IE

energy consumption in commercial sector from 1995 to 2000

	1995	1996	1997	1998	1999	2000	Growth 95-2000	Flexible index energy/GDP
GDP (Billion VND 1994)	195.567	213.833	231.264	244.596	256.272	273.666	6,95%	
Energy consumption, KTOE								
LPG	18	53	54	109	89	94	39,2%	5,64
Electricity	77	84	95	105	117	160	15,8%	2,27
Coal	140	213	258	258	259	276	14,5%	2,09
DO	158	190	176	212	234	239	8,6%	1,24
Oil	205	258	135	146	147	253	4,3%	0,62
FO	59	80	74	95	117	129	16,9%	2,44

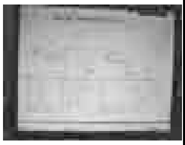
State of energy consumption



- In 2004, source by UN, the percentage of Vietnam's domestic energy consumption as below:
  - ✓ Oil: 50%
  - ✓ Coal: 18%
  - ✓ Natural gas: 12%
  - ✓ Hydro resource: 20%
- Energy consumption estimation
  - ✓ 4.2 million TOE per year (in 1990s). And Vietnam was one of the lowest GHGs emission countries in the world.
  - ✓ In 2001, 13.25 million TOE and its increase on

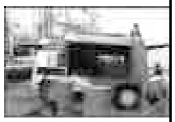
Energy Consumption in main sectors

- ❑ Manufacturing industries and construction: 40%
- ✓ Biomass: 24% with 3,330 KTOE
- ❑ Transportation: 33.9%
- ❑ Agriculture: 2.9%
- ❑ Commercial and residential: 22.44%
- ✓ Biomass: 76% as 10,670 KTOE



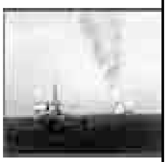
electricity capacity for demand and supply, 2008

- ❑ Electricity power Demand: 13,000 MW per year;
- ❑ However, the capacity for supply has only 12,000 MW/ year. In which of:
- ✓ Hydropower: about 4,500 MW to 5,000 MW
- ✓ Thermal power by coal and natural gas generated
- ✓ Imported from China: 400 MW
- ❑ Trend of Demand: increase flequently



CAPACITY OF VIETNAM ENERGY FIELD TO 2015

- ❑ **Total Capacity**: 42,470 MW, including as:
- ✓ Thermal power by coal generated: 12,100 MW.
- ✓ Hydro power: 13,600 MW.
- ✓ Thermal power by oil and natural gas generated: 13,400 MW.
- ✓ Renewable energy: 1,270 MW.
- ✓ Export Electricity: 2,100 MW
- ✓ Nuclear Power plants: up to 2017 – 2020 (following by planned as 4,000 MW). After 2020, nuclear power will supply about 20% of total capacity.



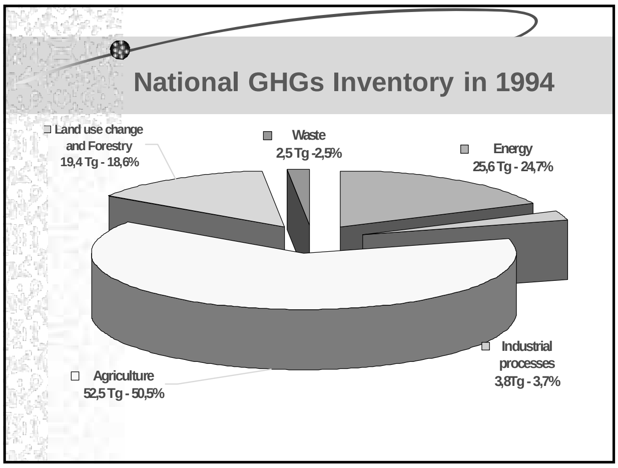
GHGs emission issues

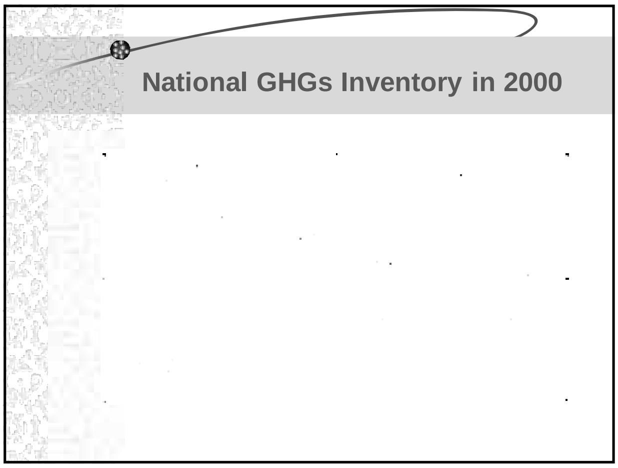
MAIN CONTENTS OF national GHGs inventory

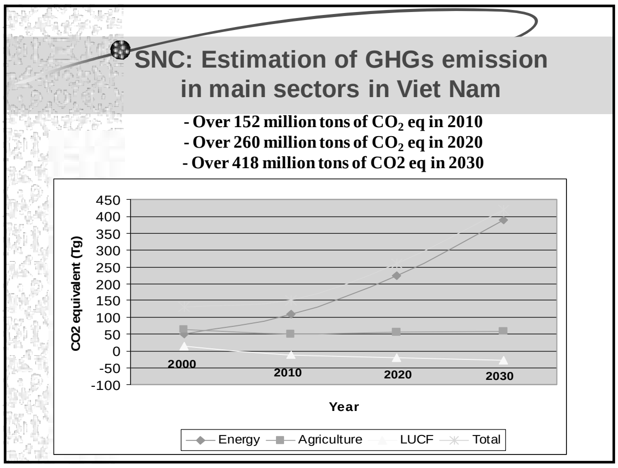
- ❖ By National GHGs Inventory in 1994, the total GHGs emission was 103.8 million tons CO2 equivalent; In 1998 with 120.8 million tons C02 eq and in 2000, GHGs emission reached 130.5 million tons C02 eq.
- ❖ GHGs mitigation options in following sectors: Energy, Land Use Change and Forestry LUCF, Agriculture.
- ❖ Climate change impacts and adaptation measures in the sectors: water resources,

MAIN CONTENTS OF GHGs emission in energy sector

Year	Million tons C02 eq (Tg).
1990	21.4
2004	98.6
2010	110.4 (of which transport as 31.5)
2020	224.5/ 60.6
2030	387.4/ 103.7
The amount of 2.27 tons C02 eq for one person per year.	


National GHGs Inventory in 1994
Land use change and Forestry 19,4 Tg - 18,6%
Waste 2,5 Tg -2,5%
Energy 25,6 Tg - 24,7%
Industrial processes 3,8Tg - 3,7%
Agriculture 52,5 Tg - 50,5%


National GHGs Inventory in 2000


SNC: Estimation of GHGs emission in main sectors in Viet Nam
- Over 152 million tons of CO_2 eq in 2010
- Over 260 million tons of CO_2 eq in 2020
- Over 418 million tons of CO2 eq in 2030
450
400
350
300
250
200
150
100
50
0
-50
-100
CO2 equivalent (Tg)
2000
2010
2020
2030
Year
Energy
Agriculture
LUCF
Total


Thank you for your attention!

Presentation 4.4.1.4

The 7th Workshop on GHG Inventories in Asia (WGIA7)
7-10 July 2009,
Seoul, Republic of Korea

Energy statistics in Mongolia

(experiences gained through their development for GHG Inventory)

Dr. DORJPUREV JARGAL
EEC Mongolia

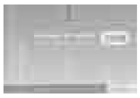
Energy Statistics

The main sources of Energy Statistics

- Mongolian Statistical Yearbook
- Energy statistics (Yearbook)
- Energy policy and statistics in Northeast Asia
- Country report on Energy outlook in Northeast Asia
- Sources from Ministry of Minerals and Energy and other related ministries

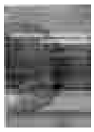
Mongolian Statistical Yearbook by National Statistical office

Coal balance
Electricity balance
Heat balance
Import of petroleum products



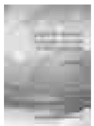
Energy statistics (Yearbook) by Energy regulatory Agency

Technical economical and financial data of energy systems and power plants
Energy price indexes



Energy policy and statistics in Northeast Asia

Energy demand structure changes 1990-2005
Energy supply structure changes 1990-2005



Country report on Energy outlook in Northeast Asia

Energy demand and Supply outlook up to 2020

Energy balance

Coal

- Coal supplies about 93% of Mongolia's electricity and heat requirements. All of this coal are produced domestically. Lignite and bituminous coals are used for energy production.
- Lignite is still the principle energy source in power generation of the central and eastern energy system. Lignite is consumed by CHPs, boilers and households.
- Bituminous coal deposits are located mainly in the Western and relatively low developed regions of the country causing the low production of this rank of coal comparing with lignite production. However, bituminous coal is still the principle energy source in the residential sector.
- The main course of coking coal is Tavan tolgoi coal mine, the only coking coal deposit to produce and export metallurgical coal.

Energy balance

Coal balance (source: National Statistical yearbook)

	1999	2000	2001	2002	2003	2004	2005	2006
Resources- Total	5,187.0	5,398.0	5,337.0	5,692.5	5,823.6	7,091.8	7,860.4	8,465.1
Stock at the beginning of the year	193.0	170.0	186.0	148.0	157.2	226.5	342.9	390.8
Produced	4,964.0	5,185.0	5,141.0	5,544.4	5,666.1	6,865.0	7,517.1	8,074.1
State owned mining companies		4,495.7	4,457.5	4,807.3	4,086.1	4,130.1	4,458.5	4,941.0
Private sector's mining companies		689.3	683.5	737.1	1,580.0	2,734.9	3,058.6	3,133.1
Import	30.0	43.0	10.0	0.1	0.3	0.3	0.4	0.2
Consumption-Total	5,017.0	5,211.4	5,189.0	5,535.3	5,161.7	5,188.5	5,472.6	5,691.2
Consumed by thermal power stations	4,127.0	4,449.0	4,324.0	4,723.2	4,380.2	4,478.6	4,619.6	4,595.2
Distributed to economic sectors	890.0	762.4	865.0	812.1	781.5	709.9	853.0	1,096.0
Of which:								
Industry & construction	347.0	180.0	152.0	151.7	153.5	90.6	106.6	237.3
Transport & communication	58.0	73.0	55.0	78.3	3.2	63.8	101.4	120.9
Agriculture	32.0	3.0	4.0	7.6	8.6	5.3	18.3	8.2
Communal housing	202.0	406.4	334.0	435.7	464.9	451.2	513.9	549.9
of which: household	87.0	180.0	205.0	379.0	409.0	412.2	337.0	549.9
Other	251.0	100.0	320.0	138.8	151.3	99.0	112.8	179.7
Export		0.6	-	-	435.4	1,560.4	2,116.2	2,456.6
Stock at the end of the year	170.0	186.0	148.0	157.2	226.5	342.9	271.6	317.3

Gaps for GHG Inventory:

- Only total coal balance;
- No separation of coal by coal categories

Energy statistics for GHG Inventory

Official Energy Statistics → Develop energy statistics for GHG Inventory → Energy statistics for GHG Inventory

Coal Balance (source: National Statistical yearbook) → Coal production and consumption data for all mines; Coal quality and category data for all mines; Classification of coal mines for coal category → Coal balance prepared for GHG Inventory by Reference approach; Coal balance prepared for GHG Inventory by Sectoral approach

Energy statistics for GHG Inventory

Coal balance prepared for GHG Inventory by Reference approach

	Production				Import				Export				Stock Change				Consumption			
	Coking	Sub-bit	Lignite	Total	Coking	Sub-bit	Lignite	Total	Coking	Sub-bit	Lignite	Total	Coking	Sub-bit	Lignite	Total	Coking	Sub-bit	Lignite	Total
1990	185.7	587.1	6,384.2	7,157.0	-	73.0	-	73.0	-	-	490.0	490.0	9.0	41.8	40.2	91.0	176.7	618.3	5,854.0	6,649.0
1991	230.3	528.7	6,278.0	7,037.0	-	-	-	-	-	-	121.0	121.0	(3.0)	11.7	(84.7)	(76.0)	233.3	517.0	6,241.7	6,992.0
1992	145.8	370.8	5,730.4	6,247.0	-	-	-	-	-	-	88.0	88.0	(3.9)	4.9	(61.0)	(60.0)	149.7	365.9	5,703.4	6,219.0
1993	89.5	206.4	5,321.1	5,617.0	-	-	-	-	-	-	-	-	(3.5)	(9.9)	(33.6)	(47.0)	93.0	216.3	5,354.7	5,664.0
1994	53.9	154.2	4,949.9	5,158.0	-	-	-	-	-	-	-	-	(2.6)	(6.0)	(0.4)	(9.0)	56.5	160.2	4,950.3	5,167.0
1995	49.3	286.0	4,683.7	5,019.0	-	211.0	-	211.0	-	-	1.0	1.0	(2.3)	(1.7)	29.0	25.0	51.6	498.7	4,653.7	5,204.0
1996	24.8	170.5	4,914.7	5,110.0	-	23.0	-	23.0	-	-	1.0	1.0	-	-	(7.0)	(7.0)	24.8	193.5	4,920.7	5,139.0
1997	20.4	24.6	4,879.0	4,924.0	-	100.0	-	100.0	-	-	-	-	-	-	(11.0)	(11.0)	20.4	124.6	4,890.0	5,035.0
1998	20.2	21.2	5,015.6	5,057.0	-	38.0	-	38.0	-	-	3.1	3.1	-	-	105.9	105.9	20.2	59.2	4,906.6	4,986.0
1999	-	203.0	4,761.0	4,964.0	-	30.0	-	30.0	-	-	-	-	-	-	(23.0)	(23.0)	-	233.0	4,784.0	5,017.0
2000	-	225.0	4,960.0	5,185.0	-	43.0	-	43.0	-	0.6	-	0.6	-	-	16.0	16.0	-	267.4	4,944.0	5,211.4
2001	-	385.0	4,756.0	5,141.0	-	10.0	-	10.0	-	-	-	-	-	-	(38.0)	(38.0)	-	395.0	4,794.0	5,189.0
2002	-	196.8	5,347.6	5,544.4	-	0.1	-	0.1	-		-	-	-	(0.1)	9.3	9.2	-	197.0	5,338.3	5,535.3
2003	-	1,059.5	4,606.6	5,666.1	-	0.3	-	0.3	-	435.4		435.4	-	(1.2)	70.5	69.3	-	625.6	4,536.1	5,161.7
2004	26.2	1,721.5	5,117.3	6,865.0	-	-	-	-	26.2	1,534.2	-	1,560.4	-	11.9	104.2	116.1	-	175.4	5,013.1	5,188.5
2005	360.7	1,956.7	5,199.7	7,517.1	-	-	-	-	360.7	1,755.5	-	2,116.2	-	(11.5)	(60.2)	(71.7)	-	212.7	5,259.9	5,472.6
2006	707.5	2,079.6	5,287.0	8,074.1	-	0.2	-	0.2	707.5	1,749.1		2,456.6	-		(73.5)	(73.5)	-	330.7	5,360.5	5,691.2

Energy balance

Coal balance prepared for GHG Inventory by Secroral approach

	1990	1995	2000	2001	2002	2003	2004	2005	2006
Consumption-Total	6,649.0	5,204.0	5,211.4	5,189.0	5,524.3	5,161.7	5,188.5	5,472.6	5,691.2
Consumed by thermal									
power stations	4,324.0	3,883.0	4,449.0	4,324.0	4,723.2	4,380.2	4,478.6	4,619.6	4,595.2
Coking coal									
Sub-Bit	360.0	300.0	110.0	160.0	87.7	89.3	74.6	88.9	120.0
Lignite	3,964.0	3,583.0	4,339.0	4,164.0	4,635.5	4,290.9	4,404.0	4,530.7	4,475.2
Total	4,324.0	3,883.0	4,449.0	4,324.0	4,723.2	4,380.2	4,478.6	4,619.6	4,595.2
Distributed to economic sectors									
and households	2,325.0	1,321.0	762.4	865.0	812.1	781.5	709.9	853.0	1,096.0
Of which:									
Industry & construction	995.0	651.0	180.0	152.0	151.7	153.5	90.6	106.6	237.3
Coking coal	176.7	51.6							
Sub-Bit	120.0	90.0	80.0	90.0	7.5	10.9	14.7	13.2	40.0
Lignite	698.3	509.0	100.0	62.0	144.2	142.6	75.9	93.5	157.3
Total	818.3	599.0	180.0	152.0	151.7	153.5	90.6	106.7	197.3
Transport & communication	114.0	97.0	73.0	55.0	78.3	3.2	63.8	101.4	120.9
Coking coal									
Sub-Bit				3.0	3.6	1.3	1.0	1.1	
Lignite	114.0	97.0	73.0	52.0	74.7	1.9	62.8	100.3	120.9
Total	114.0	97.0	73.0	55.0	78.3	3.2	63.8	101.4	120.9
Commercial/instituional Sector	302.0	190.0	226.4	129.0	56.7	55.9	39.0	176.9	549.9
Coking coal									
Sub-Bit		60.0	10.0	25.0	9.0	1.5	12.8	11.2	14.0
Lignite	302.0	133.4	216.4	104.0	47.7	55.2	26.9	173.9	135.9
Total	302.0	193.4	226.4	129.0	56.7	56.7	39.7	185.1	149.9
Residential sector	565.0	122.0	180.0	205.0	379.0	409.0	412.2	337.0	549.9
Coking coal									
Sub-Bit	138.3	48.7	67.4	77.0	66.7	60.8	61.5	80.0	130.7
Lignite	426.7	73.3	112.6	128.0	312.3	348.2	350.7	257.0	319.2
Total	565.0	122.0	180.0	205.0	379.0	409.0	412.2	337.0	449.9
Agriculture	159.0	28.0	3.0	4.0	7.6	8.6	5.3	18.3	8.2
Coking coal									
Sub-Bit					0.3		0.1		
Lignite	159.0	28.0	3.0	4.0	7.3	8.6	5.2	18.3	8.2
Total	159.0	28.0	3.0	4.0	7.6	8.6	5.3	18.3	8.2
Other	190.0	233.0	100.0	320.0	138.8	151.3	99.0	112.8	179.7
Coking coal									
Sub-Bit			-	40.0	11.2	37.1	10.7	18.3	26.0
Lignite	190.0	230.0	100.0	280.0	116.6	113.4	87.6	86.2	143.8
	190.0	230.0	100.0	320.0	127.8	150.5	98.3	104.5	169.8

Energy statistics for GHG Inventory

Liquid fuel

Mongolia imports all of oil product demand from Russia and China.
There are official statistics of import of petroleum products in Mongolian Statistical Yearbook

Liquid Fossil Fuel types	1990	1991	1992	1993	1994	1995	1996	1997	1998
Gasoline	341.10	218.40	210.10	174.50	158.80	178.90	193.20	178.90	211.40
Jet fuel	34.00	30.00	23.80	24.00	22.40	20.40	27.50	24.70	20.30
Gas / Diesel Oil	364.30	264.30	162.40	282.10	130.40	103.70	120.40	128.20	132.20
Residual Fuel Oil	63.40	72.50	46.10	56.60	47.50	29.84	33.60	34.50	31.80
Lubricants	36.00	3.80	12.20	10.30	4.70	5.00	0.40	0.50	-

Liquid Fossil Fuel types	1,999	2,000	2,001	2,002	2,003	2,004	2,005	2,006
Gasoline	193.20	233.70	247.20	243.70	259.07	270.07	254.77	280.44
Jet fuel	15.90	18.40	22.80	20.50	23.89	22.76	18.91	41.36
Gas / Diesel Oil	159.40	161.70	197.10	190.60	214.82	258.24	270.85	309.96
Residual Fuel Oil	22.70	14.60	17.50	9.50	12.35	11.10	4.93	4.42
Lubricants	2.50	1.50	2.90	6.30	2.72	1.68	1.83	1.52

Engine	*Gasoline*	*Diesel*	*Jet fuel*
	Road transport	Road transport	Aviation
		Railway	
		Agriculture, Mining and Construction	
		Energy	
Steam generator	*Residual fuel*		
	Thermal Power Station		
	Industrial Furnace		

Energy statistics for GHG Inventory

Liquid fuel statistics developed for GHG Inventory

		1999	2000	2001	2002	2003	2004	2005	2006
Energy Industry									
	Other Kerosene	73.15	6.31	5.18	5.77	5.85	4.38	3.36	2.58
	Gas/Diesel oil	11.40	10.20	10.20	11.00	12.57	11.30	9.10	8.00
	Residual Fuel Oil	22.70	14.60	17.50	9.50	12.35	11.10	4.93	4.42
Industry & construction									
	Other Kerosene	9.28	8.78	7.41	8.92	8.61	7.51	7.20	6.71
	Gas/Diesel oil	14.80	14.20	14.60	17.00	18.50	19.40	19.50	20.80
	LPG							0.30	0.60
	Lubricants	2.50	1.50	2.90	6.30	2.72	1.68	1.83	1.52
Transport & communication									
	Gasoline	193.20	233.70	247.20	243.70	259.07	270.07	254.77	280.44
	Jet Kerosene	11.86	15.50	18.39	18.51	12.90	15.68	18.13	17.90
	Other Kerosene	19.64	22.39	21.56	25.87	25.12	24.22	27.13	18.57
Rail way	Gas/Diesel oil	31.30	36.20	42.50	49.30	53.97	62.54	73.47	57.56
Auto transport	Gas/Diesel oil	72.10	72.70	101.90	85.00	98.43	135.00	137.50	195.50
	Residual Fuel Oil	45.23	44.96	51.70	44.60	45.82	52.28	50.77	63.07
	LPG							0.50	0.63
Agriculture									
	Other Kerosene	18.70	17.56	14.16	14.85	14.59	11.62	11.55	9.07
	Gas/Diesel oil	29.80	28.40	27.90	28.30	31.35	30.00	31.28	28.10
Residential sector									
	LPG	0.05	0.15	0.3	0.6	1	1.5	2.7	3.27

Energy statistics for GHG Inventory

Biomass fuel

Traditional biomass fuel. This is the most difficult part of the collection of activity data in the National Emission Inventory. In the biomass fuel included both wood and dung used for heat production in private house. The consumers are nomadic herders and households living in ger (traditional round Mongolian tent) or private houses surrounding area of big city like Ulaanbaatar, Darkhan, Erdenet and province center. Therefore, it is required to accurately estimate demand of traditional biomass fuel in households. These estimations were done by scientist group from Mongolian technical university of Mongolia. The estimation based on research and survey results and tested. Therefore, it is accessible for inventory estimation.

Thank you for attention

Presentation 4.4.1.5

Presentation to The 7th Workshop on GHG Inventories in Asia
Seoul, 7-10 July

Energy Balance in Korea

Taesik Park
Korea Energy Economics Institute

Contents

- Briefs of Energy Statistics in Korea
- National Energy Balance
- Difference between criteria of NEB and IEA
- Further activities for IEA questionnaires
- Issues to be solved

Briefs of Energy Statistics in Korea

- **Energy data reported prior to 1980**
  - *Electricity (Korea Electric Power Corporation)*
  - *Coal (Korea Coal Corporation)*
- **Overall energy data are available starting in the 1980s**
  - *Korea administration started to report Energy Balance in 1982*
  - *Thereafter, "Yearbook of Energy Statistics" began to be published*
- **Energy Balances are reported on basis of commodity balances**

Briefs of Energy Statistics in Korea

- **Commodities statistics are provided by**
  - *Coal : Korea Coal Association*
  - *Oil : Korea National Oil Corp.(KNOC)*
  - *Natural Gas : Korea Gas Corp.(KNOC), POSCO, K-Power*
  - *City Gas : Korea City Gas Association*
  - *Electricity : Korea Electric Power Corp.(KEPCO)*
  - *Heat : Korea District Heating Corp.(KDHC), SH Corp., GS Power*
  - *Renewable and Wastes : Korea Energy Management Corp.(KEMCO)*
- **Data collected from Reporting organization**
  - *Monthly basis(about 2 months later)*
  - *By means of network(Petro-net), fax, or publications*
  - *Korea administration started to use a new survey system in 2008 in order to collect reliable and detailed data, but it's still at a test run phase*

Briefs of Energy Statistics in Korea

- *The unit of account adopted into EB*
  - *1,000 toe on a gross calorific basis*
- **Conversion factors** *applied to EB*
  - *presented at Energy Fundamental Law*
  - *revised in 2006 (on the basis of 2 years' study)*
- **Primary energy conventions**
  - *Primary energy equivalent of nuclear, hydro, wind and solar photovoltaic: the amount of energy to generate an identical amount of electricity in conventional thermal power plants.(by partial substitution method)*
  - *Prior to 2007, 2,500 kcal / kwh (34.4%)*
    → 2,150 kcal / kwh (assuming an efficiency of 40%)

National Energy Balance

- **Energy flow (40 categories)**

Supply	transformation	Final Energy Consumption	
Production	Electricity	Industry	Machinery
Import	District heating	Agri., Forest., Fishing	Others
(Petroleum production)	Gas manufacturing	Mining	Construction
(Petroleum imports)	Own use & losses	Manufacturing	Transport
Export		Food/Beverage	Rail
Intl' marine bunkers		Textile/Clothing	Road
Stock changes		Wood/product	Navigation
Opening stock		Pulp/Paper/Printing	Aviation
Closing stock		Petrochemical	Residential
Statistical difference		Non metallic	Commercial
Total Primary Supply		Iron & Steel	Public and others
		Non ferrous metal	

National Energy Balance

- **Energy Commodities (36 categories)**

Coal	Anthracite	Domestic, Imported
	Bituminous	Coking Coal, Steam Coal
Oil	Fuel oil	Gasoline, Kerosene, Diesel, B-A, B-B, B-C, JA-1, JP-4, Avi-gas
	LPG	Propane, Butane
	Non energy	Naphtha, Solvent, Asphalt, Paraffin wax, Pet-coke, Other
LNG		
City gas		
Hydro		
Nuclear		
Electricity		
Heat		
Renewable & Wastes		
Total		

The 7th Workshop on GHG Inventories in Asia

National Energy Balance

- **Energy Conversion factors**
  - *Included in "Energy Fundamental Law" (2006. Sep. 1)*
  - *Based on gross calorific values*
  - *Below figures are applied from 2007 data*

	Unit	GCV(kcal)		Unit	GCV(kcal)		Unit	GCV(kcal)
Crude oil	Kg	10,750	Naphtha	ℓ	8,050	Anthracite 1	Kg	4,650
Gasoline	ℓ	8,000	Solvent	ℓ	7,950	Anthracite 2	Kg	6,550
Kerosene 1	ℓ	8,800	Aviation-gasoline	ℓ	8,750	Steam coal	Kg	6,200
Kerosene 2	ℓ	8,950	Asphalt	ℓ	9,900	Coking coal	Kg	7,000
Diesel	ℓ	9,050	Lubricant	ℓ	9,250	Sub bituminous	Kg	5350
B-A	ℓ	9,300	Pet coke	ℓ	8,100	Cokes	Kg	7,050
B-B	ℓ	9,650	Derived fuel1	ℓ	8,850	Electricity	kWh	860
B-C	ℓ	9,900	Derived fuel2	ℓ	9,700			2,150
Propane	Kg	12,050	LNG	Kg	13,000	Fire wood	Kg	4,500
Butane	Kg	11,850	City gas	N㎥	10,550			

The 7th Workshop on GHG Inventories in Asia

National Energy Balance

- **Comparing Energy consumption in NEB with one of IEA**
  - *Primary energy consumption in 2006 was 233.37 Mtoe according to national energy balance, while IEA showed 216.50 Mtoe. (8% gap)*
  - *Final energy consumption in NEB differs from IEA around 20%*

< Energy consumption in 2006 >

	National EB (M toe)	IEA EB (M toe)	Gap(A/B)
TPES	233.37	216.50	1.08
TFC	173.58	145.08	1.20

- **The gaps between KEB and IEA come from ;**
  - *Coverage of energy sources and transformation*
  - *Calorific values, definition etc.*

The 7th Workshop on GHG Inventories in Asia

Difference between criteria of NEB and IEA

- **Energy Coverage**

	IEA EB	Excluded in NEB
Coal	Anthracite, Coking coal, Steam coal Sub-bituminous, Coke oven coke, COG, BFG, LDG	Sub-bituminous, Coke oven coke, COG, BFG, LDG
Oil	Crude, NGL, Other HC, Refinery Feedstock, Refinery gas, LPG, Naphtha, Aviation gasoline, Jet oil, Gasoline, Kerosene, Diesel, Heating oil, Solvent, Asphalt, Paraffin wax, Pet coke, Other	Crude, Refinery feedstock, Refinery gas
Electricity & Heat	Electricity only, CHP, Heat only Main activity producer, Auto producer	Auto producer
Renewables	Hydro, Wind, Tide, PV, Solar thermal, Geothermal, Industrial & Municipal waste, Biomass, Biogas, Biofuel	Biofuel, Industrial waste(incl. coal gas, refinery gas etc.)

The 7th Workshop on GHG Inventories in Asia

Difference between criteria of NEB and IEA

- **Conversion factors**

	NEB (Kcal/kwh)	IEA EB (Kcal/kwh)
Nuclear	2,500 (34.4%) → 2,150 (40%)	2,606 (33.0%)
Hydro, PV, Wind	2,500 (34.4%) → 2,150 (40%)	860(100.0%)
Calorific base	gross	net
Petroleum	National factors	Average factors

- **Energy flows**
  - *Definition of Intl' bunkering*
  - *Coverage on transformation sector : petroleum refinery, auto-producer for electricity plants and heat plants, coal transformation, other (petro-chemical)*
  - *Concept of transportation sector*
  - *Agriculture and fishing excluded in industrial sector*
  - *Non energy use : separate from industrial and transportation sector*

The 7th Workshop on GHG Inventories in Asia

Difference between criteria of NEB and IEA

- **Intl' marine bunkers(Intl' bunkering)**
  - *IEA : covers those quantities delivered to ships of all flags that are engaged in international navigation*
  - *NEB : those ones delivered to ships of all flags and aircrafts of foreign flags that are engaged in international navigation as well as aviation*
- **Electricity, CHP and Heat plants**
  - *IEA : Both main activity producer and auto producer plants are included*

  ※ for auto producer CHP plants, all fuel inputs to electricity production are taken into account, while only the part of fuel inputs to heat sold is considered.

  Fuel inputs for production of heat consumed within the auto producer's establishment are not included here
  - *NEB : Auto producer plants are excluded and CHP plants are not classified separately*

The 7th Workshop on GHG Inventories in Asia

Difference between criteria of NEB and IEA

- **Petroleum refineries**
  - *IEA : the use of primary energy for the manufacture of finished petroleum products and the corresponding output*
  - *NEB : Imports comprise the output of finished petroleum products in refineries, instead of excluding it in the transformation sector as well as crude oil*
- **Coal transformation**
  - *IEA : Transformation of coal from primary to secondary fuels and from secondly to tertiary fuels(hard coal to coke, coke to BFG etc.)*
  - *NEB : reports hard coal which is used for coke production purposes as final energy consumption in iron & steel manufacture.*
    Coal transformation is not treated in transformation sector.
  - *※ Coal transformation occurs at the plants which combine the coke production and iron manufacturing stages as well as the treatment and finishing of steel(integrated steel plants) in Korea.*

The 7th Workshop on GHG Inventories in Asia

Difference between criteria of NEB and IEA

- **Other transformation**
  - *IEA : includes the blending of other gases with natural gas, backflows from the petrochemical sector*
  - *NEB : excludes other transformation in transformation sector*
- **Final consumption in transport sector**
  - *IEA : includes all fuels used for transport except international marine bunkers*
  - *NEB : excludes the fuels delivered to aircrafts of foreign flags that are engaged in international navigation*

The 7th Workshop on GHG Inventories in Asia

Further activities for IEA questionnaires

- **Gathering more and detailed data**
  - *Electricity, CHP, Heat : collecting auto producers' data (around 100 enterprises) from KPX(Korea power exchange) and KEMCO(Korea energy management corp.) and estimating fuel amount used for generating electricity*
  - *Petroleum refineries : existing data (from KNOC)*
  - *Coal transformation : gathering corresponding data from POSCO.(integrated steel company)*

	Coking coal	Semi anthracite	cokes	COG	BFG	LDG/CFG
Production			+	+	+	+
Consumption	+	+	+	+	+	+
Cokes Oven	+			+	+	+
Furnace/		+	+	+	+	
Power generation				+	+	+
Other process			+	+	+	+

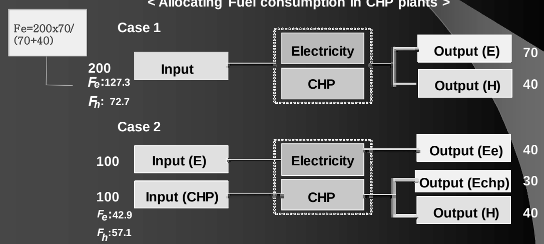
  - *Backflow(other transformation) : existing data (from KNOC)*

The 7th Workshop on GHG Inventories in Asia

Further activities for IEA questionnaires

- **Estimate fuel consumption in auto producers' power plants**
  - *The auto producers' data contains electricity generated and kind of fuel, except of fuel consumption*
  - *Efficiency : Average Efficiency of Conventional Power Plants*

< Allocating Fuel consumption in CHP plants >



The 7th Workshop on GHG Inventories in Asia

Further activities for IEA questionnaires

- **Petroleum refinery**
- **Treatment in an energy balance**
  - *Refinery Intake(Crude, Feedstock) : 100 unit*
  - *Refinery output : 30 unit*
  - *Refinery fuel(refinery gas, Residual) : 10 unit*

	Crude	Feedstock	Petroleum products
Transformation sector			
Petroleum refinery	-	-	+
Energy Sector			
Own Use			-

The 7th Workshop on GHG Inventories in Asia

Further activities for IEA questionnaires

- **Backflows to refineries from petrochemical sector**
- **Treatment in an energy balance**
  - *Gross delivers to petrochemical(naphtha) : 100 unit*
  - *Backflows to refinery : 30 unit*
  - *Input to refinery : 30 unit*

	Feedstock	Petroleum product	(Naphtha)
Transformation sector			
Petroleum refinery	-30	+30	
Petrochemical(other)	+ 30		-30
TFC			+70
Non energy			+70

The 7th Workshop on GHG Inventories in Asia

Further activities for IEA questionnaires

- **Treatment of Coal transformation in an energy balance**

	Coking coal	Coke oven coke	COG	BFG/LDG
Transformation sector				
Coke oven	-	+	+	
Blast furnace()		-		+
Own Use			-	-

- **Treatment of Biofuel in an energy balance**

	Diesel	Biofuel
Production		+
Transformation		
Petroleum refinery	-	
Final Consumption		+

The 7th Workshop on GHG Inventories in Asia

Issues to be solved

- **Improvement of data survey system**
  - *Statistical List necessary for IEA questionnaires*
  - *Improvement of data gathering methodology*
    - *Data reporting mechanism for basic energy statistics : Developing energy statistics manual*
  - *Build up the survey system on consumption sector*
    - *Energy use in the petrochemical sector : petrochemical companies*
    - *Autoproducers' generation and sales of electricity and heat*
  - *Institutional supports(legal basis)*

The 7th Workshop on GHG Inventories in Asia

Thank you
For your attention!

The 7th Workshop on GHG Inventories in Asia

Presentation 4.4.1.6

7^{th} Workshop on Greenhouse Gas Inventories in Asia
7-10 July 2009, Seoul, Korea

Introducing Calculation Methodologies for CH_4 and N_2O from Stationary Combustion in Japan

Ken Imai
Suuri-keikaku (SUR), Japan
Cooperative Researcher, GIO, NIES

7^{th} Workshop on Greenhouse Gas Inventories in Asia

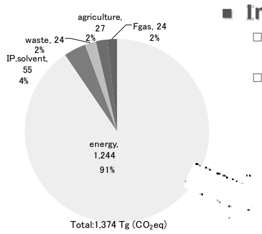
Overview

- GHG emissions in Japan
- CH_4 and N_2O emissions from stationary combustion
  - Methodology of Estimating CH_4 and N_2O emissions from Stationary Combustion
  - Emission factors and activity data
- The aim of statistical survey of Air Pollutant Emissions from Stationary Sources
- Co-benefits approach to Climate Change
  - Viewing Inventories from Co-benefits perspective
  - Co-benefits approach of Climate Change concerning developing counties
  - CDM chances

2

7^{th} Workshop on Greenhouse Gas Inventories in Asia

GHG emissions in Japan



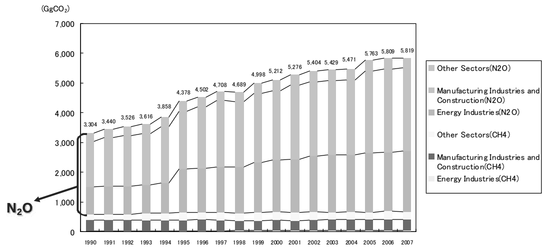
- In 2007 emissions,
  - In 2007, total GHG emissions were 1,374 Tg (CO_2eq).
  - GHG emissions from energy sector (1.A and 1.B) were 1,244 Tg (CO_2eq). (91 per cent of the total emissions)

CH_4 and N_2O emissions were 9 Tg (CO2eq).

3

7^{th} Workshop on Greenhouse Gas Inventories in Asia

CH_4 and N_2O emissions from stationary combustion



- Notes:
  - CH_4 and N_2O emissions from this category represented a very small portion of the total national emissions. (0.4%,2007)
  - CH_4 and N_2O emissions from this category have risen 76% from 1990 to 2007.
  - N_2O emissions were the largest portion in this category.

4

7^{th} Workshop on Greenhouse Gas Inventories in Asia

The primary factor in the increase of emissions in this category

- N_2O emissions from Fluidized Bed Boiler are relatively large in this category. And the emissions have increased because the introduction of Fluidized Bed Boiler has been advanced since 1990 in Japan.
- The reasons for increasing number of Fluidized Bed Boiler are …
  - Wide range of fuel type
  - Low NOx, SOx emissions
  - High combustion efficiency
  - Space-saving and easy maintenance

5

7^{th} Workshop on Greenhouse Gas Inventories in Asia

Methodology of Estimating CH_4 and N_2O emissions from Stationary Combustion

- CH_4 and N_2O emissions from stationary combustion were estimated using IPCC Tier 2 method in accordance with the 1996 Revised IPCC Guidelines and Good Practice Guidance (2000). Emissions were obtained by multiplying country-specific emission factors (by fuel type and furnace type) by energy consumption (by fuel type, furnace type and sector type).

$$E = \sum (EF_{ij} \cdot A_{ijk})$$

E : Emissions from stationary combustion ($kgCH_4$, kgN_2O)
EF_{ij} : Emission factor for fuel type i, furnace type j ($kgCH_4/TJ$, kgN_2O/TJ)
A_{ijk} : Fuel consumption for fuel type i, furnace type j, sector k (TJ)

6

Emission Factors

- Based on the study results of actual measurements of CH_4 and N_2O concentrations emitted from stationary sources, emission factors were estimated by the fuel type and furnace type.

Samples of Furnace Type	
Boiler	Other drying kilns
Sintering furnace (excluding copper, lead, and zinc) for refining	Electric arc furnace
Pelletizing furnace (steel and non-ferrous metals)	Other industrial furnaces
Metal rolling furnace, metal treating furnace, metal forging furnace	Gas turbine
Petroleum and gas furnace	Diesel engine
Catalytic regenerator	Gas engine, gasoline engine
Brick kiln, ceramic kiln and other types of kiln	Household equipments
Aggregate drying furnace, cement raw material drying furnace, brick raw material drying furnace	

7

Calculation procedure for establishing EFs

- Equation for calculating emission factors

1. Calculate emission factors from actual measurement data of CH_4, N_2O and O_2 concentrations in flue gas.

$$EF = C \cdot \left(G_0' + (m-1) \cdot A_0\right) \cdot MW / V_m / GCV$$

EF: Emission factor ($kgCH_4/TJ$, kgN_2O/TJ)
C: CH_4 or N_2O concentration in emission gas (ppm)
G_0': Theoretical amount of emission gas (dry) from combusted fuel ($m^3N/kg,l,m^3N$)
A_0: Theoretical amount of air necessary to completely combust fuel ($m^3N/kg,l,m^3N$)
m: Air ratio ≡ Actual air amount / Theoretical air amount (= *21/(21-CO_2)*)
MW: Molecular weight of CH_4 or N_2O (constant)
V_m: Volume of 1 mole of ideal gas under normal conditions (constant) ($10^{-3}m^3/mol$)
GCV: Gross calorific value of combusted fuel ($MJ/g,l,m^3N$)

8

2. Calculate average emission factors by fuel type and furnace type for each facility.

3. A t-test with a 1% significance level was also conducted when calculating the average emission factors. The rejected data by the t-test, also called outliers, were eliminated from the average calculation. Even in the cases where the t-test results do not point out any outliers, if experts judged the data as an outlier, the specified data was eliminated from the average.

9

Activity Data

- Determine energy consumption
  - Energy consumption from stationary combustion activities has been grouped by fuel type in each sector (Energy Industry, Manufacturing Industry and Construction, Commercial & Others and Residential; Obtained from the General Energy Statistics).
  - Break Energy consumption data into furnace type.
    In *the General Energy Statistics*, fuel consumption amounts are not indicated clearly by furnace type for stationary combustion. In the case of Japan, the Research of Air Pollutant Emissions from Stationary Sources provides statistics that will help to determine fuel consumption amount by furnace type and fuel type.
    Therefore, the proportion of fuel consumption by each furnace type is estimated using data from the Research.

10

Calculations of activity data

- The equation for calculating the activity data

$$A_{ijk} = A_{EBik} \cdot w_{ijk}$$

A_{ijk}: Activity data for fuel type i, furnace type j, sector k (TJ)
A_{EBik}: Fuel consumption for fuel type i, sector k from *the General Energy Statistics* (TJ)
w_{ijk}: Ratio of furnace type j associated with consumption of fuel type i in sector k

$$w_{ijk} = A_{RESijk} / \sum_m A_{RESimk}$$

A_{RESijk}: Fuel consumption for fuel type i, furnace type j, sector k according to *the research* (TJ)

11

- Calculation of activity data

1. Calculating A_{RESijk} from the research
   - Sum up the fuel consumption data in the research by fuel type, furnace type, and sector, and calculate A_{RESijk} (fuel type i, furnace type j, sector type k, according to the research).
2. Calculating w_{ijk}
   - Calculate w_{ijk} (ratio of furnace type j by fuel type i in sector type k) by dividing A_{RESijk} by $\Sigma_m A_{RESimk}$.
   - If the research data is not available for the target year, interpolate data of years before and after the target year to calculate w_{ijk}.

12

3. **Calculating activity data by fuel type, furnace type, and sector**
   - Calculate activity data A_{ijk} for fuel type i, furnace type j, and sector type k, by multiplying w_{ijk} by fuel consumption data A_{EBik} of fuel type i, sector type k from *the General Energy Statistics*.
4. **Calculating activity data for fuel types, furnace types, and sectors that cannot be determined from *the General Energy Statistics*.**
   - Use fuel consumption data A_{RESijk} from the research as activity data, for fuel consumption data for fuels (such as charcoal) that are not specified in *the General Energy Statistics* and furnace types for which fuel consumption data from *the General Energy Statistics* cannot be used.
5. **Calculating activity data for the residence sector.**
   - For the residence sector, fuel consumption by fuel type stated in the General Energy Statistics are used.

13

The aim of statistical survey of Air Pollutant Emissions from Stationary Sources

- **This survey is conducted using questionnaires.**
- **Statistical survey is conducted to**
  1. Promote reasonable and effective atmospheric environmental policy,
  2. Obtain information on current activities within the context of the Air Pollutant Control Law (e.g., the current status of regulation of stationary sources that emit soot and smoke in facilities that are registered to a local government and in facilities that emit ordinary soot or particular soot, and the current status of air pollutant control),
  3. Develop the submitted data on facilities emitting soot and smoke,
  4. Estimate the amounts of air pollutant emissions from facilities that emit soot and smoke.

14

Viewing Inventories from Co-benefits perspective

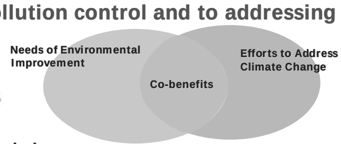
- The data of Air Pollutant Emissions from Stationary Sources are used for estimating GHG emissions in Japan.
- The data of fuel consumption and air pollutant emissions from facilities emitting soot and smoke are useful for addressing environment control as well as reducing Climate Change.
- The air pollution measurement data also contributes to Climate Change.

Example
- Lower CH_4 and N_2O EFs from stationary sources

15

Co-benefits approach of Climate Change concerning developing counties

- Co-benefits approach means contributing to environmental pollution control and to addressing climate change.



Example of benefits
- **Climate benefits**
  - Reduction of GHG emissions
- **Environmental benefits**
  - Reduction of pollutants (ex. SOx,NOx,dust,etc)
  - Reduction of BOD,COD
  - Reduction of waste amount ,etc

16

CDM chances

- Viewing from co-benefits perspective is very important. Prompting the implementation of co-benefits approach will improve opportunities of CDM.

Examples of co-benefits approach projects (Registered CDM project activities)

CDM-EB Ref	CDM Project	Host Parties	Climate Change Benefits Emission Reduction (tCO2/y)		Environmental Benefits
1397	Comprehensive utilization of waste coal gas for electricity generation project in Shaanxi Xinglong Cogeneration Co.	China	CO_2	270,045	soot and dust 21 tons Sox 0.232 tons
0032	Methane capture and combustion from swine manure treatment for Peralillo	Chili	CH_4	78,867	Prevent water pollution

URL:http://cdm.unfccc.int/Projects/registered.html

- I hope this case study in Japan is helpful in addressing Climate Change in your countries.

17

Thank you very much!

Ken Imai （今井 健）
Suuri-keikaku (SUR), Japan （株式会社数理計画）
Cooperative researcher, Greenhouse gas inventory office of Japan, NIES
imai@sur.co.jp

18

Presentation 4.4.2.1

Greenhouse gas Inventory Office of Japan

Agricultural Sector
Group Discussion

INTRODUCTION

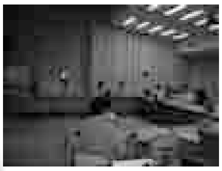
9 July 2009, Seoul, Korea
7th Workshop on GHG Inventories in Asia

Kohei Sakai
Greenhouse Gas Inventory Office of Japan (GIO)
National Institute for Environmental Studies (NIES)

Background Information

WGIA6

- Focused on strategies to improve reliability and current status and challenges in agriculture sector inventory.
- Discussed how to get reliable data of agriculture.
- Agriculture WG participants recommend that each country present country-specific EFs developments and exchange agriculture information at WGIA7.




Greenhouse gas Inventory Office of Japan

Agriculture WG in WGIA 7

WGIA7

- Theme: Emission Factors utilized for the NCs
  - Understanding of Country-Specific EFs development and reporting progress of NCs
  - Availability to the other country of CS-EFs, and possibility of joint research
  - Exchange agriculture information (including mitigation potential)
- *Chair: Kazuyuki Yagi,*
- *Rapporteur: Batimaa Punsalmaa*

Greenhouse gas Inventory Office of Japan

Time Schedule *(WGIA7 Day 3, 9:30~12:20)*

WGIA7 Day 3 , 9:30～12 :20

- 9:30-9:35 Introduction
- 9:35-9:50 Koki Maeda (NARO) CS-EFs for Livestock Manure Management
- 9:50-10:05 Kazuyuki Yagi (NIAES) CS-EFs for Soils and Rice Cultivation
- 10:05-10:20 Leandro Buendia CS-EFs for Rice Cultivation in Philippine
- 10:20-10:35 Prihasto Setyanto (Indonesia) CS-EFs in Indonesia
- 10:35-10:45 Kohei Sakai (GIO) Agricultural Mitigation Potential

10:45-10:55 ----Caffee Break---- 10min.

- 10:55-11:50 *Group discussion* for CS-EF, NCs (or mitigation potential) (with short reports by Vietnam, Mongolia, Myanmar)
- 11:50-12:20 *Make WG Report for Wrap-up Session*

Greenhouse gas Inventory Office of Japan

WGIA-EFDB

- WGIA secretariat collects EFs using in NCs in each WGIA country and makes a database for them.
  - Yesterday's presentation by Junko Akagi.
- Part of the agricultural sector is distributed as source material of today's discussion.
- We hope to gather more EFs from other countries as well.
  - if possible, with background information such as literature

Greenhouse gas Inventory Office of Japan

Summary for agricultural sector WG

- Status of CS-EFs development in agricultural sector
  - enteric fermentation
  - manure management
  - rice cultivation
  - N_2O emission from soils

Greenhouse gas Inventory Office of Japan

Summary for agricultural sector WG

- Discussion
  - (Country-specific emission factors)
  - (Mitigation potential)
  - (Availability to the other country of CS-EFs)
  - (Other)

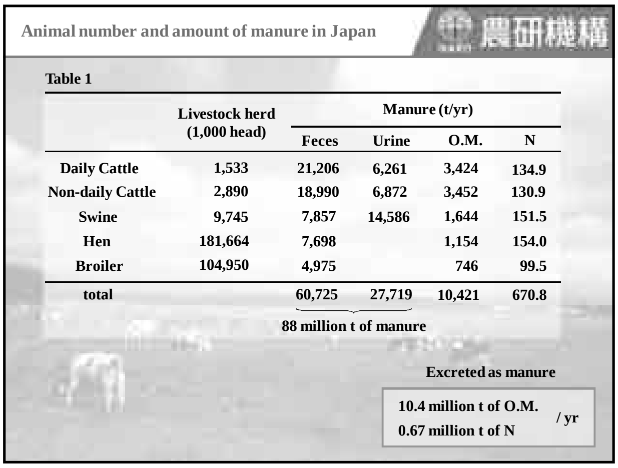
Greenhouse gas Inventory Office of Japan

Summary for agricultural sector WG

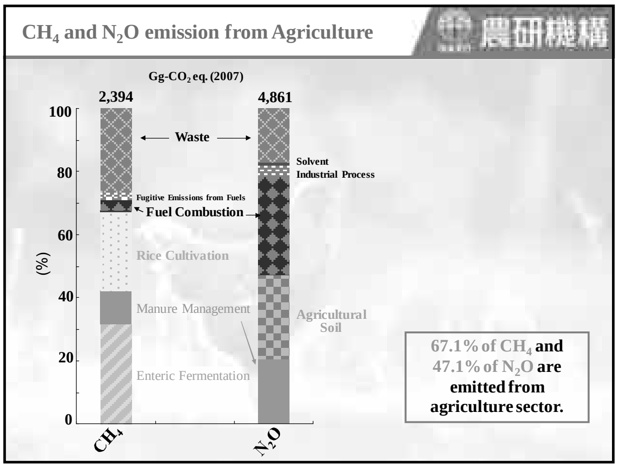
- About WGIA-EFDB
- What do you want to discuss in WGIA8 and in future WGIA ?

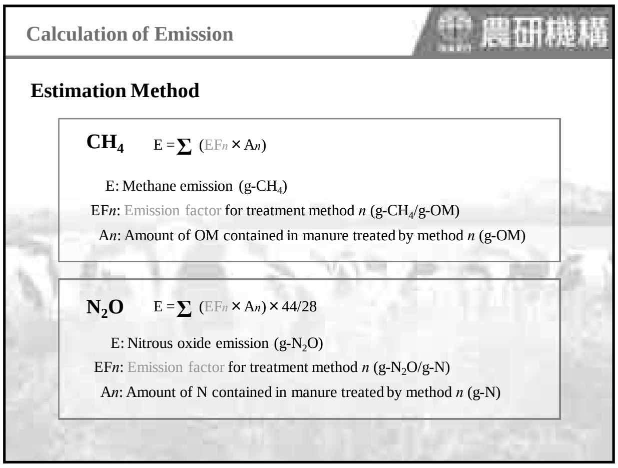
Greenhouse gas Inventory Office of Japan

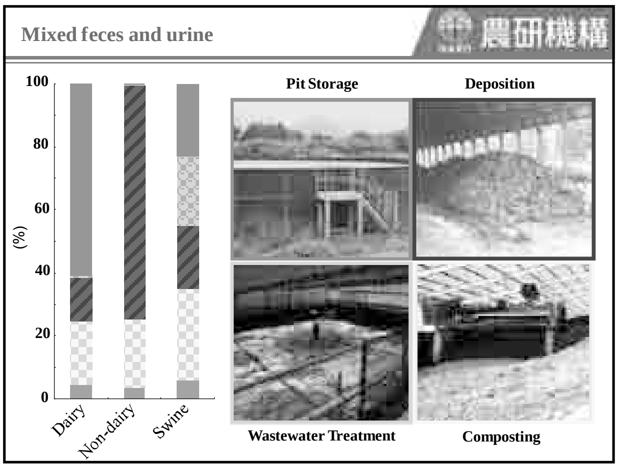
Presentation 4.4.2.2



	Livestock herd (1,000 head)	Manure (t/yr)			
		Feces	Urine	O.M.	N
Daily Cattle	1,533	21,206	6,261	3,424	134.9
Non-daily Cattle	2,890	18,990	6,872	3,452	130.9
Swine	9,745	7,857	14,586	1,644	151.5
Hen	181,664	7,698		1,154	154.0
Broiler	104,950	4,975		746	99.5
total		60,725	27,719	10,421	670.8







Emission Factor

		Dairy Cattle	Non-dairy Cattle	Swine	Hen Broiler
CH_4	Pit Storage	3.9	3.0	8.7	
	Sunlight Drying	0.2	0.2	0.2	0.2
	Composting (feces)	0.044	0.034	0.097	0.14
	Composting (feces and urine mixed)	3.8	0.13	0.16	0.14
	Deposition	0.4	0.4	0.4	0.4
	Incineration	0.044	0.034	0.097	
	Wastewater management	0.0087	0.0067	0.019	
N_2O	Pit Storage	0.1			
	Sunlight Drying	2.0			
	Composting (feces)	0.25			
	Composting (feces and urine mixed)	2.4	1.6	2.5	2.0
	Deposition	0.1			
	Incineration	2.0			
	Wastewater management	5.0			

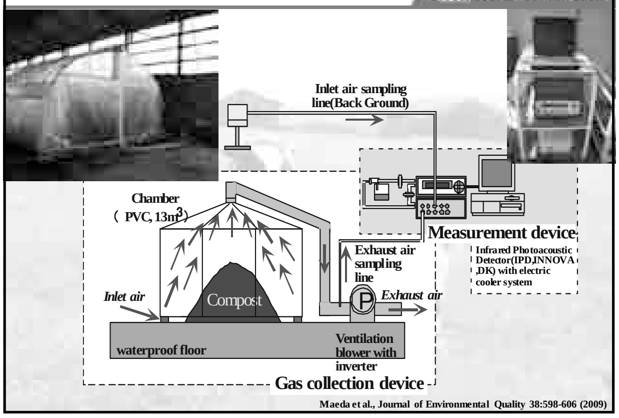
(%)

Established by data of Japan
Default value of IPCC Guideline

So How Can We Estimate the Emission Factor?

ex) cattle manure static composting process

Measurement of GHG emission from cattle manure composting process

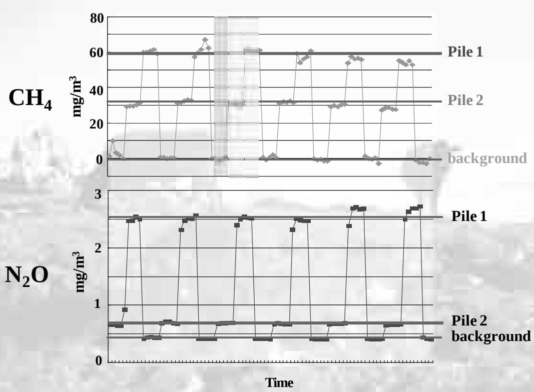


Maeda et al., Journal of Environmental Quality 38:598-606 (2009)

Raw data 1 (gas conc.)

	Time	NH_3	N_2O	CO_2	CH_4 (ppm)
Pile 1	2007/5/21 11:11	13.6	1.54	1918.3	12.4
	2007/5/21 11:13	16.4	1.53	1912.6	12.8
	2007/5/21 11:15	17.2	1.54	1922.5	11.5
	2007/5/21 11:17	17.4	1.55	1924.3	12.1
Change port	2007/5/21 11:19	17.3	1.54	1896.1	12.1
Pile 2	2007/5/21 11:21	19.9	1.92	1725.2	27.8
	2007/5/21 11:23	23.2	1.95	1779.7	28.2
	2007/5/21 11:25	24.9	1.95	1783.4	28.5
	2007/5/21 11:27	25.7	1.95	1762.5	27.4
Change port	2007/5/21 11:29	26.1	1.96	1776.1	27.7
background	2007/5/21 11:31	0.8	0.45	406.4	2.6
	2007/5/21 11:33	5.1	0.44	395.8	2.4
	2007/5/21 11:35	2.4	0.44	393.5	3.2
	2007/5/21 11:37	1.3	0.45	393.7	3.0
	2007/5/21 11:39	0.8	0.45	400.2	2.3
	⋮	⋮	⋮	⋮	⋮

Raw data 2

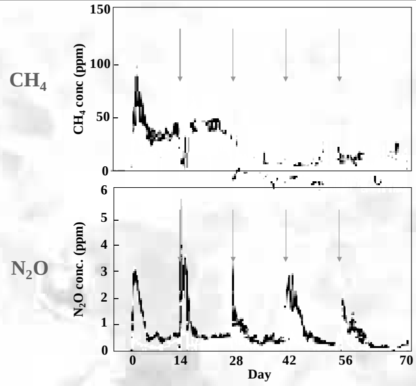


Calculation of GHG emission

E (mg/30 min) =
(conc. of outlet air (mg/m^3) – conc. of inlet air (mg/m^3)
× 30(min)/60(min) × ventilation rate (m^3/h)

☆ Constant air flow which does not affect the microorganism revitalization
☆ Continuous, accurate measurement of GHG concentrations
☆ Sampling number as many as possible

GHG emission data



Maeda et al., Microbial Ecology, in press.

Mass balance

Carbon	(%/OM)
CH_4-C	0.24 - 0.46
CO_2-C	13.8 - 28.7
Mature Product	27.5 -36.7

Nitrogen	(% initial N)
N_2O-N	1.2 - 1.3
NH_3-N	4.1 - 7.9
Mature Product	52.2 - 63.8

0.2-0.5% of initial OM was emitted as CH_4-C.
1.2-1.3% of initial N was emitted as N_2O-N.

Conclusion

- 0.2-0.5% of initial OM was emitted as CH_4-C
- 1.2-1.3% of initial N was emitted as N_2O-N

during cattle manure composting process.

- Constant air flow which does not affect the microorganism revitalization
- Continuous, accurate measurement of GHG concentrations
- Sampling number as many as possible

Enables precise evaluation of actual GHG emission.

- N_2O was emitted just after the turnings with spike shapes.
- The stable isotope analysis indicate that N_2O was emitted mainly from the denitrification process. (Data not shown)
- The accumulated NO_2^--N and NO_3^--N in the surface indicates the reduction of these inorganic nitrogen seemed to be occurred after the mixing by the turnings.
- The abundance of *amoA* sequences were agreed with the accumulated NO_2^--N and NO_3^--N in the surface of the pile, which suggested that the *Nitrosomonas*-like AOB contribute the nitrification.

Thank you

Presentation 4.4.2.3

The 7th Workshop on GHG Inventories in Asia (WGIA7)
7-10 July 2009, Seoul, Republic of Korea

Country-specific Emission Factors for Agricultural Soils and Rice Cultivation in Japan

Kazuyuki Yagi

National Institute for Agro-Environmental Sciences, Tsukuba, Japan

NIAES

Country-specific Emission Factors for agricultural soils and rice cultivation in Japan

CONTENTS

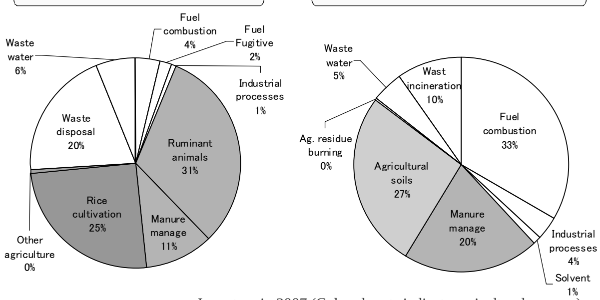
- EF for direct and indirect N_2O from agricultural soils
- EF for CH_4 from rice cultivation
- Activity data preparation
- Recent programs for mitigation

NIAES

National Inventory for Japan
Anthropogenic Sources for CH_4 and N_2O

CH_4 : 1.08 Mt (22.6 Mt CO_2 eq.)

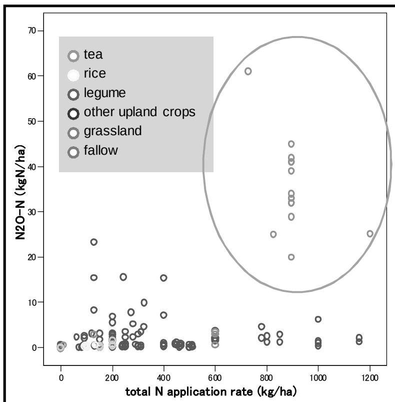
N_2O : 0.049 Mt N (23.8 Mt CO_2 eq.)



Inventory in 2007 (Colored parts indicate agricultural sources)

National Inventory for Japan
N_2O from agricultural soils
Methodology

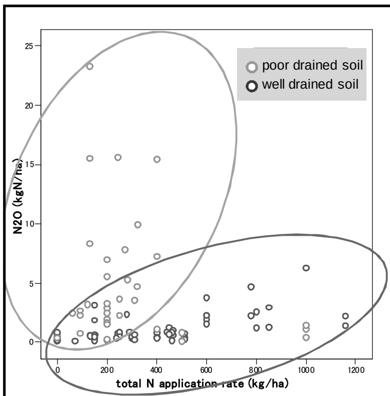
- Tier 2 methodology for N_2O from mineral fertilizer and animal manure
- Country-specific EFs for 3 crop types, which are based on seasonal field monitoring at 36 sites
- Identical EFs for mineral fertilizer and animal manure
- Tier 1 methodology for other N_2O sources



- No clear relationship with N application rate
- Emissions from tea are remarkably high
- Emissions from rice are remarkably low
- Therefore, country specific EFs are set for 3 categories:
  - tea
  - paddy rice
  - other upland crops

Relationship between N inputs and N_2O emissions from different crop types

---



Further analysis for other upland crops

- Soil drainage classes were categorized from soil types
- Poorly drained soil > well-drained soil
- No clear relationship for poorly drained soil
- Well-drained soil: r^2= 0.38

Relationship between N inputs and N_2O emissions from upland fields with different soil drainage type (measurement period more than 90 days)

Table
Summary of N2O-N emission and
fertilizer induced N2O-N emission factor from Japanese upland field (except tea filed)
measurement period more than 90 days

soil drainage #	n	mean	standard deviation	median	min	max
N2O-N emission (kgN ha-1)						
well drained soil	67	1.03 a**	1.14	0.61	0.09	6.28
poorly drained soil	35	4.78 b	5.36	2.88	0.07	23.3
Fertilizer induced N2O-N emission factor (%)						
well drained soil	15	0.32 a**	0.49	0.16	0.07	2.02
poorly drained soil	9	1.40 b	0.95	1.26	0.57	3.30
estimated emission factor for all soil		0.62 $	0.48 $$			

☻ poorly drained soil ＞ well-drained soil
☻ EF for upland = 0.62 ± 0.48 % (weighted by area of soil type)
☻ measurement period: more than 90 days
assuming that most of the fertilizer-induced N2O emission should be included in this period, because data availability

National Inventory for Japan
N_2O from agricultural soils
Adopted EFs

Direct N_2O: Mineral fertilizer/Animal manure
- Paddy rice: 0.31 (±0.31) % (IPCC default values)
- Tea: 2.90 (±1.82) % (from national data analysis)
- Other crops: 0.62 (±0.48) % (from national data analysis)

Direct N_2O: Crop residues/Legumes
- IPCC default values

Direct N_2O: Organic soils
- Paddy: 0.30 kg N_2O-N/ha/year (from national data)
- Upland: IPCC default values (similar to national data)

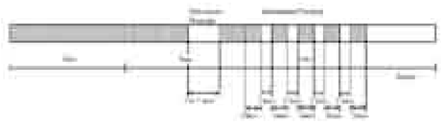
Indirect N_2O
- Atmospheric deposition (IPCC default values)
- Leaching and run-off: 1.24 % (IPCC default values)

National Inventory for Japan
CH_4 Emissions from Rice Cultivation
Methodology

- Tier 2 methodology
- Country-specific EFs for 5 soil types, which are based on seasonal field monitoring at 35 sites over the country during 1992-94
- Country-specific scaling factors (SFs) for 3 organic amendment
- Water management was assumed to be homogeneous intermittent-irrigation for 98% of the rice fields

National Inventory for Japan
CH_4 Emissions from Rice Cultivation
Water Management Categorization

- Water management was assumed to be homogeneous intermittent-irrigation for 98% of the rice fields



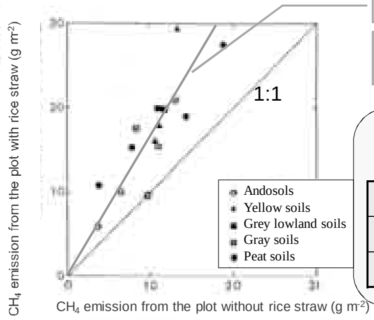
- A scaling factor of 1.77 is applied for continuous flooding fields which accounted for 2% of the area
- No consideration for water regime in the pre-season

National Inventory for Japan
CH_4 Emissions from Rice Cultivation
Emission Factors

Type of soil	No. of data	Straw amendment	Various compost amendment	No-amendment	Proportion of area
		[gCH$_4$/m²/year]			%
Andosol	2	8.50	7.59	6.07	11.9
Yellow soil	4	21.4	14.6	11.7	9.4
Lowland soil	21	19.1	15.3	12.2	41.5
Gley soil	6	17.8	13.8	11.0	30.8
Peat soil	2	26.8	20.5	16.4	6.4

- Based on field monitoring campaign during 1992-1994 at 35 sites over Japan
- Measured by conventional water management with mid-season drainage followed by intermittent flooding

National Inventory for Japan
CH_4 Emissions from Rice Cultivation
Calculation for Organic Amendment Applied

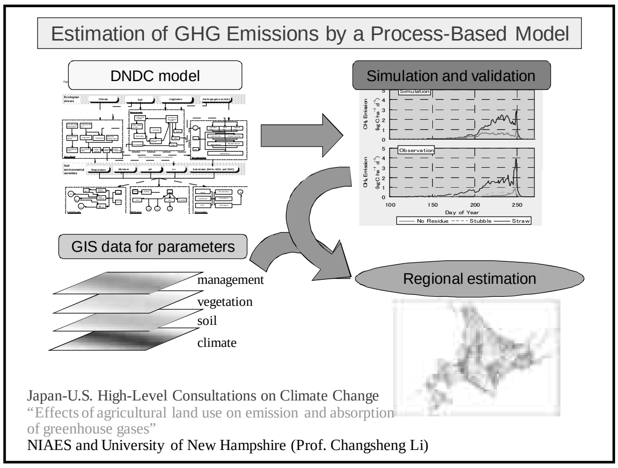


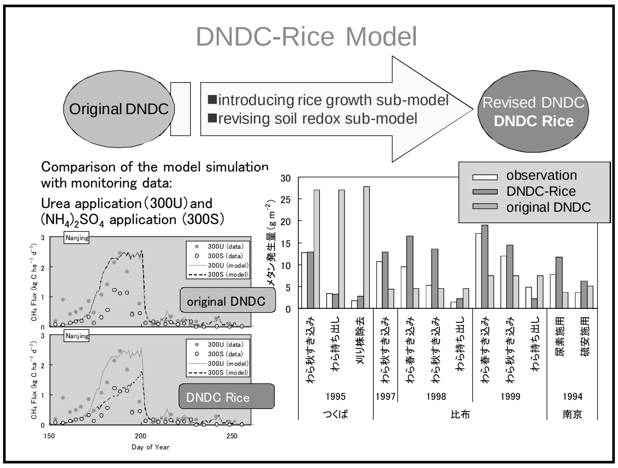
SFo for straw: 1.68

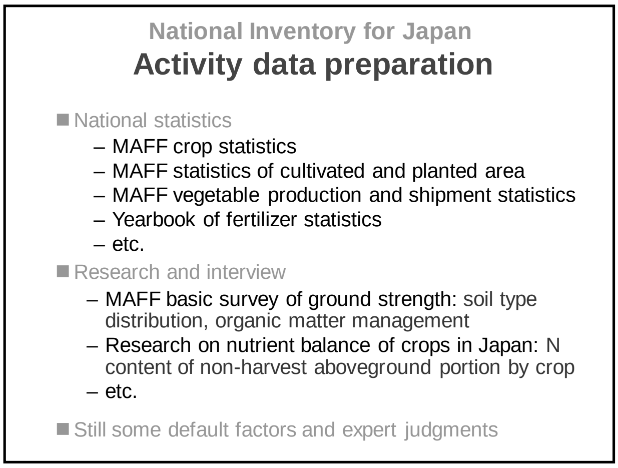
SFo for various compost: 1.25

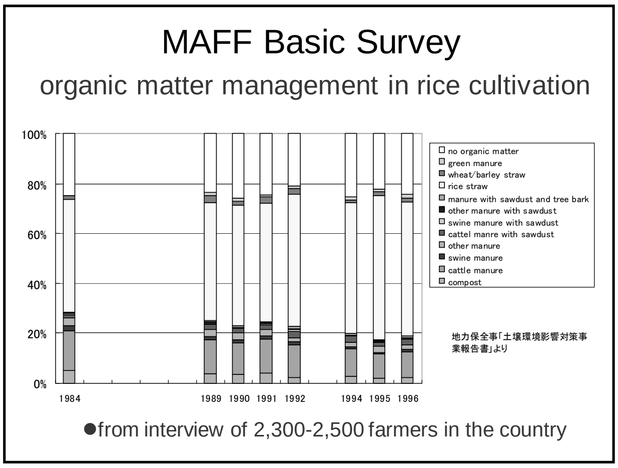
Activity data based on interview with ca. 2,000 farmers by MAFF

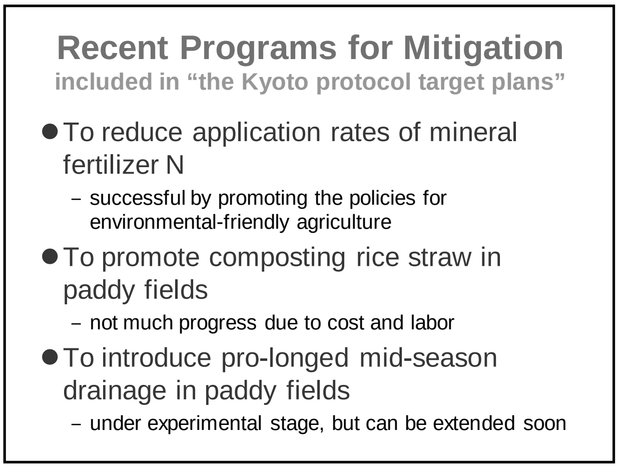
Straw	60%
Compost	20%
No	20%

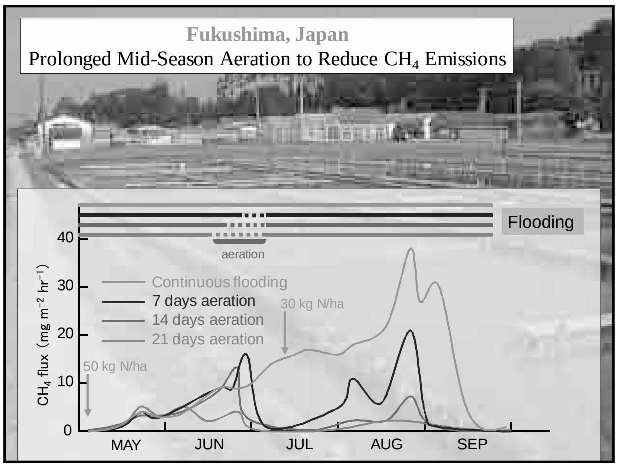

Estimation of GHG Emissions by a Process-Based Model
DNDC model
Simulation and validation
GIS data for parameters
management
vegetation
soil
climate
Regional estimation
Japan-U.S. High-Level Consultations on Climate Change
"Effects of agricultural land use on emission and absorption of greenhouse gases"
NIAES and University of New Hampshire (Prof. Changsheng Li)


DNDC-Rice Model
Original DNDC
■introducing rice growth sub-model
■revising soil redox sub-model
Revised DNDC
DNDC Rice
Comparison of the model simulation with monitoring data:
Urea application (300U) and
(NH4)2SO4 application (300S)
original DNDC
DNDC Rice
Day of Year
observation
DNDC-Rice
original DNDC
1995
1997
1998
1999
1994
つくば
比布
南京

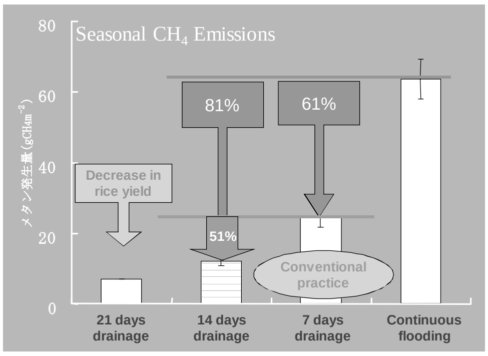

National Inventory for Japan
Activity data preparation
■ National statistics
– MAFF crop statistics
– MAFF statistics of cultivated and planted area
– MAFF vegetable production and shipment statistics
– Yearbook of fertilizer statistics
– etc.
■ Research and interview
– MAFF basic survey of ground strength: soil type distribution, organic matter management
– Research on nutrient balance of crops in Japan: N content of non-harvest aboveground portion by crop
– etc.
■ Still some default factors and expert judgments


MAFF Basic Survey
organic matter management in rice cultivation
100%
80%
60%
40%
20%
0%
1984
1989
1990
1991
1992
1994
1995
1996
no organic matter
green manure
wheat/barley straw
rice straw
manure with sawdust and tree bark
other manure with sawdust
swine manure with sawdust
cattel manre with sawdust
other manure
swine manure
cattle manure
compost
地力保全事「土壌環境影響対策事業報告書」より
●from interview of 2,300-2,500 farmers in the country


Recent Programs for Mitigation
included in "the Kyoto protocol target plans"
● To reduce application rates of mineral fertilizer N
– successful by promoting the policies for environmental-friendly agriculture
● To promote composting rice straw in paddy fields
– not much progress due to cost and labor
● To introduce pro-longed mid-season drainage in paddy fields
– under experimental stage, but can be extended soon


Fukushima, Japan
Prolonged Mid-Season Aeration to Reduce CH4 Emissions
Flooding
aeration
Continuous flooding
7 days aeration
14 days aeration
21 days aeration
30 kg N/ha
50 kg N/ha
CH4 flux (mg m-2 hr-1)
40
30
20
10
0
MAY
JUN
JUL
AUG
SEP

Fukushima, Japan
Mid season drainage at different period



National Inventory for Japan

Summary for Soil Emissions

Present state:

- ■ Tier 2/Tier 1 for N_2O from soils
- ■ Tier 2 for CH_4 from rice
- ■ Tier 1 for CH_4 & N_2O from residue burning

Further improvement:

- ● CS-EF for N_2O from organic amendment and crop residues/legumes
- ● Tier 3 for CH_4 from rice by the DNDC model
- ● introducing factors for mitigation

GHG studies can contribute to sustainable development

For example:

- ● C sequestration in agricultural soils

=> can enhance soil fertility and crop production

- ● Improved water management for CH_4 mitigation

=> can increase rice production

- ● Various N_2O mitigation options

=> can reduce other environmental impact by reactive N losses

Roles of Soil Scientists

- **● to develop the alternative systems for sustainable agriculture**
- **● to promote the international agreements on reasonable land use**

Presentation 4.4.2.4

Country-specific Emission Factors for Rice Cultivation in the Philippines

7th Workshop on GHG Inventories in Asia
7-10 July 2009, Seoul, Republic of Korea

Leandro Buendia
Team Leader, Agriculture Sector of the Philippine SNC GHG Inventory

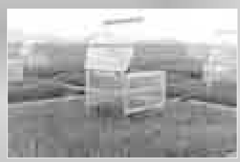
Outline

- Concerns with the EFs used in 1994 inventory
- The IRRI Project on methane measurement
- How country-specific EFs were developed
- Views about the newly developed EFs
- Conclusion and Recommendation

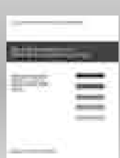
Concerns with 1994 EFs in Rice

- For the Philippine NC1, the EFs used were:
  - For irrigated: 2.3 kg/ha/day
  - For rainfed: 0.4 kg/ha/day
  - These EFs were based on IRRI Methane Project **preliminary** results in 1994
- The 1996 IPCC default value = 2 kg/ha/day
- However, the IRRI Methane Project continued the measurements until 1999; thus **more data and information were generated**

The IRRI International Research Program on Methane Emissions from rice fields in Asia

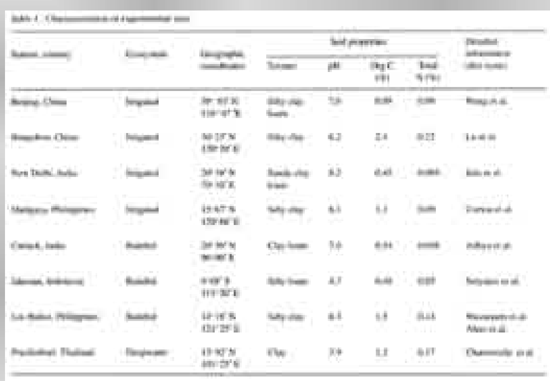


- Automated closed chambers measuring system: 24 hours/day for the whole growing season; 2-3 cropping seasons.
- Five countries (8 stations):
  - China (2)
  - India (2)
  - Indonesia (1)
  - Philippines (2)
  - Thailand (1)

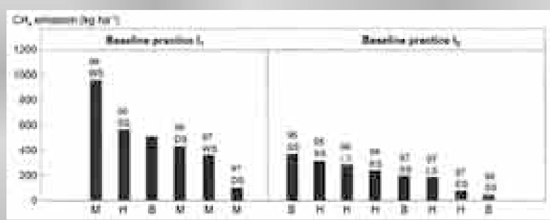


All findings were published in a book "**Methane Emissions from Major Rice Ecosystems in Asia**", Development in Plant and Soil Sciences, Kluwer Academic Publishers

Characterization of the experimental sites



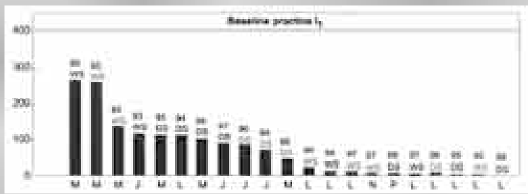
Seasonal CH4 Emissions under different baseline practices



I1 = continuous flooding with organic amendments
I2 = midseason drainage with organic amendments

Note: X-axis labels are first letters of Hangzhou, Beijing, and Maligaya.

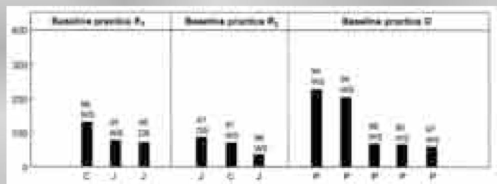
Seasonal CH4 Emissions under different baseline practices



I3 = continuous flooding, without organic amendments

Note: X-axis labels are first letters of Maligaya, Jakenan, Los Banos, New Delhi and Prachinburi.

Seasonal CH4 Emissions under different baseline practices

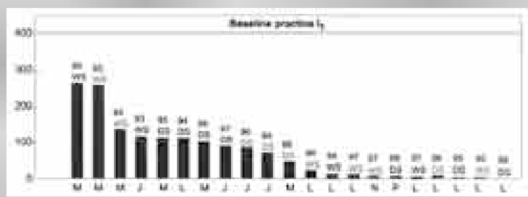


R1 = continuous flooding with organic amendments
R2 = midseason drainage with organic amendments

Note: X-axis labels are first letters of Cuttack, Jakenan, and Prachinburi.

What the IRRI Findings suggest?

I3 = continuous flooding, without organic amendments

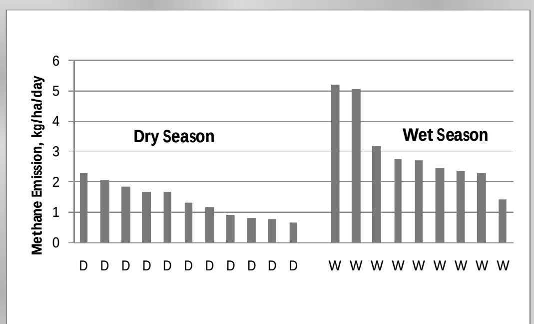


Note: X-axis labels are first letters of Maligaya, Jakenan, Los Banos, New Delhi and Prachinburi.

Table 1. Summary of baseline emissions (i.e. continuously flooded and without organic amendment)

Station	Year	Season	Cultivar	Mean Emission (mg/m2/d)	Mean Emission (kg/ha/d)	Mean DS (kg/ha/d)	Mean WS (kg/ha/d)
Maligaya	1994	Dry	IR72	90.00	0.90	0.86	
			IR72	64.00	0.64		
			IR64	74.00	0.74		
			IR64	114.00	1.14		
	1994	Wet	IR72	269.00	2.69		2.43
			IR72	232.00	2.32		
			IR72	227.00	2.27		
			IR72	243.00	2.43		
	1995	Dry	IR72	184.00	1.84	1.72	
			IR72	166.00	1.66		
			IR72	205.00	2.05		
			IR72	131.00	1.31		
	1995	Wet	IR72	503.00	5.03		3.69
			IR72	317.00	3.17		
			IR72	516.00	5.16		
			IR72	139.00	1.39		
	1996	Dry	IR72	165.00	1.65	1.65	
		Wet	IR72	272.00	2.72		2.72
	1998	Dry	PSBRc28	79.00	0.79	0.79	
Los Banos	1994	Dry	IR72	227.00	2.27	2.27	
			Mean Emission		**2.11**	**1.46**	**2.95**

CH4 Emissions by season



EFs for rice cultivation in the Philippines

Variety	Water Management	Organic amendment	Cropping Season	Emission Factor, kg/ha/day
IR72	Continuous flooding	none	dry season	1.46 (0.64 - 2.27)
IR72	Continuous flooding	none	wet season	2.95 (1.39 -5.16)

Source: Corton et al. 2000; Wassmann et al. 2000

Adjusted country-specific EFs

Cropping Season	Rice Ecosystem	SFp	SFw	SFo	EFc kg/ha/day	EFi kg/ha/day
Dry season	Irrigated	1.0	0.57	1.27	1.46	1.05
	Rainfed	1.0	0.27	1.17		0.46
Wet season	Irrigated	1.0	0.57	1.76	2.95	2.97
	Rainfed	1.0	0.27	1.54		1.23

CH4 Emission from Rice Cultivation in the Philippines, 2000

MODULE	AGRICULTURE
SUBMODULE	METHANE EMISSIONS FROM FLOODED RICE FIELDS
WORKSHEET	4-2
SHEET	1 OF 1
COUNTRY	Philippines
YEAR	2000

Water Management Regime			A	B	C	D	E
			Harvested Area (1000 ha)	Season length, days	Baseline emission factor for continuously flooded field without organic amendment (EFc) (kg/ha/day)	Adjusted daily emission factor (EFi) (kg/ha/day)	CH_4 Emissions (Gg)
							E = (A x B x D)/1000
Irrigated							0.00
	Continuously flooded	dry season	1265.742	114	1.46	1.05	151.51
		wet season	1437.612	114	2.95	2.97	486.75
Rainfed	dry season		471.881	113		0.46	24.53
	wet season		862.85	113		1.23	119.93
Deep Water	Water Depth 50-100 cm						0.00
	Water Depth > 100 cm						0.00
Totals			**4,038.085**				**782.71**

Conclusion

- We are confident in using the new country-specific EFs for rice cultivation in the Philippines
- We believe that they have improved our estimates of CH4 emissions from rice field since we were also able to disaggregate by season
- We think that other countries could benefit from the IRRI findings in generating CSEF and in improving their estimate of methane emissions.

Thank you!

Presentation 4.4.2.5

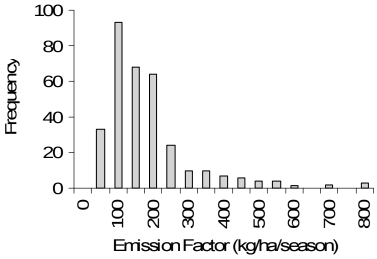
INDONESIA EXPERIENCE IN DETERMINING COUNTRY SPESIFIC EMISSION FACTOR IN AGRICULTURE SECTOR

Dr. Prihasto Setyanto
Prof. Dr. AK Makarim
Prof. Hidayat Pawitan
Prof. Iswandi Anas
Dr. Le Istiqlal Amien
Elza Sumaini

Formula for Estimating Rice CH_4 Emission

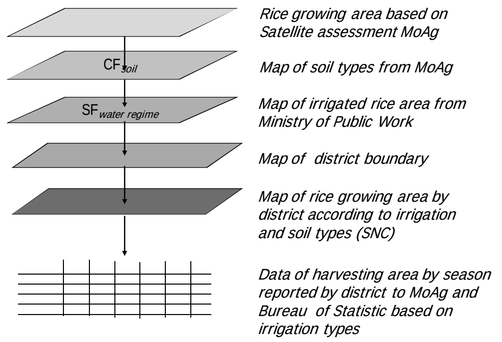
- ***CH_4 Emission$_{rice}$ = A*CF$_{soil}$*SF$_{water\ regime}$*EF$_{rice}$***
  - *CH_4 Emission$_{rice}$= annual methane emission from rice cultivation (Gg CH_4/year)*
  - *A = seasonal harvested area (ha/year)*
  - *CF_{soil} = Correction factor of different soil types*
  - *$SF_{water\ regime}$= Scaling factor of different water regime. For continuous flooded is equal to 1*
  - *EF_{rice} = Methane emission factor from rice (kg CH_4/ha)*

Rice Emission Factors



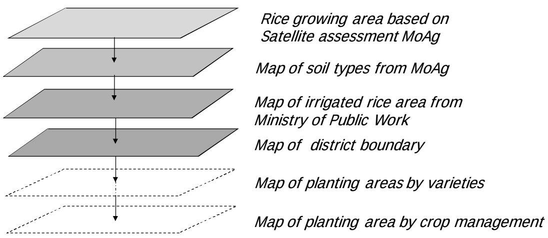
- Average of emission factor is 169.9 kg/ha/season based on 349 field experiments conducted in 10 different soil types and 3 different water management using 22 rice varieties (all in Java)

Process of Determining Rice Area by soil types and irrigation



Next Step

- *Introducing new scaling factor for variety (SF_v) and crop management (SF_{cm})*
- *CH_4 Emission$_{rice}$ = A*CFsoil*SFwr*SF_v*SF_{cm}*EF*



This approach can assist the sector to evaluate the effectiveness of mitigation technologies intervention by district

Rice cultivation scaling factors

1. Water regimes
2. Soil Types
3. Rice varieties
4. Organic matter
5. Establishment of herbicides
6. Crop establishment

Examples of database of various GHG emission research in Indonesia (1996-2006)

Year	Units	CH4 emission	Yield (t/ha)	Rice cultivar	Organic matter amendment	Water regime	References
1996	kg CH4/ha /season	538	6.34	Cisadane			IAERI annual report 1996/97
		440	5.15	Memberamo			
		246	4.92	IR 64			
		357	6.46	IR 36			
		412	3.25	Dodokan			
1997	kg CH4/ha /season	461	4.03	Cisadane			
		215	3.86	Memberamo			
		194	3.56	IR 64			
		282	3.11	Dodokan			
		421	4.63	IR 72			
		226	5.12	Batang anai			
1996	kg CH4/ha /season	89	3.13	IR 64	no organic amendment		IAERI annual report 1996/97
		189	6.27	IR 64	animal manure		
		170	5.51	IR 64	animal manure		
		165	5.90	IR 64	straw		
		176	4.98	IR 64	straw		
		156	4.71	IR 64	compost		
		136	4.76	IR 64	compost		
1997	kg CH4/ha /season	250	3.59	IR 64	no organic amendment		
		403	6.28	IR 64	animal manure		
		372	5.69	IR 64	animal manure		
		344	6.26	IR 64	straw		
		374	5.99	IR 64	straw		
		359	5.35	IR 64	compost		
		295	5.77	IR 64	compost		

Table continued..

RS 1997/98	kg CH4/ha /season	47.7	2.20	Cisadane			IAERI 1997/1998 annual report. Pengaruh beberapa varietas padi terhadap emisi gas metana pada lahan sawah
		40.3	2.97	Memberamo			
		30.7	3.05	Maros			
		39.0	2.85	IR 64			
		44.7	3.39	IR 36			
		65.7	3.67	Batang anai			
DS 1998	kg CH4/ha /season	147.7	4.09	Cisadane			
		121.3	3.82	Memberamo			
		117.0	4.31	Maros			
		65.8	4.20	IR 64			
		101.0	4.87	IR 36			
		168.8	4.96	Batang anai			
RS 1997/98	kg CH4/ha /season	207	3.15	Memberamo			IAERI 1997/1998 annual report. Pengaruh pemberian pupuk anorganik terhadap emisi gas metan pada lahan sawah
		188	5.81	Memberamo			
		186	5.81	Memberamo			
		181	6.63	Memberamo			
		175	6.68	Memberamo			
		197	7.62	Memberamo			
DS 1998	kg CH4/ha /season	185	3.79	Memberamo			
		176	4.46	Memberamo			
		174	4.76	Memberamo			
		168	4.47	Memberamo			
		164	5.86	Memberamo			
		184	4.83	Memberamo			
RS 1997/98	kg CH4/ha /season	99.83	6394	Memberamo		Continous flooded	IAERI 1997/1998 annual report. Emisi metan dari berbagai sistem pengaturan air pada lahan sawah
		34.54	5703	Memberamo		Intermittent irrigation	
		31.28	5439	Memberamo		Intermittent irrigation	
		93.67	6588	Memberamo		Continous flooded	
		75.04	5890	Memberamo		Saturated irrigation	
		20.70	6217	Memberamo		Intermittent irrigation	
DS 1998	kg CH4/ha /season	145.94	3201	Memberamo		Continous flooded	
		46.19	2985	Memberamo		Intermittent irrigation	
		45.92	3306	Memberamo		Intermittent irrigation	
		91.58	3346	Memberamo		Continous flooded	
		65.38	3149	Memberamo		Saturated irrigation	
		17.81	2991	Memberamo		Intermittent irrigation	

Adjusted scaling factor for water regimes and soil correction factors

Category	Sub-category			SF (adapted from IPCC Guidelines 1996)	Adjusted SF (based on current studies in Indonesia)	Adjusted CF from different soil types of Indonesia
Upland	None			0		
Lowland	Irrigated	Continuously Flooded		1.0	1.00	
		Intermittently Flooded	Single Aeration	0.5 (0.2-0.7)	0.46 (0.38-0.53)	
			Multiple Aeration	0.2 (0.1-0.3)		
	Rainfed	Flood Prone		0.8 (0.5-1.0)	0.49 (0.19-0.75)	
		Drought Prone		0.4 (0-0.5)		
	Deep Water	Water Depth 50-100 cm		0.8 (0.6-1.0)		
		Water Depth < 50 cm		0.6 (0.5-0.8)		

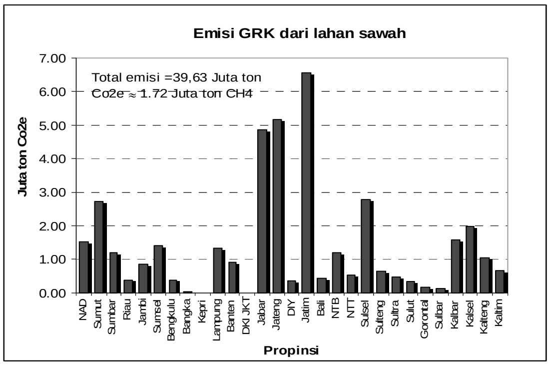
Adjusted CF from different soil types of Indonesia

Soil Types	Inceptisol	1.12 (1.0-1.23)
	Oxisol	0.29 (0.1-0.47)
	Entisol	1.02 (0.94-1.09)
	Vertisol	1.02 (0.46-1.99)
	Alfisol	0.84 (0.32-1.59)
	Histosol	2.39 (0.92-3.86)
	Mollisol	-
	Andisol	1,02**
	Ultisol	0.29*

Distribution of rice soils of Indonesia

No.	Ecosystem / rice soil types	distribution
A	Lowland Aquept, Aquent (Alluvial and Gley soil)	55%
B	Highland Udept (Latosols and Regosols)	17%
C	Complex (Combination between A and B)	
1	Vertisols (Grumusols) (Sub ordo Aquert, udert, and ustert)	7%
2	Ultisols and Oxisols (Red yellowish podsolic) (Sub ordo: Aquult and Paleudult, Aquox and Kandiudox)	6%
3	Alfisols (Red yellowish Mediteranean) Sub ordo udand, ustand, and aquand	4%
4	Newly opened rice field: Ultisols (red yellowish podsolic)	10%
5	Newlye opened rice field: Oxisols (Latosol, lateritic)	1%
	Total	100%

GHG emissions from different province of Indonesia based on soil CF and adjusted SF water regimes



Scaling factors of CH4 emission under different organic amendments based on studies conducted in Indonesia

Organic matter	Mean emission (kg CH4/ha/musim)	SD	CV (%)	Number of Data	SF
No OM	65.9	39.23	59.56	13	1.00
FYM[1]	149.7	93.80	62.66	31	2.27
Straw[2]	137.1	107.47	78.36	14	2.08
Composts[3]	236.5	108.03	45.68	4	3.59
Mix FYM+straw[4]	70.5	15.33	21.74	4	1.07

Scaling factors under different rice varieties established in Indonesian rice field (based on studies at IAERI)

Rice Variety	average emission (kg CH4/ha/season)	SD	CV (%)	Number of Data	SF
Gilirang	496.9			1	**2.46**
Fatmawati	365.9			1	**1.81**
Aromatic	273.6	138.87	50.8	3	**1.35**
Tukad Unda	244.2	106.54	43.6	2	**1.21**
IR 72	223.2	133.01	59.6	5	**1.10**
Cisadane	204.6	133.85	65.4	14	**1.01**
IR 64*	202.3	165.17	81.7	164	**1.00**
Margasari	187.2	89.93	48.0	3	**0.93**
Cisantana	186.7	53.71	28.8	6	**0.92**
Tukad Petanu	157.8	32.16	20.4	2	**0.78**
Batang Anai	153.5	81.24	52.9	3	**0.76**
IR 36	147.5	121.56	82.4	5	**0.73**
Memberamo	146.2	99.49	68.1	64	**0.72**
Dodokan	145.6	144.54	99.2	6	**0.72**
Way Apoburu	145.5	84.21	57.9	36	**0.72**
Muncul	127.0	26.87	21.2	2	**0.63**
Tukad Balian	115.6	25.87	22.4	2	**0.57**
Cisanggarung	115.2	62.77	54.5	3	**0.57**
Ciherang	114.8	103.14	89.8	29	**0.57**
Limboto	99.2	40.80	41.1	6	**0.49**
Wayrarem	91.6	38.09	41.6	6	**0.45**
Maros	73.9	61.02	82.6	2	**0.37**

Scalling factors under different water regimes and herbicide application

no	Application	Average emission (kg CH4/ha/season)	SD	CV (%)	Number of Data	SF
1	cont flooding + 0 herbicide	700.7	298.88	42.7	41	1.0
2	cont flooding + herbicide	266.7	243.06	91.1	78	0.4
3	intermittent + herbicide	118.2	139.65	118.2	78	0.2
4	saturated + herbicide	65.3	52.84	81.0	78	0.1

Scaling factors of CH4 flux under different crop establishment

Crop establishment	average flux (kg/ha/hari)	SD	CV (%)	Number of data	CF
Transplanted rice*	1.067	0.75	70.0	48	**1.00**
Direct seeded rice **	1.322	0.79	60.1	48	**1.24**

Some of the references

IAERI. 1999 annual report. Pengaruh rejim air tanah terhadap besarnya emisi gas metan pada lahan sawah. 1998/1999 annual report

IAERI. 2001. Pengaruh varietas padi terhadap besarnya emisi gas CH4 pada lahan sawah irigasi vertisol. Laporan tahunan 2001.

IAERI. 2001. Pengaruh dosis dan jenis pupuk N terhadap besarnya emisi CH4 dan N2O pada lahan sawah irigasi Vertisol. Laporan tahunan 2001

IAERI 2001. Emisi dan mitigasi gas CH4 dan N2O dari pengolahan tanah, varietas dan pemberian bahan organik dalam pola tanam padi-palawija pada lahan sawah tadah hujan. Laporan tahunan 2001

IAERI. 2002. Pengaruh takaran azolla pada sistem minapadi terhadap produktivitas dan emisi GRK di lahan sawah. Laporan tahunan 2002

IAERI. 2002. Pengaruh jenis ikan terhadap produktivitas dan emisi GRK di lahan sawah pada sistem minapadi. Laporan tahunan 2002

Husin, Y.A. 1994. Methane flux from Indonesia wetland rice: the effects of water management and rice variety.[Disertation]

Setyanto, P. 2000. Methane emission from three soil types planted with flooded rice (Thesis)

Setyanto, P. 2004. Methane emission from rice field under different crop establisments and rice cultivars.[Disertation]

Continued

Setyanto, P, Makarim, A, K., Fagi, A, M., Wassmann, R, Buendia, L, V. 2000. Crop management affecting methane emission from irrigated and rainfed rice in central Java. Nutrient Cycling in Agroecosystm 58 : 85-93

Setyanto, P. Suharsih, A. Wihardjaka, A. K Makarim. 1999. Pengaruh pemberian pupuk anorganik terhadap emisi gas metan pada lahan sawah. Risalah Seminar hasil penelitian emisi gas rumah kaca dan peningkatan produktifitas padi di lahan sawah. 36-43.

Suharsih, P. Setyanto, A.K. Makarim. 2004. Emisi gas metan pada lahan sawah irigasi inceptisol akibat pemupukan nitrogen pada tanaman padi. PP Tanaman Pangan 22 (2) : 43-47

Suryahadi, A.R. Nugraha, R. Boer, A.Bey, 1998. Laju Konversi Metan dan Faktor Emisi pada Kerbau yang Diberi Ragi Tape *Saccharomyces cerevisiae*. Journal Agromet 4 : 22-30

Mulyadi, A. Pramono, Poniman dan A. Wihadjaka. 2004. Pengaruh Pupuk Kandang Terhadap Hasil Padi Gogo Rancah dan Emisi Gas CH4 di Lahan sawah Tadah Hujan. Seminar nasional pengelolaan lingkungan pertanian. 479-485.

Setyanto,P. Burhan, H., Jatmiko, S.Y. 2008. Effectiveness of water regime and soil management on methane emission reduction from rice field. Prosiding seminar Nasional pencemaran lingkungan pertanian melalui pendekatan pengelolaan daerah aliran sungai (DAS) secara terpadu. 219-233

Terima Kasih

Presentation 4.4.2.6

Greenhouse gas Inventory Office of Japan

Summary of Agricultural Mitigation Potential

- UNFCCC document -

9 July 2008, Seoul, Korea
7th Workshop on GHG Inventories in Asia

Kohei Sakai
Greenhouse Gas Inventory Office of Japan (GIO)
National Institute for Environmental Studies (NIES)

Topics in UNFCCC

- Mitigation potential in the agricultural sector are taken up in AWG-LCA of UNFCCC.
- Technical paper for "*Challenges and opportunities for mitigation in the agricultural sector*" was released in 21 Nov. 2008. (See "FCCC/TP/2008/8")
- Workshop was held during the 5th session of the AWG-LCA in 4 Apr 2009.
  - UNFCCC, IPCC, FAO and 9 counties presented

Greenhouse gas Inventory Office of Japan

Summary of UNFCCC Technical Paper

- Overviews mitigation practices in the agricultural sector, and identifies policies and measures (PAMs)
- Addresses mitigation potential, methodological & technical challenges, possible barriers for their implementation
- Identifies win-win options, best practices and co-benefit & synergies
- Identifies knowledge gaps and research & development needs for future work
- Provides background information on emissions, trends and projections in livestock, and crops and soils
- Consideration of the regional and national circumstances for the feasibility and applicability of mitigation practices

Greenhouse gas Inventory Office of Japan

Emissions and Trends

- 10-12% of the total global anthropogenic GHG emissions or about 6.8 Gt of CO_2 eq per year from agricultural sector (including soil C).
- 17% increase from 1990 to 2005, and 74% of total is from developing countries.
- Projected to increase further in the coming decades.

  - Figure 1. Trends for global non-CO2 emission, by source
  - Figure 2. Regional trends for non-CO2

Greenhouse gas Inventory Office of Japan

Mitigation Potential

- High technical mitigation potential (5.5-6 GtCO2 eq. per year by 2030)
- **Soil carbon sequestration**; cropland and grazing land management, restoration of organic soils and degraded lands, bioenergy and water management
- **CH_4 reductions**; rice, livestock and manure management
- **N_2O reductions**; soils (mainly crop management)

Source: IPCC AR4

Greenhouse gas Inventory Office of Japan

Key Challenges and Opportunities

Key Challenges
- Limit or maximum capacity of soil to store C
- Risk of losing C stored
- Difficulties in establishing a baseline
- High level of uncertainty in emissions estimates
  - lack of information

Opportunities
- Alleviating poverty
- Sustainable development
- Food security
- Energy security
- Improvement of environmental quality

Greenhouse gas Inventory Office of Japan

Information for Asian Countries

- Non-CO_2 emissions were highest in South and Southeast Asia and Latin America and Caribbean regions (see Fig.2).
- CH_4 emissions from rice cultivation have a high mitigation potential in China, South and Southeast Asia by low cost (see Table 3).
- Cropland emissions (N_2O and soil C) have a little emission reduction potential in Asia (see Table 2).
- In South and Southeast Asia, where energy-related emissions are highest, biodiesel and electricity generation from renewable energy sources offer meaningful mitigation opportunities.
- Large livestock population (Cattle, Swine, Sheep, Goat and Poultry) in Asia region (Fig.10 and Table 5).

Greenhouse gas Inventory Office of Japan

Details for Mitigation Practices

- Mitigation practices, gaps and future needs, and relevant information are collected up in the Annex at the end of the *Technical Paper*.

Annex II~V

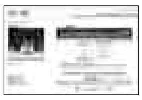
- Table 28 Current mitigation practices in Livestock
- Table 29 Future mitigation practices (Livestock)
- Table 30 Current mitigation practices in Crop & Soil
- Table 31 Future mitigation practices (Crop & Soil)

Greenhouse gas Inventory Office of Japan

Information on Documents and Webcasts

Technical Paper

Technical Paper, FCCC/TP/2008/8:
"*Challenges and opportunities for mitigation in the agricultural sector*", released in 21 Nov 2008
http://unfccc.int/resource/docs/2008/tp/08.pdf#search='FCCC/TP/2008/8'



Webcast for Workshop

Workshop ; the 5th session of the AWG-LCA in 4 Apr 2009.
http://unfccc.int/meetings/ad_hoc_working_groups/lca/items/4815.php
Webcast ***(04 Apr 09,*** *AWG-LCA 5 Workshop)*
http://unfccc.meta-fusion.com/kongresse/090329_AWG_Bonn/templ/ovw_page.php?id_kongressmain=67

Greenhouse gas Inventory Office of Japan

Presentation 4.4.3.1

Greenhouse gas Inventory Office of Japan

Session III: WG3: LULUCF Sector Introduction

National States of Application of Remote Sensing and GIS to LULUCF Inventories

9 July 2009, Seoul, Korea
7th Workshop on GHG Inventories in Asia

Takako Ono
Greenhouse Gas Inventory Office of Japan (GIO)
National Institute for Environmental Studies (NIES)

0

Topic and Objectives of this Session

- Topic:
  - How to utilize remote sensing and GIS data for LULUCF inventories
- Objectives:
  - To share information on how to concretely apply remote sensing and GIS data as Activity Data of LUULCF inventories,
  - To discuss how to ensure actual application of remote sensing and GIS data to LULUCF inventories.

Outcomes from WGIA6

- Result of Discussion in WGIA6:
  - Combination of remote sensing, GIS data and modeling is effective for estimation of the LULUCF sector.
- Recommendations:
  - The participants in the previous LULUCF group session recommended:
    - to hold a training session for Tier 3 modeling,
    - to share country experiences on uncertainty assessment and activity data collection.

Progresses after WGIA6

- **Training Session for Tier 3 modeling:**
  - Inquired a person in charge of developing the Century model about the possibility of a half-day training session,
  - Received an answer that a half-day session is too short and insufficient for training the model,
  - Decided to postpone this topic as a future issue.
- **Data Collection:**
  - Received a recommendation to focus on collecting data by utilizing remote sensing and GIS data and discuss it more in detail than the previous LULUCF session in WGIA6,
  - Researched current national states of applying remote sensing and GIS data to LULUCF Inventories.

Current national states of applying remote sensing and GIS data to LULUCF Inventories.

- Annex I:
  - Two Annex-I countries developed LULUCF inventories by using only remote sensing data as their Activity Data.

Nation	Used Remote Sensing Data
Australia	NOAA/AVHRR Landsat MMS, TM, ETM+
France (French Guiana only)	Landsat, SPOT

Current national states of applying remote sensing and GIS data to LULUCF Inventories.

- non-Annex I:

Nation	Used Remote Sensing Data
Brazil	Landsat
India	Landsat, IRS P6 (Sensor LISS III)
Thailand	Landsat TM, SPOT

Nation	Remote Sensing Data interested in using
Cambodia	Landsat
Korea	Kompsat II
Malaysia	ALOS, EOS AM-1 (MODIS)
Mongolia	Landsat
Myanmar	Landsat
Thailand	EOS AM-1 (MODIS)

Presentations in the LULUCF group session

1. Utilizing Global Map for addressing Climate Change
   - Ms. Noriko Kishimoto (Japan)
2. Application of Remote Sensing to Forest Inventory for Identifying Deforestation and Degradation
   - Dr. Yasumasa Hirata (Japan)
3. Thailand's experience with Remote Sensing and GIS
   - Dr. Savitri Garivait (Thailand)
4. Korea's experience with Remote Sensing and GIS
   - Dr. Hyun Kook Cho (Korea)

Points of Discussion

- How do we identify or estimate concrete data by applying remote sensing and GIS data?
  - For example, how the following data are identified or estimated?:
    - Forest carbon stocks, forest types and degradation,
    - Land areas of cropland and grassland,
    - Soil data.
- How do we verify remote sensing and GIS data?
- What kind of resources are necessary for utilizing remote sensing and GIS data?
- What type of institutional arrangement is effective for applying remote sensing and GIS data to LULUCF inventories?

Greenhouse gas Inventory Office of Japan

Thank you
and
Let's start this session!!

Presentation 4.4.3.2

Utilizing Global Map for addressing Climate Change

WGIA7
9th July, 2009
Seoul, Republic of Korea

Noriko KISHIMOTO
n-kishimoto@gsi.go.jp
Geographic Survey Institute, JAPAN

Outline of the Global Map

What is Global Map ?

Digital Geographic Dataset

- Covering the whole land area of the globe
- With unified specifications
- Open to the public

  freely downloadable for non-commercial use

Aims of Global Mapping

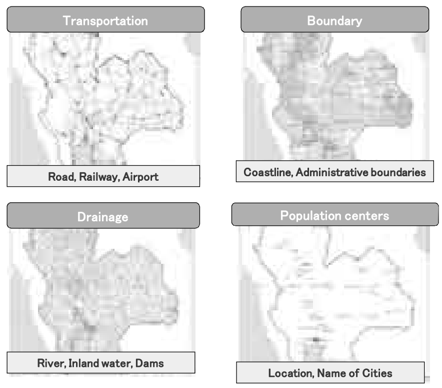
Global Mapping aims to contribute to

- Solving and tackling with global environmental issues
- Achieving sustainable development
- Mitigating large scale disasters

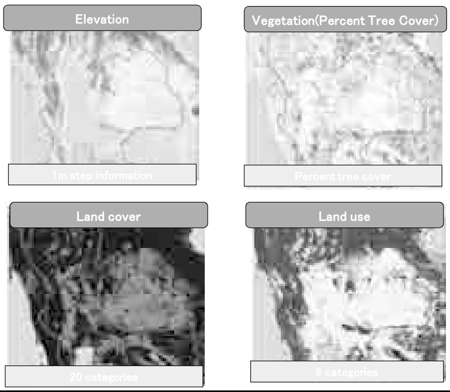
Global Map Specifications

- Spatial resolution: **1km**
  (equivalent to 1:1,000,000 scale)
- **8 layers**
  - Vector data (point, line, area)
    Transportation, Boundaries
    Drainage, Population centers
  - Raster data (grid)
    Elevation, Vegetation (Percent Tree Cover),
    Land Cover, Land Use
- Update interval: **Five years**

Vector Data



Raster Data



Global Mapping Project

Who makes Global Map?

Each National Mapping Organization (NMO)

- Responsible for developing data of its own country
- Supported by other NMOs, aid organizations

Coordinating Mechanism

ISCGM (International Steering Committee for Global Mapping)

- Established in 1996
- Conducts policy making and progress management
- Secretariat :Geographical Survey Institute(GSI), Japan

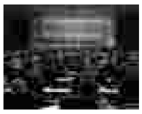
History of Global Mapping Project

Establishment of the Project

- 1992: Agenda 21 was adopted at the Earth Summit. Japan advocated "Global Map" concept.
- 1996: ISCGM was established. (Secretariat: Geographical Survey Institute ,Japan)

Development of Global Map Data

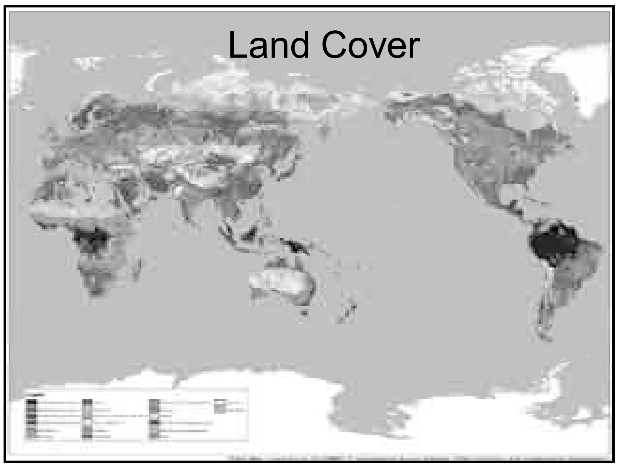
- 2002: Johannesburg Summit（WSSD） Global mapping is included in adopted "Implementation Plan".
- 2008: Release of Global Map Version 1

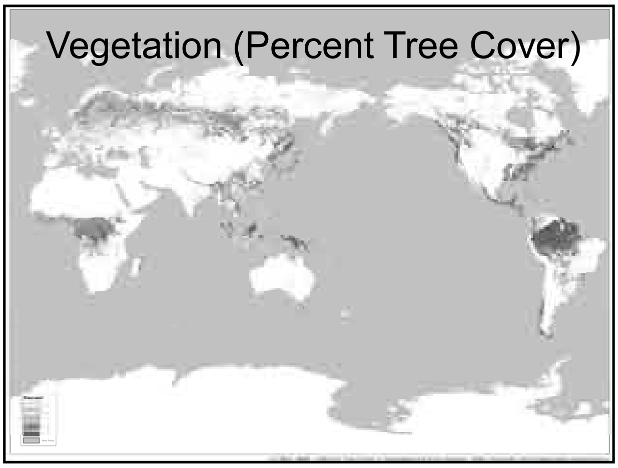


WSSD

180 countries and regions are participating in the project

Progress of Global Mapping Project





For Addressing Climate Change

Why Global Map？

for addressing Climate Change

Comparability ⇐
- Global Coverage
- Unified specifications
- 5-year update

Usability ⇐
- Essential environmental data
- Open data policy

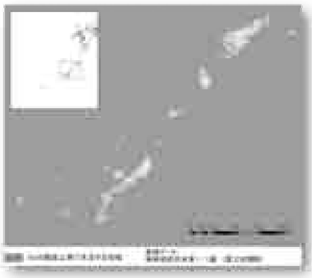
Reliability ⇐
- Government authorization

Analyses based on Global Map contribute to ensuring equitability and effectiveness in Climate Change Policy Framework

Adaptation

- Global Map is used for various simulations for adaptation measures.

Ex: sea level rise, inundation, drought



Red areas: to be inundated at 5m- rise in sea level, NANSEI SHOTO (Japan)

REDD

Vegetation (Percent Tree Cover) of GM is used to

- Grasp the forest areas and distribution and their changes
- Policy formulation and planning

Percent tree cover data

compare

Percent tree cover data after several years

Understand places which need priority of measures and take measures for these places

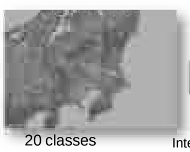
LULUCF

Land Cover data of GM is used to

•GHGs inventory calculation

•Policy formulation and planning

*Global Map is introduced in “IPCC GPG for LULUCF” and “2006 IPCC Guidelines for national Greenhouse Gas Inventories”



20 classes of land cover data

Integrate classification

6 classes of LULUCF

calculate emission and removal of GHGs and formulate measures against it

For LULUCF

Procedure to calculate each area of land cover 6 classes

Outline

① Download GM Land Cover (LC) data

② Interpret GM 20 classes to LULUCF 6 classes

③ Convert LC data from raster to vector

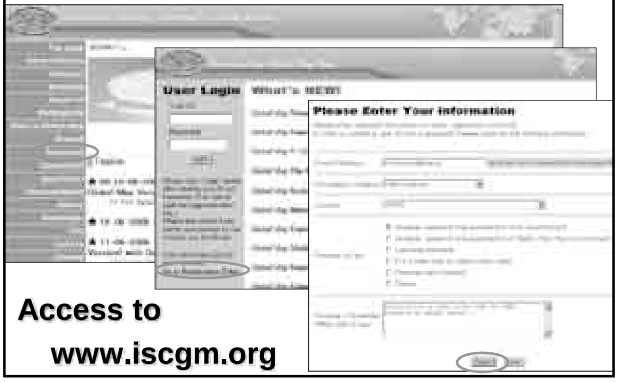
④ Clip vector data using International boundary data

⑤ Give a map projection

⑥ Calculate each area of 6 classes

Process by GIS Software

① Download GM Land Cover data



Access to www.iscgm.org

① Download GM Land Cover data

- **Global Version**
- **National and Regional Version**
  - Produced by National Mapping Organizations of respective countries

➢TIFF and BIL format data are downloadable

➢Detailed information about data is described in metadata

② Interpret GM 20 classes to LULUCF 6 classes

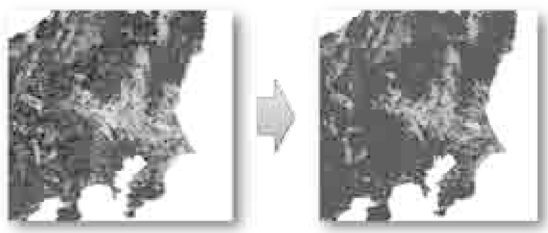
- Decide classes of interpretation by referring to …
  - Definition of each class on the GM LC data
  - Definition of the IPCC guideline, GPG-LULUCF and KP

➢GM Global version is Adopting Land Cover Classifications System version 2 (LCCS2) developed by FAO as definition of LC class

Example of interpretation Interpretation requires further consideration

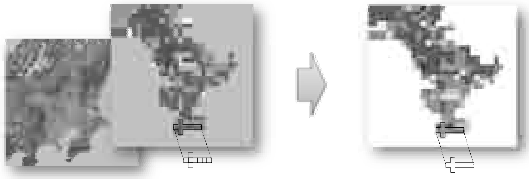
GM LC 20 Classes	LULUCF 6 Classes
Broadleaf Evergreen Forest	Forest land
Broadleaf Deciduous Forest	Forest land
Needleleaf Evergreen Forest	Forest land
Needleleaf Deciduous Forest	Forest land
Mixed Forest	Forest land
Tree Open	Forest land
Mangrove	Forest land
Shrub	Grassland
Herbaceous	Grassland
Herbaceous with Sparse Tree/Shrub	Grassland
Sparse vegetation	Grassland
Cropland	Cropland
Paddy field	Cropland
Cropland/Other Vegetation Mosaic	Cropland
Wetland	Wetlands
Urban	Settlements
Bare area, consolidated (gravel, rock)	Other land
Bare area, consolidated (sand)	Other land
Snow/Ice	Other land
Water	Other land

② Interpret GM 20 classes to LULUCF 6 classes



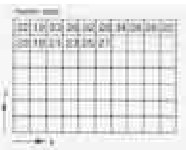
GM 20 classes LULUCF 6 classes

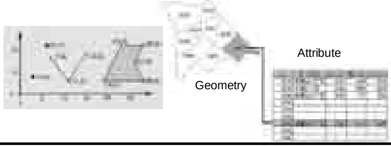
③ Convert LC data from raster to vector



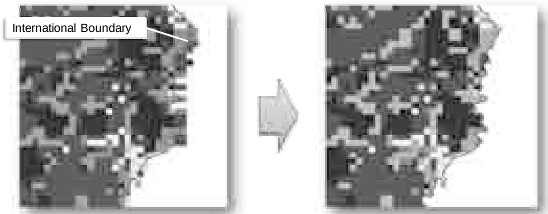
Raster : Grid Cell based

Vector:areas, lines, and points
- ➢ can measure the area more accurately





④ Clip vector data using International boundary



- Clip data to cut outside of the country area
- International Boundary is also available from GM dataset

⑤ Give a map projection

latitude/longitude

(**Geographic Coordinate system**)

- ➢ Downloaded GM data is represented in latitude/longitude

Appropriate projection

to represent accurate area of each country

- ➢ This time I used Mollweide projection for Japan

⑥ Calculate each area of 6 classes

- Calculate areas of respective polygons

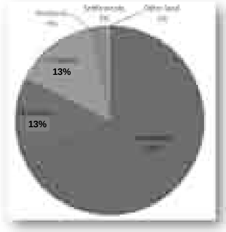
- Sum up areas of polygons of respective classes

⑥ Calculate each area of 6 classes

LULUCF class	Area (Mha)
Forestland	26.5
Grassland	4.8
Cropland	5.0
Wetlands	0.0
Settlements	1.2
Other land	0.2
Total	37.7

Area of LULUCF 6 classes

Rate of area of LULUCF 6 classes



Conclusion

- Required thing to calculate LC areas
  - – GM data, GIS software, Fundamental GIS skills
- Useful points of GM for LULUCF
  - – Comparability (Continuity), Usability, Reliability

➢ If you have any questions about GM data or how to process GM data by GIS software, Please e-mail to sec@iscgm.org (Secretariat of ISCGM)

Others

Capacity Building Programs

- JICA Group Training Course on Global Mapping（implemented by GSI Japan）
  94 experts of 57 countries participated(1994～2008)
- Global Mapping Partnership Program (by MLIT Japan)
  Global Map Africa Seminar:
  86 experts of 35 countries in participated(2002～2007)

Thank you

http//www.iscgm.org

sec@iscgm.org

Presentation 4.4.3.3

7-10 July 2009, The 7th Workshop on GHG Inventories in Asia in Seoul

Application of Remote Sensing to Forest Inventory for Identifying Deforestation and Degradation

Forestry and Forest Products Research Institute
Yasumasa Hirata

Outlines

- National Forest Resource DB (NFRDB)
- Forest Monitoring using satellite remote sensing
- Forest degradation in developing countries
- New remote sensing technologies
- Technical issues
- Conclusions

Outlines

- **National Forest Resource DB (NFRDB)**
- Forest Monitoring using satellite remote sensing
- Forest degradation in developing countries
- New remote sensing technologies
- Technical issues
- Conclusions

National Forest Resources Database – NFRDB –

- Two servers
  - Main system in Forestry Agency
    - Ordinary use
  - Sub system in FFPRI
    - Backup system
    - Research and development

Forestry and Forest Products Research Institute

Outline of NFRDB

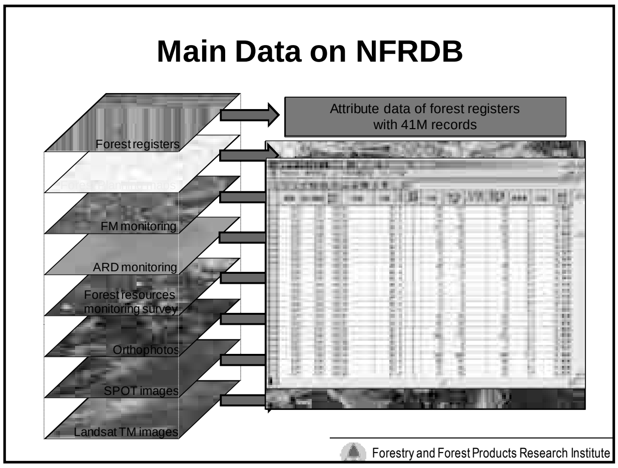
- Purpose
  - Accounting and reporting for KP
  - Integration of forest information
  - Forest statistics
  - Forest plannning
  - Evaluation of multifunction of forests
- System boundary
  - Whole forests including national and private forests in Japan

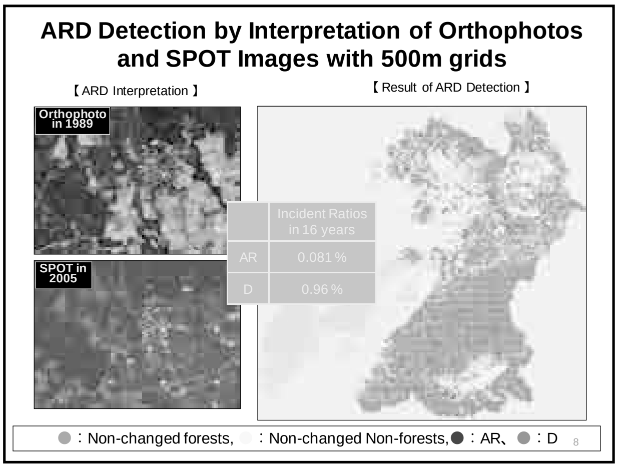
Forestry and Forest Products Research Institute

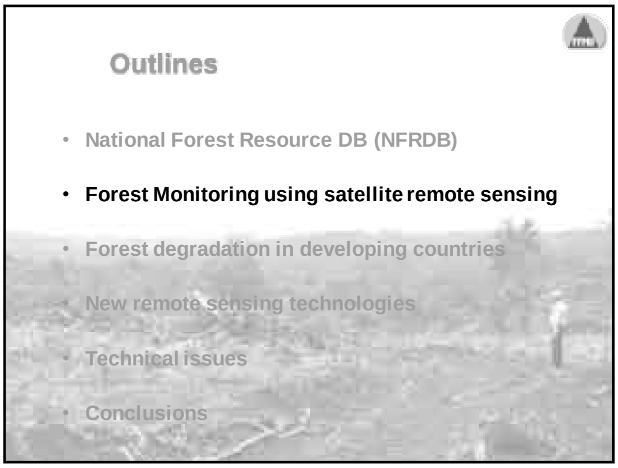
Outline of NFRDB

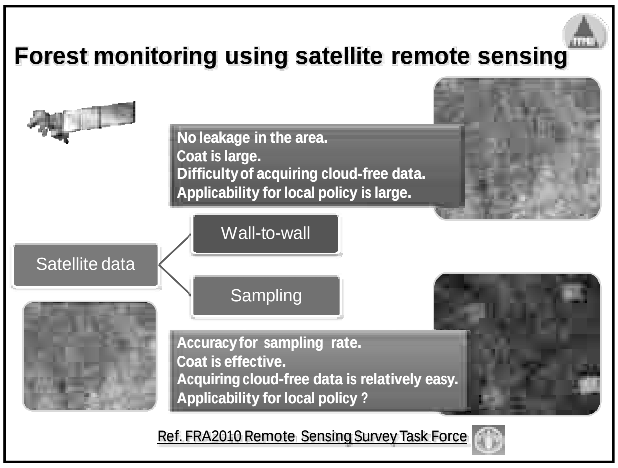
- Functions
  - Basic functions
    - Database, GIS, Data import & export, Data analysis, Image analysis
  - Accounting and reporting
    - Estimation of Carbon flux, Identification of ARD & FM, Presentation
  - Totaling forest resources for
    - Forestry statistics, Forest planning, Forestry census, etc.

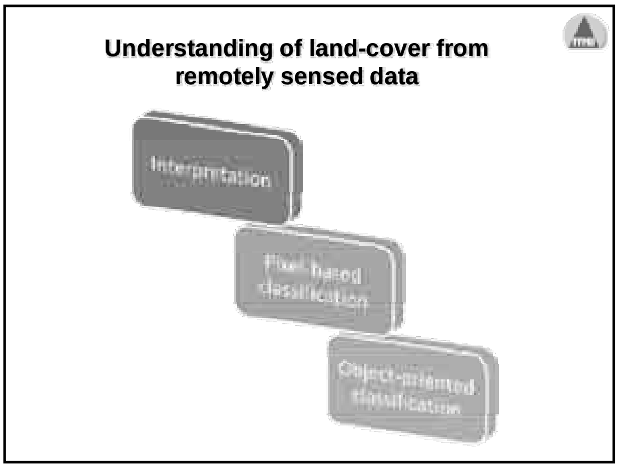
Forestry and Forest Products Research Institute

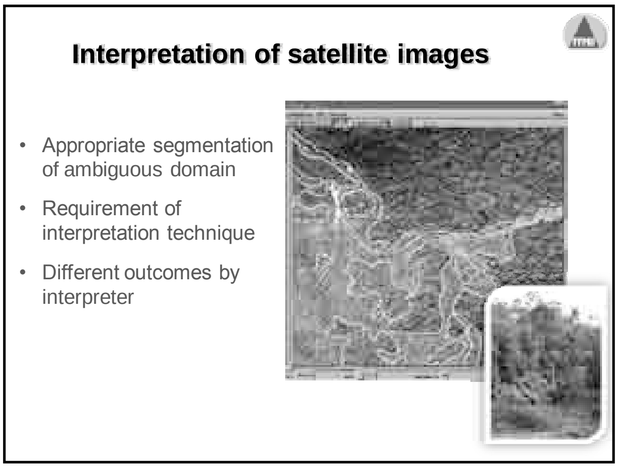

Main Data on NFRDB
Attribute data of forest registers with 41M records
Forest registers
FM monitoring
ARD monitoring
Forest resources monitoring survey
Orthophotos
SPOT images
Landsat TM images
Forestry and Forest Products Research Institute

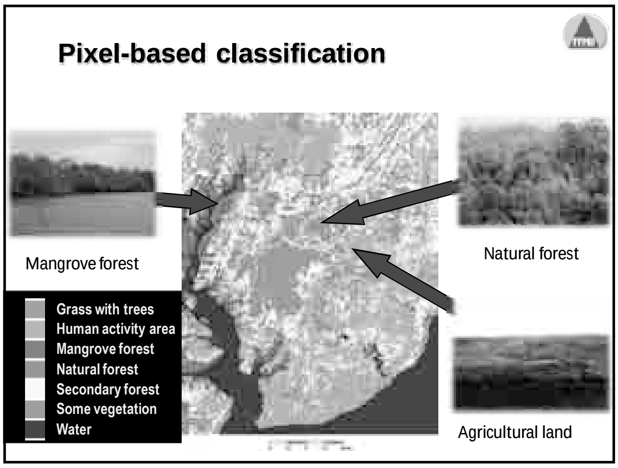

ARD Detection by Interpretation of Orthophotos and SPOT Images with 500m grids
【ARD Interpretation】
【Result of ARD Detection】
Orthophoto in 1989
SPOT in 2005
Incident Ratios in 16 years
AR 0.081 %
D 0.96 %
: Non-changed forests, : Non-changed Non-forests, : AR、 : D
8

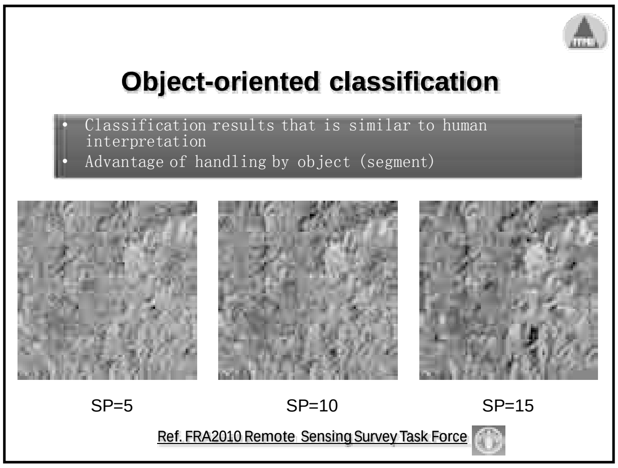

Outlines
National Forest Resource DB (NFRDB)
Forest Monitoring using satellite remote sensing
Forest degradation in developing countries
New remote sensing technologies
Technical issues
Conclusions

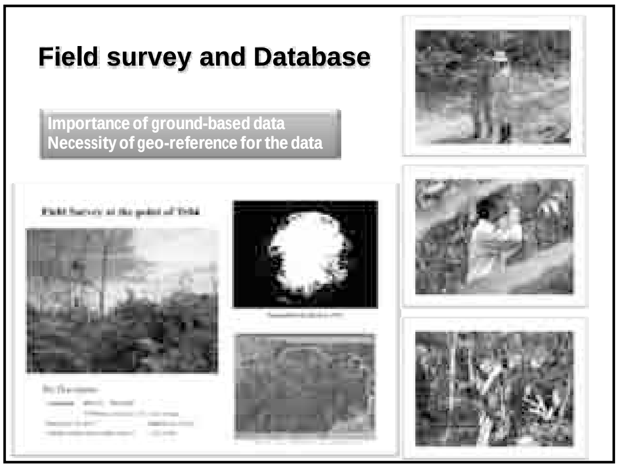

Forest monitoring using satellite remote sensing
No leakage in the area.
Coat is large.
Difficulty of acquiring cloud-free data.
Applicability for local policy is large.
Wall-to-wall
Satellite data
Sampling
Accuracy for sampling rate.
Coat is effective.
Acquiring cloud-free data is relatively easy.
Applicability for local policy ?
Ref. FRA2010 Remote Sensing Survey Task Force

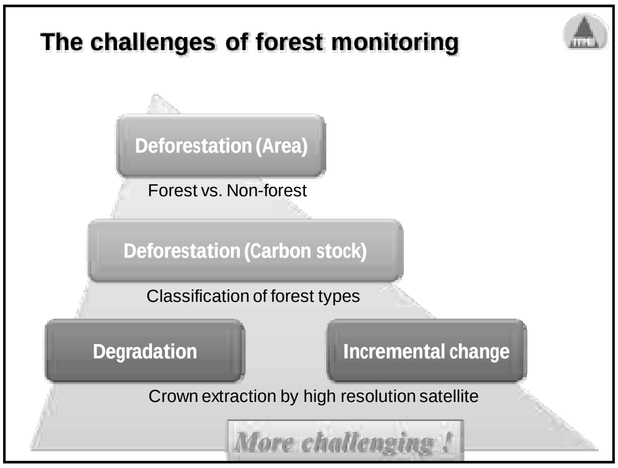

Understanding of land-cover from remotely sensed data
Interpretation
Pixel-based classification
Object-oriented classification

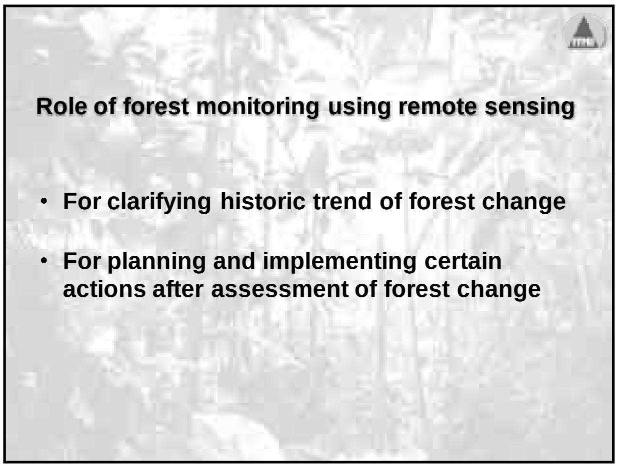

Interpretation of satellite images
Appropriate segmentation of ambiguous domain
Requirement of interpretation technique
Different outcomes by interpreter


Pixel-based classification
Mangrove forest
Natural forest
Agricultural land
Grass with trees
Human activity area
Mangrove forest
Natural forest
Secondary forest
Some vegetation
Water

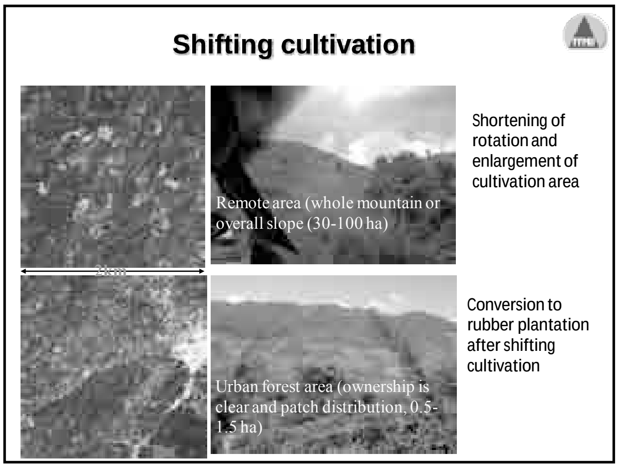

Object-oriented classification
• Classification results that is similar to human interpretation
• Advantage of handling by object (segment)
SP=5
SP=10
SP=15
Ref. FRA2010 Remote Sensing Survey Task Force

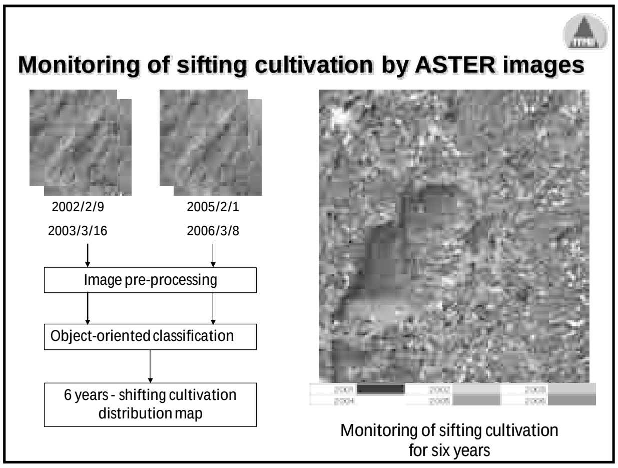

Field survey and Database
Importance of ground-based data
Necessity of geo-reference for the data

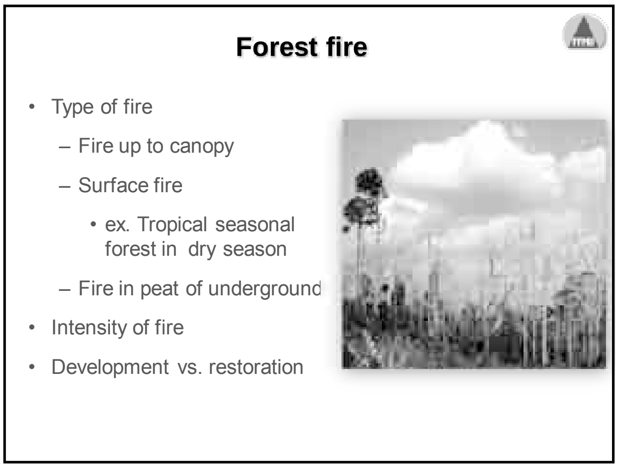

The challenges of forest monitoring
Deforestation (Area)
Forest vs. Non-forest
Deforestation (Carbon stock)
Classification of forest types
Degradation
Incremental change
Crown extraction by high resolution satellite
More challenging !

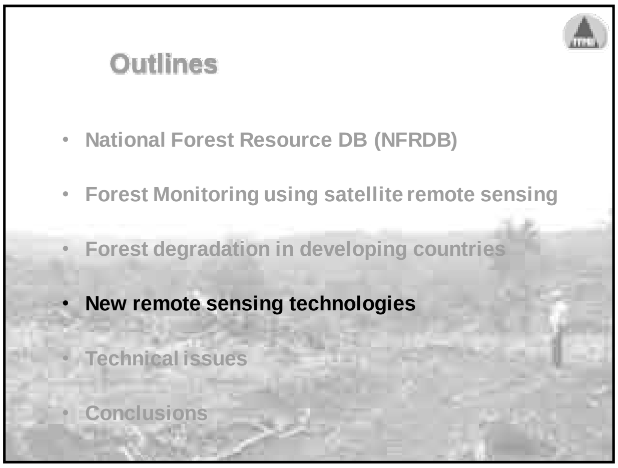

Role of forest monitoring using remote sensing
• For clarifying historic trend of forest change
• For planning and implementing certain actions after assessment of forest change

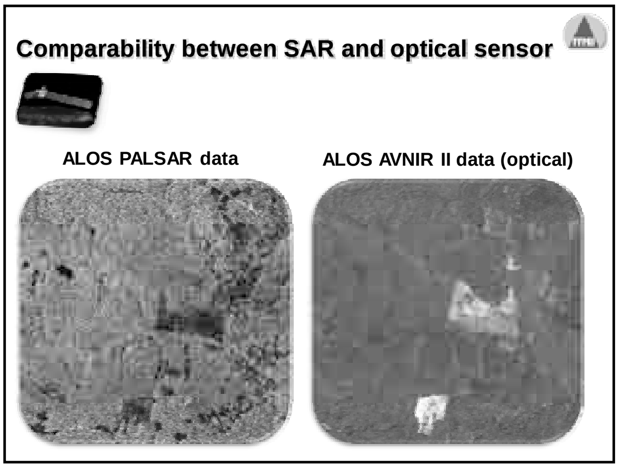

Outlines
• National Forest Resource DB (NFRDB)
• Forest Monitoring using satellite remote sensing
• Forest degradation in developing countries
• New remote sensing technologies
• Technical issues
• Conclusions

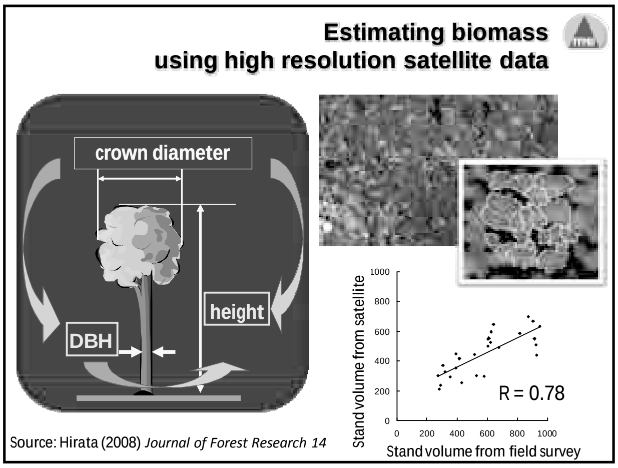

Shifting cultivation
Remote area (whole mountain or overall slope (30-100 ha)
Shortening of rotation and enlargement of cultivation area
Urban forest area (ownership is clear and patch distribution, 0.5-1.5 ha)
Conversion to rubber plantation after shifting cultivation


Monitoring of sifting cultivation by ASTER images
2002/2/9
2003/3/16
2005/2/1
2006/3/8
Image pre-processing
Object-oriented classification
6 years - shifting cultivation distribution map
Monitoring of sifting cultivation for six years


Forest fire
• Type of fire
– Fire up to canopy
– Surface fire
• ex. Tropical seasonal forest in dry season
– Fire in peat of underground
• Intensity of fire
• Development vs. restoration

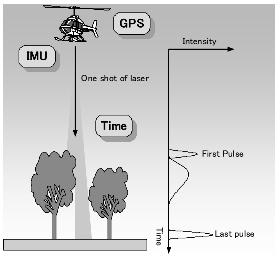

Outlines
• National Forest Resource DB (NFRDB)
• Forest Monitoring using satellite remote sensing
• Forest degradation in developing countries
• New remote sensing technologies
• Technical issues
• Conclusions

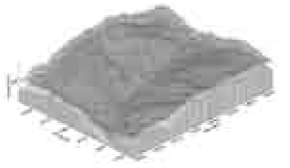

Comparability between SAR and optical sensor
ALOS PALSAR data
ALOS AVNIR II data (optical)


Estimating biomass using high resolution satellite data
crown diameter
height
DBH
Stand volume from satellite
Stand volume from field survey
R = 0.78
Source: Hirata (2008) Journal of Forest Research 14

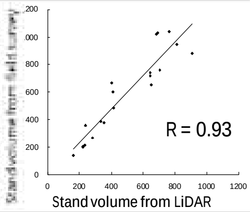
3-D forest measurement with LiDAR

A part of the laser beam reflects on canopy .
The rest goes through canopy and reflects on the ground.





Measurement of ground and canopy surface

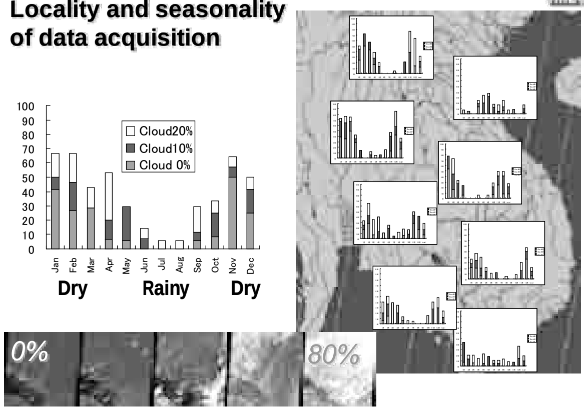


Source: Hirata et al (2008) *Journal of Forest Planning 14*

Outlines

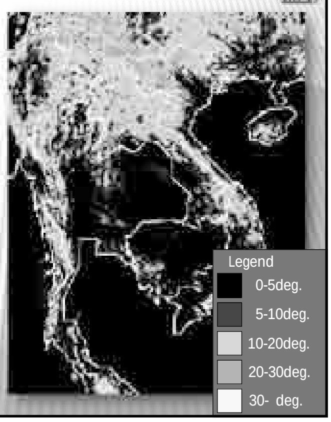
- National Forest Resource DB (NFRDB)
- Forest Monitoring using satellite remote sensing
- Forest degradation in developing countries
- New remote sensing technologies
- **Technical issues**
- Conclusions

Locality and seasonality of data acquisition



Topographic effect

- Forest remains in mountainous area.
- Effect of topography on both SAR and optical sensor data

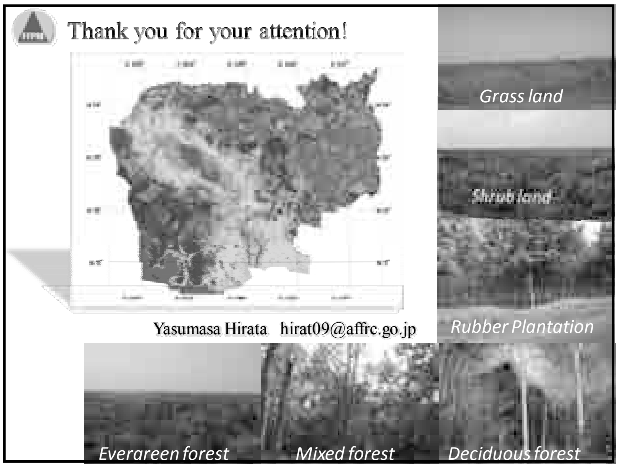


Outlines

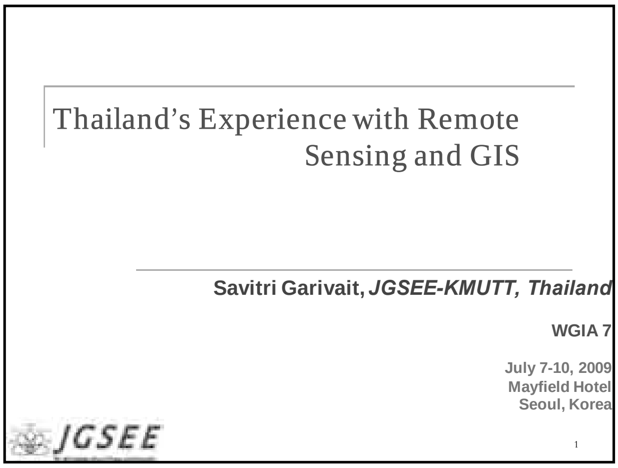
- National Forest Resource DB (NFRDB)
- Forest Monitoring using satellite remote sensing
- Forest degradation in developing countries
- New remote sensing technologies
- Technical issues
- **Conclusions**

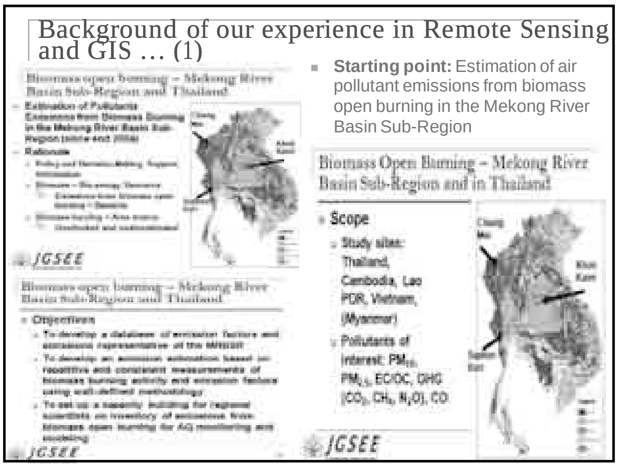
Conclusions

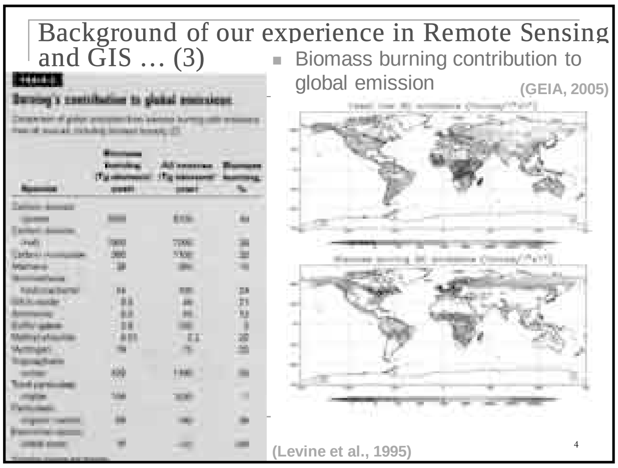
- Consistency of satellite data and the results
- Determining methodology
- Issue of definition
- Importance of field survey
  - There is much grand-based data, which was collected by different organizations, for different factors with different formats, without geo-reference
- Established methods and further challenging studies

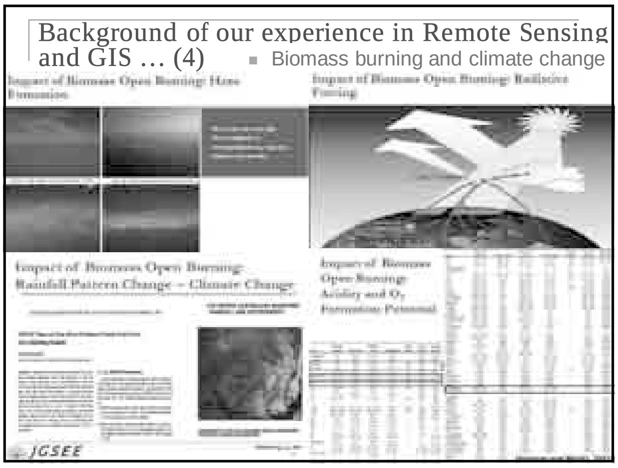

Thank you for your attention!
Yasumasa Hirata hirat09@affrc.go.jp
Grass land
Shrub land
Rubber Plantation
Evergreen forest
Mixed forest
Deciduous forest

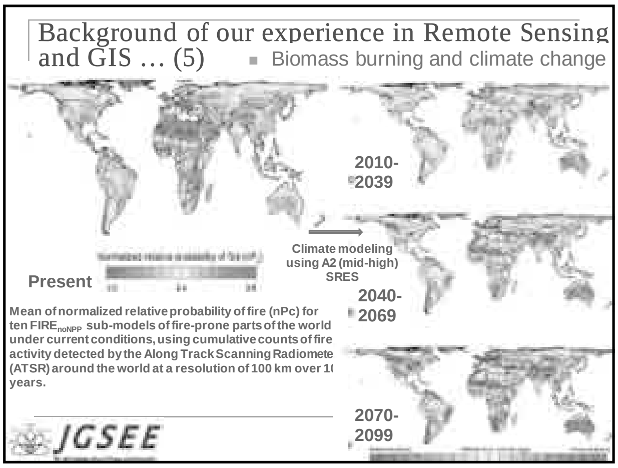
Presentation 4.4.3.4



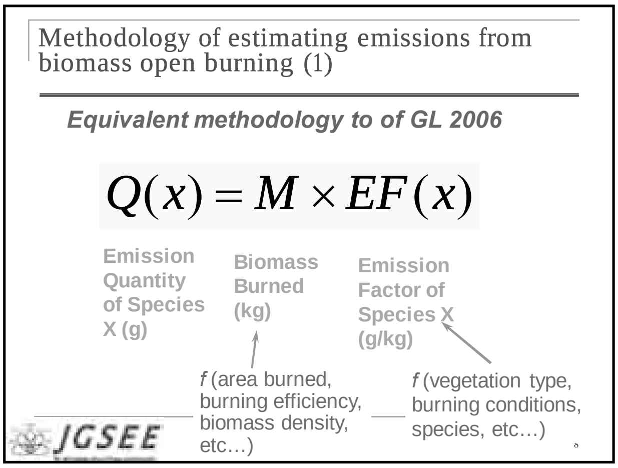


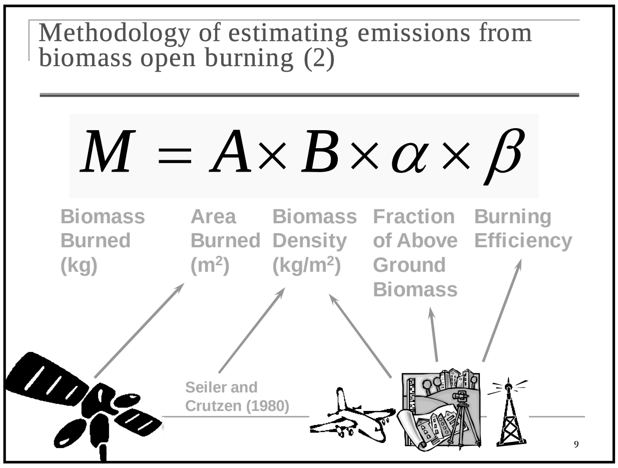


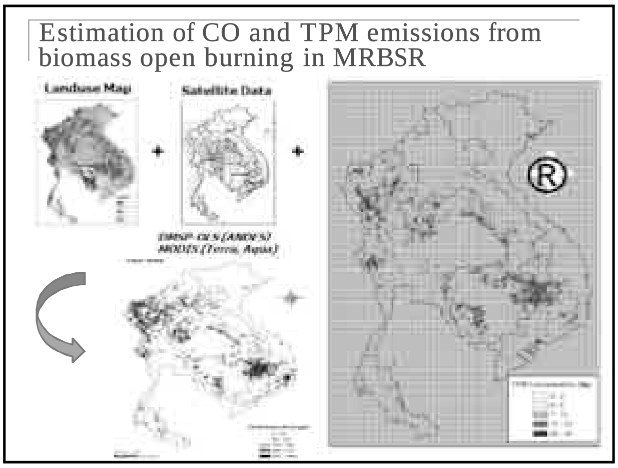


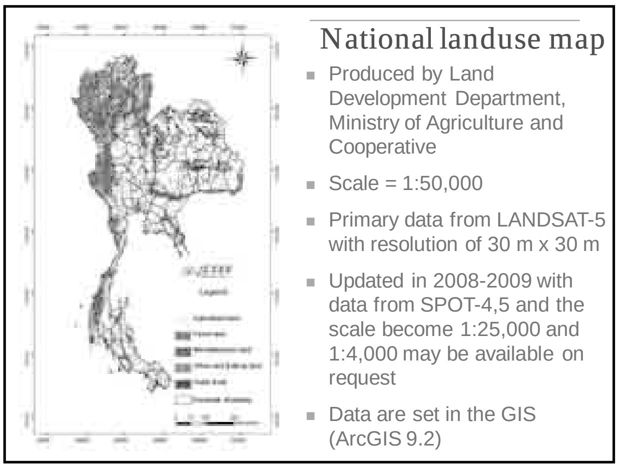


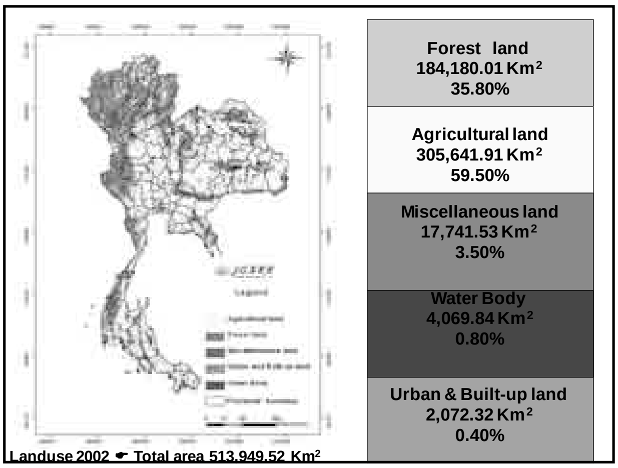

Background of our experience in Remote Sensing and GIS … (6)
Biomass burning in ASEAN
Biomass burning – ASEAN countries
Haze in Malaysia during Indonesian forest fire in 1997
JGSEE
Haze in Chiang Mai in 2007


Methodology of estimating emissions from biomass open burning (1)
Equivalent methodology to of GL 2006
$Q(x) = M \times EF(x)$
Emission Quantity of Species X (g)
Biomass Burned (kg)
Emission Factor of Species X (g/kg)
f (area burned, burning efficiency, biomass density, etc…)
f (vegetation type, burning conditions, species, etc…)
JGSEE

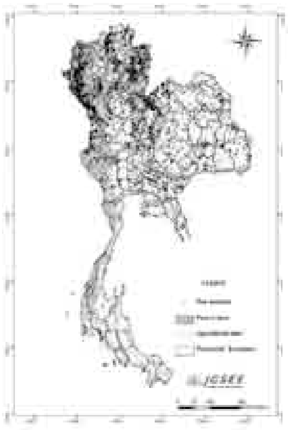

Methodology of estimating emissions from biomass open burning (2)
$M = A \times B \times \alpha \times \beta$
Biomass Burned (kg)
Area Burned (m^2)
Biomass Density (kg/m^2)
Fraction of Above Ground Biomass
Burning Efficiency
Seiler and Crutzen (1980)
9


Estimation of CO and TPM emissions from biomass open burning in MRBSR
Landuse Map
Satellite Data
+
+


National landuse map
Produced by Land Development Department, Ministry of Agriculture and Cooperative
Scale = 1:50,000
Primary data from LANDSAT-5 with resolution of 30 m x 30 m
Updated in 2008-2009 with data from SPOT-4,5 and the scale become 1:25,000 and 1:4,000 may be available on request
Data are set in the GIS (ArcGIS 9.2)


Forest land 184,180.01 Km2 35.80%
Agricultural land 305,641.91 Km2 59.50%
Miscellaneous land 17,741.53 Km2 3.50%
Water Body 4,069.84 Km2 0.80%
Urban & Built-up land 2,072.32 Km2 0.40%
Landuse 2002 ☛ Total area 513,949.52 Km2

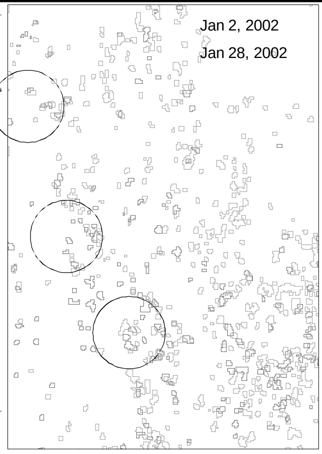
Fire Hot Spots (FHS) map



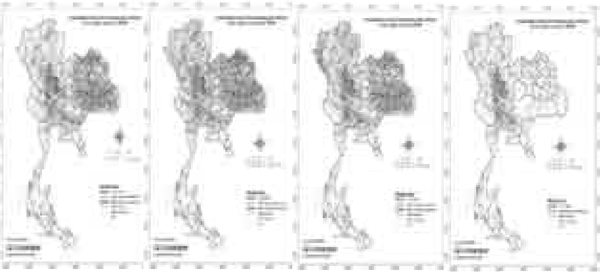
- Primary data with resolution of 1 km x 1 km from DMSP-OLS (ANDES) for 2000-2004 and MODIS (Terra and Aqua) from 2005 onward ☛ for spatial and temporal distribution
- For better accuracy of area burnt ☛ LANDSAT or SPOT, however the accuracy is limited by the period of pass over the same geographic position:
  - 16 days for LANDSAT
  - 26 days for SPOT

Examples of uncertainties – *Remote Sensing*

- **Fires occurred in the same area on two different days**



Examples of uncertainties – Remote Sensing: Agricultural open burning in Thailand in 2005



Burned areas: Un-irrigated paddy fields>Sugarcane>Maize
Season: - Un-irrigated paddy: January/February
- Irrigated paddy: April
- Sugarcane: January/Februar/March
- Maize: January/February/March

MODIS data = HIGHLY UNDERESTIMATE

Current work: Use of RS data for GHG inventory of LULUCF and in ALU

Use of data of global land cover from European agencies, other sources of EOS (USGS, USDA, LANDSAT, …), national land use map, … in order to fill data gaps of LUCF since data only exist for 2000, 2004 and 2005

16

On-going works and ext steps …

- Improve accuracy of area burnt using MODIS data by conducting specific ground survey
- Time series consistency check based on remote sensing data of global land cover.
- Time series consistency check based on national statistics
- Data gaps filling for LULUCF

17

Acknowledgements

ขอบคุณค่ะ
Khob Khun Kha
สวัสดีค่ะ
Sawasdee Kha

Presentation 4.4.4.1

Session III: Group Discussion on Sector-Specific Issues- Group 4: Waste

The 7th Workshop on GHG Inventories in Asia (WGIA7)
9 July 2009,
Seoul, Republic of Korea

Takefumi Oda
Greenhouse Gas Inventory Office of JAPAN (GIO)
National Institute for Environmental Studies (NIES)

List of participants

- Mr. Haneda Sri Mulyanto (Indonesia)
- Mr. Khamphone Keodalavong (Lao PDR)
- Ms. Azlina Othman (Malaysia)
- Dr. Sirintornthep Towprayoon * (Thailand)
- Dr. Seungdo Kim (Republic of Korea)
- Mr. Byong-bok Jin (Republic of Korea)
- Mr. Wonseok Baek (Republic of Korea)
- Mr. Youngsung Kwon (Republic of Korea)
- Dr. Jeon-seong Ho (Republic of Korea)
- Dr. Chang-hwan Jung (Republic of Korea)
- Dr. Masato YAMADA (Japan)
- Dr. Tomonori ISHIGAKI * (Japan)
- Mr. Hiroyuki UEDA* (Japan)
- Dr. Kosuke KAWAI (Japan)
- Dr. Takefumi ODA (Japan)

15 persons. * : participants of WGIA6

Thank you for your participation!

2

Recommendation from WGIA6

➢ There are two topics carried over from WGIA6.

- For Data collection system
  - Establishment of data collection format
  - Identification of country specific waste stream
  - Guidelines for four separate levels of data collection systems namely :
    no data, not enough data, poor data quality and good quality data .
- "WGIA7 should focus more on wastewater emission."

3

Theme of the session for waste sector

- We set up two theme for this WGIA7.
  - **Theme 1:** Improvement of data collection scheme for the Waste Sector
    - How about the state of data collection in each country?
    - How can we establish the data collection format of waste sector in Asian countries?
    - What method is available for estimation of waste generations?...etc.
  - **Theme 2:** Information exchange on wastewater handling
    - What is problem on estimation of GHG emissions from wastewater handling in each country? ...etc.

4

Schedule of Working Group

9:30~10:50	**Theme 1: Improvement of data collection scheme for the Waste Sector** **Chair: Seungdo Kim, Rapporteur: Byong-bok Jin**	
9:30~9:35	Takefumi Oda	Introductory presentation
9:35~9:45	Wonseok Baek	Change of MSW Composition by Landfill Ban of Food Waste
9:45~9:55	Kosuke Kawai	How to Accumulate the Waste Data in each Asian Country
9:55~10:50	All	Discussion
10:50~11:00		***Tea Break***
11:00~12:20	**Theme 2: Information exchange on wastewater handling** **Chair: Sirintornthep Towprayoon, Rapporteur: TBD**	
11:00~11:10	Hiroyuki Ueda	GHG Emissions from Wastewater Treatment and Discharge in Japan
11:10~11:20	Tomonori Ishigaki	Possibly Co-benefit? Advanced Wastewater Treatment Process
11:20~12:20	All	Discussion

5

Hand-outs for Discussion

For these discussions, we have prepared some materials.

➢**For theme 1.**

- To share Japan`s data collection method
  - **'Japan's data collection system for statistics of waste disposal'**
  - **'How to estimate time-series data in Japan'**
- To understand status of participants data collection
  - **'Answer for questionnaires from participants'**
    - Before we hold this session, we have received five answers to our questionnaires from Malaysia, Mongolia, Korea, Philippines and Japan.
  - **'Country report on WM in Laos'**

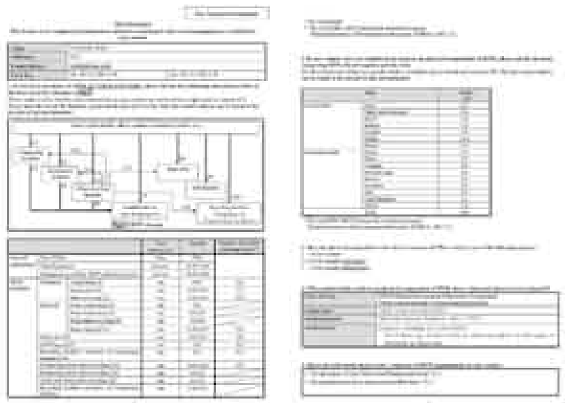
➢**For theme 2**

- **Slides of presentations**

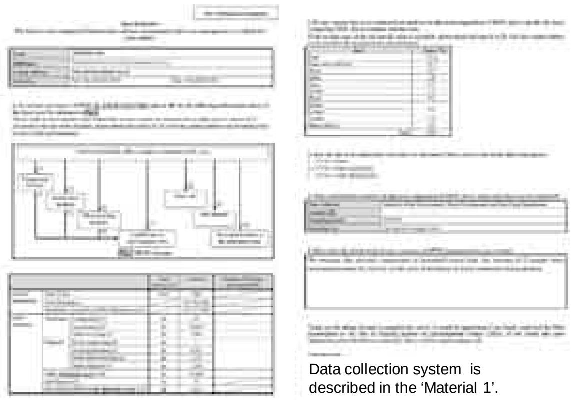
6

Answer from Mongolia

Answer from Malaysia



Answer from Korea (For National Government)



Answer from Japan (For National Government)

Let`s start this session!

Presentation 4.4.4.2

Change of MSW Composition attributed by Ban on Direct Landfill of Foodwaste in Korea

WGIA7 Session III : Group Discussion on Sector-Specific Issues

2009. 7. 9

Wonseok Baek

GHG Inventory team, Climate Environment Dept.

wsbaek@emc.or.kr

1

Contents

I Driving Process of a Policy

Background and Process

Expansion of Foodwaste Disposal Facility

II Results and Effects

Change of the Foodwaste Generation and Disposal

Influence of MSW Composition

Impact of Green House Gas Emission

2

Ban on Direct Landfill of Foodwaste

Limited area	Seoul, metropolitan cities, small cities (District excluded)
Start Date	2005.1.1
Details	Waste generated from Seoul, metropolitan cities, and small cities should be landfilled only after incineration, fertilizing, feeding and any other disposal process required. Direct landfill is legally prohibited.
Regulation	ENFORCEMENT REGULATIONS of WASTES CONTROL ACT An attached table 4 (1997.7.19 Revision)

3

Keynote of Foodwaste in Korea

Water 80~85%

pH 4.5~5.2 (Acidity)

Salt 1~2.3%

foreign substance, Decay, et.

Landfill	Incineration	Recycling
- Foul odor - Leachate	- Imperfect combustion - Use of auxiliary fuel	- Feeding - Composting

4

Driving process of a Policy

Background

- Among generated municipal waste, foodwaste accounts for 26%
- As food resource insufficient in Korea, generation of foodwaste result in squandering valuable resource
  - ○ Food self-sufficiency rate: 30%
  - ○ Feedstuff self-sufficiency rate : 4%
  - ○ Food resource wasted: approx. 14.7 trillion won annually
- As Korean food contains much water, it causes secondary pollution in disposal processes of landfill, incineration etc.

5

Progress

Change in Policies of Foodwaste Disposal

Regulation strengthened

1995.1 | 1995.7 | 1996.11 | 1996.12 | 1997.3 | 1997.7 | 1998.8 | 2005.1 | 2007 | 2008 | 2009~

1995. 1	Enforcement of Volume-rate Waste Charge System and arising of foodwaste problems
1995. 7	8 authorities including MOEK, Ministy for Health etc. established [Committee on Foodwaste Management]
1996. 11	Sudokwon Landfill, prohibited cargos with overloaded foodwaste
1996. 12	[Comprehensive Foodwaste Reduction Plan (1997~2001)] settled
1997. 3	Sudokwon Landfill, prohibited of carrying in foodwaste in 3rd section/agreement made on Odor Control Plan
1997. 7	Revision of Enforcement on Waste Management Plan for ban on direct landfill of foodwaste in Jan. 2005, MOEK
1998. 8	[Foodwaste Reduction, Resource Master Plan(1998~2002)] conducted by MOEK
2005. 1	Ban on landfill of foodwaste generated from Seoul, metropolitan cities, small cities

6

Expansion of Foodwaste Disposal Facility

<Installation and Operation Status of Annual Foodwaste Disposal Facility>

(Unit : No. of facility, ton/day)

Year	'97	'98	'99	'00	'01	'02	'03	'04	'05
Total	46 (1,076)	167 (3,178)	231 (4,228)	233 (5,195)	225 (5,671)	249 (8,575)	262 (9,815)	253 (11,232)	256 (13,364)
Public	32 (547)	50 (1,007)	73 (1,223)	80 (1,905)	81 (2,099)	80 (2,598)	80 (2,945)	85 (3,239)	90 (4,198)
Private	14 (529)	117 (2,171)	158 (3,005)	153 (3,290)	144 (3,572)	169 (5,977)	182 (6,870)	168 (7,993)	166 (9,166)

◆ Public and private disposal facilities increased after 1997

○ Public disposal facility : increased 4.1 time compared to '97 level (2005)

○ Private disposal facility : increased 17.3 time compared to '97 level (2005)

◆ Among total capacity of facilities, public facility accounts for 31.4%, private facility accounts for 68.6%

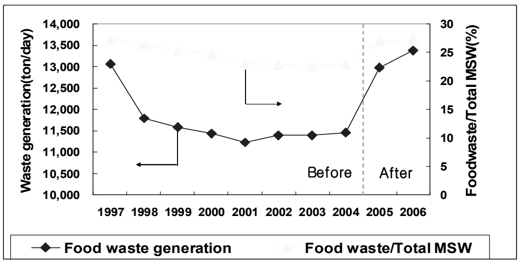
7

Results and Effects

Generation and Disposal of Foodwaste

Year	1997	2000	2004	2005	2006
Total MSW generation(ton/day)	47,895	46,438	50,007	48,398	48,844
Foodwaste generation(ton/day)	13,063	11,434	11,464	12,977	13,372
Foodwaste/Total MSW(%)	27	25	23	27	27
Landfill(ton/day)	10,973	5,185	1,607	356	261
Landfill ratio(%)	84	45	14	3	2
Incineration(ton/day)	815	1,088	541	516	509
Incineration ratio(%)	6	10	5	4	4
Recycling(ton/day)	1,275	5,161	9,316	12,104	12,317
Recycling ratio(%)	10	45	81	93	92

Increase in Foodwaste Generation



◆ Foodwaste generation per day : 13,028 ton (accounts for 26% of municipal waste)

○ 13.6% increase of foodwaste generation per day (11,424ton) compared to 2004

9

Increase in Foodwaste Generation

(Unit : %)

year	Household	Feeding facilities	Restaurant	Large scale store*
2002	65.9	4.2	21.1	8.8
2003	67.5	5.3	21.0	6.2
2004	71.1	5.3	17.3	6.3
2005	71.5	5.6	17.9	5.0

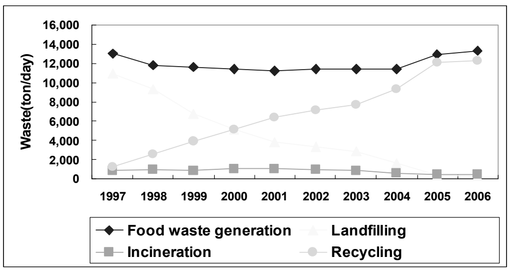
* : Agriculture and fisheries market, Tourism equipment

◆ After mass media and private organizations put effort on promoting and educating to reduce foodwaste, food culture has improved However, foodwaste generation sharply increased since the ban of direct landfill

○ As Life level enhance and concerns of health extend, consumption of fruits and vegetables increased which caused foodwaste generation from residents tend to increase

10

Change of Foodwaste Disposal Method

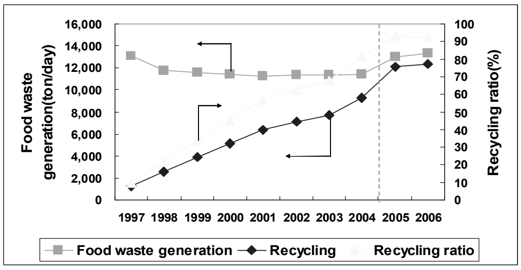


◆ Since 1997, landfill decrease, recycling increase

○ Recycling increase (10% -> 92%)
Landfill decrease (84% -> 2%)

11

Increase in Foodwaste Recycle



◆ After enforcement of volume-rate waste charge system in '95 and ban on direct landfill of foodwaste in '05.1, recycling rate sharply increased to 93% by late '05

12

Influence of MSW Composition

Target and Method for the Survey

Sampling	Location : 1 city	Chungbuk Jecheon city (Population : 140,000)			
	Points : 10 ea	APT (3)	Detached (3)	Shopping (2)	Outskirts (2)
	Dates : 3	Aug-04	Nov-04	May-04	
Analysis	Physico-chemical properties	Conical quarter dividing method, 3-Composition(ASTM)			
	Gas generation estimates	Scholl canyon model (First order decay model)			

13

Change of MSW Physical Composition

Sampling time		Food	Paper	Vinyl /Plastic	Textile	Wood	Leather	Metal	Glass	Misc.
Components unit : wt %		Combustible						Incombustible		
2004	August	35.9	30	13.7	1.7	2	0.8	2.1	5.6	8.2
	November	32.2	25.7	15.9	2	0.6	0.5	1.1	4.6	17.4
	Average	34.1	27.9	14.8	1.9	1.3	0.7	1.6	5.1	12.8
2005	May	27.3	37.6	16.8	4.5	1.7	1.5	1.8	3.1	5.6

Results

- Foodwaste : At about 12% decrease
- Paper : At about 10% increase
- Ratio (Component/Total MSW) : Paper > Foodwaste > Vinyl/Plastic

14

Change of MSW Physical Composition

Sampling time (Components unit : wt %)		Food	Paper	Vinyl /Plastic	Textile	Wood	Leather	Metal	Glass	Misc.
2004	Apartment	31.18	36.3	14.03	1.83	0.83	0.7	0.85	3.72	10.55
	Detached house	44.53	18.52	14.4	2.5	0.4	0.6	2.12	4.48	12.42
2005	Apartment	24.66	47.56	13.94	3.47	1.71	1.51	0.77	1.35	5.04
	Detached house	28.67	32.55	20.02	2.54	2.1	1.92	0.72	2.67	8.82

Results

- Apartment : At about 6.5% decrease
- Detached house : At about 11.8% decrease

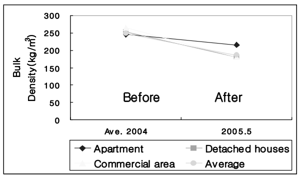
15

Change of Bulk Density of MSW

	Before and after landfill ban of Foodwaste			
	Before			After
	2004.8	2004.11	Ave. 2004	2005.5
Apartment	217.6	274.0	245.8	216.5
Detached houses	224.2	282.6	253.4	179.6
Commercial area	273.1	256.7	264.9	179.9
Average	226.4	270.9	248.7	186.7

Results

- Bulk density : 25% decrease

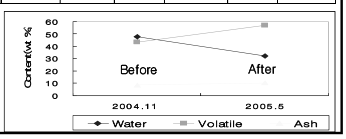


Change of 3-composition of MSW

Sample	3-Components	Food	Paper	Vinyl /Plastic	Textile	Wood	Leather	Misc.	Average
2004.8	Water	69.82	34.68	8.30	25.78	35.40	21.15	54.84	45.10
	Volatile	24.62	55.43	84.98	68.31	60.17	71.01	31.96	46.68
	Ash	5.56	9.89	6.72	5.92	4.43	7.84	13.20	8.22
2004.11	Water	78.03	25.84	12.52	25.97	36.67	11.02	62.15	47.63
	Volatile	16.28	61.33	82.43	67.61	55.48	75.89	27.68	43.60
	Ash	5.69	12.83	5.04	6.42	7.86	13.09	10.17	8.77
2005.5	Water	70.80	18.54	4.91	18.52	43.71	5.22	49.81	32.31
	Volatile	20.58	67.50	90.41	73.66	49.44	72.24	34.27	57.04
	Ash	8.62	13.95	4.68	7.82	6.85	22.54	15.93	10.65

Results

- Water : 14% decrease
- Volatile : 11.9% increase
- Ash : 2.2% increase
- LHV increase factor



Increase of LHV (Low Heating Value) of MSW

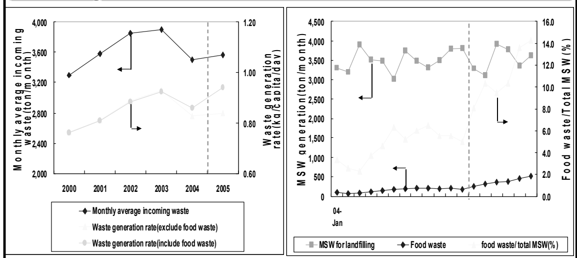
	Contribution to LHV in 1kg wet MSW							Low heating value of MSW (kcal/kg)
	Food	Paper	Vinyl /Plastic	Textile	Wood	Leather	Misc.	
'04.8	260.6	679.4	1,088.1	45.0	60.9	36.1	99.9	2,270.1
'04.11	94.3	660.2	1,183.9	55.2	18.1	25.8	168.8	2,206.4
'04 ave	177.5	669.8	1,136.0	50.1	39.5	30.9	134.3	2,238.2
'05.5	189.2	1,085.9	1,380.1	138.0	45.8	70.1	82.2	2,991.4

Results

- LHV : 753.2 kcal/kg increase
- LHV increase factor
  - Water content decreased while paper & vinyl/plastic materials relatively increase
  - Paper which absorbs water easily, its water content decreased which increased the calorific value

18

Change in Amount of Landfill

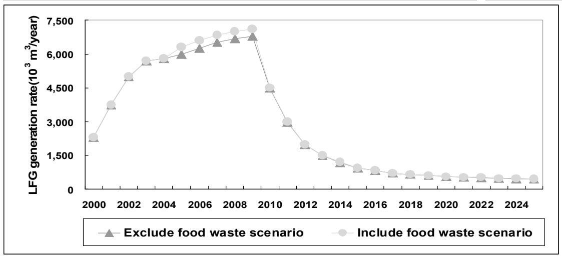


Results

- ◆ Generation of waste from 1person per day decreased: 8% decrease compared to 2003 level (2005 data)
- ◆ Generation of foodwaste from 1person per day: 0.1kg

19

Prediction of Landfill Gas Generation Rate Change



Results

- ◆ Compared with primary landfill : methane generation decreased by maximum 5%, 340,000 m^3/yr

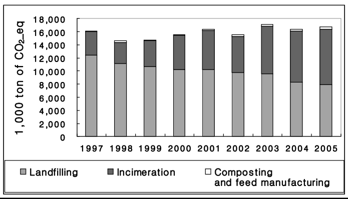
20

Impact of Green House Gas Emission

Trends in GHG Emissions of Waste Sector

Unit : 1,000 ton CO2_eq

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005
Landfilling	12,486	11,146	10,685	10,242	10,205	9,705	9,584	8,316	7,919
Incineration	3,480	3,228	3,930	5,176	5,979	5,591	7,244	7,769	8,422
Composting and feed manufacturing	159	261	75	164	166	237	225	255	354



Trends

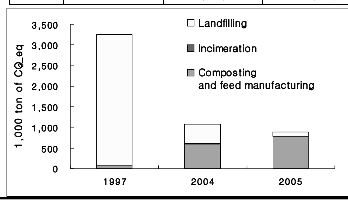
- **Landfill : Decrease**
- **Incineration : Increase**
- **Compositing : Increase**

21

Trends in GHG Emissions by Foodwaste Disposal

Unit : ton/day

Year	Foodwaste Generation rate	Foodwaste disposal		
		Landfill	Incineration	Composting and feed manufacturing
1997	13,063	10,973 (84%)	815 (6%)	1,275 (10%)
2004	11,463	1,607 (14%)	540 (5%)	9,316 (81%)
2005	12,976	356 (3%)	516 (4%)	12,104 (93%)



Trends

- **Disposal method**
  Landfill → Composting
- **GHG emission (Foodwaste/Total waste)**
  20% (1997) → 5% (2005)

22

Thank you

23

Reference

- ◆ Seokpyo Yoon, Haksang Lim, Change of municipal solid waste composition and landfilled amount by the landfill ban of food waste, Journal of KORRA, Vol.13, No.3, 2005
- ◆ SukHui Lee et al., Evaluation of environmental burdens caused by changed of food waste management systems in Seoul, Korea, Science of the Total Environment, 387, pp 42-53, 2007

24

Presentation 4.4.4.3

National Institute for Environmental Studies

WG 4: Waste Sector
Theme 1: Improvement of data collection scheme for the Waste Sector

How to accumulate the waste data in each Asian country

The 7th Workshop on GHG Inventories in Asia (WGIA7)
9 July 2009
Seoul, Republic of Korea

Kosuke Kawai, Ph.D.

Research Center for Material Cycles and Waste Management
National Institute for Environmental Studies (NIES), Japan
E-mail: kawai.kosuke@nies.go.jp

1/10

National Institute for Environmental Studies *How to accumulate the waste data in each Asian country*

Necessities for estimating GHG inventories from waste sector

Activity data
- Waste streams (the amount of generation, treatment and disposal)
- Waste compositions (physical composition)

→ National governments, Municipalities

Parameters
- Emission factor for incinerating (CO_2)
- Emission factor for composting (CH_4, N_2O)
- Emission factor for anaerobic digestion (CH_4, N_2O)
- Methane correction factor (MCF)
- Degradable organic carbon (DOC)
- Fraction of degradable organic carbon which decomposes (DOC_f)
- Fraction of CH_4 in landfill gas (F)
- Methane recovery (R)
- Oxidation factor (OX)
- The half-life

→ Research Institutes, Universities

2/10

National Institute for Environmental Studies *How to accumulate the waste data in each Asian country*

Questionnaires on activity data

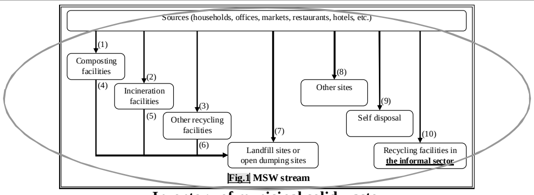


Fig.1 MSW stream

Inventory of municipal solid waste **QUANTITATIVE DATA**

QUALITATIVE DATA

Item	Ratio (%)
Food	
Paper and cardboard	
Plastic	
Metal	
Glass	
Garden	
Wood	
Rubber	
Leather	
Textiles	
Others (if any)	
Total	100

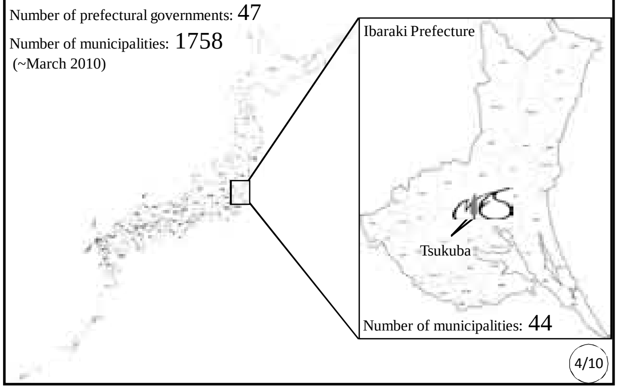
physical composition of municipal solid waste

3/10

National Institute for Environmental Studies *How to accumulate the waste data in each Asian country*

Number of prefectural governments and municipalities in Japan

Number of prefectural governments: 47
Number of municipalities: 1758
(~March 2010)



4/10

National Institute for Environmental Studies *How to accumulate the waste data in each Asian country*

Roles of prefectural governments

Businesses specified by the Cabinet Order as those who have places of business generating industrial waste abundantly as a result of their business activities shall **make the plan on reduction and other management of industrial waste** from the said places in accordance with the standards specified by the Ordinance of the Ministry of the Environment and **submit it to the prefectural governors**.
(Waste Management and Public Cleansing Law)

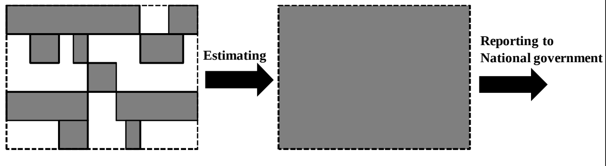
Prefectural governments are in charge of accumulating and estimating **INDUSTRIAL WASTE DATA**.

5/10

National Institute for Environmental Studies *How to accumulate the waste data in each Asian country*

Industrial waste data

Prefectural governments grasp the status of waste generation and disposal from reports from related businesses. High-volume generating businesses which have generated more than **1 kilo metric tons** in the previous year are obligated to **report** on the annual disposal plan and actual results to the prefectural governments.
Other businesses status is **estimated** from sampling survey of questionnaires and the actual results of industrial waste disposal contractors.



How to estimate industrial waste data in a prefecture

6/10

National Institute for Environmental Studies *How to accumulate the waste data in each Asian country*

Roles of municipalities

The municipalities shall **collect, transport and dispose of** municipal solid waste in their municipal areas before they interfere with the conservation of the living environment, according to the municipal solid waste management plan.

The municipalities shall specified forth a definite plan for management of municipal solid waste in their respective administrative areas.
The municipal solid waste management plan shall include the following matters in regard to the management of municipal solid waste in their administrative areas according to the Ordinance of the Ministry of the Environment.

1) Estimate of the volume of municipal solid waste to be generated and that to be managed.
2) Matters related to measures for suppressing discharge of municipal solid waste.
3) Kinds of municipal solid waste to be presorted for collectors and descriptions of those kinds.
4) Fundamentals of proper municipal solid waste management and also the fundamentals relating to the authorities/persons carrying out such management.
5) Matters pertaining to the improvement or expansion of municipal solid waste disposal facilities.
6) Other matters necessary for the management of municipal solid waste.

(Waste Management and Public Cleansing Law)

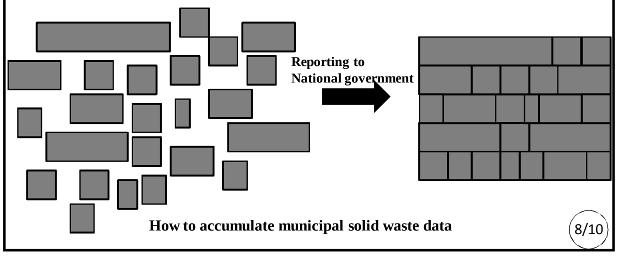
Municipalities are in charge of accumulating **MUNICIPAL SOLID WASTE DATA**.

7/10

National Institute for Environmental Studies *How to accumulate the waste data in each Asian country*

Municipal solid waste QUANTITATIVE data

Municipal governments and business relations associations investigate the amount of waste generation transported to the disposal facility from inside the designated disposal area, disposal and resource recovery.
The national government integrates the amount of waste generation, disposal and resource recovery reported by municipal governments. By using such figures, the national government reports the national statistics of 'Waste treatment in Japan.'



How to accumulate municipal solid waste data

8/10

National Institute for Environmental Studies *How to accumulate the waste data in each Asian country*

Municipal solid waste QUALITATIVE data

Municipal governments shall analyze municipal solid waste QUALITATIVE data at incineration plants at least four times a year with **KANSEI Vol.95**.

- Sampling more than 200 kg of waste
- Reducing the samples to 5~10 kg
- Measuring the gravity of the samples
- Drying the samples (At 105 ± 5 degrees)
- Sorting the samples into six categories (1 Paper and textiles, 2 Plastic, rubber and leather, 3 Wood, 4 Food, 5 Noncombustible, 6 Others)
- Measuring the weight of the sorted samples (Dried basis)
- Measuring the proximate composition (Combustible, ash and water)

Procedure of KANSEI Vol.95 for analyzing municipal solid waste qualitative data

9/10

National Institute for Environmental Studies *How to accumulate the waste data in each Asian country*

How to accumulate the waste data in each Asian country

At this time, it is impossible to collect the **ALL** national waste data because of financial and technical problems.

For accumulating QUANTITATIVE data,
It is important to **estimate** the waste data **properly** for the time being.

For accumulating QUALITATIVE data,
It is important to adopt **reliable methods** for analyzing the waste data.

Essential consideration
-Cooperation of municipalities is vital for national governments to accumulate the waste data in each Asian country.
-Research Institutes should encourage municipalities to accumulate the waste data.

TOPICS in this session
-How do your country currently accumulate the waste data?
-How should your country accumulate the waste data in the near future?

10/10

Presentation 4.4.4.4

7th Workshop on Greenhouse Gas Inventories in Asia
7-10 July 2009, Seoul, Korea

GHG Emissions from Wastewater Treatment and Discharge in Japan

Hiroyuki Ueda
SUR, Japan
Cooperative Researcher, GIO, NIES

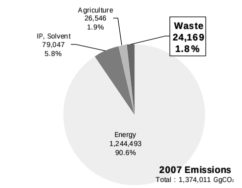
Outline

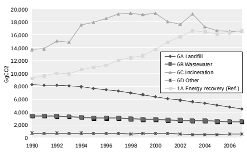
- Introduction of Japan's emission estimations from wastewater treatment and discharge (WWTD, 6.B)
  - Structure of 6.B WWTD category* in Japan's inventory
  - CH_4 and N_2O emission sources in 6.B
  - EFs, AD and methodologies
- Sharing experience and information exchange
  - Early and well-planned preparation
  - Prioritization of targets
  - Process for improvement

* In the annual inventory, Japan reports GHG emissions as "6.B wastewater handling" according to FCCC/CP/2002/8. However, this presentation uses more appropriate definition of "wastewater treatment and discharge (WWTD)" from 2006GL instead.

2

Overview of GHG emissions in Japan





GHG Emissions in the waste sector

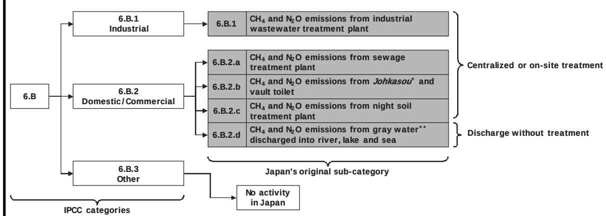
- Japan's 2007 inventory*
  - Emissions from the waste sector amounted 24,169 $GgCO_2$ or 1.8 per cent of total.
  - Emissions from 6.B amounted 2,528 $GgCO_2$ or 10.5 per cent of the waste sector.
  - Emissions from 6.B decreased by 25.9 per cent from 1990 to 2007. The key driver was the decrease of emission from gray water discharged into river, lake and sea.

* Japan has submitted 2007 data inventory to UNFCCC in April 2009.

3

Structure of Japan's 6.B inventory

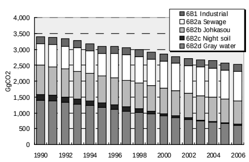
- 5 sub-categories in 6.B
  - Japan divides IPCC 6.B category into 5 original sub-categories according to methodologies for GHG emission estimations.



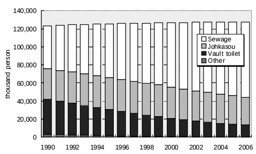
* *Johkasou* : Japan's original on-site domestic wastewater treatment system
**Gray water: Miscellaneous domestic wastewater except night soil

4

Emissions of Japan's 6.B inventory



GHG Emissions from each sub-category in the waste sector



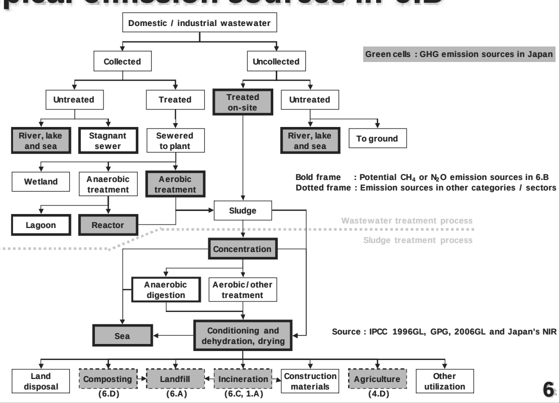
Domestic wastewater treatment population in Japan

- Continuous decrease since 1990
  - In 1990, the largest emission source in 6.B was 6.B.2.d, however, decreased by 785 $GgCO_2$ or 56.0 per cent between 1990 and 2006*.
  - This decline has contributed to the decrease of 6.B total emissions (882 $GgCO_2$ from 1990 to 2006).
  - The key driver for the decline of 6.B.2.d was the progress of conversion of vault toilet to sewage system.

* In 2009 inventory, 2007 data is in preparation and 2006 data was substituted.

5

Typical emission sources in 6.B



Green cells : GHG emission sources in Japan

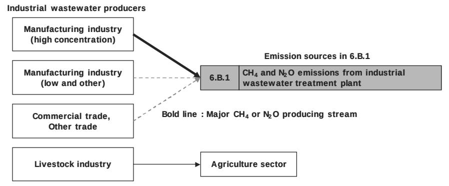
Bold frame : Potential CH_4 or N_2O emission sources in 6.B
Dotted frame : Emission sources in other categories / sectors

Source : IPCC 1996GL, GPG, 2006GL and Japan's NIR

6

Industrial WWT system in Japan

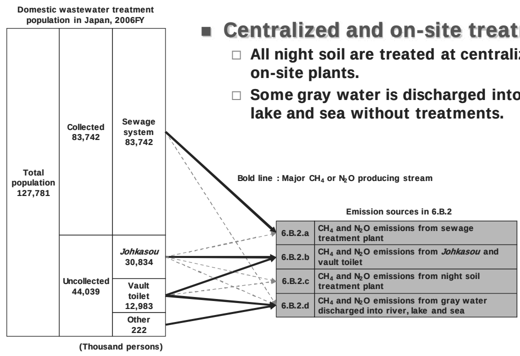
- **On-site treatment**
  - Every industries that produce polluted wastewater are required to treat the polluted wastewater by on-site plants according to the Water Pollution Control Law.
  - Wastewater from livestock industry is considered in the agriculture sector, not in 6.B, according to IPCC GL.



7

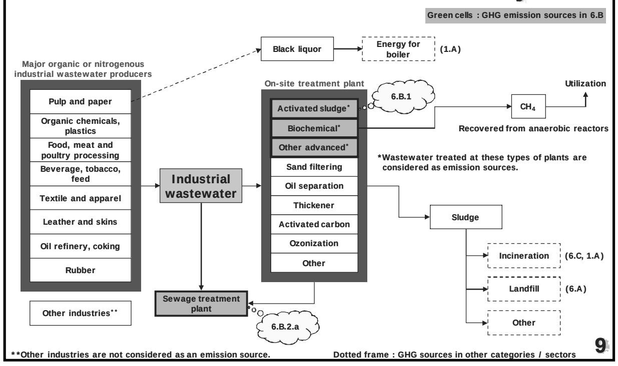
Domestic WWT system in Japan

- **Centralized and on-site treatment**
  - All night soil are treated at centralized or on-site plants.
  - Some gray water is discharged into river, lake and sea without treatments.



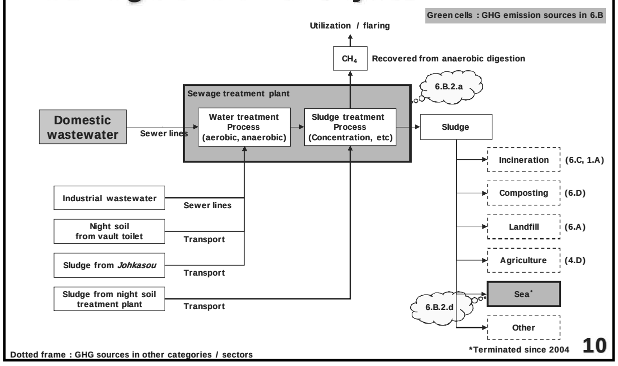
8

GHG sources in Industrial wastewater treatment system



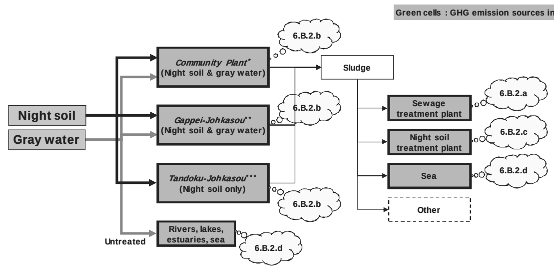
9

GHG sources in Sewage treatment system



10

GHG sources in *Johkasou* system

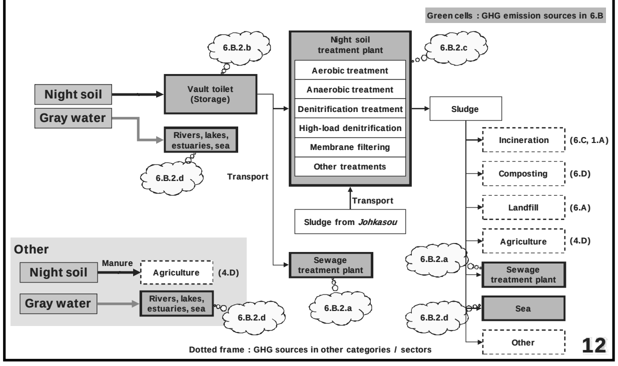


* *Community Plant* : collectively treats domestic wastewater and have similar features to a large-scale *Gappei-Johkasou*.
** *Gappei-Johkasou* : is designed for both night soil and gray water treatment at household.
*** *Tandoku-Johkasou* : is an old-type *Johkasou* and treats only night soil. Newly installation has been prohibited since 2001.

Dotted frame : GHG sources in other categories / sectors

11

GHG sources in Vault toilet and other system



12

Equation for CH_4 estimation

- Japan's country specific equation for CH_4 is as follows.
  - Japan's country specific equation for 6.B.2.a, 6.B.2.b and 6.B.2.c uses m^3 or person as AD, according to domestic research.
  - Basic theory is almost the same with IPCC equation*, that uses kg of organic matter (BOD or COD) as AD. *Equation 5.5 in GPG and 6.1, 6.4 in 2006GL
  - Recovered CH_4 from anaerobic reactor or digestion are not used for CH_4 because country specific EF is not "CH_4 production" but "CH_4 emission".

CH_4 Emission = EF • AD
EF : CH_4 emissions per m^3 ($kgCH_4/m^3$) or person ($kgCH_4$/person)
AD : treated wastewater (m^3) or person (person)

Summary for method, AD and EF of CH_4 estimation in Japan

Sub-category		Method	AD	EF
6.B.1	Industrial wastewater treatment plant	D	kg BOD	CS
6.B.2.a	Sewage treatment plant	CS	m^3	CS
6.B.2.b	*Johkasou* and vault toilet	CS	person	CS
6.B.2.c	Night soil treatment plant	CS	m^3	CS
6.B.2.d	Gray water discharged into river, lake and sea	D	kg BOD	D

CS: Country Specific
D : Default value or method of IPCC GL, GPG.

13

7th Workshop on Greenhouse Gas Inventories in Asia

Equation for N_2O estimation

- Japan's country specific equation for N_2O is as follows.
  - Japan's country specific equation for 6.B.2.a and 6.B.2.b uses m^3 or person as AD, according to domestic research.
  - Basic theory is almost the same with IPCC equation*, that uses kg of nitrogen or person as AD. *Equation 6.7, 6.9 in 2006GL

N_2O Emission = EF • AD
EF : N_2O emissions per m^3 (kgN_2O/m^3) or person (kgN_2O/person)
AD : treated wastewater (m^3) or person (person)

Summary for method, AD and EF of N_2O estimation in Japan

Sub-category		Method	AD	EF
6.B.1	Industrial wastewater treatment plant	D	kg N	CS
6.B.2.a	Sewage treatment plant	CS	m^3	CS
6.B.2.b	*Johkasou* and vault toilet	CS	person	CS
6.B.2.c	Night soil treatment plant	D	kg N	CS
6.B.2.d	Gray water discharged into river, lake and sea	D	kg N	D

CS: Country Specific
D : Default value or method of IPCC GL, GPG.

14

7th Workshop on Greenhouse Gas Inventories in Asia

6.B.1 GHG from Industrial wastewater treatment plant

- Methodology, EFs and AD
  - Emissions from activated sludge or anaerobic treatment of industrial wastewater that contain high concentration of organic matter or nitrogen are estimated due to domestic research.
  - As country specific EF for CH_4 or N_2O from industrial wastewater treatment are unavailable, EFs of domestic wastewater are substituted.
  - As the concentration of industrial wastewater differs from domestic, EFs ($kgCH_4/m^3$, kgN_2O/m^3) are converted to ($kgCH_4$/kgBOD, kgN_2O/kgN).
  - Statistical data of the volume (m^3) of industrial wastewater treated with activated sludge or anaerobically, multiplied by BOD or nitrogen concentration of each industry, are used as AD.

Emission = EF • AD
EF : CH_4 or N_2O emissions per kg or BOD ($kgCH_4$/kgBOD) or N (kgN_2O/kgN)
AD : BOD or N in the wastewater treated with activated sludge or anaerobically (kgBOD, kgN)

Summary for method, AD and EF of industrial wastewater treatment plant

GHG	Method	AD	EF
CH_4	D	kg BOD	CS
N_2O	D	kg N	CS

15

7th Workshop on Greenhouse Gas Inventories in Asia

6.B.2.a GHG from Sewage treatment plant

- Methodology, EFs and AD
  - IPCC GL indicates aerobic system may not be CH_4 sources. However, Japan has detected CH_4 production and regarded it as the emission source as well as anaerobic (AO, A2O and A2) system.
  - EF is the mean value of measured EFs at 14 plants (CH_4) and 8 plants (N_2O). Both wastewater and sludge treatment process are considered.
  - Statistical data of the volume (m^3) of all wastewater treated at sewage treatment plants except primary treatment are used as AD.

Emission = EF • AD
EF : CH_4 or N_2O emissions per m^3 ($kgCH_4/m^3$, kgN_2O/m^3)
AD : Volume of all wastewater treated at sewage treatment plants (m^3)

Summary for method, AD and EF of sewage treatment plant

GHG	Method	AD	EF
CH_4	CS	m^3	CS
N_2O	CS	m^3	CS

16

7th Workshop on Greenhouse Gas Inventories in Asia

6.B.2.b GHG from *Johkasou* and vault toilet

- Methodology, EFs and AD
  - Emissions are calculated by 3 types of *Johkasou* including *Community Plant*, *Gappei-Johkasou* and *Tandoku-Johkasou*. EFs are the mean value of measured EFs at each *Johkasou*.
  - Vault toilet is not *Johkasou* but storage tank of night soil. Its GHG producing process is unknown but seems to be similar with *Tandoku-Johkasou*, therefore, emission from vault toilet is calculated by the same method and EF of *Tandoku-Johkasou*.
  - Statistical data of the treatment population (person) of each types of *Johkasou* and vault toilet are used as AD.

Emission = $\sum(EF_l \bullet AD_l)$
EF_l : CH_4 or N_2O emissions per person at *Johkasou* l ($kgCH_4$/person, kgN_2O/person)
AD_l : Treatment population at *Johkasou* l (person)

Summary for method, AD and EF of *Johkasou* and vault toilet

GHG	Method	AD	EF
CH_4	CS	m^3	CS
N_2O	CS	m^3	CS

17

7th Workshop on Greenhouse Gas Inventories in Asia

6.B.2.c GHG from Night soil treatment plant

- Methodology, EFs and AD
  - Emissions are calculated by every types of treatment methods in the night soil treatment plant*.
  - CH_4 EF for anaerobic, denitrification and high-load denitrification are set from domestic research results. EF for the rest are substituted by the average of denitrification and high-load denitrification.
  - N_2O EF for high-load denitrification and membrane filtering are set from domestic research results**. EF for the rest are substituted by the EF of high-load denitrification because of lack of research output.
  - Statistical data of the volume of night soil treated at plants (CH_4) and the amount of nitrogen included in the night soil (N_2O) are used as AD.

Emission = $\sum(EF_l \bullet AD_l)$
EF_l : CH_4 emissions per m^3 ($kgCH_4/m^3$) and N_2O per nitrogen in human waste (kgN_2O/kgN)
AD_l : Volume of all wastewater (m^3) and nitrogen in human waste (kgN)

Summary for method, AD and EF of night soil treatment plant

GHG	Method	AD	EF
CH_4	CS	m^3	CS
N_2O	D	kg N	CS

* Treatment of aerobic, anaerobic, denitrification, high-load denitrification, membrane filtering and other.
**EF of recent plant decreased because of progress of structure standard and maintenance technology.

18

6.B.2.d GHG from
Gray water discharged into river, lake and sea

- **Methodology, EFs and AD**
  - □ Emissions from gray water and sludge discharged into river, lake and sea without treatment are estimated by IPCC default method* and EFs, because country specific method and EF is unavailable.
  - □ Gray water from household which use *Tandoku-Johkasou*, vault toilet or self-treatment and sludge from *Johkasou*, sewage treatment plant and night soil treatment plant are regarded as GHG producing activity.
  - □ Statistical data of the volume (m^3) of discharged gray water and sludge, multiplied by BOD or nitrogen concentration of each activity are used as AD.

$$\text{Emission} = EF \bullet \sum (AD_i)$$

EF : CH_4 or N_2O emissions per kg or BOD ($kgCH_4$ / kgBOD) or N (kgN_2O / kgN), default value

AD_i : BOD or N in gray water and sludge discharged without treatment (kgBOD, kgN)

Summary for method, AD and EF of gray water and sludge discharged into river, lake and sea

GHG	Method	AD	EF
CH_4	D	kg BOD	D
N_2O	D	kg N	D

19

Sharing experience 1:
Importance of early and planned preparation

- Category 6.B has some specific problems compared with other categories in the waste sector.
  - □ Few or no statistics are available for activity data.
  - □ Country specific methodologies and EFs are not sufficiently developed.
  - □ The extent of emission sources are diverse and obscure.
  - □ Condition and mechanism of GHG production are not sufficiently cleared.
  - □ The amount of emissions in 6.B are likely to be much smaller than other categories in the waste sector.

As it takes a long time to make accurate 6.B inventory, early and well-planned preparation is important.

20

Sharing experience 2 :
Importance of prioritization of targets

- Human, institutional and financial resources are often limited. However, many things are to be resolved for accurate 6.B inventory.

Prioritization of targets is important.

- □ Estimate major (or all) GHG emissions
- □ Estimate GHG emissions in both urban and rural areas
- □ Estimate GHG emissions back to the past year
- □ Improve accuracy of EFs, AD and methodologies
- □ Make detailed and transparent documents
- □ Apply quality assurance and quality control (QA/QC)
- □ Estimate uncertainty
- □ Other

21

Sharing experience 3 :
Procedure for improving 6.B inventory

One of the way to improve 6.B inventory is as follows.

1. Understand all emission sources in 6.B (slide 6)
2. List all industrial and domestic WWT system (slide 7 and 8)
3. List all emission sources in each system (slide 9 to 12)
4. Consider methodologies, EFs and AD (slide 13 to 19)
   - Collect available statistics for AD
   - Collect candidates for EF (CS, default, EFDB and other countries)
   - Decide methodology (Tier 1, 2 or 3) according to AD and EF
5. List problems to be improved in the future
   - List problems on EF, AD, methodologies in terms of transparency, comparability, completeness, consistency and accuracy
   - Share the experience and exchange information (in the future WGIA)

22

Thank you for your attention.

Hiroyuki Ueda （植田 洋行）
Suuri-keikaku (SUR), Japan （株式会社 数理計画）
Cooperative researcher, Greenhouse gas inventory office of Japan, NIES
ueda_hiroyuki@sur.co.jp

23

Presentation 4.4.4.5

7th Workshop on Greenhouse Gas Inventories in Asia

Possibly Co-benefit ? Advanced Wastewater Treatment Process

Tomonori ISHIGAKI
Dept. of Environmental Solution Technology
Ryukoku University, Japan

Introductory topic on GERF B-071
Upgrading of GHGs Inventory and Evaluation of Countermeasure for Emission Reduction in Waste category

- Joint Research by National Institute for Environmental Studies (NIES), Osaka Univ., Ryukoku Univ.
- Works by Osaka Univ. (Prof. Ike, Prof. Soda)
- Detailed outcome will be presented at 3rd IWA-ASPIRE (Oct. 2009, Taipei)

Emission Estimation

IWWTP, Sewer

E =EF x A

E : Amount of CH4 or N2O emitted from sewage treatment plants in conjunction with
domestic/commercial wastewater treatment (kg CH4, kg N2O)
EF : Emission factor (kg CH4/m3, kg N2O/m3)
A : Yearly amount of IWW/sewage treated at a treatment plant (m3)

Domestic Sewage Treatment Plant (mainly septic tanks)

$$E=\Sigma(EF_i \times A_i)$$

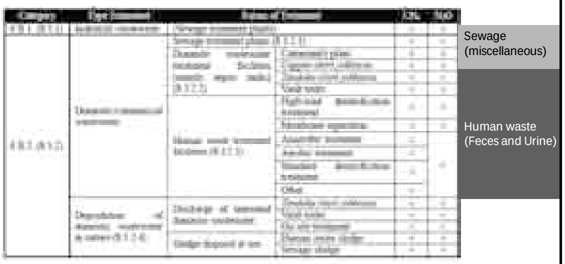
E : Emissions of methane and nitrous oxide from the processing of domestic and commercial wastewater at domestic sewage treatment plants (i.e. household septic tanks) (kg CH4, kg N2O)
EFi : Emission factor for domestic sewage treatment plant i (kg CH4/person, kg N2O/person)
A : Population (persons) requiring waste processing at domestic sewage treatment plant i per year

---

Source category and GHGs emission potential in wastewater sector (2006)

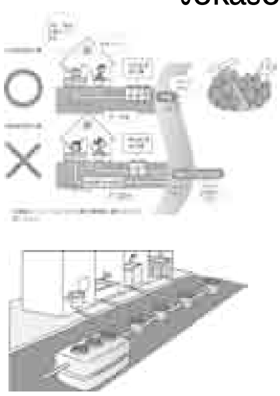
Types of treatment and disposal				CH4 and N2O emission potentials	Comments
Collected	Untreated		River discharge		Rivers with high organics loadings can turn anaerobic
			Sewers (closed and under ground)	Not a source of CH4/N2O.	Fast moving, clean. (Insignificant amounts of CH4 from pump stations, etc)
			Sewers (open)	Stagnant, overloaded open collection sewers or ditches/canals are likely significant sources of CH4.	Open and warm
	Treated	Aerobic	Centralized aerobic wastewater treatment plants	May produce limited CH_4 from anaerobic pockets. Poorly designed or managed aerobic treatment systems produce CH4. Advanced plants with nutrient removal (nitrification and denitrification) are small but distinct sources of N2O.	Must be well managed. Some CH4 can be emitted from settling basins and other pockets.
					Not well managed. Overloaded.
			Sludge anaerobic treatment in centralized aerobic wastewater treatment plant	Sludge may be a significant source of CH4 if emitted CH4 is not recovered and flared.	CH4 recovery is not considered here.
			Aerobic shallow ponds	Unlikely source of CH4/N2O. Poorly designed or managed aerobic systems produce CH4.	
		Anaerobic	Anaerobic lagoons	Likely source of CH4. Not a source of N2O.	Depth less than 2 metres, use expert judgment.
					Depth more than 2 metres
			Anaerobic reactors	May be a significant source of CH4 if emitted CH4 is not recovered and flared.	CH4 recovery is not considered here.
Uncollected	Septic tanks			Frequent solids removal reduces CH4 production.	Half of BOD settles in anaerobic tank.
	Open pits/Latrines			Pits/latrines are likely to produce CH4 when temperature and retention time are favourable.	Dry climate, ground water table lower than latrine, small family (3-5 persons)
					Dry climate, ground water table lower than latrine, communal (many users)
					Wet climate/flush water use, ground water table higher than latrine
					Regular sediment removal for fertilizer
	River discharge			See above.	

Source Category in Japan NIR



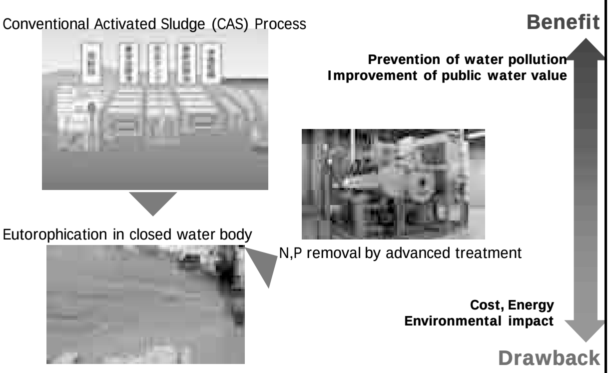
Public sewerage system is spreading from large cities to smaller municipalities and used by 65.5% of the population.
Domestic wastewater treatment systems (e.g. gappei shori jokasou) are being promoted as an effective means of supplementing sewerage systems in smaller municipalities with low population densities and little flat land. In 2006, septic tanks (jokasou) were used by 24.1% of the population, with the remainder being treated after collection or on-site.

Jokasou system



The *gappei-shori and tandoku-shori Jokasous are decentralized wastewater treatment facilities installed at an* individual home. *The gappei-shori processes feces and urine and miscellaneous wastewater, whereas tandoku-shori processes only feces and urine. A community plant is small-scale sewage facility where* urine and the miscellaneous wastewater of each region are processed.

Advanced Wastewater Treatment



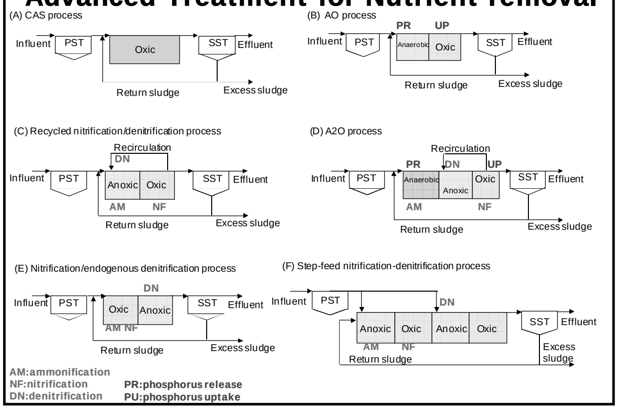
Evaluation of Advanced Treatment

- Eutrophication potential (EP): PO_4eq
  - NOx, T-N, T-P, BOD
- Global Warming Potential (GWP):CO_2eq
  - CO2, CH4, N2O
- Life Cycle Impact Assessment Approach using LIME (JEMAI)

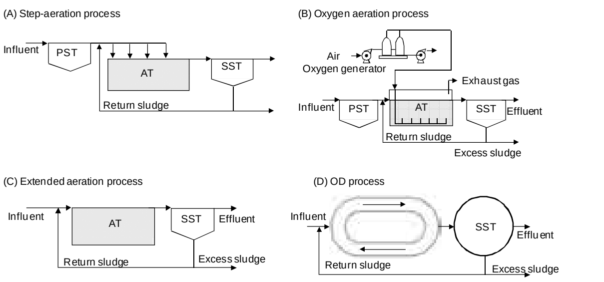
Statistics on 1500 WWTPs (JSWA)

	Number of WWTPs [a] Annual treatment, m^3/y			Planned effluent quality, mg/L [b] (Typical removal, %)		
	$< 10^6$	10^6-10^8	$> 10^8$	BOD	T-N	T-P
CAS	63	282	145	10-15 (90-95)		
AO	14	10	15	10-15		< 3 (75-95)
Recycled nitrification/denitrification	7	6	0	10-15	< 20 (65-75)	
A2O	5	4	2	10-15	< 20 (65-75)	< 3 (75-95)
Nitrification/endogenous denitrification	4	1	0		(75-95)	
Step-feed nitrification-denitrification	0	3	2		(75-85)	
Step aeration	0	4	6	10-15 (90-95)		
Oxygen aeration	1	3	3	(90-95)		
Extended aeration	25	1	0	(90-95)		
Oxidation ditch	459	30	0	(90-95)		

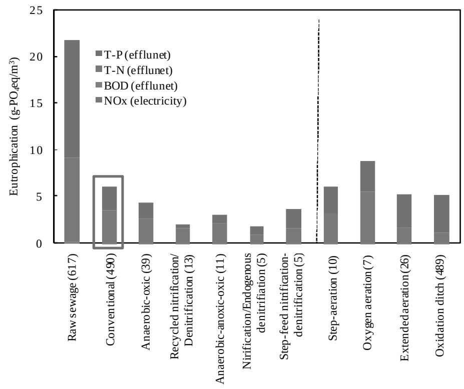
Evaluation Target Process: Advanced Treatment for Nutrient removal



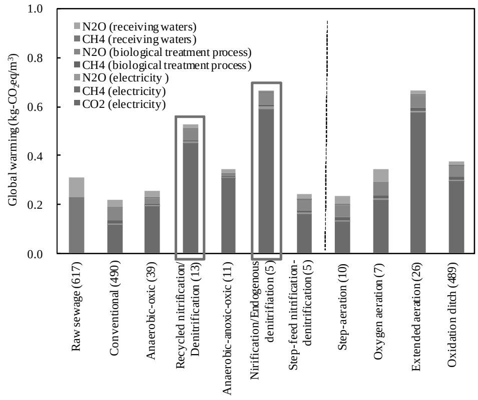
Evaluation Target Process: AT for other purpose



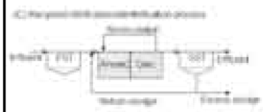
Eutrophication Potential



Global Warming potential



Electricity Consumption

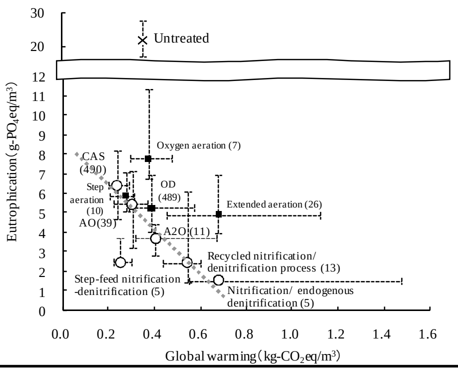


Enough nitrification needs Long SRT
Electricity for recirculation of nitrified liquor

Enough denitrification needs Long HRT
Appilication to small scale plant
Electricity per unit must be uneffective

No recirculation of nitrified liquor
Anoxic tanks in the process
Less electricity than full-aeration tanks

Trade-off Relationship



Conclusion

- Importance of **Operation-related GHGs** (especially electricity) on GWP evaluation
- **Negative correlation** between **EP** and **GWP** values of the nutrient removal processes
  - Endeavours to reduce the EP value of 1.0 mg-PO_4eq compensate with increase in the GWP of 86.5 g-CO_2eq.
- **Step-feed nitrification-denitrification process**
  - only exception of the trade-off among the nutrient removal processes
  - possible candidate for co-benefit process.

Presentation 4.5.1

WGIA7

Session I
Review of Progress since WGIA6

Chairperson: Dominique Revet
Rapporteur: Damasa Magcale Macandog

Uncertainty Analysis

(as of July 2009)

Country	Guideline	Sector	Sources of uncertainty	Key Category Analysis
Cambodia				Yes
India	IPCC 2006 Approach 1	all		Yes
Indonesia	IPCC 2006 Approach 1	all	AD in Forestry, industry, waste	Yes
South Korea	IPCC 2000 Approach 1	all		Yes
Lao PDR				
Malaysia		Energy & LULUCF		Yes (all)
Mongolia	IPCC 1996	Energy, agriculture, waste	AD & EF	
Myanmar		Not implemented yet, but it could be included in INC.		Not implemented yet, but it could be included in INC.
Thailand	IPCC 2006 Approach 1	all	Assumptions & methods; AD & EF; calculation errors	Yes
Vietnam		Expected to complete in September 2009		Expected to complete in September 2009

Lessons learned

(Presentation by Thailand)

- Lack of data is a major problem
- Need for country-specific EF
- QA/QC can reduce uncertainty
- Approach 1 useful to better understand key source/sink

Raising Awareness on GHG inventories in developing countries

- Summary for Policy Makers (SPM)
  - Background
  - National GHG Inventory
  - Building Sustainable Inventory Management System
  - Conclusion and Recommendation

  - Contents of SPM varies with country; no specific format
  - SPM may elicit more support for quality inventory

GHG inventories

- Value of GHG inventories towards national development and planning should be included/ emphasized in the **Executive Summary** of NC reports
- Inventories should be ***offensive*** in addressing national development, mitigation planning and adaptation

Time Series Estimates

(as of July 2009)

Country	Updates/Accomplishments
Cambodia	N/A (Based on availability of funding)
India	No information
Indonesia	All sectors using 2000 baseline year (projection by 2030)
South Korea	Waste sector; 2005-2020 projection
Lao PDR	Energy and LULUCF 1990-2007
Malaysia	Energy, LULUCF, Waste; 1990-2007
Mongolia	Recaluculation 1990-1998; New calculations 1999-2006
Myanmar	All sectors for INC
Thailand	2000-2005 time series estimation
Vietnam	Being done, due Sept 2009

Time Series Analysis
(Presentations by Mongolia, Indonesia, Thailand)

- 2006 Guidelines: Use actual emissions (not potential emissions)
- Country-specific EF very useful; need to recalculate using new values for EF for comparisons
- Major obstacle is lack of AD and CSEF
- GIS mapping and RS are useful in determining rice areas based on certain factors (soil type, irrigation) and developing scaling factors (rice variety, crop management)
- Database from various research studies needed to develop scaling factors

Projection of GHG Emissions

- AIM model
- Annual training courses on AIM model
- Minimum data, mathematics, microeconomics: step-wise projection
- More difficult analysis, use more complicated models
- Can link outputs of the model to other models like cap and trade model (macroeconomics)

Time series consistency Techniques
(Hands-on training)

- Splicing – to calculate backwards
- Interpolation – filling in missing values
- Trend Extrapolation – data not collected annually
- Surrogate data – lacking data strongly correlated with readily available indicative data

Conclusions and plans of action

- Continue efforts on doing activities on UA and time series analysis
- UA is very important to make GHG inventories useful
- Elaborate more on UA in SNC reports
- Confidence level of GHG inventories increases with UA, thus need continued efforts on all sectors
- Inventory team to make in-depth preparation of Executive Summary
- Comment on the revision of SPM; Develop SPM for each country

Presentation 4.5.2

Summary of Session II

Plans for Future Activities Beyond SNC

Chairperson: Batimaa Punsalmaa
Rapporteur: Leandro Buendia

Issues/Concerns

- What kind of (new) activities will be useful after completion of the latest NCs?
- How we will realize them?
- How the WGIA can support each country's activities?
- What we should do by WGIA8?

Possible Future Activities

- Ongoing:
  - Support to WGIA
    - WGIA-EFDB
    - WGIA Roster of Experts in Asian countries
    - WGIA Mailing List and Website (for information exchange)
  - Support to SWGA
    - Establishment of reliable waste data
    - Understanding waste stream and disposal technology
    - Enhance collaboration for better waste management (linked to GHG inventory)
- New:
  - Continuity of GHG Inventory (funding)
    - Submit proposal for GEF funding to ensure continuity of GHG inventory (note: this could be done before completion of current NC); maybe sharing of experience/knowledge on how to prepare a proposal in consultation with UNFCCC secretariat
    - Other funding source: collaboration with JICA Project on Climate Change; explore other regional initiatives

Possible Future Activities

- New:
  - Aim for a sustainable and high quality GHG inventory
    - Improving activity data collection (e.g. using guidance from 2006 GL)
      - this could also enhance efficiency (time to prepare GHG inventory);
      - Involving Statistic Officers in GHG Inventory training and discussions
    - Use of new (updated) emission factors and methods:
      - Country-specific EFs in WGIA-EFDB
      - Updated EFs in 2006 GL
      - Estimating "actual emission" instead of "potential emission" (e.g. In fluorinated compounds, in CH_4 emission from landfill)
    - Learning from experience gained thru mutual GHG Inventory Review
      - The case between Korea and Japan as a good example
      - Use of WGIA website as platform for review of GHG Inventories

Possible Future Activities

- New:
  - Linking GHG Inventory Activities to Mitigation
    - GHG Inventory and Projections are needed in evaluating mitigation options and opportunities (see SPM)
    - Policymakers are interested in potential mitigation options
      - Technical mitigation potential (technology based)
      - Economic mitigation potential (cost-effectiveness)
    - Training on mitigation?

Presentation 4.5.3

Energy Statistics

Previous Meetings (WGIA 4)

- IPCC Guidelines give two approaches
  - Reference Approach (based on energy balance) can give national estimates or used ot check sectoral approach. Only for CO_2.
  - Sectoral Approach (based on consumption by sector) the best approach for all GHG
- Energy balances can be used but efforts should be made to find sectoral data

Energy Data Availability

	Energy Balance - Reference Approach	Sectoral Consumption - Sectoral Approach	Years Availability
Cambodia	Yes	No	2000
Vietnam	Not every year	Yes	1994 -2000
Mongolia	Yes (No split by coal type)	Yes	1990-2006
	(Additional methods for biomass consumption)		
Korea	Yes (Difference between national and IEA)	Yes	1990-2006
Japan	Yes	Yes (CH_4 and N_2O based on technology)	1990-2007

Energy Balances in Asian Region

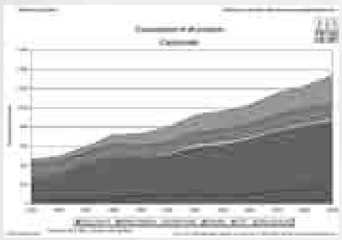
- 3 stages of development
  1. Limited data on balances (e.g. Cambodia)
  2. Some experience but not available annually (e.g. Vietnam)
  3. Balances annually (e.g. Mongolia and Korea)
- **All** can be improved

What to prioritise?

- Key energy statistics
  - balances & detailed consumption
- Countries need to decide their priorities – a suggestion:
  - Energy Balances first?
  - As Balances develop attention should switch to Detailed Statistics
    - Allows non-CO_2 estimates
    - Understanding of co-benefits
- Need to develop official data collection
  - Co-ordination and communication between stakeholders

Comparison

- Compare National data with international statistics, e.g. IEA, APEC



Co-Benefits

- Detailed Energy Statistics allow understanding of potential Co-Benefits
  - E.g. reduction of local air pollutants

Presentation 4.5.4

Agricultural Sector

9 July 2009, Seoul, Korea
7th Workshop on GHG Inventories in Asia

Batimaa Punsalmaa

Agriculture WG in WGIA 7

- Understanding of Country-Specific EFs development
- Availability to the other country of CS-EFs, and possibility of joint research
- Exchange agriculture information (including mitigation potential)

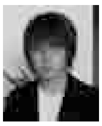
Chair: Kazuyuki Yagi
Rapporteur: Batimaa Punsalmaa

Time Schedule *(WGIA7 Day 3, 9:30~12:20)*

Discussed

- CS-EFs for Livestock Manure Management
  Koki Maeda (NARO)
- CS-EFs for Soils and Rice Cultivation
  Kazuyuki Yagi (NIAES)
- CS-EFs for Rice Cultivation in Philippine
  Leandro Buendia
- CS-EFs in Indonesia
  Prihasto Setyanto (Indonesia)
- Agricultural Mitigation Potential
  Kohei Sakai (GIO)
- Short information by Vietnam, Mongolia, Myanmar

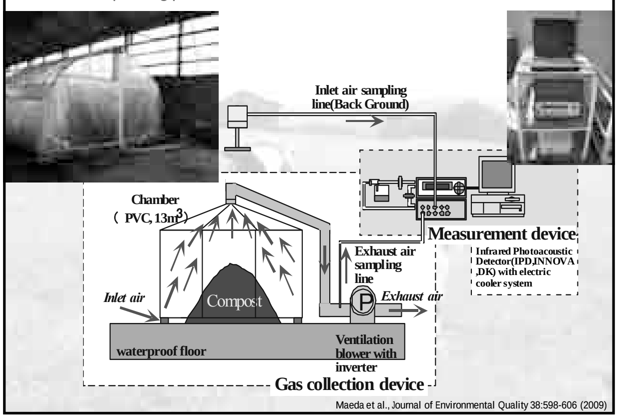
GHG Emission from Livestock waste management



Koki Maeda

National Agricultural and Food Research Organization (NARO)
National Agricultural Research Center for Hokkaido Region

Measurement of GHG emission from cattle manure composting process



Maeda et al., Journal of Environmental Quality 38:598-606 (2009)

Emission Factor

		Dairy Cattle	Non-dairy Cattle	Swine	Hen Broiler	(%)
CH_4	Pit Storage	3.9	3.0	8.7		
	Sunlight Drying	0.2	0.2	0.2	0.2	
	Composting (feces)	0.044	0.034	0.097	0.14	
	Composting (feces and urine mixed)	3.8	0.13	0.16	0.14	
	Deposition	0.4	0.4	0.4	0.4	
	Incineration	0.044	0.034	0.097		
	Wastewater management	0.0087	0.0067	0.019		
N_2O	Pit Storage	0.1				
	Sunlight Drying	2.0				
	Composting (feces)	0.25				
	Composting (feces and urine mixed)	2.4	1.6	2.5	2.0	
	Deposition	0.1				
	Incineration	2.0				
	Wastewater management	5.0				

Established by data of Japan
Default value of IPCC Guideline

The 7th Workshop on GHG Inventories in Asia (WGIA7)
7-10 July 2009, Seoul, Republic of Korea

Country-specific Emission Factors for Agricultural Soils and Rice Cultivation in Japan

Kazuyuki Yagi

National Institute for Agro-Environmental Sciences, Tsukuba, Japan

NIAES

National Inventory for Japan
N_2O from agricultural soils

Adopted EFs

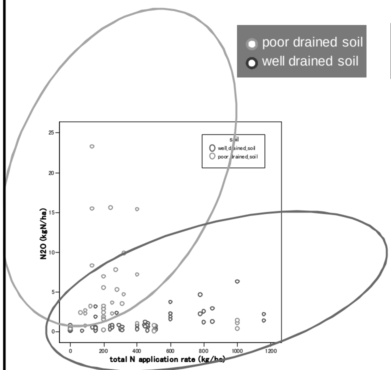
Direct N_2O: Mineral fertilizer/Animal manure
- Paddy rice: 0.31 (±0.31) % (IPCC default values)
- Tea: 2.90 (±1.82) % (from national data analysis)
- Other crops: 0.62 (±0.48) % (from national data analysis)

Direct N_2O: Crop residues/Legumes
- IPCC default values

Direct N_2O: Organic soils
- Paddy: 0.30 kg N_2O-N/ha/year (from national data)
- Upland: IPCC default values (similar to national data)

Indirect N_2O
- Atmospheric deposition (IPCC default values)
- Leaching and run-off: 1.24 % (IPCC default values)

Further analysis for other upland crops



- •Soil drainage classes were categorized from soil types
- •Poorly drained soil > well-drained soil
- •No clear relationship for poorly drained soil
- •Well-drained soil: r^2= 0.38

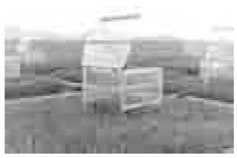
Relationship between N inputs and N_2O emissions from upland fields with different soil drainage type (measurement period more than 90 days)

Country-specific Emission Factors for Rice Cultivation in the Philippines

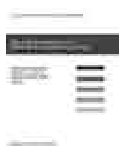
7th Workshop on GHG Inventories in Asia
7-10 July 2009, Seoul, Republic of Korea

Leandro Buendia
Team Leader, Agriculture Sector of the Philippine SNC GHG Inventory

The IRRI International Research Program on Methane Emissions from rice fields in Asia



- Automated closed chambers measuring system: 24 hours/day for the whole growing season; 2-3 cropping seasons.
- Five countries (8 stations):
  - China (2)
  - India (2)
  - Indonesia (1)
  - Philippines (2)
  - Thailand (1)



All findings were published in a book "**Methane Emissions from Major Rice Ecosystems in Asia**", Development in Plant and Soil Sciences, Kluwer Academic Publishers

EFs for rice cultivation in the Philippines

Variety	Water Management	Organic amendment	Cropping Season	Emission Factor, kg/ha/day
IR72	Continuous flooding	none	dry season	1.46 (0.64 - 2.27)
IR72	Continuous flooding	none	wet season	2.95 (1.39 -5.16)

Source: Corton et al. 2000; Wassmann et al. 2000

Table 5.11 [illegible]

	Emission factor	Error range
CH_4 emission (kg CH_4 ha^{-1} d^{-1})	[illegible]	[illegible]

Source: [illegible]

INDONESIA EXPERIENCE IN DETERMINING COUNTRY SPESIFIC EMISSION FACTOR IN AGRICULTURE SECTOR

Dr. Prihasto Setyanto
Prof. Dr. AK Makarim
Prof. Hidayat Pawitan
Prof. Iswandi Anas
Dr. Le Istiqlal Amien
Elza Sumaini

Rice cultivation scaling factors

1. Water regimes
2. Soil Types
3. Rice varieties
4. Organic matter
5. Establishment of herbicides
6. Crop establishment

Adjusted scaling factor for water regimes and soil correction factors

Category	Sub-category			SF (adapted from IPCC Guidelines 1996)	Adjusted SF (based on current studies in Indonesia)	Adjusted CF from different soil types of Indonesia
Upland	None			0		
Lowland	Irrigated	Continuously Flooded		1.0	1.00	
		Intermittently Flooded	Single Aeration	0.5 (0.2-0.7)	0.46 (0.38-0.53)	
			Multiple Aeration	0.2 (0.1-0.3)		
	Rainfed	Flood Prone		0.8 (0.5-1.0)	0.49 (0.19-0.75)	
		Drought Prone		0.4 (0-0.5)		
	Deep Water	Water Depth 50-100 cm		0.8 (0.6-1.0)		
		Water Depth < 50 cm		0.6 (0.5-0.8)		

Summary

➢CS-EFs development in agricultural sector
- enteric fermentation
  Mongolia, India and Japan
- manure management
  Japan
- rice cultivation
  Cambodia, India, Japan, Philippines, Thailand and Vietnam
- N_2O emission from soils
  Japan

Participants mentioned that CS EFs is not always the best case.

Summary

➢Technical paper for "*Challenges and opportunities for mitigation in the agricultural sector*" was released in 21 Nov. 2008. ("FCCC/TP/2008/8") –Kohei Sakai

- Mitigation potential
  Many research have done: *management rice cultivation management of fertilizer application, soil carbon sequestration*
- Availability to the other country of CS-EFs

Summary

- **About WGIA-EFDB**

  There is considerable amount of information

- **What could be discussed in WGIA8 and in future WGIA ?**

  To share experiences (software, tools) how to move from simple tier 1 to tier 2 beyond SNC

  To combine LULUCF and Agriculture sector

  To focus on agricultural soil and livestock

  To discuss about mitigation options in sub-sectors of AS

  To discuss on a possibility to separate rice cultivation from other crops

Thank you for your attention

Presentation 4.5.5

WG3-LULUCF Sector: How to Utilize RS and GIS Data for LULUCF Inventory

Rahim Nik (Malaysia), Takahiko Hiraishi (Japan),
Savitri Garivait (Thailand), Takako Ono (Japan),
Lee Kyeong-hak (Korea), Noriko Kishimoto (Japan),
Yasumasa Hirata (Japan), Hyun Kook Cho (Korea),
U Than Naing Win (Myanmar), Junko Akagi (Japan),
Rizaldi Boer (Indonesia)

Objectives

- To share experience and lesson learnt in applying RS and GIS data for LULUCF inventory
- To discuss actual application of RS and GIS data for LULUCF inventory

Points for discussion

1. How do we identify or estimate concrete data by applying RS and GIS data?
2. How do we verify RS and GIS data?
3. What kind of resource necessary for utilizing RS and GIS data?
4. What type of institutional arrangement is effective for applying RS and GIS data for LULUCF inventory?

1, 2 and 3. How do we identify or estimate concrete data by applying RS and GIS data and their verification as well resources required for that?

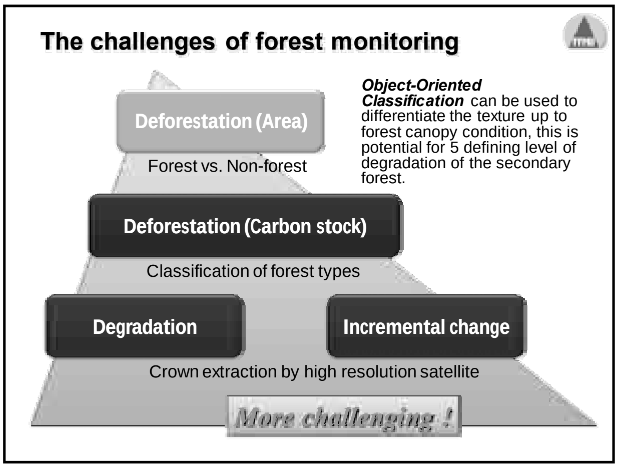
- There are three presentations
  - The use of Global Map for addressing CC (Noriko Kishimoto)
  - Application of RS for forest inventory for identifying DD (Yasumasa Hirata)
  - Thailand's experience in using RS and GIS data for estimating (Savitri Garivait)

- Global Map containing land cover data of the globe released in 2008 is downloadable for free through website
  - URL: www.iscgm.org
  - E-mail: sec@iscgm.org (for any inquiries)
- Scale: 1:1000,000

Progress of Global Mapping Project

Example of interpretation Interpretation requires further consideration

GM LC 20 Classes	LULUCF 6 Classes
Broadleaf Evergreen Forest	Forest land
Broadleaf Deciduous Forest	Forest land
Needleleaf Evergreen Forest	Forest land
Needleleaf Deciduous Forest	Forest land
Mixed Forest	Forest land
Tree Open	Forest land
Mangrove	Forest land
Shrub	Grassland
Herbaceous	Grassland
Herbaceous with Sparse Tree/Shrub	Grassland
Sparse vegetation	Grassland
Cropland	Cropland
Paddy field	Cropland
Cropland/Other Vegetation Mosaic	Cropland
Wetland	Wetlands
Urban	Settlements
Bare area, consolidated (gravel, rock)	Other land
Bare area, consolidated (sand)	Other land
Snow/Ice	Other land
Water	Other land



- Dr. Garivait (Thailand) presented specific application of RS and GIS in estimating pollutants emissions from biomass open burning (*forest fire, rice husk/straw burning and garbage burning*) in Mekong River Basin
- It was indicated that biomass burning will affect rainfall pattern and acidity and Ozone formation. Particle matter from biomass burning may inhibit the formation of cloud
- The use of MODIS data is highly underestimate for hot spot data, particularly area for agriculture burning
- Problem, when fire occur, the satellite already pass over the sites (1x1 km, this is too large). Need to cross check with data from forest fire control statistics and ground survey, but still use many assumption is getting an estimates for biomass and burning efficiency

1, 2 and 3. How do we identify or estimate concrete data by applying RS and GIS data and their verification as well resources required for that?

- A margin error may occur when Global Data is applied to national context, thus a country should take care of this
- Many of GIS experts in developing countries have not been exposed to the application of RS and GIS in climate change
- More ground data is required for verifying the use of RS and GIS data, in particular for estimating EF and RF data (carbon stock of the five pools)

1, 2 and 3. How do we identify or estimate concrete data by applying RS and GIS data and their verification as well resources required for that?

- Need training for RS and GIS experts on utilization of RS and GIS data for climate change, in particular GHG Inventory
- Need to explore the use RS technology for estimating peatland C-stock such as ALOS (can estimate with reasonable accuracy)

4. What type of institutional arrangement is effective for applying RS and GIS data for LULUCF inventory?

- Different country has different institutional arrangement for effective use of RS and GIS data for LULUCF Inventory (e.g. Indonesia has set up alliance of 18 institutional who has RS and GIS base data; Korea set up the inventory team within one institution ~ effective coordination)
- Need to engage GIS experts and RS agencies within the country.
- Many global datasets available and can be accessed freely by developing countries to improve their inventory

4. What type of institutional arrangement is effective for applying RS and GIS data for LULUCF inventory?

- Next year Activities:
  - Need to have further discussion on identification of gaps, barriers and approaches in producing high quality National GHG inventory especially in obtaining data needs (many Asia countries have complete their inventory)
  - How to acquire relevant data nationally and globally for GHG Inventory (training GIS expert on the deriving AD and EF from global data)
  - What will be national system to support the development of high quality inventory in subsequent National Communication
  - Need to merge Agric and LULUCF experts and RS and GIS experts in the application of RS and GIS data for AFOLU

Presentation 4.5.6

7th Workshop on Greenhouse Gas Inventories in Asia
7~10 July 2009, Seoul, Republic of Korea

Session Ⅲ Group Discussion on Sector Specific Issues

WG 4 : Waste Sector

List of participants

• Mr. Haneda Sri Mulyanto	(Indonesia)
• Mr. Khamphone Keodalavong	(Lao PDR)
• Ms. Azlina Othman	(Malaysia)
• Dr. Sirintornthep Towprayoon *	(Thailand)
• Dr. Damasa M. Macandog	(Philipines)
• Dr. Seungdo Kim	(Republic of Korea)
• Mr. Byong-bok Jin	(Republic of Korea)
• Mr. Wonseok Baek	(Republic of Korea)
• Mr. Byong-Ok Yoo	(Republic of Korea)
• Mr. CheonHee Bang	(Republic of Korea)
• Dr. Masato YAMADA	(Japan)
• Dr. Tomonori ISHIGAKI *	(Japan)
• Mr. Hiroyuki UEDA*	(Japan)
• Dr. Kosuke KAWAI	(Japan)
• Dr. Takefumi ODA	(Japan)
• Dr. Edit Nagy-Tanaka	(Japan)

16 persons. * : participants of WGIA6

Recommendation from WGIA6

There are two topics carried over from WGIA6.

- For Data collection system
  - Establishment of data collection format
  - Identification of country specific waste stream
  - Guidelines for four separate levels of data collection systems namely :
    no data, not enough data, poor data quality and good quality data .
- "WGIA7 should focus more on wastewater emission."

3

Schedule of Working Group

9:30~10:50	**Theme 1: Improvement of data collection scheme for the Waste Sector** **Chair: Seungdo Kim, Rapporteur: Byong-bok Jin**	
9:30~9:35	Takefumi Oda	Introductory presentation
9:35~9:45	Wonseok Baek	Change of MSW Composition by Landfill Ban of Food Waste
9:45~9:55	Kosuke Kawai	How to Accumulate the Waste Data in each Asian Country
9:55~10:50	All	Discussion
10:50~11:00		***Tea Break***
11:00~12:20	**Theme 2: Information exchange on wastewater handling** **Chair: Sirintornthep Towprayoon, Rapporteur: Takefumi Oda**	
11:00~11:10	Hiroyuki Ueda	GHG Emissions from Wastewater Treatment and Discharge in Japan
11:10~11:20	Tomonori Ishigaki	Possibly Co-benefit? Advanced Wastewater Treatment Process
11:20~12:20	All	Discussion

4

Hand-outs for Discussion

➢ **For theme 1, we had prepared some materials.**

- To share Japan`s data collection method
  - **'Japan's data collection system for statistics of waste disposal'**
  - **'How to estimate time-series data in Japan'**
- To identify participants country specific waste stream
  - **'Answer for questionnaires from participants'**
    - Before we hold this session, we have received five answers to the question naires on the newly established format, from Malaysia, Mongolia, Korea, Philippines and Japan.
  - **'Country report on WM in Laos'**

Theme 1: Improvement of data collection scheme for the Waste Sector

Chair: Seungdo Kim
Rapporteur: Byong-bok Jin

Main discussion

- Improvement of data collection scheme for the waste sector
  - How about the state of data collection in each country?
  - How can we establish the data collection format of waste sector in Asian countries?
  - What method is available for estimation of waste generations?

Change of MSW Composition attributed by Ban on Direct Landfill of Foodwaste in Korea

(Wonseok Baek, ROK)

- Direct landfill is prohibited in Seoul, metropolitan cities, small cities of Korea from 2005 by enforcement regulations of wastes control act ('97.7.19. revised)
  → In fact, this act was enacted in 1995, but due to many disputes, took effect on January 1, 2005
- In the result, the present generated quantity of foodwaste is similar to before, but the ratio of landfilled quantity was decreased from 84% in 1997 to 2% in 2005 and the ratio of composed quantity was increased from 10% in 1997 to 92% in 2005

Change of MSW Composition attributed by Ban on Direct Landfill of Foodwaste in Korea

- In the future, compared with primary landfill in 2000, methane generation will be decreased by maximum 5%
- By change on national policy of foodwaste disposal, GHG emissions of waste sector are decreased in landfill and increased in incineration and composting

How to accumulate the waste data in each Asian country

(Kosuke Kawai, Japan)

- For Japan, prefectural governments and municipalities are in charge of accumulating each industrial data and municipal solid waste data by waste management and public cleansing law
  - Prefectural governments grasp the status of waste generation and disposal from reports from related businesses
  - Municipal governments shall analyze municipal solid waste qualitative data at incineration plants at least four times a year with KANSEI VOL.95

How to accumulate the waste data in each Asian country

- It is impossible to collect the ALL national waste data because of financial and technical problems
- For accumulating quantitative data, it is important to estimate the waste data properly for the time being and to adopt reliable methods for analyzing the waste data
- To this end, it is essential to construct data collection system.

How to accumulate the waste data in each Asian country

- To accumulate the waste data, each country must have essential considerations
  - Cooperation of municipalities is vital for national governments to accumulate the waste data in each Asian country
  - Research Institutes should encourage municipalities to accumulate the waste data & provide guidelines how to collect data
  - It is critical to develop centralized data collection system with measurable, reportable and verifiable manner

Theme 2: Information exchange on wastewater handling

Chair: Sirintornthep Towprayoon

Rapporteur: Takefumi Oda

Presentation 1

- **Hiroyuki Ueda**
- **GHG Emissions from Wastewater Treatment and Discharge in Japan**
  - Overview of Japan`s GHG emissions
  - Sharing experiences

Conclusions

- Category 6.B (emission from wastewater handling) has some specific problems compared with other categories in the waste sector.
- Human, institutional and financial resources are often limited. However, many things are to be resolved for accurate 6.B inventory.

➢ Following topics are Discussed
  - Reasons for the decrease of 6B emissions in Japan
  - Regulations/laws about waste water handling

14

Presentation 2

- Tomonori Ishigaki
  - Possibly Co-benefit? Advanced Wastewater Treatment Process
    - Advanced waste water treatment
    - Evaluation of advanced treatment

Conclusions

- Importance of Operation-related GHGs (especially electricity) on GWP evaluation
- Negative correlation between Eutorophication potential and Global Worming Potential values of the nutrient removal processes
- Step-feed nitrification-denitrification process
  - possible candidate for co-benefit process.

➢ Following topics were discussed
  - Waste water treatment depends on the characteristics of the country

15

General Discussion

- The participant countries shared their experiences
- Problems:
  - data is insufficient or not available.
  - lack of funds to support waste water treatment
  - national system and database are not yet established
  - more regulations/laws are needed for environmental protection and waste management

16

Recommendations for next WGIA

1) Information sharing among us about new waste management policy schemes, introduced in the individual countries
2) Provision of our knowledge and data to waste managers, which would make them know more about GHG emissions and climate change

These conclusions are not only related wastewater handling but also solid waste management

17

Annex I: Agenda

Day 1, Tuesday 7th July		
13:30~14:00	**Participant Registration**	
14:00~16:10	**Opening Session** Master of Ceremonies: Junheung Yi Chair: Taka Hiraishi	**BALL ROOM**
14:00~14:05	Byung-Wook Lee	Opening Address (Vice Minister, MOEK)
14:05~14:10	Reo Kawamura	Welcome Address (Deputy Director, Climate Change Policy Division, MOEJ)
14:10~14:15	Ki-Jong Woo	Welcome Address (Secretary-General, Presidential Committee on Green Growth)
14:15~14:35	All	Introduction of Participants
14:35~14:45	Yukihiro Nojiri	Overview of WGIA7
14:45~14:55	All	Q&A
14:55~15:15		***Group Photo & Tea Break***
15:15~15:25	Dominique Revet	Update on non-Annex I National Communications
15:25~15:40	Reo Kawamura	Japan's Climate Change Policies and MRV Initiatives
15:40~15:55	Rinsan Joung	Low Carbon, Green Growth in Korea
15:55~16:10	Jang-won Lee	Korea's GHG Inventory Management
16:10~17:30	**Session I: Review of Progress since WGIA6** Chair: Dominique Revet	**BALL ROOM** Rapporteur: Damasa Magcale Macandog
	The participants will share information and experiences gained through the activities to follow up the conclusions of WGIA6, namely: uncertainty assessment exercise and awareness-raising.	
16:10~16:20	Takako Ono	Introductory Presentation
16:20~16:35	Savitri Garivait	Thailand's uncertainty assessment
16:35~16:55	All	Discussion
16:55~17:20	Leandro Buendia	Raising Awareness on National GHG Inventories in Developing Countries: A Proposal
17:20~17:40	All	Discussion
18:30~		***Dinner (ORCHID)***

Day 2, Wednesday 8th July		
9:30~12:00	**Session I : Review of Progress since WGIA6 (cont.)**	**BALL ROOM**
	The participants will share information on the progress in their inventory preparation, in particular on time series estimates to be included in the national GHG inventory for the SNC. The participants will discuss the emission trends in the past as well as projections of emissions in the future.	

9:30~9:40	Kohei Sakai	Introductory Presentation
9:40~9:55	Dorjpurev Jargal	Time series estimates made for Mongolia's GHG inventory included in the SNC
9:55~10:10	Sirintornthep Towprayoon	Time series estimates made for Thailand's GHG inventory included in the SNC
10:10~10:25	Rizaldi Boer	Time series estimates made for Indonesia's GHG inventory included in the SNC
10:25~10:50	All	Discussion
10:50~11:10		***Tea Break***
11:10~11:40	Shuichi Ashina	Projection of GHG emissions - Make the inventory and AIM models will give the future pathways
11:40~12:00	All	Discussion
12:00~13:10		***Lunch Time***
13:10~17:00	**Session II: Plan for Future Activities beyond SNC** **BALL ROOM** Chair: Batimaa Punsalmaa Rapporteur: Leandro Buendia	
	The participants will discuss to come up with suggested plans for activities in the future, particularly after completion of SNC, by their own countries as well as by WGIA (including promotion of cooperation with other regional programmes) taking the "Kobe Initiative" into account.	
13:10~13:25	Kiyoto Tanabe	Introductory Presentation
13:25~13:40	Junko Akagi	On-going WGIA activities
13:40~13:55	Masato Yamada	Workshop on "Improvement of solid waste management and reduction of GHG emissions in Asia (SWGA)"
13:55~ 15:15	**Presentations on further improvement in data collection**	
13:55~ 14:20	Simon Eggleston	2006 IPCC Guidelines & Data Collection
14:20~ 14:40	Takako Ono	Statistical capacity building under the UN Framework for Development of Environment Statistics (UN-FDES)
14:40~ 15:15	All	Discussion
15:15~15:35		***Tea Break***
15:35~ 17:00	**Proposals for new cooperative actions by WGIA participating countries**	
15:35~ 16:00	Kazuya Suzuki	JICA's support activities on Climate Change
16:00~ 16:25	Byong-bok Jin	Experience gained through the mutual GHG inventory review between Korea and Japan (Waste Sector)
16:25~ 16:50	All	Discussion

16:50~17:00 ***Break (Set-up for the Hand-on Training Session)***

17:00~18:00	**Hands-on Training Session**	**BALL ROOM**
17:00~ 18:00	Simon Eggleston	Techniques how to fill data gaps Time Series Consistency
	Day 3, Thursday 9th July	
9:30~12:20	**Session III: Group Discussion on Sector-Specific Issues**	
	The participants will split into 4 groups to discuss sector-specific issues. A GIO member in each group will give you a short guidance prior to the discussion. See detail discussion topics below.	
9:30~12:20	**WG 1: Energy Sector** **BALL ROOM** **Theme: Statistics for the Energy Sector** Chair: Kiyoto Tanabe	Rapporteur: Simon Eggleston
	Yuriko Hayabuchi	Introductory presentation
	Va Canmakaravuth	Emissions in Energy in Cambodia 2000
	Nguyen Thi Xuan Thang	Viet Nam's Energy Consumption and GHGs Inventory Issue
	Dorjpurev Jargal	Energy statistics in Mongolia - experiences gained through their development for GHG Inventory
	Tae-Sik Park	Energy Balance in Korea
	Ken Imai	Introducing Calculation Methodologies for CH_4 and N_2O from Stationary Combustion in Japan
9:30~12:20	**WG 2: Agriculture Sector** **ORCHID** **Theme: Emission Factors utilized for the NCs** Chair: Kazuyuki Yagi	Rapporteur: Batimaa Punsalmaa
	Kohei Sakai	Introductory presentation
	Koki Maeda	GHG Emission from Livestock waste management
	Kazuyuki Yagi	Country-specific Emission Factors for Agricultural Soils and Rice Cultivation in Japan
	Leandro Buendia	Country-specific Emission Factors for Rice Cultivation in the Philippines
	Prihasto Setyanto	Indonesia experience in determining country specific emission factor in Agriculture Sector
	Kohei Sakai	Summary of Agricultural Mitigation Potential - UNFCCC document -
9:30~12:20	**WG 3: LULUCF Sector** **ORCHID** **Theme: Activity Data - Remote Sensing and GIS** Chair: Rahim Nik	Rapporteur: Rizaldi Boer
	Takako Ono	Introductory presentation
	Noriko Kishimoto	Utilizing Global Map for addressing Climate Change
	Yasumasa Hirata	Application of Remote Sensing to Forest Inventory for Identifying Deforestation and Degradation

	Savitri Garivait	Thailand's experience with Remote Sensing and GIS
9:30~12:20	**WG 4: Waste Sector** **ORCHID** **Theme 1: Improvement of data collection scheme for the Waste Sector** Chair: Seungdo Kim Rapporteur: Byong-bok Jin **Theme 2: Information exchange on wastewater handling** Chair: Sirintornthep Towprayoon Rapporteur: Takefumi Oda	
	Takefumi Oda	Introductory presentation
	Theme 1: Improvement of data collection scheme for the Waste Sector	
	Wonseok Baek	Change of MSW Composition attributed by Ban on Direct Landfill of Foodwaste in Korea
	Kosuke Kawai	How to accumulate the waste data in each Asian country
	Theme 2: Information exchange on wastewater handling	
	Hiroyuki Ueda	GHG Emissions from Wastewater Treatment and Discharge in Japan
	Tomonori Ishigaki	Possibly Co-benefit? Advanced Wastewater Treatment Process
12:20~13:30		***Lunch Time***
13:30~17:00	**Wrap-up Session** **BALL ROOM** Chair: Taka Hiraishi	
13:30~13:50	Session I Rapporteur	Summary of Session I
13:50~14:10	Session II Rapporteur	Summary of Session II
14:10~15:10	Session III Rapporteurs	Summary of WG1: Energy Sector Summary of WG2: Agriculture Sector Summary of WG3: LULUCF Sector Summary of WG4: Waste Sector (1) Summary of WG4: Waste Sector (2)
15:10~15:30		***Tea Break***
15:30~16:50	All	Discussion and Wrap-up
16:50~16:55	Chang-han Joo	Closing Remarks (Executive Director, EMC)
16:55~17:00	Yukihiro Nojiri	Closing Remarks (Manager, GIO)

Day 4, Friday 10th July	
9:30~16:00	**Excursion**

Annex II: List of Participants

CAMBODIA
Mr. Ouk NAVANN
General Directorate of Administration,
Protected Area and Biodiversity Conservation,
Ministry of Environment

Mr. Vuth Chanmakara VA
Industrial Environmental Office,
Ministry of Industry, Mines and Energy

INDONESIA
Dr. Rizaldi BOER
Centre for Climate Risk Opportunity and Management

Mr. Haneda Sri MULYANTO
Climate Change Mitigation,
State Ministry of Environment

Dr. Prihasto SETYANTO
Greenhouse Gas Emission Research Group,
Indonesian Agricultural Environment Research Institute

JAPAN
Dr. Junko AKAGI
Greenhouse Gas Inventory Office of Japan,
Center for Global Environmental Research,
National Institute for Environmental Studies

Dr. Shuichi ASHINA
Center for Global Environmental Research,
National Institute for Environmental Studies

Ms. Elsa HATANAKA
Greenhouse Gas Inventory Office of Japan,
Center for Global Environmental Research,
National Institute for Environmental Studies

Ms. Mayuko HATTORI
Climate Change Policy Division,
Global Environmental Bureau,
Ministry of the Environment, Japan

Dr. Yuriko HAYABUCHI
Greenhouse Gas Inventory Office of Japan,
Center for Global Environmental Research,
National Institute for Environmental Studies

Mr. Yasumasa HIRATA
Department of Forest Management,
Forestry and Forest Products Research Institute

Mr. Ken IMAI
Project Development Team,
Suuri-Keikaku Co., Ltd.

Dr. Tomonori ISHIGAKI
Dept. of Environmental Solution Technology,
Ryukoku University

Dr. Kosuke KAWAI
Research Center for Material Cycles and Waste Management,
National Institute for Environmental Studies

Mr. Reo KAWAMURA
Climate Change Policy Division,
Global Environmental Bureau,
Ministry of the Environment, Japan

Mr. Kazumasa KAWASHIMA
Environmental Policy Consulting Dept.,
Mitsubishi UFJ Research and Consulting Co., Ltd.

Ms. Noriko KISHIMOTO
Environmental Geography Division,
Geographical Survey Institute,
Ministry of Land, Infrastructure, Transport and Tourism

Mr. Koki MAEDA
Hokkaido Research Subteam for Waste Recycling System, National Agricultural and Food Research Organization

Mr. Takashi MORIMOTO
Environmental Policy Consulting Dept.,
Mitsubishi UFJ Research and Consulting Co., Ltd.

Dr. Edit NAGY-TANAKA
Center for Global Environmental Research,
National Institute for Environmental Studies

Dr. Shuzo NISHIOKA
National Institute for Environmental Studies
Institute for Global Environmental Strategies

Dr. Yukihiro NOJIRI
Greenhouse Gas Inventory Office of Japan,
Center for Global Environmental Research,
National Institute for Environmental Studies

Dr. Takefumi ODA
Greenhouse Gas Inventory Office of Japan,
Center for Global Environmental Research,
National Institute for Environmental Studies

Ms. Takako ONO
Greenhouse Gas Inventory Office of Japan,
Center for Global Environmental Research,
National Institute for Environmental Studies

Mr. Kohei SAKAI
Greenhouse Gas Inventory Office of Japan,
Center for Global Environmental Research,
National Institute for Environmental Studies

Mr. Kiyoto TANABE
Greenhouse Gas Inventory Office of Japan,
Center for Global Environmental Research,
National Institute for Environmental Studies

Mr. Hiroyuki UEDA
Project Development Team,
Suuri-Keikaku Co., Ltd.

Ms. Masako WHITE
Greenhouse Gas Inventory Office of Japan,
Center for Global Environmental Research,
National Institute for Environmental Studies

Dr. Kazuyuki YAGI
Carbon and Nutrient Cycling Division,
National Institute for Agro-Environmental Sciences

Dr. Masato YAMADA
Research Center for Material Cycles and Waste Management, National Institute for Environmental Studies

LAO, P.D.R.

Mr. Khamphone KEODALAVONG
Industrial Environment Division, Ministry of Industrial and Commerce; Department of Industry

Ms. Thounheuang Ly BUITHAVONG
Climate Change Office, The Water Resources and Environment Administration

MALAYSIA

Ms. Azlina OTHMAN
Air Division,
Department of Environment Malaysia

Dr. Abdul Rahim Bin NIK
Forest Research Institute Malaysia

MONGOLIA

Dr. Dorjpurev JARGAL
Energy Conservation and Environment Research and Consulting Co. Ltd.

Prof. Namkhainyam BUSJAV
Mongolian University of Science and Technology,
Power Engineering School

Dr. Batimaa PUNSALMAA
Integrated water resources management,
Water Authority, Ministry of Nature, Environment and Tourism

MYANMAR

Dr. Khin Lay Swe
Ministry of Agriculture and Irrigation,
Yezin Agricultural University

Mr. U Than Naing Win
Forest Research Institute,
Forest Department, Ministry of Forestry

PHILIPPINES
Dr. Damasa Magcale MACANDOG
Institute of Biological Science,
University of the Philippines Los Banos

REPUBLIC OF KOREA
Mr. Wonseok BAEK
Environmental Management Corporation

Mr. Chunhee BANG
Environmental Management Corporation

Ms. Eunhwa CHOI
Environmental Management Corporation

Mr. Seungjin HYUN
Environmental Management Corporation

Mr. Byongbok JIN
Environmental Management Corporation

Mr. Chang-Han JOO
Environmental Management Corporation

Mr. Youngsung KWON
Environmental Management Corporation

Mr. Joonho LIM
Environmental Management Corporation

Mr. Seunghwan OH
Environmental Management Corporation

Mr. Taeshik OH
Environmental Management Corporation

Ms. Youkyoung PARK
Environmental Management Corporation

Mr. Joohwa SONG
Environmental Management Corporation

Mr. Yong-Woon YANG
Environmental Management Corporation

Mr. Junheung YI
Environmental Management Corporation

Mr. Byoungok YOO
Environmental Management Corporation

Mr. Woanwoo YOON
Environmental Management Corporation

Dr. Jae-Ik RYU
Future Politics Economic Institute

Mr. Chang-Hwan JUNG
GS Construction

Dr. Seungdo KIM
Research Center for Climate Change,
Hallym University

Dr. Kyonghwa JEONG
Korea Energy Economics Institute

Dr. Tae-Sik PARK
Korea Energy Economics Institute

Ms. Seung Hee DO
Korea Energy Management Corporation

Ms. Eun Jung KIM
Korea Energy Management Corporation

Ms. Ha Na LEE
Korea Energy Management Corporation

Mr. Sung-Ho JEON
Korea Environmental Industry & Technology Institute

Dr. Hyun Kook CHO
Korea Forest Research Institute

Dr. Raehyun KIM
Korea Forest Research Institute

Dr. Kyeong Hak LEE
Korea Forest Research Institute

Dr. Yeong Mo SON
Korea Forest Research Institute

Dr. Hyung-Sik KIM
Korea Gas Corporation

Dr. Hyun-Suk RYU
Korea Gas Corporation

Mr. Wonkil CHOI
Korea Institute of Energy Research

Dr. Sung-jun HONG
Korea Institute of Energy Research

Mr. Keunhee HAN
Korea Institute of Energy Research

Dr. Soon-kwan JEONG
Korea Institute of Energy Research

Dr. Byoung-moo MIN
Korea Institute of Energy Research

Mr. Dal KIM
Korea Management Association Registration & Assessments Inc.

Dr. SeongHo HAN
Korea National Statistical Office

Ms. HyunJeong HONG
Korea National Statistical Office

Mr. KyuHo SHIM
Korea National Statistical Office

Dr. Jin-Chun WOO
Korea Research Institute of Standards and Science

Ms. Sunghee EUN
Ministry of Environment

Ms. Hye-In HEO
Ministry of Environment

Mr. Joon-seok HONG
Ministry of Environment

Mr. Raekwang JUNG
Ministry of Environment

Mr. Jang-Won LEE
Ministry of Environment

Mr. Jung-Oon LEE
Ministry of Environment

Mr. Chun-Kyoo PARK
Ministry of Environment

Mr. Jong-Soo YOON
Ministry of Environment

Mr. Sung-Hwan PARK
Ministry of Knowledge Economy

Mr. Junwoo HWANG
Ministry of Land, Transport and Maritime Affairs

Mr. Hyung-Taek PARK
Ministry of Land, Transport and Maritime Affairs

Dr. You-deog HONG
National Institute of Environment Research

Dr. Jihyung HONG
National Institute of Environment Research

Dr. Daeil KANG
National Institute of Environment Research

Dr. Dongmin LEE
National Institute of Environment Research

Dr. Ji-Ae LEE
National Institute of Environment Research

Dr. Kyung-mi LEE
National Institute of Environment Research

Dr. Jae-Hyun LIM
National Institute of Environment Research

Dr. Seong-Ho LEE
National Institute of Environment Research

Dr. Sue-Been LEE
National Institute of Environment Research

Dr. Young-Sook LYU
National Institute of Environment Research

Dr. Kwang-Seol SEOK
National Institute of Environment Research

Dr. So-Won YOON
National Institute of Environment Research

Mr. Rinsan JOUNG
Presidential Committee on Green Growth

Mr. Ki-Jong WOO
Presidential Committee on Green Growth

Dr. Kee-An ROH
Rural Development Administration

Dr. Seung-Muk YI
Graduate School of Public Health
Department of Environmental Health
Seoul National University

Dr. Yong-Taek JUNG
Soonchunhyang University

Dr. Junhaeng JO
The Korea Transport Institute

Dr. Hyunsoo LEE
The Korea Transport Institute

THAILAND
Dr. Savitri GARIVAIT
Environment Division, Joint Graduate School of Energy and Environment King Mongkut's University of Technology Thonburi

Dr. Sirintornthep TOWPRAYOON
Joint Graduate School of Energy and Environment, King Mongkut's University of Technology Thonburi

VIET NAM
Ms. Thang Thi Xuan NGUYEN
Environment Management Division,
Industrial Safety Techniques and Environment Agency,
Ministry of Industry and Trade of Vietnam

Mr. Cuong Mong NGUYEN
The Consultative Institute for Socio-Economic Development of Rural and Mountainous Areas, Research Center for Climate Change and Sustainable Development

IGES/ IPCC
Mr. Takahiko HIRAISHI
Institute for Global Environmental Strategies
Intergovernmental Panel on Climate Change

SEA GHG PROJECT
Mr. Leandro BUENDIA
Regional Capacity Building Project for Sustainable National Greenhouse Gas Inventory Management Systems in Southeast Asia

TSU-NGGIP-IPCC
Dr. Simon EGGLESTON
Technical Support Unit, National Greenhouse Gas Inventories Programme, The Intergovernmental Panel on Climate Change

JICA
Mr. Kazuya SUZUKI
Environmental Management Division 1,
Environmental Management Group,
Global Environment Department

UNFCCC
Mr. Dominique REVET
Financial and Technical Support Programme,
UNFCCC Secretariat