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Foreword

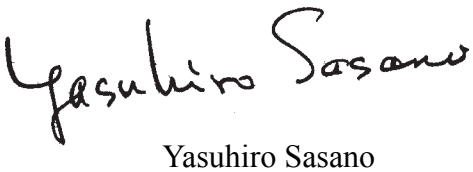
The international community now recognizes increases in emissions of greenhouse gases (GHG) as the primary cause of climate change and its impacts. In this respect, GHG inventories, which provide information on these emissions and trends over time, play a critical role as a basis for decision makers to design and implement strategies to reduce emissions.

Parties to the United Nations Framework Convention on Climate Change (UNFCCC) which entered into force in March 1994 are required to develop and publish national GHG inventories. Almost all parties have submitted their first inventories in the initial national communications and are working on their second or subsequent communications.

The National Institute for Environmental Studies (NIES) has held the "Workshop on GHG Inventories in Asia" (WGIA) annually since November 2003 with the support from the Ministry of the Environment of Japan. The purpose of WGIA is to assist countries in Asia in developing and improving their inventories by promoting regional information exchange. The participants of this workshop have found that the information exchange that is made possible through WGIA and its resulting network has played a significant part in the enhancement of their inventories and their capacity to develop them.

The Center for Global Environmental Research (CGER) was established in 1990 at NIES to contribute to enhancing the scientific understanding of global environmental changes and to elucidate and provide solutions for environmental concerns. CGER has been actively working to achieve its goals by conducting global environmental research, providing the facilities to support research projects, and implementing global environmental monitoring.

This CGER report serves as the proceedings for the 5th WGIA, which was held on September 6-8, 2007, in Kuala Lumpur, Malaysia with more than 50 experts in attendance. It is our hope that this report proves useful to all those who work in the field of GHG inventory and other areas of climate change research, and that it contributes to the progress of inventory development in the region.



Yasuhiro Sasano
Director
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Preface

The 5th Workshop on GHG Inventories in Asia (WGIA5) was held in Kuala Lumpur, Malaysia from September 6 to 8, 2007 and it provided a forum for GHG inventory experts in the Asian region to exchange their views and experiences on issues related to inventory development.

This report describes the workshop sessions and provides a reference to all contributions made by the experts. It also includes the workshop agenda and a list of the participants.

We would like to express our sincere thanks to the Ministry of Natural Resources and Environment (NRE) of Malaysia and the Forest Research Institute Malaysia (FRIM) for their excellent support and kind hospitality in hosting WGIA5. We would also like to thank all participants for their active participation and excellent contributions to the success of the workshop.

WGIA activities will be continued in order to assist countries in the Asian region to develop and improve their GHG inventories under the United Nations Framework Convention on Climate Change (UNFCCC) in the future. We believe that the WGIA meetings and networks play an important role in the development of GHG inventories in the region. We look forward to the continued participation of our member countries, and hope that WGIA meetings and networks will further contribute to inventory development in Asia.

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Climate Change Policy Division
Global Environment Bureau
Ministry of the Environment of Japan

List of Acronyms and Abbreviations

CDM	Clean Development Mechanism
CGE	Consultative Group of Experts
CH_4	Methane
CO_2	Carbon dioxide
FOD	First order decay
GHG	Greenhouse gas
GPG	Good practice guidance
HFCs	Hydrofluorocarbons
IPCC	Intergovernmental Panel on Climate Change
LUCF	Land-Use Change and Forestry
LULUCF	Land Use, Land Use Change and Forestry
MSW	Municipal solid waste
N_2O	Nitrous oxide
PFCs	Perfluorocarbons
QA	Quality assurance
QC	Quality control
SF_6	Sulphur hexafluoride
REDD	Reducing emissions from deforestation and forest degradation
SWDS	Solid waste disposal site
UNFCCC	United Nations Framework Convention on Climate Change
WGIA	Workshop on Greenhouse Gas Inventories in Asia

Photos from the Workshop

Opening remarks

Mr. Sei Kato

Mr. Azhar Bin Noraini

Presentations

Ms. Norhara Binti

Dr. Shuzo Nishioka

Closing remarks

Dr. Yukihiro Nojiri

Dr. Abdul Rahim Nik

Executive Summary

1. The 5th Workshop on Greenhouse Gas Inventories in Asia (WGIA5) was held in Kuala Lumpur, Malaysia from September 6 to 8, 2007[1]. The workshop was organized by the Ministry of the Environment (MOE) of Japan and the National Institute for Environmental Studies (NIES) of Japan, and hosted by the Ministry of Natural Resources and Environment (NRE) of Malaysia and the Forest Research Institute Malaysia (FRIM).

2. More than 50 inventory-related government officials and researchers from 13 countries in Asia and representatives from related organizations and projects attended this workshop[2].

3. The overall objectives of WGIA5 were to share experiences in national GHG inventory preparation and development, to update each other on the state of the inventory data collection process, and to discuss possible strategies to improve institutional arrangements for inventory preparation.

4. In Session I participants shared their experiences with a focus on the estimation methods used in the latest GHG inventories, key category analysis, and ways to address the problems they faced in GHG inventory preparation and development. The participants noted the usefulness of continuous and improved networking with stakeholders, the development of an online data collection system to facilitate data submission, the construction of a centralized database and the use of remote sensing techniques for cross checking LULUCF data in order to improve activity data. They also stressed the need to address the sustainability of inventory teams, engage in fund-raising for capacity building and increase efforts to enhance stakeholder awareness of the importance of GHG inventory.

5. Session II focused on the institutional arrangements for the second or third national communications. Participants discussed how to set up or improve institutional arrangements, and how to enhance long-term and inter-ministry cooperation to ensure a sustainable data collection system for GHG inventories. Making periodic surveys or developing national statistics is one of the possible long-term solutions to

[1] The agenda of WGIA5 is in Annex 1 of the proceedings.
[2] The list of participants is in Annex 2 of the proceedings.

the problem of lacking in activity data. Furthermore, it is important to recognize that inventory data can be used in other fields and for other analyses. In this context, the original purposes and multiple applications of the national statistics used in Japan's GHG inventory were introduced and participants acknowledged that sparking the motivation of relevant ministries or agencies is essential in developing a sustainable data collection system.

6. In the special session, participants heard reports from the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat, US Environmental Protection Agency (US EPA) and other projects/programs in the region.

7. Session III discussed the networking of GHG experts and the formation of a network platform. The participants noted that a new online regional network platform should be established and operated by the WGIA Secretariat. The platform should be a part of the WGIA homepage and can link to other existing networks.

8. In the wrap-up session and final discussion, participants agreed that communication with policy makers and stakeholders is essential for improving institutional arrangements for inventory preparation as well as for implementing the GHG inventories themselves. Participants emphasized the necessity of continuing WGIA meetings and strengthening the network of WGIA participants to facilitate further exchange of experiences in preparation for the second national communications, for example by setting up a mailing list. They also agreed to seek the possibility of expanding the scope of WGIA activities and to consider how to make use of inventory data in adaptation and mitigation activities. The participants finally concluded that efforts should be made to make the public more aware of WGIA activities (e.g., by publishing regular bulletins and newsletters).

Workshop Report

Background

1. The 5th Workshop on Greenhouse Gas Inventories in Asia (WGIA5) was held in Kuala Lumpur, Malaysia from September 6 to 8, 2007[1]. The workshop was organized by the Ministry of the Environment (MOE) of Japan and the National Institute for Environmental Studies (NIES) of Japan, and hosted by the Ministry of Natural Resources and Environment (NRE) of Malaysia and the Forest Research Institute Malaysia (FRIM).

2. More than 50 inventory-related individuals participated in this workshop. The list of participants included government officials and researchers from 13 Asian countries (Cambodia, China, India, Indonesia, Japan, Republic of Korea, Lao P.D.R., Malaysia, Mongolia, Philippines, Singapore, Thailand and Vietnam), representatives from the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat, the United States Environmental Protection Agency (US EPA), Mitsubishi UFJ Research & Consulting (MURC), and representatives from the following regional projects: Follow-up Project of the Collaborative Scoping Meeting for Sustainable National Greenhouse Gas (GHG) Inventory Management Systems in Southeast Asia; Asia-Pacific Integrated Model (AIM); and Improvement of Solid Waste Management and Reduction of GHG Emissions in Asia (SWGA)[2].

3. The overall objectives of WGIA5 were as follows:

- To share experiences in national GHG inventory preparation and development
- To update each other on the state of the inventory data collection process
- To discuss possible strategies to improve institutional arrangements for inventory preparation

Opening Session

4. Ms. Norhara Binti Hussein (FRIM) served as a master of ceremony in the Opening Session. The workshop was opened with a welcome address from Mr. Sei Kato (Deputy Director, Climate Change Policy Division, MOE) in which he traced the history and achievements of WGIA. In order to assist countries in Asia to develop and improve their GHG inventories, WGIA has been organized on an annual basis

[1] See Annex 1 of the proceedings for the agenda of WGIA5.
[2] See Annex 2 of the proceedings for the list of participants.

by NIES with support from MOE since 2003. He noted that networking among the participants is gaining the strength and the content of WGIA is becoming more informative year by year.

5. Mr. Kato's welcoming address was followed by a welcome speech from the host country by Mr. Azhar Bin Noraini (Deputy Undersecretary, Conservation & Environmental Management Division, NRE) who indicated that accurate GHG inventories help identify key sources and sinks of GHGs to focus on mitigation efforts and are also useful in future environmental planning. However, countries still face obstacles in inventory preparation such as a lack of accurate data, the absence of a sound data collection mechanism and methods for storing data, and a shortage of trained and experienced personnel. WGIA provides an open and lively environment for exchanging information and experiences on various aspects of GHG inventory. Discussions at the workshop should lead not only to sharing existing solutions to problems but also to developing new solutions to improve GHG inventories in the Asia region.

6. Dr. Jamsranjav Baasansuren (Greenhouse Gas Inventory Office (GIO), NIES) explained the context and schedule of the workshop. She also introduced the results of the preliminary survey[3] and indicated the key points of discussion at WGIA5 would be as follows:

- Challenges faced by countries in relation to GHG inventories, more specifically in the data collection process
- Successful experiences or good practices in inventory preparation
- Institutional arrangements for inventory development: Current status and future suggestions
- Networking of GHG inventory experts in the region: Possible options and follow-up activities

Session 1: Country Experiences of Inventory Preparation and Development

7. The session was chaired by Dr. Damasa Macandog (University of the Philippines Los Banos College). The rapporteur was Ms. Raquel Ferraz Villanueva (Department of Environment and Natural Resources, Philippines). An introductory presentation was made by Mr. Kiyoto Tanabe (GIO, NIES). The goal of the session was to share experiences in national GHG inventory preparation/development and

[3] See Annex 3 of the proceedings for the survey.

to find practical solutions to the problems faced by the countries. Mr. Tanabe called participants' attention to three specific topics that would be covered by a number of presentations in this session, namely: (i) elaboration on the estimation methods used in the latest GHG inventories, (ii) experiences with key category analysis, and (iii) successful experiences in overcoming problems. He emphasized, among other points, the importance of sharing "success stories" on practical solutions to specific problems, noting that certain problems with particular sources/gases for some countries are not necessarily a problem for other countries. He also noted that this session would focus on short-term solutions to various problems that could be immediately used in second national communications. Long-term solutions (e.g., developing national statistics) would be discussed in conjunction with issues on institutional arrangements in Session 2 on the second day.

8. Dr. Abdul Rahim Nik (FRIM) introduced the topic of GHG inventory development in Malaysia. The national GHG inventory team of Malaysia was established during the preparation of the initial national communication to the UNFCCC, which was completed and submitted in June 2000. Malaysia is currently working on the second national communication and the inventories in energy, industrial processes and land use, land-use change and forestry (LULUCF) sectors are almost completed. There have been gaps and shortcomings in inventory development including problems with data organisation, the availability of relevant data, the accessibility of data, and having to use non-representative emission factors, in addition to technical and institutional capacity needs. Improvements have been made for the second national communication, such as development of a centralized database to improve data organization and the establishment of better institutional arrangements for data sharing. Key category analysis has been performed for energy and LULUCF sectors, and is planned for the other sectors as well. During the discussion after this presentation, it was pointed out that, according to the good practice guidance (GPG) suggested by the Intergovernmental Panel on Climate Change (IPCC), key category analysis should be performed for the whole of the GHG inventory rather than for each sector separately. Having understood that, however, the Malaysian inventory team explained that it was not easy to perform key category analysis for the whole of the inventory because each sector was being dealt with by different ministries. They believed, and the participants agreed, that "sector-specific" key category analysis is still useful even though it is not entirely in conformity with the IPCC GPG. Generally, the IPCC default emission factors have been applied in Malaysia's

GHG inventory so far, but local data will be developed in the future. With regard to technical and institutional capacity needs, more improvements in energy and LULUCF sub-sectors will be made, e.g. conducting some measurements on emissions from peatland soil.

9. Ms. Radin Diana Radin Ahmad (Pusat Tenaga Malaysia (PTM)) made a presentation on the GHG inventories of Malaysia in the energy and industrial processes sectors. She reported that GHG inventories for energy and industrial processes in the second national communication are almost completed and are currently under review by the Steering Committee. The base year is 2000 and the gases covered are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6). The inventory preparation process is comprised of four steps: establishing the method, data listing and collection, data input to IPCC worksheets, and inventory report and recommendations. Data collection activities are supported by various efforts such as sending letters from NRE to data suppliers and developing and disseminating a brochure on GHG inventories. In addition, several workshops were organized to verify and discuss the results of the inventories. For the energy sector, there are two major data sources, primary data from respective agencies and secondary data from the National Energy Balance. Default emission factors from the Revised 1996 IPCC Guidelines for National GHG Inventories (1996 IPCC Guidelines) were used. Total emissions from the energy sector (sectoral approach) in 2000 were estimated to be 118,806 Gg CO_2 and energy industries and transport accounted for 31% and 30%, respectively. The production and consumption of mineral products was a main key category identified in the industrial processes sector[4] accounting for 56% of the 17,254 Gg CO_2 total emissions from the sector in 2000. One of the major points of progress since the initial national communication is the application of a local emission factor for nitric acid production based on measurements. She also reported that a number of surveys have been done to improve data organization and availability, and a series of discussions and meetings were held to identify data needs. Since data collection process is time-consuming process, online data collection has been suggested. One of the problems was with the availability of activity data (fuel consumption) at a disaggregated level for transport sub-sectors (road, rail, national navigation and domestic aviation). As a solution to this problem,

[4] This is based on key category analysis performed for the industrial processes sector, not for the whole inventory, as explained in paragraph 8.

the proportion calculated from the data sets on the segregation of fuel from one of the oil suppliers was multiplied by the total fuel consumption by the transport sector to estimate the disaggregated data of fuel consumption by each transport sub-sector.

10. Dr. Elizabeth Philip (FRIM) gave a presentation on the GHG inventory for the LULUCF sector of Malaysia. The 1996 IPCC Guidelines and IPCC Good Practice Guidance and Uncertainty Management in National GHG Inventories (GPG2003) were used for inventory preparation. Identified key categories[5] were the changes in forest and other woody biomass stocks, forest and grassland conversion, abandonment of croplands, pastures, plantation forests or other managed lands, and CO_2 emissions and removals from soils. The inventory for CO_2 emissions and removals from soils was not completed due to the unavailability of data. The estimated CO_2 removals by sink have increased in the second national communication compared to the initial communication. She noted that this is because inclusion of managed natural forest, overall improvement in estimates by application of higher tiers (Tier 2 and 3) and GPG estimation methods, the use of local data on annual growth rates, and the inclusion of abandoned managed lands in the second national communication. In addition, extensive efforts have been made in data/information collection, verification, and validation including consultative workshops involving various stakeholders, and consultative visits to Forestry Departments in various regions.

11. Dr. Jeongho Seo (Korea Forest Research Institute) introduced the GHG inventory for the LULUCF sector in Korea. Forest is a main land use, covering 65% of the total land area. Land use patterns in the country have changed due to industrialization and urbanization. Forest land is classified by ownership into national forests, private forests, and public forests. Private forests are predominant, accounting for 69.1% of forest lands. About 43% of forest lands are coniferous. The average annual (1990-2003) growth rate of CO_2 removals in the LULUCF sector was 2.6% while that of the national total GHG emissions was 5.0% in the second national communication published in 2003. Korea is now preparing its third national communication in which the GHG inventories on the LULUCF sector are being developed based on 1996 IPCC Guidelines and the Statistical Yearbook on Forestry compiled by the Korean Forest Service (KFS). The Good Practice

[5] This is based on key category analysis performed for the LULUCF sector, not for the whole inventory, as explained in paragraph 8.

Guidance for Land Use, Land-Use Change and Forestry (GPG-LULUCF) is also being implemented in conjunction with modification and refinement of the National Forestry Inventory System. There are some difficulties, however, with definitions of "forest" and "forest management", land-use matrix, etc. He noted that high uncertainty, complexity, and lack of resources for GPG2003 are existing problems in the LULUCF sector. Further efforts are planned to sort out these problems, including collection of data for estimation of C stocks in forests and testing remote sensing techniques such as light detection and ranging (LIDAR) for cross-checking purposes.

12. Mr. Cheon-Hee Bang (Environmental Management Corporation, Korea) made a presentation focusing on GHG inventories for the waste sector. The total GHG emissions from the waste sector were 13 Mt CO_2 equivalent in 2005. Emissions from solid waste disposal sites (SWDS) and waste incineration accounted for 46.7% and 44.4%, respectively. Currently, 271 open landfills and 1345 closed landfills are in operation and most of them are for municipal solid waste (MSW). Field measurements of CH_4 emissions from landfill sites were carried out and the methane generation rate constant (k, yr^{-1}) was estimated. The k value ranges between 0.080 and 0.184 yr^{-1} depending on the depth from the surface of the landfill. The amount of MSW disposed at SWDS in 2005 was 43% less than in 1990, while the amount of incinerated waste increased 10 times. Mr. Bang stated that Tier 2 methods would be used to estimate emissions from SWDS and waste incineration in the GHG inventory for the third national communication.

13. Dr. Qingxian Gao (Chinese Research Academy of Environmental Science) delivered a presentation on the GHG inventories for the waste sector for China's initial and second national communications. According to the initial national communication submitted in 2004, the national total GHG emissions in 1994 were estimated to be 3650 Mt CO_2 equivalent, of which CO_2, CH_4 and N_2O accounted for 73.05%, 19.73%, and 7.22%, respectively. The energy sector was the largest source and CO_2 emissions from the sector were estimated to be 2795 Mt in 1994. The waste sector, particularly SWDS, is one of the major contributors of CH_4 emissions. In the second national communication which is currently under preparation, new gases such as HFCs, PFCs and SF_6 will be included, the geographic region will be extended, and more research will be conducted to reduce uncertainties. The year 2005 will be used as the base year for the second national communication. Dr. Gao

also reported on a review of the waste sector in the initial national communication. According to their results, the main problem in estimating CH_4 emissions from SWDS was the difficulty in obtaining data which reflect the real situation, especially population statistics and a solid waste generation rate that greatly varies among the cities as well as regions in China. Various studies are being conducted to sort out this problem, and application of Tier 2 methods in the estimation of CH_4 emissions from SWDS, CO_2 emissions from waste incineration and N_2O emissions from waste water treatment have been planned for the second national communication. The emission factor for CO_2 emission from waste incineration is also one of the challenges existing in the waste sector.

14. Dr. Batiimaa Punsalmaa (Ministry of Nature and Environment, Mongolia) made a presentation on key category analysis. Mongolia prepared its first GHG inventory in 1996 for the base year 1990 under the U.S. Country Studies Program, and subsequently, Mongolia has improved its GHG inventory a couple of times. Mongolia's initial national communication was completed and submitted in 2001 with updated GHG inventories for 1994 and 1998. After submission of the initial national communication, key category analysis was performed by Tier 1 level method and trend assessment using the GHG inventories included in the initial national communication. The key categories identified by level assessment (with LUCF) were CO_2 emissions from energy industries, CH_4 from enteric fermentation, CO_2 from grassland conversion, and CO_2 from biomass harvest. By trend assessment, CO_2 emissions from energy industries, CH_4 from enteric fermentation, and CH_4 from traditional biomass were identified as key categories. Since GHG inventories have been updated several times, key category analysis will be performed again. Taking these results into account, Mongolia is preparing the second national communication with a focus on improving activity data and developing country specific emission factors for key categories. Referring to this experience, she noted the importance and usefulness of key category analysis in developing strategies for inventory improvement, which was well-received by the workshop participants.

15. Dr. Jose Villarin (Xavier University, Philippines) delivered a presentation on the Philippines' experiences in GHG inventory preparation focusing primarily on the industrial processes sector. He reported that national total GHG emissions of the country were estimated to be 100,864 Gg CO_2 equivalent in 1994 and CO_2, CH_4,

and N_2O accounted for 55%, 31% and 14%, respectively, according to the initial national communication published in 2000. Energy, agriculture, industrial processes and waste sectors contributed 49%, 33%, 11% and 7% to the total emissions. GHG inventory for the industrial processes sector covers the production of cement, iron and steel, chemicals, asphalt, pulp and paper, food and beverages, and halocarbons. Key category analysis was performed after submission of the initial national communication, and two key categories were identified in the industrial processes sector: the production of cement and metal with contributions of 45% and 40%, respectively, to the 10,711 Gg CO_2 total emissions from the sector. When preparing the initial national communication, the difficulty in obtaining actual production data was the main obstacle. One of the solutions to this problem was to estimate the production data by using energy consumption data as a driver. Also, various efforts were made to obtain the necessary data/information, e.g., directly querying industry associations. These efforts proved successful in improving the quality of emission estimates in this sector in the initial national communication, and therefore will likely be made again for preparation of the second national communication. Institutional arrangements for the second national communication are being developed and reinforced with more resources being available than before, such as the GHG Protocol Initiative. Memorandum of agreement between government and industries on data exchange is considered very helpful in facilitating cooperation from industries. Furthermore, attempts will be made to apply Tier 3 methods in this sector for the second national communication.

16. Dr. Sumana Bhattacharya, NATCOM Project Management Cell, the Ministry of Environment and Forests, India made a presentation on the development of CH_4 emission factors from rice cultivation in India. According to the initial national communication of India, the total GHG emission in 1994 was 1228540 Gg CO_2 equivalent and about 4 Million tons of CH_4 was emitted from rice cultivation, which is about 7% of the total CO_2 equivalent emissions from the country. . Key category analysis was performed by level assessment and rice cultivation was identified as one of the key categories. Tier 2 method and country specific emission factors were developed and applied for estimation of emissions from rice cultivation. Measurements for estimating country specific emission factors have been made since the early 1990s. The first countrywide campaign mode measurement to determine country specific CH_4 emission factors for all rice eco systems in India, was carried out in 1992. This was in response to very high value of CH_4 emissions

reported by EPA (38.4 Million tons). Static box or chamber technique has been used all along. Keeping in view the major characteristics of rice cultivation in India, namely: multiple cropping system (rabi (dry) and kharif (wet) seasons), varied water management practices that vary between arid, rainfed, irrigated, and deep water conditions; and varied soil characteristics across the country. Diurnal, seasonal and annual measurements of CH_4 flux were carried out. It was observed that CH_4 emission rates vary markedly with water regimes, multiple-aeration reduced methane emission and high organic soils emitted twice the CH_4 with respect to non-organic soils. The measurements continued for a decade. Level of uncertainties associated with the estimation of CH_4 from rice cultivation were also determined, however, the uncertainties that still persist are due to lack of assessment of year to year variability in area under different water management practices and scarce measurements in certain high CH_4 emitting regions. These are some of the research questions that can be addressed for improving the estimates further.

17. Dr. Rizaldi Boer (Bogor Agricultural University, Indonesia) reported that the emissions from the LUCF sector were 559,471 Gg CO_2 equivalent which was larger than that from the energy sector (373,609 Gg). CO_2 uptake by the LUCF sector was estimated to be 403,846 Gg. Therefore the LUCF sector was a net emitter of CO_2 in 1994 in Indonesia. Logging and the conversion of forests result in CO_2 emissions through decomposition of organic matter and burning of biomass. Dr. Boer focused on a detailed estimation method for the mean annual biomass increment of logged-over forest making use of national forest inventory data. He also extended the discussion on the method to calculate the carbon footprint for reducing emissions from deforestation and forest degradation (REDD), elaborating on his suggestion of a simple approach to estimating emissions from harvested wood. This topic was deemed beyond the scope of issues that WGIA should actively address (i.e., issues on national GHG inventories). Nevertheless, his discussion on how this group can assist developing countries to prepare for REDD drew attention and interest from the participants. This implied that it might be a possible area where WGIA could contribute in the future.

18. Mr. Takashi Morimoto (Mitsubishi UFJ Research and Consulting (MURC) Co., Ltd., Japan) shared MURC's experiences on preparing GHG inventories in the Republic of Palau and Japan, with a focus on how to estimate missing activity data as well as how to find useful data. Palau submitted its initial national communication in 2002.

MURC has been assisting Palau to prepare its second national communication. During the inventory preparation, the Palauan experts was faced with difficulties in calculating GHG emissions for several source categories because of a lack of activity data. However, the Palauan experts, with the assistance from MURC, successfully solved these problems by estimating the missing activity data by using various methods such as extrapolation using drivers, interpolation, interviewing relevant organizations, estimation using consumption units, and estimation using information from expert judgment or other sources. For example, there were no statistics on soda ash consumption which is necessary to calculate CO_2 emissions in the 1996 IPCC Source/Sink Category 2.A.4 "Soda Ash Production and Use". To solve this problem, the Palauan experts inquired at the water treatment plant, which was the only consumer of soda ash in Palau, about the weight of the soda ash per bag and the number of bags used per day. Based on these data obtained from the soda ash consumer, the experts estimated the annual soda ash consumption and then calculated CO_2 emissions. Mr. Morimoto recommended to the workshop participants, from the lessons learned through inventory preparation in Palau, that they should not give up even if activity data are not available, and that they should try to come up with "best estimations" making full use of various methods as mentioned above. He also emphasized the importance of taking follow-up steps to reconsider the "estimated" activity data with a view to further improving the quality of GHG inventories for future national communications. In addition, from the lessons learned through inventory preparation in Japan, he recommended literature reviews and interviews with experts/agencies as ways to find useful data/information. He also noted that ensuring confidentiality when necessary will help to obtain data/information from data sources. All these recommendations were well received by the workshop participants.

Special Session

19. The Special Session was chaired by Dr. Yukihiro Nojiri (GIO, NIES). In this session, participants heard reports from the UNFCCC Secretariat, US EPA and other relevant projects/programs in the region.

20. Mr. Dominique Revet (UNFCCC Secretariat) gave a presentation on the latest news on non-Annex I national communications and national GHG inventories. He informed the audience that no new national communications had been submitted since the 4th WGIA (Jakarta, Indonesia, February 2007), but more than 100

non-Annex I Parties had started the process of preparing their second national communications. He also noted that the UNFCCC non-Annex I GHG inventory software is being used increasingly and encouraged users to submit feedback on the experiences with the software. He indicated that COP 13 / SBI 27 will be held in December 2007, in Bali, Indonesia and COP 13 will decide on the mandate and terms of reference of the Consultative Group of Experts (CGE).

21. Ms. Mausami Desai (US EPA) gave a presentation on the possible strategies and applicable tools for improving GHG inventories in Southeast Asia. The presentation discussed the US EPA experience in a Central America project focusing on the templates for building sustainable national inventory management systems. The templates all focused on key elements related to managing the development of GHG inventories and included key source analysis, description and assessment of institutional arrangements, source-by-source documentation of data and methods for key sources, archiving procedures, a quality assurance/quality control (QA/QC) plan, and a national inventory improvement plan. The templates help to document, assess and prioritize the information and resources necessary to prepare inventories. For example, the institutional arrangements template is useful for the inventory coordinator to assess existing arrangements in the country, and to identify where capacity/expertise is lacking. These templates can be integrated into the national communication reports, which will facilitate countries' fulfillment of the requirements under the UNFCCC. It will also serve as an archive and reference for future inventory teams. And furthermore, it will help to identify or highlight priorities for future capacity building projects.

22. Mr. Leandro Buendia (Collaborative Scoping Meeting for Sustainable National GHG Inventory Management Systems in Southeast Asia, Philippines) introduced the Collaborative Scoping Meeting and its follow-up activities. The meeting was organized by the UNFCCC Secretariat in collaboration with the Government of the Philippines in Manila from June 11 to 13, 2007. The major objectives of the meeting were to assess past and current activities on GHG inventories in the Southeast Asian region, to increase regional capacity to better manage national GHG inventories and sustain the process of their development on a continuous basis, and to develop a capacity building program for sustainable national GHG inventory management systems in Southeast Asia. Representatives from Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Singapore, Thailand and Vietnam attended the

meeting. A number of areas of concern were identified such as the lack of local or country-specific emission factors and appropriate activity data, the lack of capacity for inventory management, the difficulty in sustaining the inventory system or inventory team, and the lack of financial and human resources. Moreover, the participants expressed their need for training on key category analysis and sharing information/experiences. He mentioned that the meeting report is being finalized and a regional program proposal is being drafted. The regional program will give priority to energy, agriculture (with a focus on rice cultivation and livestock) and LUCF sectors. The main issues for the program include assessment of existing institutional arrangements, training and pilot studies to adopt/improve the templates, hands-on training using available software, techniques and templates, and increasing awareness in the public and private sector. This regional program and WGIA are expected to establish and keep a cooperative and mutually beneficial relationship.

23. Dr. Masato Yamada (NIES) introduced the activities of SWGA. The 1st workshop was organized by NIES and held on January 18, 2007 in Yokohama, Japan. Representatives from six Asian countries (China, Indonesia, Republic of Korea, Mongolia, Thailand and Vietnam) participated in the workshop. Topics such as the applicability of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines) to the estimation of CH_4 emissions from landfill, technologies for waste management, and GHG reduction in Asia were discussed at the workshop. The major issues identified were the increasing amount of waste in Asian countries, the considerable differences between big cities and outlying regions (the waste generation rate in Bangkok, Thailand, was estimated to be 1.6 kg/person/day while in the north-east region of the country it was at 0.97 kg/person/day), the differences in status of waste management (in Korea food waste is banned for landfill), and the prevalence of open dumping and improper landfills. Statistics on the waste stream should be fundamental; however, no comparable format exists for waste statistics in Asia. The development of Asian waste statistics will be one of the major topics of SWGA. Such statistics will be very helpful to WGIA countries in improving their GHG inventories. He emphasized that the clean development mechanism (CDM) is a good opportunity to improve open dumping. He also emphasized that landfill gas recovery is a major methodology for CDM but there are several other technologies that can be used to reduce methane emissions from landfill sites.

24. Dr. Tatsuya Hanaoka (NIES) presented the activities of the AIM team, including approaches and examples of mitigation scenario analysis. The AIM team has been developing emission models and climate impact models. AIM is a combination of top-down (AIM/CGE Model) and bottom-up (AIM/Enduse Model and AIM/Energy Snapshot tool) approaches for mitigation scenario analysis. These approaches cover both the national and global scale. There are advantages and disadvantages to each approach and model. For example, the AIM/Enduse Model and AIM/Energy Snapshot tool cannot assess and analyze economic impact; on the other hand, the AIM/CGE model can access the impact of mitigation measures but cannot assess very detailed technology impacts. He also explained the low carbon scenario study in Japan. This study assesses the possibility of achieving a low-carbon society in Japan by targeting a 70% CO_2 emission reduction by 2050 compared to the 1990 level, while satisfying the expected demand for energy services in 2050. Several of models (element models) were developed to estimate activity data, which become the driving force for GHG emissions. The AIM/Energy-Snapshot tool was used to take a balance. In order to develop scenarios the following steps were taken: depiction of socio economic visions in 2050 and making a story line up to 2050, estimation of energy service demand, data collection for energy demand and supply side, quantification of energy demand and supply (from the demand side), checking the potentials for energy supply (from the supply side), and estimation of CO_2 emissions. In order to develop scenarios, two visions are considered and analyzed: Vision A is a technology-driven society and Vision B is a nature-oriented society. In order to achieve a 70% reduction in CO_2 emissions there is a need to reduce energy use from the demand side as well as the supply side. According to the results of the analysis, in the case of Vision A we would use more nuclear energy while in vision B we would use more biomass energy. Many participants got interested in the AIM model as a potential tool for projection of GHG emissions in each country.

Session II: Institutional Arrangements for the National Inventory System

25. Session II was chaired by Dr. Abdul Rahim Nik (Rapporteurs: Dr. Gary W. Theseira, FRIM and Dr. Elizabeth Philip, FRIM). Dr. Yukihiro Nojiri introduced the objectives and contents of the session. The purpose of the session was to discuss possible strategies to improve institutional arrangements for inventory preparation. Dr. Nojiri briefly reported on the results of the preliminary survey about the status of institutional arrangements in each WGIA participating country. According to the

survey, institutional arrangements have been already established in 6 countries: Cambodia, China, India, Korea, Malaysia and Vietnam. Some of these were established solely for preparation of the second national communication, while others designed to last beyond the second national communication to other future communications. Participants were invited to share their experiences and discussed how to set up or improve the institutional arrangements for the second or third national communications. Participants were also encouraged to discuss how to enhance long-term and inter-ministry cooperation to ensure sustainable data collection systems and data organization.

26. Mr. Sei Kato explained Japan's institutional arrangements for preparation of their national GHG inventory. He started his presentation by reviewing the history of Japan's institutional arrangement which has developed through four phases. When it was established in 1992 to develop a GHG inventory for the first national communication, it started with only a small team (a few staff members from the Environmental Agency and consultants) without any expert committees dedicated to inventory work. In contrast, the current core inventory team is comprised of MOE, GIO, and consultants, and there is a Committee for the GHG Emission Estimation Methods consisting of approximately 60 external experts that was established to respond to the UNFCCC requirements and to reflect the latest scientific knowledge in the inventory. Inventory compilation and improvement are conducted by GIO in collaboration with consultants and in close consultation with the Committee under MOE coordination. Specific issues in GHG inventory that need to be addressed are detected through advances in international negotiations, technical review of GHG inventories under the UNFCCC, experiences gained in preparation of GHG inventories, and information provided by stakeholders. To address these issues, studies are conducted by the scientific research community and the Committee. The results of the studies are reflected in the GHG inventories compiled in the following year. Finally Mr. Kato highlighted the strengths and weaknesses of Japan's institutional arrangement. Strengths include the active engagement of some 60 experts through the Committee, the active engagement of ministries/agencies through legislation and ministers' top-down initiatives, and the mutually beneficial relationship between ministries/agencies (in particular between MOE and the ministries/agencies) fostered through sharing data/information that are helpful for their own policy making. Weaknesses, or issues that should be considered for further improvement, include setting QA/QC procedures, the maintenance of

institutional memory, and the timely completion/submission of the GHG inventory. The points presented by Mr. Kato, in particular the history and strengths of Japan's institutional arrangement, were found to be helpful to the workshop participants in envisioning improvements to their own institutional arrangements.

27. Ms. Lavanya Rama Iyer (National Project Coordinator for Second National Communication, NRE) gave a presentation on the institutional arrangements for Malaysia's second national communication. She noted that stocktaking workshops and consultative interviews had been conducted and that providing institutional arrangements for the continuous reporting of national communications was found to be an area of main concern that should be addressed. The Project Steering Committee was established with the participation of many ministries and other stakeholders, and is now handling the second national communication. A GHG inventory Working Group (WG), a Vulnerability and Adaptation WG and a Mitigation WG were established under this committee. The GHG inventory WG is in charge of inventory preparation and development. The lead agencies for GHG inventories are as follows: PTM (Malaysian Energy Agency) for the energy and industrial processes sectors, FRIM for LULUCF, Malaysian Agricultural Research and Development Agency for the agricultural sector, and the Department of Environment for the waste sector. The main outputs of the GHG inventory WG are a database of inventory data for 1990-2004, a GHG inventory report for base year 2000, and a GHG inventory procedural manual. The WG also implements an action plan for the improvement of GHG inventories which includes a compilation of sectoral action plans and guidelines to update the database continuously and integrate new features, and provides recommendations for activities to prepare for the application of new IPCC guidelines to future inventories.

28. Mr. Heng Chan Thoeun (Ministry of Environment (MOE), Cambodia) introduced Cambodia's GHG inventory and institutional arrangements for its second national communication. MOE is the National Focal Point for the UNFCCC and the Kyoto Protocol. The Cambodian Climate Change Office was established under MOE in 2003 and acts as the Secretariat for the UNFCCC, the Kyoto Protocol and CDM Focal Points in Cambodia. The inventory is prepared on a project basis to feed into national communications. The country prepared its first GHG inventory under Cambodia's initial national communication in 1999. The inventory was based mainly on the 1996 IPCC Guidelines and covered five sectors: energy, industrial

processes, agriculture, LUCF and waste. The GHGs included were CO_2, CH_4 and N_2O. Cambodia has been experiencing problems in inventory preparation such as lack of a sustainable national GHG inventory system, lack of activity data, insufficient database management, the low technical capacity of local staff, and a lack of financial support. He listed up possible strategies and actions to address these issues, including the idea of exchanging experts among countries within the region with a view to sharing experiences that would contribute to an improvement of their own national inventories. Overall, the issue of how to raise awareness of the importance of national GHG inventories was viewed as the key to successful improvement of Cambodia's institutional arrangements.

29. Mr. Hoang Manh Hoa (Ministry of Natural Resources and Environment (MONRE), Vietnam) reported that national GHG inventories for the years 1990, 1993, 1994 and 1998 were completed using the methodologies in the 1996 IPCC Guidelines. The GHGs covered in the inventories were CO_2, CH_4 and N_2O. The data mainly came from the General Statistics Office. Total GHG emissions were estimated to be approximately 103 and 121 million tons CO_2 in 1994 and 1998, respectively, showing an increasing trend. Vietnam established an institutional framework for its second national communication. MONRE was assigned as the National Focal Agency for the UNFCCC, Kyoto Protocol and CDM. The National Project Director and Coordinator under MONRE provide guidance and advice on climate change related activities including GHG inventory and mitigation assessment. The National Inventory Team was established for systematic inventory preparation, implementation, data processing and reporting. The country is currently working on a GHG inventory for the second national communication. The inventory will cover CO_2, CH_4, N_2O, CO, NO_x, NMVOC and SO_2, and the base year is 2000. Identification of data sources and the entering of the activity data and emission factors are completed. Key category analysis is ongoing. In Vietnam, solid waste generation is expected to increase: MSW and ISW generation were 12 and 2.2 million tons in 2004, respectively. They are expected to increase to 20 and 3.2 million tons in 2010, respectively. He reported on problems that Vietnam had been facing, and underlined the importance of the training of personnel, among other factors, in order for those problems to be addressed.

30. Mr. Soon-Chul Park (Korea Energy Management Corporation) introduced the institutional arrangements for the inventory system in Korea. The Inter-Ministerial

Committee, which is the main decision-making organization on climate change in Korea, was established in 1998. The Committee produced the third comprehensive action plan for climate change (2005-2007) and 19 ministries are involved in implementing the plan. The Ministry of Commerce, Industry and Energy (MOCIE) established the Council for GHG inventories in 2006 for systematic management and review of national inventories. Ten government agencies and seven research institutes are involved. He stated that statistics on national GHG emissions are produced by the designated organization from the Inter-Ministerial Committee on Climate Change. MOCIE is responsible for the energy and industrial processes sector, MOE for the waste sector, KFS for the LULUCF sector, and the relevant ministries are also responsible for developing country-specific emission factors. Various other activities related to GHG emission estimation have been carried out in Korea. For example, in order to develop demand side statistics on energy consumption and GHG emissions (National Energy and GHG Database), a number of research projects and surveys have been conducted since 2005. Other examples are the establishment of the GHG Emission Information System, publication of GHG emission accounting guidelines at a company level, and production of web program for accounting and registration of a particular company's GHG emissions (on a voluntary basis). During the discussion after Mr. Park's presentation, it was noted that legislation and top-down initiatives (e.g., Prime Minister Instruction in 2001, Energy Fundamental Law in 2006) had been very effective in promoting institutional arrangements for the inventory system in Korea, as was also the case in Japan. Furthermore, it was noted that the continuous implementation of these institutional arrangements would lead to better and more efficient improvement of national GHG inventories than the recurrent establishment of institutional arrangements for each national communication. In this context, Mr. Park explained that Korea was planning to compile its national GHG inventories annually from 2008.

31. The presentation by Dr. Sirintornthep Towprayoon (King Mongkut's University of Technology Thonburi, Thailand) focused on sector-specific GHG inventory data collection systems that are also important elements of the institutional arrangements for GHG inventories. She elaborated particularly on the disaggregated activity data for the waste sector and emission factors for the agricultural sector in Thailand based on her studies. Regarding the waste sector, she focused on methods to estimate CH_4 emissions from SWDS because they are a major source within this

sector. She compared the mass balance approach according to the 1996 IPCC Guidelines and First Order Decay (FOD) model presented as a higher tier method in the 2006 IPCC Guidelines. She also explained different ways of obtaining activity data, emission factors and other parameters in connection with the aforementioned three different estimation methods. (For example, for total MSW, an estimated value from population and, the waste generation rate was used for the mass balance approach and actual data collected from 94 sanitary landfills currently in operation were used for the FOD approach.) According to the results of her studies, these methods with their differently derived data gave quite different results for CH_4 emission estimation. She noted that uncertainties can be reduced by using appropriate disaggregated-level activity data. For the estimation of emissions from rice fields in the agricultural sector, the plantation area can be obtained from an annual statistics report and also by using a geographic information systems (GIS) map. The emission factors vary according to the cultivation practices. The CH_4 emissions from rice fields estimated by using statistical data were 2110 Gg CH_4, while GIS-based estimation showed a value of 1059 Gg CH_4. She noted that disaggregated emission factors are important in reducing uncertainty. Spatial information obtained from GIS can be used as a substitute for a statistical report to see an overview of emissions in terms of area. She pointed out some major problems which hamper data acquisition in Thailand. One of those problems is that there is no central unit in charge of collecting and archiving national data in Thailand. At present many authorized institutes are involved in the data collection process rather independently of each other, which results in non-systematic reporting of data from different sources.

32. Ms. Upik Sitti Aslia (Ministry of Environment, Indonesia) gave a report on the institutional system for the development of national GHG inventories in Indonesia. Indonesia submitted its initial national communication in 1999. A working group on national GHG inventories has been established for the preparation of the second national communication. Developing a database of inventory data (activity data and emission factors) and calculations of GHG emissions/removals will be carried out in 2007-2008. Finalization of the GHG inventory for the second national communication is planned in early 2009. A legal basis for the institutional mechanisms for national GHG inventory development has not been established yet, but it is under preparation for future national communications.

33. As a long-term solution to the problem of the lack of activity data, sustainable data collection methods need to be introduced, for example by making periodic surveys or developing national statistics. Obviously, the cooperation of relevant ministries/agencies is essential to such a long-term solution, hence a key question is how to motivate them to develop sustainable data collection schemes. In this context, it should be noted that at WGIA4, the participants agreed on the importance of recognizing that the data used in the inventories can serve as valuable input for other analyses. With a view to promoting consideration of this issue, GIO members delivered a presentation on the original purposes and multiple applications of the national statistics used in the GHG inventory of Japan. (For details on this matter, see Annex IV.)

- Dr. Yuriko Hayabuchi's presentation focused on the statistics used in the energy sector and emphasized that the General Energy Statistics (the Ministry of Economy, Trade and Industry (METI))provides a comprehensive overview of domestic energy supply and demand with energy sources and sectors, and is a major source for activity data in the energy sector.
- Dr. Rikiya Matsumoto made a presentation on the statistics used in the industrial processes sector. He focused on the Yearbook of Ceramics and Building Materials (METI) and the Yearbook of the Current Survey of Energy Consumption, METI and their practical applications. He also explained the inventory data collection process.
- Mr. Kohei Sakai gave a presentation on the statistics used in the agricultural sector. The statistics are produced by the Ministry of Agriculture, Forestry and Fisheries (MAFF). MAFF plans and designs the survey, and conducts national level aggregation and analysis of the survey results. The overall merits for developing the statistics include the promotion of agricultural policy such as the stabilization of agricultural and livestock product prices.
- Ms. Takako Ono made a presentation on the statistics used in the LULUCF sector. The major statistics used include the Forestry Status Survey, the Statistics of Cultivated and Planted Land, the World Census of Agriculture and Forestry, and the Land Use Status Survey. She focused on the Forestry Status Survey and explained the original purposes, how the survey data are developed and the benefits of developing the data, and how they are used in the GHG inventories. She highlighted that institutional arrangements and cooperative relationships among national administrative agencies are indispensable for developing inventory data.
- Dr. Jamsranjav Baasansuren focused on the activity data and statistics used in the waste sector. She explained how the statistical surveys are conducted in Japan

focusing on the Table of Industrial Statistics Survey (METI). She emphasized that the survey data are used not only for GHG inventories, but also for economic and industrial policies, white papers, other statistics, business enterprises, universities, research institutes and international organizations (e.g. the 1996 IPCC Source/Sink Category 6.B.1. Industrial waste water). If statistical data are unavailable for an entire time series, the data gaps could be addressed by estimation using various techniques. She showed an example of such estimations in the waste sector in the GHG inventory of Japan: the estimation of biodegradable sewage sludge landfill amounts for 1980-1995 using available statistical data. It was noted that enhancing awareness of the importance of the GHG inventory is important in order to gain the cooperation of relevant ministries and agencies in collecting and producing inventory data.

During the discussion after these presentations, it was emphasized again that promoting awareness of the additional benefits and multiple applications of statistical data is important to motivate relevant ministries/agencies to develop sustainable data collection schemes. The workshop participants generally agreed on this point, and took note of the information provided in these presentations.

Session III: Networking Experts in Region

34. Session III was chaired by Mr. Leandro Buendia (Rapporteur: Dr. Sirintornthep Towprayoon). The purpose of this session was to discuss the networking of GHG experts and the formation of a network platform. Mr. Kohei Sakai presented the background of this session highlighting two contradictory facts; namely, that the importance of the networking of experts had been emphasized on many occasions including at WGIA meetings, but existing platforms that could serve for that purpose (such as the GHG Experts Network (http://www.ghgnetwork,org) and the Climate-L mailing list (http://www.iisd.ca/email/climate-L.htm)) had not been used so far by experts in WGIA participating countries, judging from the preliminary survey for this meeting. He invited participants to consider what the problems with existing platforms are, and what features would be necessary if a new regional online network were to be created. His presentation was followed by another one by Ms. Takako Ono, who enumerated the points to be discussed in this session.

35. After a broad discussion on the needs and availability of the proposed network platform, participants agreed that there are different types of information that could be exchanged through online networks at various levels, and that some types of

information might be appropriate only for access by WGIA colleagues' and not for a wider audience. Participants also agreed that a regional network hosted by WGIA would help to enhance the solidarity of the Asian GHG experts. Therefore participants concluded that a new online regional network platform should be established and operated by the WGIA secretariat. This can be initiated through a mailing list for WGIA experts. Information exchanged through this mailing list can be posted on the WGIA homepage for public access when requested or when it is considered useful. Participants also agreed that this new WGIA network platform would be used in parallel with the other existing network platforms to complement each other, and should not be regarded as replacement or competitor for them. The platform should be a part of the WGIA homepage and can link to other existing networks.

Wrap-up Session

36. The session was chaired by Dr. Shuzo Nishioka (NIES). Dr. Damasa Macandog gave a summary report for Session I where participants shared their experiences on the lessons learned from the previous inventory preparation, and discussed possible solutions to the problems that countries faced, with a focus on activity data. A number of recommendations were made for improving activity data, including continuous and improved networking with stakeholders, development of an online data collection system to facilitate data submission, construction of a centralized database and use of remote sensing techniques for crosschecking LULUCF data. They also stressed the need for the sustainability of inventory teams, fund-raising for capacity building and efforts to increase the awareness of stakeholders of the importance of their role in GHG inventory preparation.

37. Dr. Shuzo Nishioka pointed out that although the improvement of inventory data collection and institutional arrangements has been progressing in Asian countries, obtaining more appropriate activity data and country-specific emission factors, addressing the problem of high uncertainties and making use of available GHG inventory software still remain as challenges in inventory development. Communication with policy makers and stakeholders is essential for improving institutional arrangements for inventory preparation as well as improving the GHG inventories themselves. He noted that industrial structures and lifestyles are changing rapidly in the region due to rapid economic development and urbanization, and that there is an increasing need for sharing information in order for Asian

countries to respond to rapid and continual changes. Having acknowledged that the WGIA had been contributing to improvement of national GHG inventories in Asian countries, he suggested, and the participants agreed, that it might be time for WGIA to proceed to the next stage; namely, the WGIA should pursue further "horizontal expansion" of accumulated know-how on national GHG inventories, which means not only wider dissemination of the know-how within the region but also extension of the know-how to other dimensions such as methodological issues relating to CDM, issues on REDD, and methodologies for projecting GHG emissions. Also, he encouraged the participants to play a leading role in addressing methodological issues in the areas of national GHG inventories where they have plenty of experience (e.g., methane emissions from rice fields, CO_2 removals by forest management, emissions from waste incineration).

38. Finally, the participants discussed the next steps for WGIA to take. First of all, they agreed upon the necessity of continuing WGIA meetings as well as strengthening the network of WGIA participants to facilitate further exchange in the preparation of the second national communications, for example, by setting up a mailing list for this community. They also agreed to seek the possibility of expanding the scope of WGIA activities as implied in paragraph 37 above, and to consider how to make use of inventory data for adaptation and mitigation activities. Furthermore, they concluded that efforts should be made to disseminate information from WGIA (e.g., publishing regular bulletins and newsletters) in order to keep the public informed of our activities. Some attendees expressed an interest in participating in joint research to develop country-specific or region-specific emission factors, using available models for estimation of GHG emissions. Some participants also pointed out the need for publishing informational booklets on emission factors in the Asian region.

39. Dr. Yukihiro Nojiri gave his closing remarks, thanking the host organizations from Malaysia for their kind hospitality and for their support of the workshop. Dr. Abdul Rahim Nik also delivered closing remarks. He emphasized the importance of the continuous exchange of information and experience among the WGIA participants. He also thanked all participants for their contributions.

Overview of WGIA5

September 6-8, 2007
Kuala Lumpur, MALAYSIA

WGIA Secretariat
Greenhouse Gas Inventory Office of Japan (GIO)
National Institute for Environmental Studies (NIES)
j.suren@nies.go.jp

Welcome Participants!

- 56 Inventory-related government officials and researchers from 13 countries
- 7 Representatives from international organization, other relevant organizations and projects
  - United Nations Framework Convention on Climate Change (UNFCCC) Secretariat
  - United States Environmental Protection Agency (USEPA)
  - Collaborative Scoping Meeting for Sustainable National Greenhouse Gas Inventory Management Systems in Southeast Asia and Follow-up Project
  - Asia-Pasific Integrated Model (AIM)
  - Improvement of Solid Waste Management and Reduction of GHG Emission in Asia (SWGA)
  - Mitsubishi UFJ Research & Consulting (MURC)

Joint Hosting Organizations

- Ministry of the Environment of JAPAN
- National Institute for Environmental Studies
- Ministry of Natural Resources and Environment, MALAYSIA (Local host)
- Forest Research Institute MALAYSIA (Local host)

Preliminary Survey for WGIA5

- To clarify the current situation of GHG inventory in participating countries
- To identify issues facing the countries and successful experiences or good practices in inventory preparation and inventory system
- To develop the contents of the workshop most relevant to its participants

Results of the Survey

COUNTRY	Preparation of GHG Inventory for SNC (*TNC)	Key Category Analysis	Establishment of Institutional Arrangements for Inventory System
CAMBODIA	△	○	○
CHINA	○	○	○
INDIA	-	△	○
INDONESIA	-	△	△
KOREA*	○	△	○
LAO P.D.R.	-	△	△
MALAYSIA	○	-	○
MONGOLIA	-	○	△
PHILIPPINES	-	○	△
SINGAPORE			
THAILAND	-	-	-
VIETNAM	○	○	○

○ It is ongoing (For KCA, it has been perfomed for INC)
△ Will soon start (we are planning)
- Not yet started (performed)

Results of the Survey

COUNTRY	UNFCCC non-Annex I GHG Inventory Software	UNDP Handbook on National GHG Inventory	IPCC Emission Factor Database (EFDB)	GHG Experts Network
CAMBODIA	○	○	○	△
CHINA	○	○	-	-
INDIA	-	△	-	△
INDONESIA	-	△	-	△
KOREA	-	-	-	-
LAO P.D.R.	△	△	○	△
MALAYSIA	△	-	-	△
MONGOLIA	-	-	○	-
PHILIPPINES	-	△	△	-
SINGAPORE				
THAILAND	○	○	-	-
VIETNAM	○	△	○	△

○ Yes, we use it
△ No, we were not aware of this
- No, we were aware of this, but have never used it

The WGIA5 Flowchart

Day 1: September 6, 2007

Session I: Country's Experience of Inventory Preparation/Development

- Country's Report

Special Session: Invited Speeches

- Reports from International Organization and Other Relevant Organizations and Projects

Day 2: September 7

Session II: Institutional Arrangements for National Inventory System

- Country's Report

Session III: Networking Experts in the Region

- Introductory Report from GIO

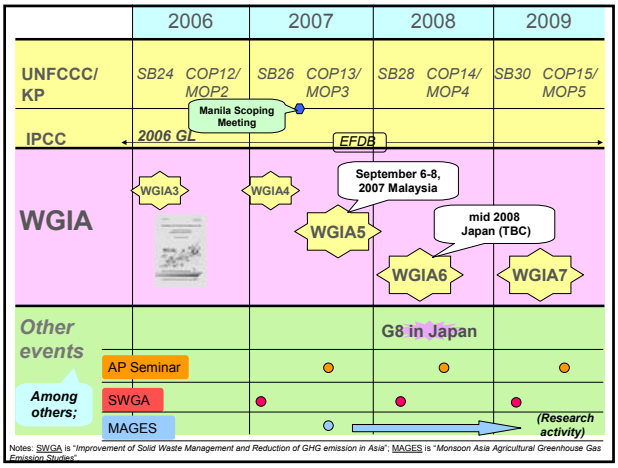
Wrap-up Session: Overall Discussion

Day 3: September 8

Excursion: Tour of the FRIM and Kuala Lumpur

Points of Discussion at WGIA5

- Challenges facing the countries in relation to GHG inventory, specifically in data collection process
- Successful experiences or good practices in inventory preparation
- Institutional arrangements for inventory development: Current status and future suggestions
- Networking GHG inventory experts in the region: Possible options and follow-up activities



Thank you

Session 1: Country's Experience of Inventory Preparation/Development

Introductory Presentation

6 September 2007, Kuala Lumpur, Malaysia
5th Workshop on GHG Inventories in Asia

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

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Objectives of Session 1

- To share experiences in national GHG inventory preparation/development to find out practical solutions to the problems each country is facing.
- To this end, we will hear in this session:
  - Elaboration on estimation methods used in the latest GHG inventories
  - Experience of key category analysis
  - Successful experiences in overcoming problems

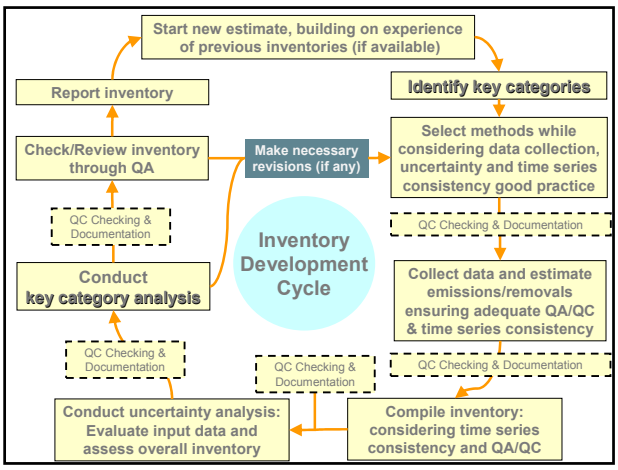
Methods in the Latest Inventories

- Malaysia has already completed 3 sectors of GHG inventory for SNC.
  - Energy
  - Industrial Processes
  - LULUCF

  → Will be presented.
- Also, recent developments in some sectors in other countries will be introduced: e.g.,
  - LULUCF, Waste sectors of Korea's inventory
  - Waste sector of China's inventory

Key Category Analysis

- Guidance provided in IPCC GPGs
- Helpful in identifying source/sink categories that should be prioritised in the inventory development process
- Non-Annex I Parties are encouraged, to the extent possible, to undertake key source analysis
  - to assist in developing inventories that better reflect their national circumstances
  - to improve inventories in the most cost-effective manner



Key Category Analysis

- According to the preliminary survey:
  - 5 countries have conducted KCA based on GHG inventory for INC.
    - Cambodia, China, Mongolia, Philippines, Viet Nam
  - Most other countries are planning to conduct it during the preparation of SNC/TNC.
  - Difficulties that countries encountered are:
    - Lack of previous inventory data (6 countries)
    - Lack of capacity of the inventory team (4 countries)
- We will hear Mongolia's experience.

Successful Experience (1)

Problems

- Lack of activity data/country-specific EFs is a major and common problem for many countries in Asia.
- According to the preliminary survey, lacked data are, for example:
  - Energy
    - Detailed data for Transport – Aviation, Road, Rail, Navigation
    - Fuel consumption under Manufacturing Industries
    - Detailed data on various types of fuel used in the informal un-organized and small scale industry sectors
    - Biomass consumption data
  - Industrial Processes
    - Quantity of Clinker or Cement Produced
    - Food Production Process (Sugar cane, oil crops, Cereals etc.)
    - Non-energy use of fuel in chemical industries

Successful Experience (2)

Problems

- Agriculture
  - (Number of) Livestock
  - Water management for paddy
  - Soil carbon
  - Area of Burned Grassland
  - Activity data for agricultural soils
- LULUCF
  - Forest land area data
  - Biomass consumption data
  - Commercial harvest according to ecosystem type
  - Status of abandoned managed land
  - Land use data of converted forests
  - Historic soil data
  - Activity data for the time series

Successful Experience (3)

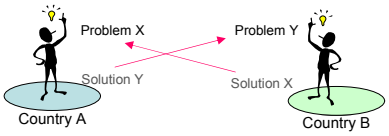
Problems

- Waste
  - Details of annual municipal solid waste (MSW) generation
  - Quantity dumped and dumpsite characteristics of MSW
  - Solid waste management
  - Waste Composition
  - Industrial COD Loading etc.
  - MCF
- However, these individual problems are not common to all countries.
- A certain problem with particular source/gas for Country A is not necessarily a problem for Country B.

Successful Experience (4)

What's the way forward?

- It will be useful for a country to learn how the other countries have addressed that problem.



- Let's share "success stories" on practical solutions to specific problems!!

Successful Experience (5)

We will hear successful experiences on:

- Energy: from Malaysia
- Industrial Processes: from Malaysia and the Philippines
- Agriculture (rice cultivation): from India
- LULUCF: from Malaysia, Korea and Indonesia
- Waste: from Thailand (in Session 2)

We will also hear:

- Advice from the point of view of consultants who assist developing countries in NC preparation

Successful Experience (6)

Please note:

- There can be two types of solutions.
  - Long-term solutions (e.g., conducting studies, making surveys, developing national statistics)
    - Take long time, Require solid institutional arrangements
  - Short-term (Ad hoc) solutions
    - May lead to estimates that are not as high quality as long-term solutions.
    - However, the great advantage is that such solutions could be immediately used for SNC/TNC.
- Some of successful experiences shared in this session may be considered short-term solutions.
- Long-term solutions will be further considered in Session 2 (tomorrow).

To summarize, we will hear in this session:

- Elaboration on estimation methods used in the latest GHG inventories
- Experience of key category analysis
- Successful experiences in overcoming problems

Thank you.

Now, let's start Session 1!!

GHG Inventory in Malaysia

5th Workshop on Green House Gas Inventory
6-7 September 2007

1

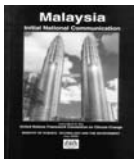
Presentation Outline

Inventory Development
- **GHG Inventory in Malaysia**
- **National Communications**
  - **Inventory of 1994 and 2000**

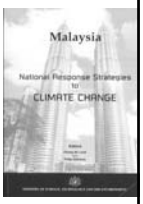
Constraints and gaps in inventory development

Improvements in the Second National Communication

GHG Inventory in Malaysia



- **Malaysia signed the United Nations Framework Convention on Climate Change (UNFCCC) on 9 June 1993 and ratified it on 17 July 1994.**



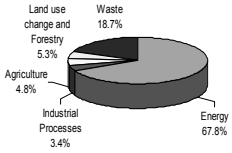
- **The national GHG inventory was established during the preparation of the Initial National Communication to the UNFCCC, which was based on 1994 database**

History of GHG Inventory

Initial National Communication

Completed and submitted in June 2000, which included:

1. **National Circumstances**
2. **Inventory of Greenhouse Gas Emissions**
3. **Environmental & Sustainable Res. Mgt.**
4. **Impacts of Climate change on Key Economic Sectors in Malaysia**
5. **Identifying Strategies to Address Issues – mitigation options**
6. **Education, Training and Public P**
7. **Research and Systematic Observ**



Current GHG Inventory

Second National Communication (proposed)

- **To be completed in Sept 2009, which covers:**
  1. **National Circumstances & Scenarios**
  2. **National Greenhouse Gas Inventory (2000)**
  3. **Measures to Mitigate Climate Change**
  4. **Assessment Vulnerability and Measures to Facilitate Adequate Adaptation to Climate Change**
  5. **Other Information relevant to Achievement of the Convention**
  6. **Constraints & Gaps; Technical & Capacity Needs**

Sub Sectors – GHG Inventory

- Energy
- Industrial Processes
- Land Use Land Change Forestry
- Waste
  - Industrial waste – Food and beverage, oil palm mills and rubber factories
  - Landfills
  - Domestic and industrial waste water
- Agriculture
  - Rice fields
  - Livestock – ruminants, pigs, chickens and horses

Constraints and Gaps in Inventory Estimation

Gaps and Constraints	Description	Potential Measures for improvement
Data Organisation	•Mismatch in sectoral detail across different published documents •Inconsistency in top-down and bottom-up data sets for same activities •Data scattered in many agencies	•Design consistent reporting formats •Design consistent reporting formats •Database for reporting raw data adopts IPCC requirements
Non-availability of relevant data	Data for refining inventory to higher tier levels	Data depths to be improved, some require data surveys
Non-accessibility of data	•Lack of institutional arrangements for data sharing – time consuming to compile data •Time delays in data access	•Establish protocols and establish effective networking with data providers •Involve industry and monitoring institutions

Constraints and Gaps in Inventory Estimation

Gaps and Constraints	Description	Potential Measures for improvement
Technical and institutional capacity needs	Training in data gathering for relevant institutions in GHG inventory methodologies and data formats	Arrange extensive training programs
Non-representative emission factor /coefficients	Inadequate data for representative emission measurements in the sectors	Conduct measurement for key categories and develop local EF

Improvements In Second National Communication

Gaps and Constraints	Description
Data Organisation	GHG Inventory assigned to lead sectoral agency • sectoral disaggregation of data for higher Tiers Consistent key categories established for each sector Centralized database is being developed
Non-availability of relevant data	Data requirements for GHG inventory would be sourced through Department of Statistics for future GHG Inventories
Non-accessibility of data	Better institutional arrangements for data sharing established

Improvements In Second National Communication

Gaps and Constraints	Improvements
Technical and institutional capacity needs	Training in planning, preparation and analysis of GHG inventory Training on data gathering for sub-sectors in GHG inventory methodologies and data formats Improvement in inventory for Energy and LULUCF sub-sectors
Non-representative emission factor/coefficients	Conduct measurement for key categories and develop local EF

Thank you

GHG Inventory in the Energy Sector and Industrial Processes

5th Workshop on GHG Inventories in Asia
(WGIA5)
6-7 September 2007

Presentation Outline

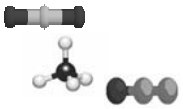
- Identification of GHG Sources
- Scope of the Inventory
- Steps Taken in Preparing the Inventory
- Data Estimation and Approach
- Key Category Analysis
- Constraints and Problem Encountered
- Further Refinement in GHG Inventory

GHG Sources

- Emissions are estimated from the following categories/sources:
  - Energy Sector
    - Fuel Combustion
    - Fugitive Emissions from Fuel (Coal Mining and Oil & Gas System)
    - Burning of biomass fuel in energy industries
  - Industrial Processes
    - Production and Consumption of Mineral products, Chemical products, Metal, Halocarbons, Sulphur Hexaflouride and other products in Malaysian industries

Identification of GHG Sources

Gases Covered:
- Carbon dioxide(CO_2)
- Methane (CH_4)
- Nitrous Oxide (N_2O)
- Hydrofluorocarbon (HFC)
- Sulphur Hexafluoride (SF_6)



- Base Year: 2000
- Guidelines: Revised 1996 IPCC Guidelines Workbook, Reference Manual and IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories

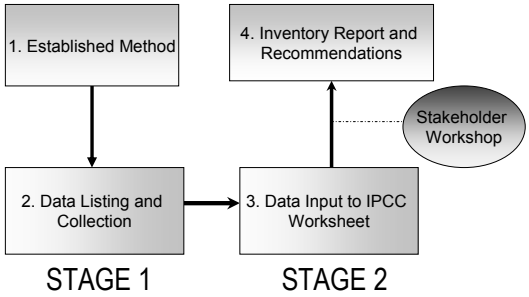
Scope of the Inventory

Sectors Covered:

i. Energy Sector (Fuel Combustion)
- Power Industry
- Transport (Road, Rail, Navigation, Aviation)
- Industry
- Residential
- Commercial
- Agriculture/Forestry/Fishery
- Others (Transformation and Military Road Transport)

ii. Industrial Processes
- Metal (Iron & Steel)
- Chemical (Ammonia, Nitric Acid, Carbide, Other petrochemical products)
- Mineral (Cement, Lime, Limestone and Dolomite)
- Consumption of Hydrofluorocarbon (HFC)
- Consumption of Sulfur Hexafluoride (SF_6)

Steps Taken in Preparing the Inventory



Established Methodology

- Review of data requirement
- Choice of methodology
- Review of methodology – Energy and Industrial Processes
- Reviews of 3 different levels of methodology
  - Tier 1, Tier 2 and Tier 3
  - Is a country specific and determined by the level of detail in the activity data available
  - Energy Sector – Tier 1 methodology was chosen as it represent the status of the data available in Malaysia
  - Industrial Processes – Tier 1 and Tier 2 were chosen as it was based on the data availability within Malaysia industry e.g. Tier 2 for Cement Production, Nitric Acid Production and Consumption of HFC and SF_6

Share of different Tiers used for GHG estimates	
Tier-I approach	96%
Tier-II approach	4%
Tier-III approach	0%

Data Listing and Collection

- Data sources – Energy and Industrial Processes
  - List down data providers
- Development of data collection method
  - List down data required
  - Initial contact with data providers
  - Follow up with written data request
    - Example: Questionnaire for Energy and Industrial Processes
- Data collection activities

Support data collection with
  - Letter explaining GHG-inventory
  - Develop GHG Inventory Brochure
  - Supporting letter from NRE
  - Follow up with telephone call, visit
- Development of GHG raw data – database
  - Excel Spreadsheet

Data Input to IPCC Worksheet

- Analyze data based on data collected
- Data input to IPCC Worksheet
  - Data collected were then inserted into the IPCC 1996 Worksheet
  - Assumptions has been made depending on the processes in the relevant industries and also in some of energy sector based on conservative approach
  - Emission Factor – default Emission Factor were used according to IPCC 1996 Guidelines
- GHG Inventory Reporting

Inventory Report and Recommendations

- Inventory report preparation
  - Contents
    - Executive Summary
    - Introduction
    - Methodology
    - Energy Sector
    - Industrial Processes
    - Uncertainties and Limitations
    - Conclusion
      - Areas of improvement and Recommendations in the preparation of GHG Inventory

Data Collection and Management for Energy Sector

Data Source

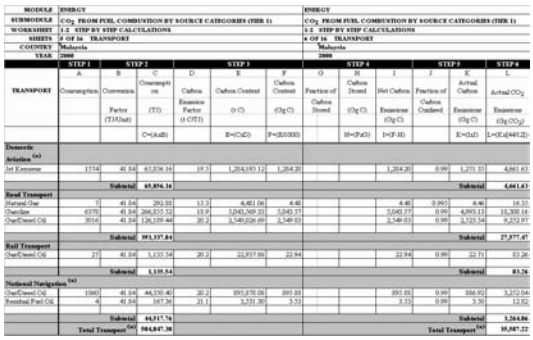
1. National Energy Balance : Secondary Data
   - which document the data on Malaysia's primary production of energy supply and final demand of energy
   - it reports a number representing a total amount of fuel use which based on fuel type
2. Primary data
   - which taken from respective agencies e.g. Malaysia Railways Limited (KTMB) and Malaysia International Shipping Corporation (MISC)
   - to fulfill the data requirement in the IPCC Worksheet e.g. Transport – Road, Rail, Navigation, Aviation

Data Estimation and Approach in Transport Sector

- Proportion of data based on the following percentage
- The proportion is based on the complete data set of segregation of fuel from the oil supplier

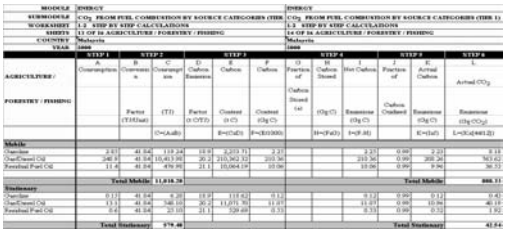
Transport Sub-sector	Percentage (%)				
	Diesel	Petrol	Natural Gas	Jet Kerosene	Residual Fuel Oil
Road	74%	100%	100%		
Rail	1%				
National Navigation	25%				100%
Domestic Aviation				100%	

IPCC Worksheet: Transport Sector



Data Estimation and Approach in Agriculture Sector

•Assumptions
- Stationary: 5%
- Mobile: 95%
- Based on discussion with Ministry of Agriculture
- Data Source: National Energy Balance Report



Data Collection and Management for Industrial Processes

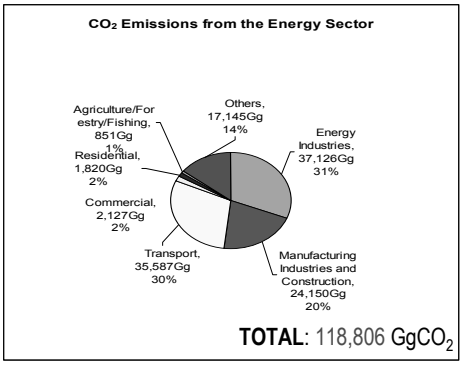
Data Estimation and Approach - Nitric Acid Production (N_2O Emission)

- Nitric Acid Production: 75,392 tonnes
- **Emission factor**: 8.79 kg N_2O/t HNO_3 (actual measurement)

MODULE	INDUSTRIAL PROCESSES
SUBMODULE	NITRIC ACID PRODUCTION
WORKSHEET	2-7
SHEET	1 OF 1 N_2O AND NO_x EMISSIONS
COUNTRY	Malaysia
YEAR	2000

A Amount of Nitric Acid Produced (t)	B Emission Factor (kg pollutant/t nitric acid produced)	C Pollutant Emitted (kg)	D Pollutant Emitted (Gg)
		C = (A x B)	D = C/1 000 000
75,392	N_2O 8.79	662,695.68	N_2O 0.66
	NO_x	0.00	NO_x 0.00

Key Category Analysis – Sectoral Approach



TOTAL: 118,806 $GgCO_2$

Key Category Analysis – Energy Sector

Sources	2000					
	CO_2		CH_4		N_2O	
Categories	Gg	%	Gg	%	Gg	%
Total National Emissions	**168,037**		**1,202.21**		**0.69**	
Energy Sector	**133,529**		**1,198**		**0.03**	
1. Reference Approach	133,529					
2. Sectoral Approach	118,806	100				
a. Energy Industries	37,126	31				
i. Autoproducers	1,799	5				
ii. Power	35,327	95				
b. Manufacturing Industries and Construction	24,150	20				
i. Manufacturing	17,790	74				
ii. Mining	268	1				
iii. Construction	6,092	25				
c. Transportation	35,587	30				
i. Road	27,577	78				
ii. Rail	83	0.2				
iii. Aviation	4,662	13				
iv. Navigation	3,265	9				

Key Category Analysis – Energy Sector

Sources	2000					
	CO_2		CH_4		N_2O	
d. Other Sectors	4,797	5				
i. Residential	1,820	38				
ii. Commercial	2,127	44				
iii. Agriculture	904	17				
iv. Fisheries	39	0.8				
v. Forestry	8	0.2				
e. Others	17,145	14				
i. Gas Transformation and Losses	17,102	99				
ii. Military Road	43	0.3				
a. Fugitive Emissions from Fuel			1,198	100		
i. Coal Mining and Handling			0.28	1		
ii. Oil and Gas System			1,197	99		
b. Emission from Biomass Fuels					0.03	100

Key Category Analysis – Industrial Processes

Sources	2000					
	CO_2		CH_4		N_2O	
Industrial Processes	**17,254**	**100**	**4.21**	**100**	**0.66**	**100**
a. Mineral Products	9,670	56				
i. Cement Production	6,617	68				
ii. Lime Production	153	2				
iii. Limestone and Dolomite Use	2,901	30				
b. Chemical Industry	1,192	7	4.21	100	0.66	100
i. Ammonia Production	1,176	99				
ii. Nitric Acid Production					0.66	100
iii. Carbide Production	16	1				
iv. Petrochemicals			4.21	100		
c. Metal Production	6,392	37				
i. Iron and Steel Production						

Key Category Analysis – Industrial Processes

Sources	HFC		SF_6	
Categories	Gg	%	Gg	%
Total National Emissions	0.2	100	0.02	100
Industrial Processes	0.2	100	0.02	100
a. Consumption of HFC 134a for Mobile Air Conditioning (MAC)	0.2	100		
b. Consumption of SF_6			0.02	100

Key Category Analysis – Results

Sectors		Emissions (Gg) A	GWPs B	CO_2 Equivalent (Gg) C=(A x B)
Energy	CO_2	133,529	1	133,529.00
	CH_4	1,198	21	25,158.00
	N_2O	0.03	310	9.3
Sub total				*158,696.30*
Industrial Processes	CO_2	17,254	1	17,254.00
	CH_4	4.21	21	88.4
	N_2O	0.66	310	204.6
	HFC	0.2	1,300	260
	SF_6	0.02	23,900	478
Sub total				*18,285.00*
Total Emissions				176,981.30
Net Total (excluding HFC and SF_6)				176,243.30

Constraints and Problems Encountered in Inventory

Constraints and Problems	Description	Strategy and Measures
Data Organisation	• Mismatch in sectoral detail across different published documents • Inconsistency in top-down and bottom-up data sets for same activities	• Survey done to organise the data • Assumptions was made based on most accurate published documents • Verification with related sources • Explanatory note for the inconsistency in the reporting
Non-availability of relevant data	Data for refining inventory to higher tier levels	-Questionnaire were prepared and survey was done in respective agencies -Conservative approach was used to estimate the data
Non-accessibility of data	• Lack of institutional arrangements for data sharing – time consuming to compile data • Time delays in data access • Proprietary data for inventory reporting at Tier II and Tier III level	• Establish protocols and establish effective networking with data providers • Create more awareness activity • Involve industry and monitoring institutions

Constraints and Problems Encountered in Inventory

Constraints and Problems	Description	Strategy and Measures
Technical and institutional capacity needs	•Discussions and meetings with certain organisation in identifying data needs •Training the specific institutions in GHG inventory methodologies and data formats	▪Series of discussions and meetings were held ▪Arrange extensive training programs
Non-representative emission factor/coefficients	Inadequate data for representative emission measurements in the sectors	Conduct measurement for key categories in future
Resources to sustain national communication effort esp. in energy sector	Sustain and enhance research networks established under Initial and second National Communications	▪Regular Updates are required to ensure sustainability of GHG Inventory (e.g. 2001 – 2005 Inventory Exercise) ▪Dedicated source of funding i.e. NRE

Further refinement in GHG Inventory

1. Continuous and improved networking with stakeholders
2. QA/QC for inventory development
3. Developing emission factors representing Malaysian conditions
4. On-line data collection to facilitate data submission

Thank You

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43650 Bangi
Selangor
Website: www.ptm.org.my
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Greenhouse Gas (GHG) Inventory of Land Use, Land-Use Change and Forestry (LULUCF) Sector in Malaysia

Forest Research Institute of Malaysia (FRIM)
52109 Kepong, Selangor.

Methodologies

- The IPCC (1996) and Good Practice Guidance (2000) used
- Key categories are:
  - Changes in forest and other woody biomass stocks
  - Forest and grassland conversion
  - Abandonment of croplands, pastures, plantation forests or other managed lands
  - CO_2 emissions and removal from soils

Key Categories

- CO_2 Sinks
  - Forest ecosystems
  - Plantation forest
  - Plantation industry (oil palm and rubber)
  - Non-forest trees
  - Abandoned managed lands
- CO_2 Sources
  - Commercial harvest
  - Forest conversion

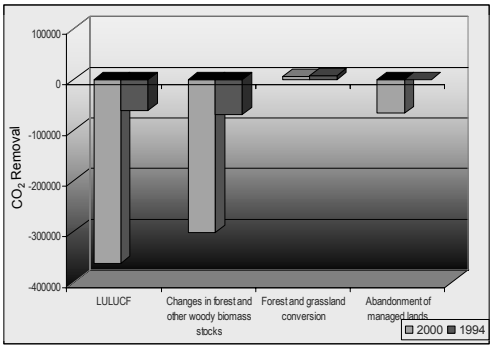
Development Data Inventory of NC2-Sink

- Key categories
  - Comprehensive classification
- Detailed categories/ sub-categories
  - Forest types/ stratas
  - Plantation species
  - Non-forest trees
  - Abandonment of Managed Lands
- Annual growth rate
  - National data
  - IPCC default data

Development Data Inventory of NC2-Source

- Harvest categories of commercial roundwood
  - Heavy hardwood; medium hardwood; light hardwood; other species
- Annual forest conversion
  - Area converted for development and agricultural purposes
- Accuracy of assumptions
  - ✓ Commercial harvest
  - ✓ Forest conversion
  - ✓ Biomass before/ after conversion
  - ✓ Estimation of biomass burned on site/ off site
  - ✓ Carbon fraction of aboveground biomass
- Consistency
  - ✓ 10 years average

Result Comparison between INC and NC2



- Signs for uptake are always (-) and for emissions (+).

Overestimation?

- Data inventory
  - Forest ecosystems
  - Plantation forest
  - Plantation industry (oil palm and rubber)
  - Non-forest trees
- Improved estimation and comprehensive approach
  - Tier 1 & 2
  - Good Practice Guidance (GPG) estimation methods
- Annual Growth Data
  - National average data (10 years or more)
  - Local/ regional data
  - Default data
- Forest conversion
  - Higher conversion estimation (source by Forestry Department)
  - Consistency and accuracy
  - 10 years data availability
- Abandoned managed lands
  - Additional inclusion/ increase of CO_2 accumulation

Sectoral Summary Report

Good Practice Guidance (GPG2003) Characteristics

- Adequate approach
  - representing carbon stock changes and GHG emissions and removals
  - Relations between land use and land-use changes
  - Improved key categories
- Consistent
  - Representing management and land-use change consistently over time
- Complete
  - All land area included
- Transparent
  - Data sources, definitions, methodologies, and assumptions clearly described
  - Reduced uncertainty
- Efficiency
  - Quality assurance and control

Capacity building

- Consultative Workshops
  - Data requirement and identification of key categories
  - Verification and validation of results
- Hands-on training
  - Trained data provider
- Consultative visits

  11 visits to FDs PM, Sabah and Sarawak
- Working Group meetings
  - 9 meetings

Conclusion

- Comprehensive inventory
- Improved methodological approach
- Validation & verification of results
- Continue and further improve on inventory
- Initiate national trend analysis

Acknowledgement

Ministry of Natural Resources and Environment (NRE)
Forestry Department Peninsular Malaysia
Sabah Forestry Department
Forest Department Sarawak
Department of Agriculture Peninsular Malaysia
Department of Agriculture Sarawak
Department of Agriculture Sabah
Malaysian Palm Oil Board (MPOB)
Malaysian Rubber Board
Universiti Putra Malaysia (UPM)

KOREA FOREST RESEARCH INSTITUTE

5th Workshop on GHG Inventory in Asia

Overview of present GHG Inventory on LULUCF Sector in Korea

Jeongho SEO, Kyeonghak LEE, Raehyun KIM
Korea Forest Research Institute

6-8. Sept. 2007
Kuala Lumpur, Malaysia

Contents

Background

Land Use and Forestry

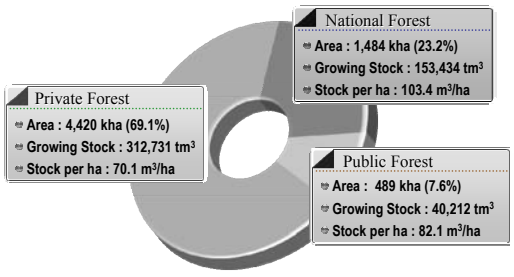
- **Major land use : 65% of total land area**
- **Location in warm temperate zone**
- **Heterogeneity in site, species, ownership and function**
- **Slow decrease of forest land : 0.1% annually**
- **Rapid increase of growing stock : 3% annually**
- **Immature stage**
- **Low economic efficiency of timber production**
- **Increasing demands for environmental services**

Statistics

Trend in Land Use Pattern

Land Use	1965	1975	1985	1995	2005
Total (kha)	9,843	9,880	9,922	9,927	9,965
Forest	67.2%	67.2%	65.8%	65.0%	64.2%
Agriculture	22.9%	22.7%	21.6%	20.0%	20.2%
Other	9.9%	10.2%	12.6%	15.0%	15.6%

Status of Forest Lands by Ownership(2005)



Status of Forest Lands by Forest Type (2005)

Coniferous Forest
- Area : 2,698 kha (43.3%)
- Growing Stock : 216,660tm³
- Stock per ha : 80.3 m³/ha

Broad-leaved Forest
- Area : 1,659 kha (26,6%)
- Growing Stock : 136,451 tm³
- Stock per ha : 82.2 m³/ha

Mixed Forest
- Area : 1,874 kha (30.1%)
- Growing Stock : 153,264 tm³
- Stock per ha : 81.8 m³/ha

GHG Inventory (2nd NC)

GHG Inventory (2nd NC)

Major Indicators of Greenhouse Gas

- Average annual GHG growth rate('90~'03) : about 5%

Classification		1990	1995	2000	2002	2003	Average Annual Growth Rate(%)
Category	Unit						
Total GHG Emissions	$MtCO_2$	**310.6**	**452.8**	**528.6**	**569.3**	**582.2**	**5.0**
GDP	Billion Won	320,696	467,099	578,665	642,748	662,655	5.7
GHG/GDP	tCO_2 per Million Won	0.968	0.969	0.964	0.886	0.879	-0.7

GHG Emissions & Removals Trend by Source

Classification	1990	1995	2000	2002	2003	Average Annual Growth Rate(%)
Total Emissions	310.6 (100%)	452.8 (100%)	528.6 (100%)	569.3 (100%)	582.2 (100%)	5.0
Energy	247.7 (79.8%)	372.1 (82.2%)	438.5 (83.0%)	473.0 (83.1%)	481.4 (82.7%)	5.2
Industry	19.9 (6.4%)	47.1 (10.4%)	58.3 (11.0%)	64.5 (11.3%)	69.6 (12.0%)	10.1
Agriculture	17.5 (5.6%)	17.8 (3.9%)	16.2 (3.1%)	15.8 (2.8%)	15.5 (2.7%)	-0.9
Waste	25.5 (8.2%)	15.7 (3.5%)	15.6 (3.0%)	16.0 (2.8%)	15.6 (2.7%)	-3.7
Land-Use Change & Forestry (Sinks)	**-23.7**	**-21.2**	**-37.2**	**-33.4**	**-33.3**	2.6
Net Emissions	286.8	431.5	491.4	535.9	548.9	5.1

GHG Inventory on LUCF

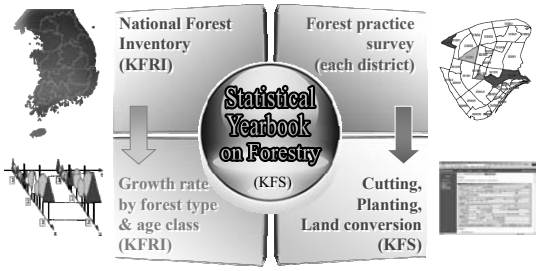
Introduction

Based on 1996 Guideline

Categories

- Changes in Forest & Woody Biomass Stocks
- Forest & Grassland Conversion – CO_2 from Biomass
- Change in Soil Carbon for Mineral Soils
- On-Sire Burning of Forest
- Abandonment of Managed Lands

Methodology



Process

CO_2 Emissions on LUCF(2005, 3rd NC)

Net CO_2 Removals in Forests

Forest Type	Net * increment of stem volume (km^3)	Oven** dried specific gravity (tdm/m^3)	Net increment of stem biomass (ktdm)	Ratio *** of above ground biomass to stem biomass	Ratio *** of total biomass to above ground biomass	Net increment of total biomass (ktdm)	**** Carbon conversion factor	Net carbon removals (GgC)
	A	B	C=AxB	D	E	F=CxDxE	G	H=FxG
Coniferous	11,152	0.47	5,241	1.29	1.28	8,654	0.5	4,327
Broadleaf	8,486	0.80	6,789	1.22	1.41	11,678	0.5	5,839
Total	19,638		12,030					10,166

* Statistical Yearbook on Forestry, FA, 2006
** Wood properties and uses of major tree species growing in Korea, Forestry Research Institute, 1994
*** "Analysis of studies on production of forest biomass in Korea", Journal of KFE 8(2), 1988
**** Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook, IPCC, 1996

CO_2 Emissions from Harvest

Forest Type	* Commercial harvest (km3)	** Above ground biomass expansion factor (tdm/m3)	Above ground biomass removed in commercial harvest (ktdm)	* Fuel wood consumption (ktdm)	Above ground biomass consumption (ktdm)	*** Ratio of total biomass to above ground biomass	Total biomass consumption (ktdm)	**** Carbon conversion factor	Total carbon emissions (GgC)
	A	B	C=AxB	D	E=C+D	F	G=ExF	H	I=GxH
Conif.	1,660	0.71	1,179		1,179	1.28	1,509	0.5	755
Brd.	690	1.15	793	150	943	1.41	1,330	0.5	665
Total	2,350		1,972		2,122		2,839		1,420

* Statistical Yearbook on Forestry, FA, 2006
** B = Conversion factor of log to stem volume (1/0.85) x Oven dried specific gravity x Ratio of aboveground biomass to stem biomass
*** "Analysis of studies on production of forest biomass in Korea", Journal of KFE 8(2), 1988
**** Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook, IPCC, 1996

Forest Conversion - CO_2 emissions from Woody biomass

Before Conversion	After Conversion (kha)	Conversion area (kha)	Density change (t/ha)	Biomass loss (kt)	Portion of on-site	Biomass decayed (kt)	Carbon emissions (kt)
Coniferous	Cropland	0.261	36	9	0.6	6	3
	Grassland	0.080	41	3		2	1
	Others	2.423	51	124		74	37
Broadleaf	Cropland	0.110	78	9		5	3
	Grassland	0.034	83	3		2	1
	Others	1.020	93	95		57	28
Mixed	Cropland	0.124	57	7		4	2
	Grassland	0.038	62	2		1	1
	Others	1.148	72	83		50	25
Non-stocked	Cropland	0.185	-12	-2		-1	-1
	Grassland	0.057	-7	0		0	0
	Others	1.722	3	5		3	2
Total				337		202	101

Change in Soil Carbon from Mineral Soil

Land Use	Soil Carbon (MgC/ha)	Land Area (1981) (Mha)	Land Area (2001) (Mha)	Soil Carbon (1981) (Tg)	Soil Carbon (2001) (Tg)	Annual Net Emissions (Mg/y)
Cropland	106.4	2.144	1.824	117.8	99.9	896
Forest	67.9	6.531	6.394	443.5	434.2	465
Others	11.5	1.239	1.744	14.2	20.1	-890
Total		9.914	9.962	575.5	554.2	1,071

Carbon Emissions from Liming of Agricultural Soils

Type of lime	Total annual amount of Lime (Mg)	Carbon Conversion Factor	Carbon Emissions from Liming (MgC)
Limestone $Ca(CO_3)$	293	0.120	35

Carbon Flux in Forests

Categories of GHG emissions/removals	Emissions	Removals	Net emissions/ removals
	(Mg)		
Total	**2,625**	**(-)11,586**	**(-)8,960**
A. Changes in Forest & other Woody Biomass Stocks	1,420	(-)11,856	(-)10,166
B. Forest & Grassland Conversion	101	0	101
C. Abandonment of managed Lands	NE	NE	NE
D. Changes in Soil Carbon for Mineral Soil	1,105	0	1,105
E. others	NE	NE	NE

IPCC GPG 2003 (LULUCF)

IPCC GPG Implementation in LULUCF

GPG2003 : expert review

- Korean edition publication & preliminary applicability analysis

Definitions : ???

- "Forest", "Managed forests" → various definitions

Identification of Lands

- Relevant digital thematic maps and records
  - ***Maps : forest type, compartment, forest function, land-use register,*** *and so on*
  - ***Records(DB): practices, reforestation, deforestation, forest fire***
- Land-use categorization, Land-use matrix : ???

Estimation of Emissions and Removals

- Inaction of New National Forest Inventory System (2006)
  - ***Systematic sampling (4 x 4km grid) : total 4,000 sample plots***
  - ***Every 5 year : 800 sample plots per year***
- Biomass Expansion Factors and Other Coefficients
  - ***more data needed for precision and subdivision***

Cross-Checking

- Satellite image, LiDAR (?)

→ *Related researches on National Forest GHG Inventory System and Emission Factors are being carried out (2006~)*

5th National Forest Inventory

Overview of National Forest Inventory

The NFI began from 1972 with 10 year interval

- 1st NFI (1972-1974), 2nd NFI (1978-1980), 3rd NFI (1986-1992), 4th NFI (1996-2005)
- 5th NFI (2006-2010) : turning point to change inventory system

Rationale for change the Inventory System

- Increasing demands of reliable forest statistics
  - SFM, FAO, KP under UNFCCC etc.

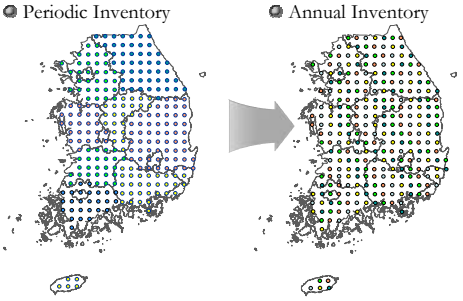
5th National Forest Inventory

Summary of changes

- Survey cycle is 5 years (10 years in past NFI)
- Re-measurements for ground plots every 5 years
- New systematic layout of 4,000 permanent plots(4x4km)
- Cluster sampling with 4 subplots
- New measurement variable
  - biodiversity, forest health, biomass, carbon stock, etc
- Interagency collaboration
  - KFS, KFRI & Forest Cooperatives Federation

Inventory cycle

- Periodic Inventory
- Annual Inventory



- 5 Panel System

Researches of KRFI

Overview of researches

Development of Forest Carbon Inventory System on UNFCCC (2002~2005)

Research for Development of Forest Biomass Map (2006)

Analysis of Forest Management Effect on Forest Carbon Stock (2007~2009)

Study on the Basis of Forest Carbon Accounting in Korea (2007~2010)

- Integration of Forest Carbon Accounting System
- Development of BEF & CCF for Korean 12 Tree Species
- Analysis of the Potential Carbon Credit of Korea
- Analyze new Guideline : AFOLU 2006

Current Results of KFRI on UNFCCC & KP

CarbonTree Calculator (2006)

- Purpose : the PR of research results & importance of forest

CarbonTree Calculator educational version (2006)

- Purpose : Application as a study material at science class

Biomass Expansion Factor for Korean 8 Tree Species (2005)

Development of Equations to Estimate Forest Biomass (2005)

Forest Carbon Inventory System on UNFCCC (2005)

Lessons

Uncertainty & Complexity (vs. Energy)

Constraints for policy makers to take action

- **Role of Forest Carbon Sinks**
  - Dynamic and heterogeneous ecosystem
  - Potential reversibility with global warming (?)
- **Negotiation**
  - At present, only for 1st CP, ? for Post-2012
- **GHG Inventory and Carbon Accounting**
  - GPG2003, many decisions and documents only for LULUCF
- **Relationships with Relevant International Organizations/ Agreements**
  - UNFCCC, CBD, UNCCD, …

Lack of Resources for GPG2003(vs.1996GL)

Constraints to prepare an accurate and complete reporting

- **Land-Use Matrix with 6 Categories**
- **All Carbon Pools and Non-CO_2 Gases**
- **Linkage of Biomass and Soil Carbon Pools**
- **Definitions and Geographical Information**
- **Harvested Wood Products (potentially)**
- **Uncertainty and QA/QC**

→ ***Need additional significant efforts***
(data, information, technology, capacity building, etc)

Recent Development on Korea's Inventories with regard to Waste

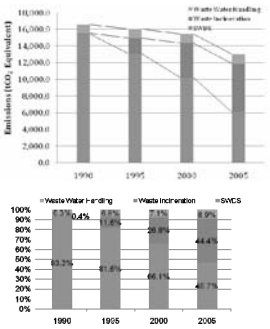
Byong-Bok Jin, Cheon-Hee Bang
Environmental Management Corporation, Korea

GHG Emission from Waste Sector

(Unit : tCO_2 Equivalent)

Year	SWDS	Waste Incineration		Waste Water Handling		Total
	CH_4	CO_2	N_2O	CH_4	N_2O	tCO_2
1990	15,469.3	46.6	21.3	78.3	962.1	16,578.1
1992	17,244.7	149.6	37.8	96.6	940.9	18,469.4
1993	14,220.4	93.5	41.1	97.6	931.0	15,383.5
1994	16,294.7	872.3	115.5	125.9	931.0	18,339.2
1995	13,102.1	1,694.7	162.4	138.2	958.8	16,056.3
1996	14,164.7	2,102.5	166.8	94.3	968.0	17,496.2
1997	13,505.8	2,028.0	183.7	90.9	977.5	16,786.0
1998	11,275.7	2,308.2	179.7	81.2	995.9	14,840.5
1999	11,656.0	3,032.7	207.5	120.3	1,003.6	16,020.0
2000	10,221.2	3,883.4	260.7	91.0	1,012.7	15,468.9
2001	9,676.7	4,699.6	265.8	104.2	983.8	15,729.6
2002	9,795.1	4,594.0	255.9	113.0	988.2	15,746.5
2003	9,309.7	4,687.1	271.0	114.0	994.4	15,376.2
2004	8,386.0	5,086.4	242.4	120.0	1,030.0	14,864.7
2005	**6,095.5**	**5,588.0**	**200.9**	**123.7**	**1,034.4**	**13,042.3**

Note) The above value is estimated by Tier 1 method



Solid Waste Disposal on Landfill

Plan to estimate the emissions of landfill gas the following,

- Methodology (IPCC GPG 2000, First Order Decay)

CH_4 emissions (t/yr) = Σ [(A • k • $MSW_T(X)$ • $MSW_F(X)$ • $L_O(X)$ • $e^{-k(t-x)}$) – R] • (1 – OX)

t = year of inventory

x = years for which input data should be added

A = (1 – e^{-k}) / k ; normalization factor which corrects the summation

k = Methane generation rate constant (1/yr)

MSW_T (x) = Total municipal solid waste (MSW) generated in year x (t/yr)

MSW_F (x) = Fraction of MSW disposed at SWDS in year x

L_0 (x) = Methane generation potential (t CH_4 / t waste)

R = Recovered CH_4 in inventory year t (t/yr)

OX = Oxidation factor (fraction)

Solid Waste Disposal on Landfill

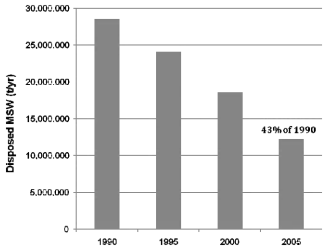
- Recent Landfill of Korea (2005)

Type of Site	Landfill (Open)			Landfill (Closed)		
	MSW	Industrial Waste	Hazardous Waste	MSW	Industrial Waste	Hazardous Waste
Total	**1,616**					
Subtotal	**271**			**1,345**		
Managed SWDS	231	26	13	198	49	33
Unmanaged SWDS	1	0	0	1,065	0	0

Solid Waste Disposal on Landfill

- Amount of MSW disposed at SWDS

Year	Amount of MSW disposed at SWDS (ton/yr)
1990	28,508,690
1991	30,079,891
1992	31,780,185
1993	26,207,000
1994	27,840,302
1995	23,998,239
1996	25,493,389
1997	27,031,389
1998	14,399,546
1999	19,474,502
2000	18,547,220
2001	19,139,469
2002	19,579,914
2003	17,667,825
2004	15,035,044
2005	12,145,193



Ref. : National Waste Statistics (Ministry of Environment, Korea)

Solid Waste Disposal on Landfill

- Parameters Determination

1	Methane generation potential (L_0)	$MCF \times DOC \times DOC_F \times F$ (t CH_4/t Waste)		
		Parameters	Values	Remark
		MCF	1.00	(Methane Correction Factor) 1: anaerobic, 0 : aerobic
		DOC	Calculation	(Degradable organic carbon) :
		Food waste(%) **0.114**, Paper(%) **0.320**, Wood(%) **0.366** etc		
		DOC_F	0.55	(Fraction of DOC dissimilated) : IPCC GPG(2000) default value
		F	0.50	(Fraction by volume of CH_4 in landfill gas) : IPCC GPG(2000) default value
		16/12	-	Conversion from C to CH_4
2	R(=0.13)	Recovered CH_4(t/yr) : 'Surveying GHG emissions from waste, Ministry of Environment, 2000'		
3	OX(=0.10)	Oxidation factor(fraction) : IPCC GPG(2000) default value		

- DOC is calculated from 'National Waste Statistics, Ministry of Environment, 1996'

Solid Waste Disposal on Landfill

- Process for k-value estimation

  - Selecting objective landfills for measuring CH_4 emissions

    (In 2007, measuring in Ansung and Gapyung landfill)

  - Estimate k-value using the fortran program of trial-error method

    (Program is made from 2002 by EMC)

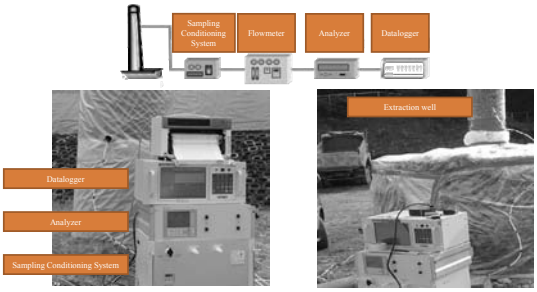
Solid Waste Disposal on Landfill

- Measurement System

Type	Measurement Method
Extraction well	- Measurement Method : Non-dispersive infrared absorption - Measurement Time : 24hour (continuously) per each well
Landfill Surface	- Sampling : Static Chamber Method (Chamber→Filter→Pump→Gauge→Analyser→Data Logger) - Measurement Method : Non-dispersive infrared absorption - Measurement Time : 3 times per each site ×2 hour per day

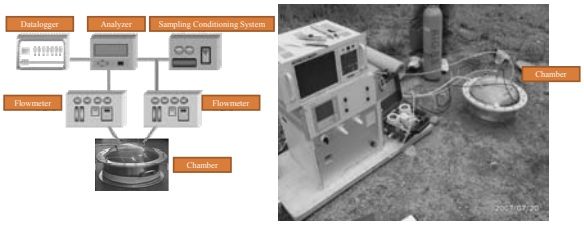
Solid Waste Disposal on Landfill

- Measurement System (Extraction well)



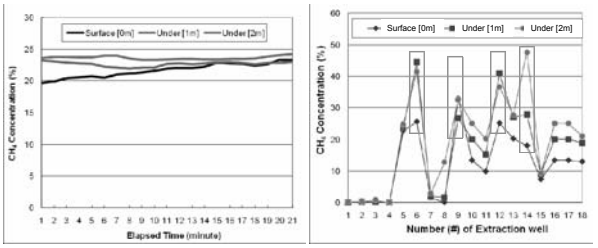
Solid Waste Disposal on Landfill

- Measurement System (Landfill Surface)



Solid Waste Disposal on Landfill

- CH_4 Concentration at Extraction well (For Ansung Landfill)

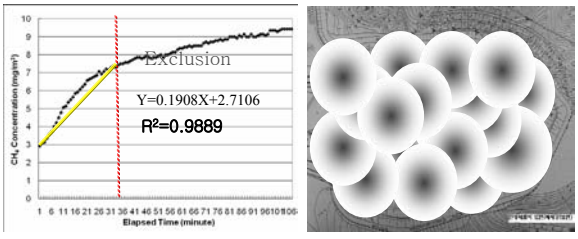


Well #5 of Ansung landfill

: reversed concentration by depth
: large concentration difference by depth

Solid Waste Disposal on Landfill

- CH_4 Concentration at Landfill Surface (For Ansung Landfill)



Estimation to Section R^2>0.95

high low

Solid Waste Disposal on Landfill

- Result of k-value estimation (For Ansung landfill)

	Measuring Depth (Extraction Well)	Total Emission (ton/year)	k value	IPCC default
Ansung landfill	Surface [0m]	255.6328	**0.080**	0.02 - 0.2
	Under [1m]	355.7603	**0.131**	
	Under [2m]	422.3432	**0.184**	

Solid Waste Disposal on Landfill

- Estimated Emission using k value

Landfill name	k value	2002	2003	2004	2005	2006	2007
Ansung landfill	**0.080**	30.012	115.429	208.842	250.820	253.498	255.970
	0.131	47.929	182.138	323.127	376.133	365.024	355.279
	0.184	65.605	246.340	428.535	483.374	450.145	422.500

Waste Incineration

- Methodology (IPCC GPG 2000) (Targeting Tier 2)

CO_2 emissions (t/yr) = Σ (IW • CCW • FCF • EF • 44/12)

IW = Amount of incinerated waste (t/yr)

CCW = Fraction of carbon content in waste

FCF = Fraction of fossil carbon in waste

EF = Burn out efficiency of combustion of incinerators for waste (fraction)

N_2O emissions (t/yr) = Σ (IW • EF • 10^{-6})

IW = Amount of incinerated waste (t/yr)

EF = Aggregate N_2O emission factor for waste (g N_2O/ t)

Waste Incineration

- Recent Waste Incineration of Korea (2005)

	Total	Type of Technology					
		Subtotal	**Stoker**	Fixed bed	Fluidized bed	Decomposition	Other
Total	**310**	**230**	**121**	90	5	7	7

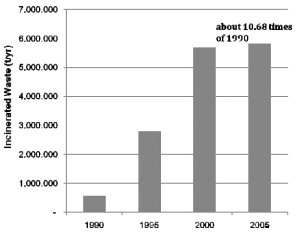
	Total	Type of incineration				Waste Treatment Corp.
		Subtotal	**Continuous**	Batch	Semi-continuous	
Total	**310**	**230**	**60**	147	23	80

• Model incinerator : Stoker-Continuous type incinerating MSW of 300 t/day (Operated by EMC)

Waste Incineration

- Amount of Incinerated Waste

Year	Amount of incinerated waste
1990	544,945
1991	546,456
1992	1,045,360
1993	921,628
1994	2,166,859
1995	2,778,745
1996	3,368,804
1997	3,492,221
1998	3,765,982
1999	4,486,385
2000	5,673,998
2001	6,159,302
2002	6,127,000
2003	6,320,194
2004	6,280,008
2005	5,818,465



Ref. : National Waste Statistics (Ministry of Environment, Korea)

Waste Incineration

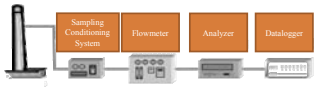
- Parameters Determination

Parameter	MSW component (%)					
	Food waste	Paper, Nappies	Wood	Textiles	Plastics	Incombustibles
Composition Data	27.2	37.1	3.7	6.9	20.7	4.4
Carbon Content in Waste (CCW)	47.3	52.1	51.0	52.6	78.7	-
Fraction in Fossil Carbon (FCF)	-	1	-	20	100	-
Burn out efficiency of combustion of incinerators (EF)	100					

Note) 1. Management data of model incinerator on June~August
2. FCF , EF use 2006 IPCC default

Waste Incineration

- N_2O Measurement System

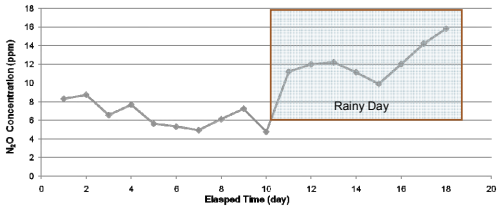


Sampling | Flowmeter | Measurement System

Waste Incineration

- N_2O Emission Concentration of Waste Incineration

Measuring Day	N_2O Concentration (ppm)	Incinerated Waste (ton/day)	Flow (m^3/day)
18	9.09 (4.75 ~ 15.82)	238.325 (212.085 ~ 267.345)	1,898,004 (1,660,934~2,204,194)



Waste Incineration

- Emission Estimation

Greenhouse gas	Amount of Incinerated Waste (ton/day)	Emission Factor	Emissions (t/yr)
CO_2	238.325	0.512 (t CO_2/t)	37,568.16
N_2O	238.325	135.431 (g N_2O/t)	12.544

Future Planning

- Solid Waste Disposal on Landfill (SWDS)
  - Expansion of landfills to measure according to IPCC guidelines up to 2012
  - Decision of standard operating procedure (SOP) for measuring landfill gas
  - Estimation of greenhouse gas as to Tier 2 (First Order Decay) up to 2012
- Waste Incineration
  - Expansion of waste incineration to measure according to incineration type or technology up to 2012
  - Estimation of greenhouse gas as to Tier 2 up to 2012

Chinese Second National Communication (SNC) GHG Inventory of Waste Sector

Gao Qingxian

Chinese Research Academy of Environmental Science (CRAES)

Contents

- Current GHG Emissions in China
- The review of waste sector in INC of China
- The preparation of waste sector in SNC of China
- Discussion

Current GHG Emissions in China

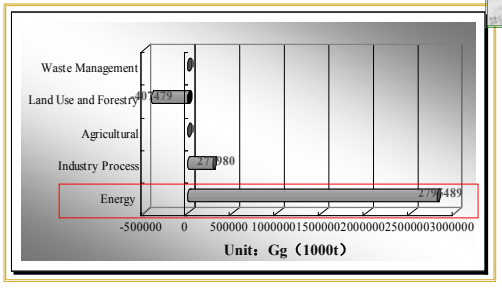
- According to the ***Initial National Communication on Climate Change of the People's Republic of China***, The national total amount of carbon dioxide emission in 1994 was 3,073 million tons, and carbon sink from land-use change and forestry was about 407 million tons. The net carbon dioxide was 2,666 million tons, and the per capita emission was about 0.6 ton carbon per year.

Current GHG Emissions in China

- **The total GHG in China in 1994 was 3650 million tons of carbon dioxide equivalent, of which carbon dioxide, methane and nitrous oxide account for 73.05%, 19.73%, and 7.22% respectively.**

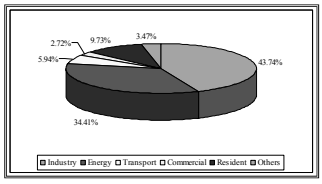
Current GHG Emissions in China

The GHG Emission in different sectors of China (1994)

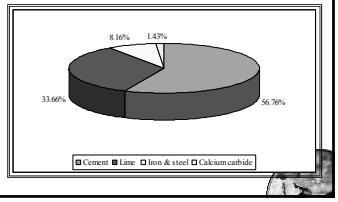


Current GHG Emissions in China

The CO_2 emission from energy sector was 2795 million tons in 1994.

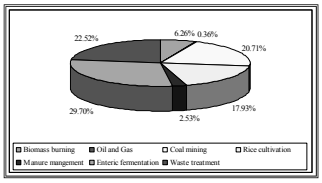


The CO_2 emission from industrial process was 278 million tons in 1994

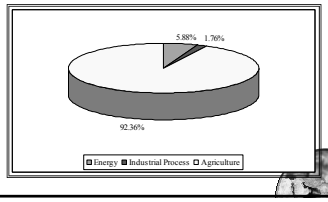


Current GHG Emissions in China

The methane emission was about 34.29 million tons in 1994



The nitrous oxide emission was about 850,000 tons in 1994.



Current GHG Emissions in China

According to tentative estimates by experts from China, China's total GHG emission in 2004 is about 6,100 tCO_2e (5,600 million tons of net emissions), of which 5,050 million tons of CO_2, 720 million tCO_2e of CH_4 and 330 million tCO_2e of N_2O.

The review of waste sector in INC of China

EQUATION I

Methane emissions (Gg/yr)

=

$$(MSW_T \times MSW_F \times MCF \times DOC \times DOC_F \times F \times 16/12 - R) \times (1\text{-}OX)$$

Methane Emissions (Gg/yr)
MSW_T = Total production of MSW(Gg/yr)
MSW_F = The Ratio of treatment of MSW(%)
MCF = The methane correction factor
DOC = The Degradable Organic Carbon
DOC_F = The ratio of DOC in MSW
F = the ratio of methane in landfill gases(default value =0.5)
R = reused amount of methane (Gg/yr)
OX = oxidation factor(default value = 0)

The review of waste sector in INC of China

- The default method will give a reasonable annual estimate of actual emissions if the amount and composition of deposited waste have been constant or slowly varying over a period of several decades. If the amount or composition of waste disposed of at SWDS is **changing more rapidly over time**, however, the IPCC default method will not provide an accurate trend. For example, if there is a reduction in the amount of carbon deposited at SWDS, the default method will underestimate emissions and overestimate reductions.

IPCC Good Practice Guidance

The review of waste sector in INC of China

- **Population Statistics Data**
- **Data of MSW Generation Rates**
- **The Disposed Rate of MSW to SWDSs**
- **The analysis Composition of MSW**
- **The Degradable Organic Carbon (DOC) Content of Waste**
- **Categories of Waste Disposal Sites**
- **Other Default Values Recommended by IPCC**

Total generation of MSW (Gg/yr)

For developing countries and countries with economies in transition, the population data may be the total urban population only, because the rural population is assumed to dispose of waste in such a way that CH_4 emissions are extremely low. **(revised 1996 IPCC Guidelines)**

P_T: Total population
P_C: Population in the City
P_R: Population in rural area
P_E: immigrated people in the City

The survey shows that there are about 70 million people from rural areas who worked in urban areas in recent 10 years

MSW_T

Revised 1996 IPCC Guidelines:
Total MSW can be calculated from Population (thousand persons) x Annual MSW generation rate (Gg/thousand persons/yr).

Weigh(metage)

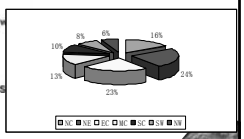
Carrying Amount

Visual

But In China, we have The Municipal Construction Statistics Yearbook, in which have carrying amount and disposal percentage of municipal waste.

Categories of Waste Disposal Sites:

1. Northeast
2. Northwest
3. North of China
4. East of China
5. South of China
6. Southwest
7. Middle of China



The Carrying Amount of Waste in 7 Regions of 1994

In different region, according the scope of the city, we classified the cities of China into 5 types:

- **Super City【 > 2 Million 】, there 14 super cities in China and we survey 10 cities of them and got the real data of them;**
- **Large City【 1~2 Million 】, there 23 lager cities in China and we survey 15 cities of them and go to site investigation for 6 larger cities;**
- **Big City【 0.5~1 Million 】, there 47 big cities in China and we survey 21 cities of them and go to site investigation for 6 big cities;**
- **Medium City【 0.2~0.5 Million 】, there 159 big cities in China and we survey 39 cities of them and go to site investigation for 11 big cities;**
- **Small City【 < 0.2 Million 】, there 425 small cities in China and we survey 52 cities of them and go to site investigation for 2 big cities;**

For Region, To get investigation information of waste and its treatment from 47 cities in East region of China, 42 cities in North of China, 48 cities in West and Middle region of China; To carry out site survey in 15 cities in east region, 10 cities in north region and 10 cities in west and middle region.

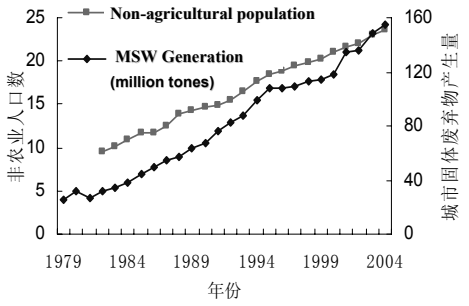
Northeast of China

To determine DOC from the composition of waste listed below:
Kitchen Waste
Papers
Rubbers and Plastic
Textile
Woods and Straw
Others
Notes: the dust include sweeping dust, dust, it account for almost 50% of total other waste composition.

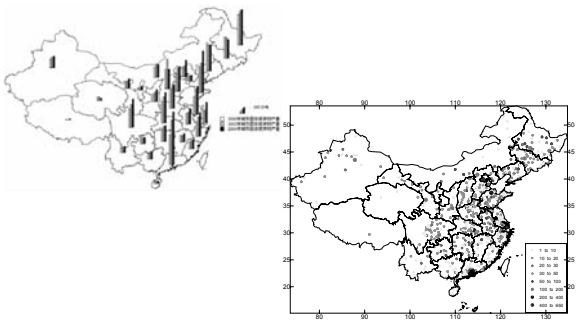
Middle of China

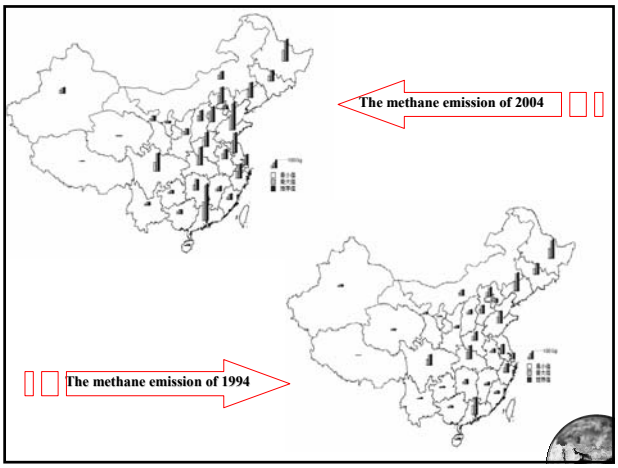
(1) Synthesis Areas of Resident, Serving and Manufactory;
(2) New Developing Districts;
(3) Old Residential Districts;
(4) Synthesis Supermarket with foods stuffs;
(5) Modern Supermarket with daily article for use;
(6) a landfill with 1000 tone of daily input;

MSW Generation amount and population from 1970 to 2004



MSW Generation amount distribution (2000,2002,2004)





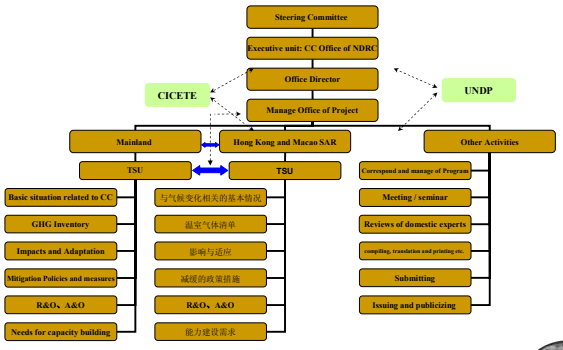
Newly progress of SNC

- To submit lately National Greenhouse gases inventory of China
  - ***INC：1994***
  - ***SNC：2005***
- To add new gases sources
  - ***INC：CO_2、N_2O、CH_4***
  - ***SNC： CO_2、N_2O、CH_4、HFCs、 PFCs、SF_6***

Newly progress of SNC

- **Geographic Region extending**
  - **INC： Mainland of China**
  - **SNC：Mainland of China, Hong Kong Special Administrative Region (SAR) of China and Macao SAR of China**
- **To Set up a *Target Research of Impact, vulnerability and adaptation of climate change***
  - **INC：Initial status with huge uncertainties in some sectors.**
  - **SNC：To reduce uncertainties with the support of TRIVACC.**

Newly progress of SNC：Institutional arrangement for SNC



Greenhouse Gases inventories preparation for waste treatment (SNC)

Purpose:

To Complete China's Greenhouse Gases emission inventories from the waste, including :

- ✓ China's landfill Methane emission inventory;
- ✓ China's waste incineration Carbon Dioxide emission inventory;
- ✓ China's industrial wastewater Methane emission inventory and living sewage water Methane emission inventory;
- ✓ China's wastewater / sewage treatment Nitrous Oxide emission inventory.

Greenhouse Gases inventories preparation for waste treatment (SNC)

Output:

- China's Methane emission inventory from waste landfill treatment
- China's Carbon Dioxide emission inventory from waste incineration treatment
- China's Methane emission inventory from industrial wastewater treatment
- China's Methane emission inventory from living sewage water treatment.
- China's Nitrous Oxide emission inventory from wastewater / sewage water treatment.
- Comprehensive study on China's waste inventories and Greenhouse Gases inventories preparation

Greenhouse Gases inventories preparation for waste treatment (SNC)

Output 1: China's Methane emission inventory from waste landfill treatment method

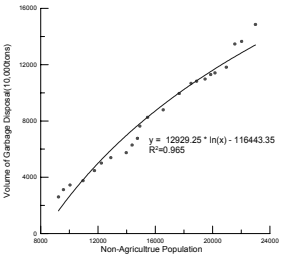
Methodology: Tier 2 from IPCC guideline
Activity Data: Data from statistics yearbook(1980-2007) and
Calculated data (1950 – 1979) based on the driving factors
Emission Factor: Country specific data and IPCC default value

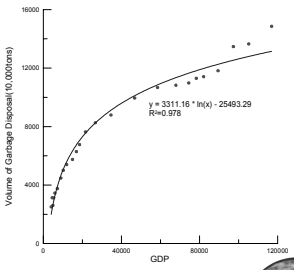
Future planning for 2nd NC

- **MSW sampling analysis for each region**
- **choose 3-5 landfills for monitoring methane emission and using Tier 2 to compare their results**
- **different scale cities compare (set up a reasonable calculating routine for each region)**
- **further survey for MSW and WW**
- **waste water sector (sampling analysis)**
- **industrial waste water**

Greenhouse Gases inventories preparation for waste treatment (SNC)

The relationship of MSW Generation amount and its driving forcing





Greenhouse Gases inventories preparation for waste treatment (SNC)

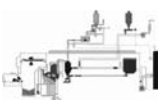
The relationship of MSW Generation amount and its driving forcing

- Estimate model for MSW
  - Non-agricultural population:
    $MSW = 12929.25\ln(x) - 116443.35$
    Where, x resprent non-agricultural population (ten thousand person)
  - GDP:
    $MSW = 3311.16\ln(x) - 25493.29$
    Where, x resprent GDP (100 million Yuan RMB)
  - GDP per capita
    $MSW = 3608.13\ln(x) - 19706.85$
    Where, x resprent GDP per capita (Yuan RMB)

Greenhouse Gases inventories preparation for waste treatment (SNC)

Output 2: China's Carbon Dioxide emission inventory from waste incineration treatment

Methodology: Default methodology of IPCC guideline
Activity Data: Data from survey in recent 5 years, and
Based on the expert judgment for AD
Emission Factor: Country specific data (expert judgment) and IPCC default value



Greenhouse Gases inventories preparation for waste treatment (SNC)

Output 3: China's Methane emission inventory from industrial wastewater treatment

Output 4: China's Methane emission inventory from living sewage water treatment.

Output 5: China's Nitrous Oxide emission inventory from wastewater / sewage water treatment.

Methodology: Default methodology of IPCC guideline
Activity Data: Data from statistics yearbook and survey in and
Based on the expert judgment for AD
Emission Factor: Country specific data (expert judgment) and IPCC default value

Greenhouse Gases inventories preparation for waste treatment (SNC)

Output 6: Comprehensive study on China's waste inventories and Greenhouse Gases inventories preparation

Comment and discussion

- **Any good practices form other Asia countries?**
- **EF data sharing?**
- **New & High technology for waste treatment?**
- **……**

THANKS

The 5th Workshop on GHG Inventories in Asia
Kuala Lumpur, Malaysia
September 6-7, 2007

Key category analysis

Batima P. Institute of Meteorology and Hydrology
E-mail: mcco@magicnet.mn

Inventory

- Mongolia prepared its first greenhouse gases (GHG) inventory in 1996 for the base year 1990 under the US Country Studies Programme
- Updated within the Asia Least-Cost Greenhouse Gas Abatement Strategy (ALGAS),
- As part of the enabling activities of preparation of the Initial National Communication (GEF/UNEP), the GHG inventories were updated to 1998 with base year 1994.
- **Capacity Building for Improving the Quality of Greenhouse Gas Inventories (Europe/CIS region) (RER/01/G31)** (Albania, Armenia, Azerbaijan, Croatia, Georgia, Macedonia, Moldova, Mongolia, Slovenia, Tajikistan, Turkmenistan and Uzbekistan) **June 2003**

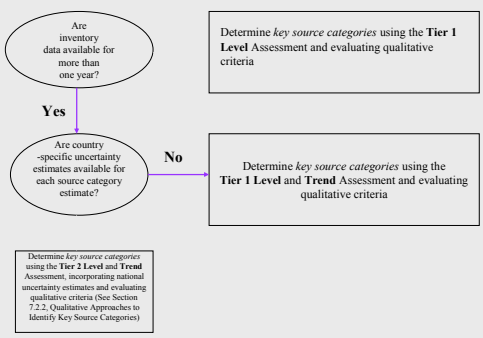
Improvements

- AD assessment
- EF assessment
- Methodology assessment

Methodologies

- IPCC Guidelines for National GHG Inventories (IPCC, 1995) and the Revised 1996 Guidelines (IPCC, 1997);
- GPG

Decision Tree to Identify Key Source Categories



Level assessment

EQUATION 7.1 GPG

Source Category Level Assessment = Source Category Estimate / Total Estimate

$$Lx,t = Ex,t / Et$$

Level Assessment with LULUCF

	IPCC source categories	Direct Greenhouse Gas	Base year	Latest Year	Level assesment	Cumulative total
1	Fuel Combustion, Energy Industries	CO2	8444.7	8899.0	0.394	39.4
2	Agriculture, Enteric Fermentation	CH4	5005.6	6121.5	0.271	66.5
3	Land use change $ forestry, Grassland Conversion	CO2	3939.8	3883.9	0.172	83.6
4	Land use change $ forestry, Biomass harvest	CO2	2359.0	2828.8	0.125	96.2
5	Fuel Combustion, Traditional biomass	CH4	275.1	306.6	0.014	97.5
6	Agriculture, Manure Management	CH4	179.3	218.4	0.010	98.5
7	Fugitive Emissions, Solid fuels	CH4	100.8	96.6	0.004	98.9
8	Waste, Solid Waste Disposal on Land	CH4	71.8	71.4	0.003	99.2
9	Fuel Combustion, Bunker	CO2	47.7	64.4	0.003	99.5
10	Industrial Processes, Cement Production	CO2	42.8	54.3	0.002	99.7
11	Industrial Processes, Lime Production	CO2	52.1	43.8	0.002	99.9
12	Fuel Combustion, Traditional biomass	N2O	31.0	24.8	0.001	100.0
13	Waste, Domestic and Commercial Wastewater	CO2	0.4	0.4	0.000	100.0
14	Waste, Industrial Wastewater	CO2	0.4	0.4	0.000	100.0

Level Assessment without LULUCF

	IPCC source categories	Direct Greenhouse Gas	Base year	Latest Year	Level assesment	Cumulative total
1	Fuel Combustion, Energy Industries	CO2	8444.7	8899.0	0.560	56.0
2	Agriculture, Enteric Fermentation	CH4	5005.6	6121.5	0.385	94.5
3	Fuel Combustion, Traditional biomass	CH4	275.1	306.6	0.019	96.4
4	Agriculture, Manure Management	CH4	179.3	218.4	0.014	97.8
5	Fugitive Emissions, Solid fuels	CH4	100.8	96.6	0.006	98.4
6	Waste, Solid Waste Disposal on Land	CH4	71.8	71.4	0.004	98.9
7	Fuel Combustion, Bunker	CO2	47.7	64.4	0.004	99.3
8	Industrial Processes, Cement Production	CO2	42.8	54.3	0.003	99.6
9	Industrial Processes, Lime Production	CO2	52.1	43.8	0.003	99.9
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11	Waste, Domestic and Commercial Wastewater	CO2	0.4	0.4	0.000	100.0
12	Waste, Industrial Wastewater	CO2	0.4	0.4	0.000	100.0

Trend assessment

EQUATION 7.22

Source Category Trend Assessment = (Source Category Level Assessment) . | (Source Category Trend – Total Trend) |

$$Tx,t = Lx,t \cdot \left| \{[(Ex,t - EX,0) / Ex,t] - [(Et - E0) / Et]\} \right|$$

Trend Assessment with LULUCF

	IPCC source categories	Direct Greenhouse Gas	Base year	Latest Year	Level assesment	Trend assessment	Contribution to the trend	Cumulative total
1	Fuel Combustion, Energy Industries	CO2	8444.7	8899.0	0.394	0.016	0.221	22.1
2	Agriculture, Enteric Fermentation	CH4	5005.6	6121.5	0.271	0.025	0.344	56.5
3	Land use change & forestry, Grassland Conversion	CO2	3939.8	3883.9	0.172	0.018	0.254	81.9
4	Land use change & forestry, Biomass harvest	CO2	2359.0	2828.8	0.125	0.009	0.131	95.0
5	Fuel Combustion, Traditional biomass	CH4	275.1	306.6	0.014	0.000	0.002	95.2
6	Agriculture, Manure Management	CH4	179.3	218.4	0.010	0.001	0.012	96.4
7	Fugitive Emissions, Solid fuels	CH4	100.8	96.6	0.004	0.001	0.008	97.2
8	Waste, Solid Waste Disposal on Land	CH4	71.8	71.4	0.003	0.000	0.004	97.6
9	Fuel Combustion, Bunker	CO2	47.7	64.4	0.003	0.000	0.007	98.3
10	Industrial Processes, Cement Production	CO2	42.8	54.3	0.002	0.000	0.004	98.7
11	Industrial Processes, Lime Production	CO2	52.1	43.8	0.002	0.001	0.008	99.5
12	Fuel Combustion, Traditional biomass	N2O	31.0	24.8	0.001	0.000	0.005	100.0
13	Waste, Domestic and Commercial Wastewater	CO2	0.4	0.4	0.000	0.000	0.000	100.0
14	Waste, Industrial Wastewater	CO2	0.4	0.4	0.000	0.000	0.000	100.0

Trend Assessment without LULUCF

	IPCC source categories	Direct Greenhouse Gas	Base year	Latest Year	Level assesment	Trend assessment	Contribution to the trend	Cumulative total
1	Fuel Combustion, Energy Industries	CO2	8444.7	8899.0	0.560	0.0225	0.369	36.9
2	Agriculture, Enteric Fermentation	CH4	5005.6	6121.5	0.385	0.0350	0.575	94.4
3	Fuel Combustion, Traditional biomass	CH4	275.1	306.6	0.019	0.0002	0.004	94.7
4	Agriculture, Manure Management	CH4	179.3	218.4	0.014	0.0012	0.020	96.7
5	Fugitive Emissions, Solid fuels	CH4	100.8	96.6	0.006	-0.0008	-0.013	95.3
6	Waste, Solid Waste Disposal on Land	CH4	71.8	71.4	0.004	0.0004	0.007	96.1
7	Fuel Combustion, Bunker	CO2	47.7	64.4	0.004	0.0007	0.011	97.2
8	Industrial Processes, Cement Production	CO2	42.8	54.3	0.003	0.0004	0.007	97.9
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11	Waste, Domestic and Commercial Wastewater	CO2	0.4	0.4	0.000	0.0000	0.000	100.0
12	Waste, Industrial Wastewater	CO2	0.4	0.4	0.000	0.0000	0.000	100.0

Thank you for your attention

Philippine experience in GHG inventory preparation

Jose Ramon T Villarin

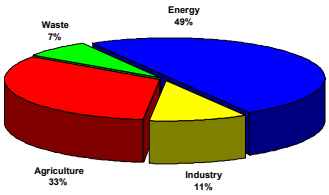
5th Workshop on GHG Inventories in Asia
Kuala Lumpur, Malaysia
6-8 September 2007

Outline

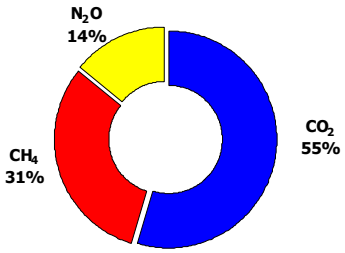
- Overview of Philippine GHG inventory
- Country experience (focus: Industry)
- Institutional arrangements

1994 Total GHG Emissions (non-LUCF)

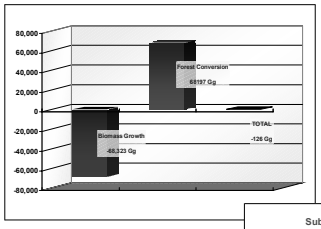
SECTOR	CO_2 Emissions (Gg)
Energy	50,038
Industry	10,603
Agriculture	33,130
Waste	7,094
TOTAL	100,864



GHG Fraction of Philippine Emissions



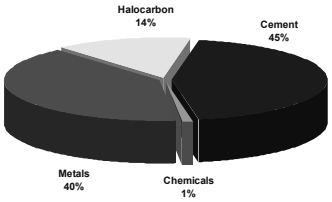
LUCF



Sub Sector	CO_2 Emissions(+) and Uptake(-) (Gg)
Change in Forest/Woody Biomass	**-68,323**
Biomass Growth	-110,704
Roundwood/Fuelwood Harvests	42,381
Forest/Land Use Change	**68,197**
On Site Burning	28,868
Off Site Burning	6,553
Decay	32,774
TOTAL	-126

Country experience: Industry

Subsector	CO_2 Emissions (Gg)
Cement	4,771
Chemicals	99
Metals	4,334
Halocarbons	1,507
TOTAL	**10,711**



Country experience: Industry

- Coverage: cement, iron and steel, chemicals, asphalt, pulp and paper, food and beverages, halocarbons
- Energy consumption as a driver
- Source of data: national statistics, reports of industry associations
- Production and consumption reports usually in monetary terms

Country experience: Industry

- Industry associations provide contacts
  - Phil Iron and Steel Institute
  - Samahan sa Pilipinas ng mga Industriyang Kimika (SPIK)
- Example: Chemical industry (300 units)
  - SPIK
  - production and ARCs (probable overestimate)
- Example: asphalt
  - Data from bitumen petroleum producers (Shell Philippines and Petron Corporation)

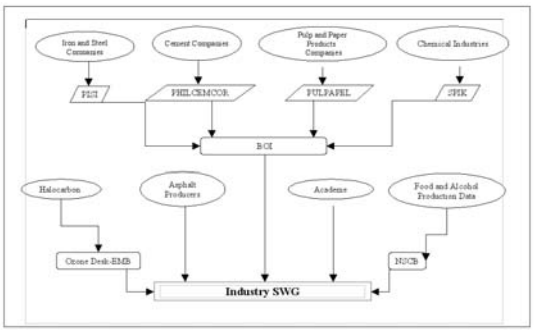
Country experience: Industry

- Example: Food and beverage
  - Data sources: Food balance sheet of the Philippines, FAO
  - Aggregated activity data (alcoholic beverages)
- Example: Halocarbons
  - potential (not actual) emissions
  - Data source: importation data from Ozone Desk (EMB)

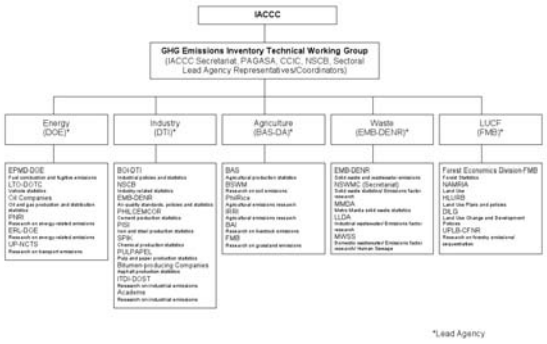
Institutional arrangements

- Convening of industry associations
- Philippine Business for the Environment
- GHG Protocol Initiative (WRI)
- DENR: AQ information (e.g. CEMs), emissions trading
- MOA
  - Data exchange
  - Trust: Confidentiality clause

Institutional arrangements



Institutional arrangements



Thank you.

Developing CH4 emission factors from rice cultivation in India - Triumphs and Challenges

Sumana Bhattacharya
NATCOM India

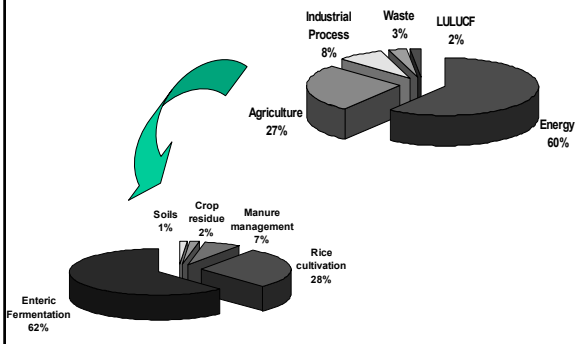
Contents

GHG Emissions from Sources and Removals by Sinks - India 1994

GHG source and sink categories (Gg per year)	CO_2 emissions	CO_2 removals	CH_4	N_2O	CO_2 eq. emissions*
Total (Net) National Emission	817023	23533	18083	178	1228540
1. All Energy	679470		2896	11.4	743820
2. Industrial Processes	99878		2	9	102710
3. Agriculture			14175	151	344485
4. Land use, Land-use change and Forestry	37675	23533	6.5	0.04	14292
5. Other sources as appropriate and to the extent possible					0
5a. Waste			1003	7	23233
5b. Emissions from Bunker fuels	3373				3373

*Converted by using GWP indexed multipliers of 21 and 310 for converting CH_4 and N_2O respectively.

Sectoral Distribution of GHG emissions



Key source analysis – Level Assessment (1994)

(CS: Country Specific EF, D: IPCC default EF, R: Improvement Required).

Sources of emission	CO_2 equivalent (Gg)	Percentage of total emissions	Cumulative emission (Gg)	Cumulative emission vs. total emission (%)	Tier used	EF used	Status of EF envisaged in SNC
Energy and transformation industries	355037	28.9	355037	28.9	Tier II	CS	R
Enteric Fermentation	188412	15.3	543449	44.2	Tier II	CS	R
Industry	150674	12.3	694123	56.5	Tier I	D	D
Rice Cultivation	**85890**	**7.0**	**780013**	**63.5**	**Tier II**	**CS**	**R**
Transport	80286	6.5	860299	70.0	Tier I	CS	R
Emission from Soils	45260	3.7	905559	73.7	Tier I	D	CS
Iron and steel production	44445	3.6	950004	77.3	Tier I	D	CS
Energy use in Residential sector	43918	3.6	993922	80.9	Tier I	D	D
Biomass burnt for energy	34976	2.8	1028898	83.7	Tier I	D	D
All other energy sectors	32087	2.6	1060985	86.4	Tier I	D	D
Cement production	30767	2.5	1091752	88.9	Tier I	CS	R
Energy consumed in Commercial/institutional	20571	1.7	1112323	90.5	Tier I	D	D
Manure Management	20176	1.6	1132499	92.2	Tier I	D	D
Ammonia production	14395	1.2	1146894	93.4	Tier I	D	CS
Land-use, Land-use change & Forestry	14292	1.2	1161186	94.5	Tier I	D	CS
Coal mining	13650	1.1	1174836	95.6	Tier III	CS	CS

Key source analysis – Level Assessment (1994)

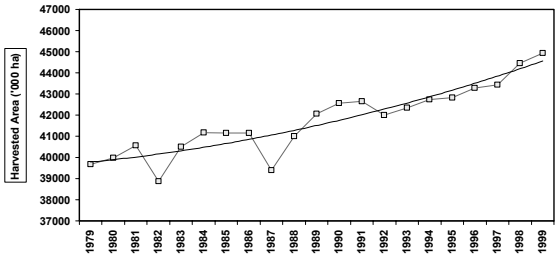
(CS: Country Specific EF, D: IPCC default EF, R: Improvement Required).

Sources of emission	CO_2 equivalent (Gg)	Percentage of total emissions	Cumulative emission (Gg)	Cumulative emission vs. total emission (%)	Tier used	EF used	Status of EF envisaged in SNC
Oil and natural gas system	12621	1.0	1187457	96.7	Tier I	D	D
Municipal Solid Waste Disposal	12222	1.0	1199679	97.7	Tier I	D	CS
Domestic Waste water	7539	0.6	1207218	98.3	Tier I	D	D
Lime stone and dolomite use	5751	0.5	1212969	98.7	Tier I	D	D
Agricultural crop residue	4747	0.4	1217716	99.1	Tier I	D	D
Nitric acid production	2790	0.2	1220506	99.3	Tier II	CS	CS
Human Sewage	2170	0.2	1222676	99.5	Tier I	D	D
Lime production	1901	0.2	1224577	99.7	Tier I	D	D
Industrial Waste Water	1302	0.1	1225879	99.8	Tier I	D	CS
Ferro alloys production	1295	0.1	1227174	99.9	Tier I	D	D
Aluminium production	749	0.1	1227923	99.9	Tier I	D	D
Carbide production	302	0.0	1228225	100.0	Tier I	D	D
Soda ash use	273	0.0	1228498	100.0	Tier I	D	D
Black carbon and styrene prod.	42	0.0	1228540	100.0	Tier I	D	D

Characteristic of Rice Cultivation in India

- Multiple Cropping System – both Rabi and Kharif season
- Variety of cultivars in use
- Cultivated all over India in upland, gangetic plains, and in the deccan plateau in the South
- Water management practices vary between arid, rainfed, irrigated, and deep water conditions
  - About 50% of area is irrigated
  - the rest is distributed between other water management practices

INDIAN RICE PADDY HARVESTED AREA FROM 1979-1999



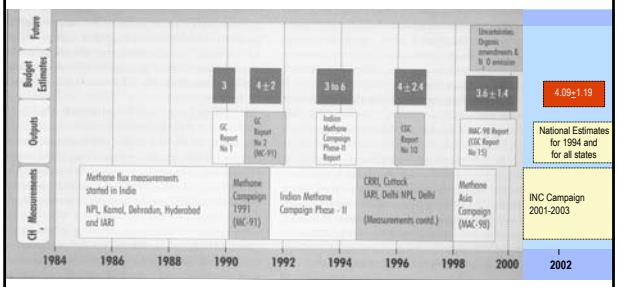
Parameters affecting CH4 emission from rice cultivation

- Water management
- soil organic carbon content
- Soil Sulphate Content
- Soil Temperature
- Rice cultivar
- Fertilizer application

Methane emission rates vary markedly with water regimes

A single mid season drainage or multiple-aeration may reduce methane emission by about 50% without compromising on the rice yield

Chronology of Measurements of Methane Efflux from Paddy Fields in India



Methodology

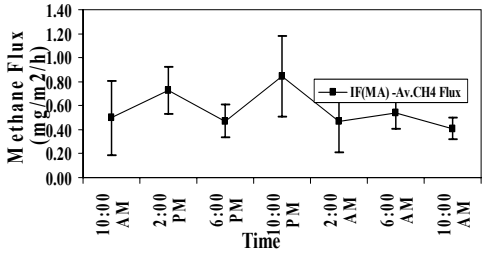
Static box or chamber technique

Flux measurements made in the forenoon and afternoon twice each week

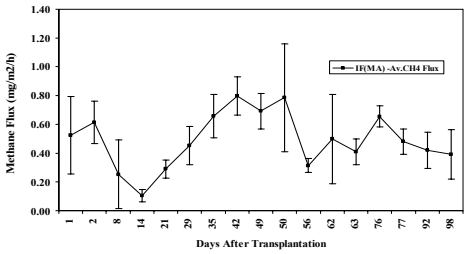
Samples at all sites collected manually in glass vials or syringes

- Automatic sampling systems also used at IRRI sites
- CH4 concentrations in samples determined using Gas chromatograph with flame ionisation detector (FID)
- NIST USA traceable methane calibration standards used Secondary standards calibrated nationally and internationally and inter-compared

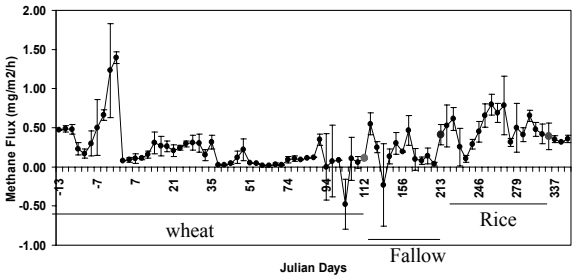
Diurnal Methane flux Variations from Rice crop from Intermittently Flooded-MA fields for two days in October



Seasonal Methane flux Variations from Rice crop in an Intermittently Flooded-MA for the period Aug to Nov



Annual Methane Flux Variation Intermittently flooded- MA (Dec. 2001-Dec 2002)



SIF(gm-2): 2.42 ± 0.92

Methane emission factors (*E*sif) for Indian paddy eco-systems (1991-2003)

Rice Eco-Systems → Soil Organic Carbon/ Amendments ↓	Rainfed *(flood prone)*	Rainfed *(drought prone)*	Continuously flooded	Intermittently flooded *(single aeration)*	Intermittently flooded *(multiple aeration)*	Deep water
Low Soil Org. C	19.0±6.0	6.9±4.3	15.3±2.6	6.9±4.3	2.2±1.5	19.0±6.0
Low Soil Org. C, with Org. Amend.	–	12.5	12.0±4.0	12.5	4.8	–
High Soil Org. C	–	7.95±1.5	26.3±6.7	7.95±1.5	3.7±1.2	–
High Soil Org. C, with Org. Amend.	–	–	63±17	–	–	–
Average E_{sif} (g/m^2) (Range)	**19.0±6.0**	**9.12** (6.9 to 12.5)	**29.2** (12 to 63)	**9.12** (6.9 to 12.5)	**3.6** (2.2 to 4.8)	**19.0±6.0**

Averaged for low & high organic carbon paddy soils including with and without organic amendments

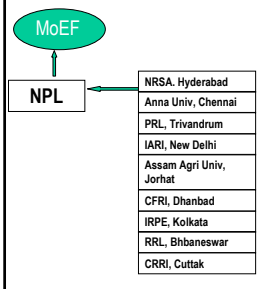
Effect of water management/organic amendments on *E*sif

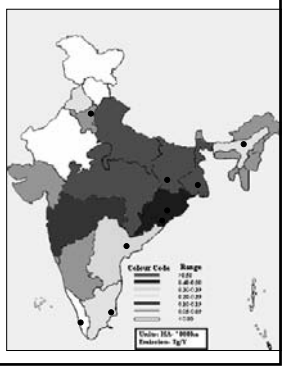
Methane emission (E_{sif} g m^{-2}) during 1998 (Kharif or Wet season)

	Pant Nagar, UP Cultivar: Pant-4 NPK-60,50,40 kg/ha + FYM @ 50%N			NPL New Delhi Cultivar: P-169 Only FYM @10t/ha		
	IF	CF(SA)	Factor	IF	CF	Factor
With organic amendment	7.15	12.5	**1.75**	2.0	12.05	**6.03**
Without organic amendments	5.36	7.07	**1.32**	–	–	–
Scaling factor	**1.33**	**1.77**		–	–	–

Reference: Methane Asia Campaign, 1998

Institutional Arrangement (NATCOM)





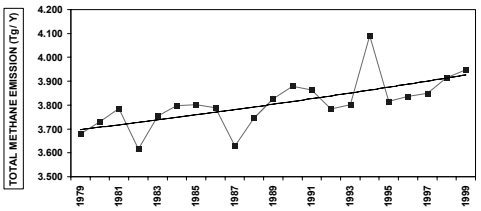
Comparison of Emission Factors Across Different Studies

Rice Ecosystem	Emission Factor (EF) in g m^{-2}		
	IPCC-96	After MAC-98/ Earlier EFs	NATCOM Campaign Data Included
Upland	0	0	0
Rainfed Flood Prone	16	19±6	19±6
Rainfed, Drought Prone (RF-DP)	8	6.9±4.3	6.95±1.86
Irrigated, Continuously Flooded (IRR-CF)	20	15.3±2.6	17.48±4.0
Irrigated, Single Aeration (IRR-SA)	10	6.9±4.3	6.62±1.89
Irrigated Multiple Aeration (IRR-MA)	4	2.2±1.5	2.01±1.49
Deep Water	16	19±6	19±6

Distribution of Area Under Different Water Management Regime

Water regime				Percentage of area	Area (mha)
UPLAND				15	6.35
LOWLAND	Rain-fed	Flood prone		10	4.23
		Drought prone		16	6.77
	Irrigated	Continuously flooded		16	6.77
		Intermittently flooded	Single aeration	23.5	9.92
			Multiple Aeration	13.5	5.74
	Deep water	Water depth 50-100 cm		6	2.54
		Water depth >100 cm		-	-

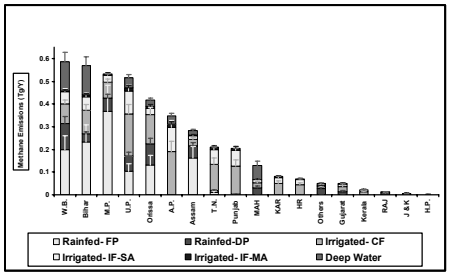
Trends of CH4 Emission Across two Decades



State Wise distribution of CH4 Emission from rice Paddy Field

STATES	CH4 Emission (Tg/Y)
W.B.	0.59 ± 0.17
Bihar	0.57± 0.17
M.P.	0.53± 0.16
U.P.	0.52± 0.15
Orissa	0.42± 0.12
A.P.	0.35± 0.10
Assam	0.28± 0.08
T.N.	0.21± 0.06
Punjab	0.20± 0.06
Maharashtra	0.13± 0.04
Karnataka	0.08± 0.02
Haryana	0.07± 0.02
Others	0.05± 0.01
Gujarat	0.05± 0.01
Kerala	0.02± 0.01
Rajasthan	0.01± 0.00
J & K	0.00± 0.00
H.P.	0.00± 0.00
Total	4.09± 1.19

Cumulative State Wise CH4 emission Distribution from different states in India



Achievements

Pre -1995	Post 1995
Estimates restricted to irrigated, rainfed, upland	Estimates made for rainfed flood prone, rainfed drought prone; irrigated continuously flooded, irrigated single aeration, aerated multiple aeration; deep water & upland
Sporadic diurnal measurements in the cropping period	Seasonal (1995 onwards) and Annual (beyond 1998)
Restricted to North and western part of India	Campaign spread to the rice major growing regions including the South, East and the North East parts of India

Achievements – Post 1995

- CH4 Emission factors also assessed for soils with high organic content
- Estimates of CH4 brought down from 37.6 Mt to around 4 Mt
- Strong element of quality control and quality control in the measurements
- Level of uncertainties associated with the estimates of CH4 from rice cultivation determined
- Areas where single aeration and multiple aeration practices can replace the practice of continuously flooding the fields

Uncertainties and Research Questions

- Annual variations in rice area under various water management practices
- High level of uncertainties introduced due to lack of data in certain hotspots like Madhya Pradesh

Thank you

LULUCF GHG Inventories: Indonesia

Rizaldi Boer[1] and Upik Sitti Aslia[2]
[1]Laboratory of Climatology, Bogor Agricultural University
[2] Ministry of Environment, Republic of Indonesia

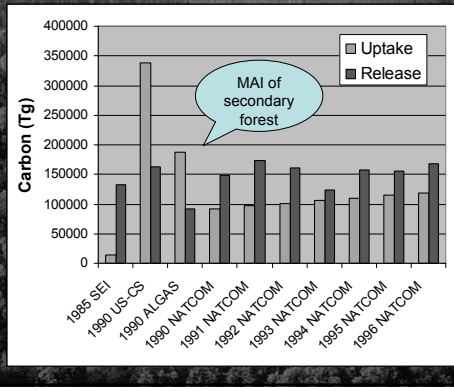
Indonesia GHG Inventory: 1994

Sources and Sinks	CO_2 Uptake	CO_2 Release	CH_4	CO	N_2O	NOx
Energy		373,609	674		6	
Industrial Processes		19,120	1		0	
Agriculture			3,244	331	53	19
LUCF	403,846	559,471	367	3,214	3	91
Waste			402			
TOTAL	403,846	952,200	4,687	3,545	61	110
BIOMASS ENERGY		124,417				
INT. BUNKER		1,684				

Source: MOE (1999)

Using Revised 1996 IPCC Guideline

GHG Inventory: Forestry Sector



Approaches 1: Forest Inventory Data from Concessionaires

Diameter class (D in cm)	Mean number of stems/ha	Volume of stem (V in m^3)[1]	Total Volume of stem (m^3/ha)	Diameter after growing (Dg in cm)[2]	Volume of stem after growing (V in m^3)[1]	Total Volume of stem (m^3/ha)	Volume increment (m^3 ha^{-1} yr^{-1})[3]
(1)	(2)	(3)	(4)=(2)x(3)	(5)=(1)+*Di*	(6)	(7)=(2)x(6)	(8)=(7)-(4)
14.50	249.4	0.087	21.8	14.82	0.093	23.1	
24.50	104.1	0.347	36.1	24.91	0.362	37.7	
34.50	50.2	0.852	42.8	34.93	0.880	44.2	
44.50	22.2	1.662	36.9	44.92	1.704	37.8	
54.50	10.4	2.831	29.4	54.90	2.887	29.9	
64.50	5.2	4.407	22.7	64.92	4.484	23.1	
70.00	3.6	5.464	19.7	70.47	5.560	20.1	
			209.3			215.9	**6.5**

[1]Allometric equation for estimating volume of wood is $V=0.00007771D^{2.267}$, and [2]$Di=0.000006D^3 - 0.0008D^2 + 0.0335D - 0.0178$ (R^2=48%). [3]Using BEF of 1.5 (Ruhiyat, 1995) and wood density of 0.6, the mean annual biomass increment of logged-over forest was about 5.9 t ha^{-1} yr^{-1}

Approach-2: From NFI (wood volume)

- $MAI_{LoF}=((WV_{VF}-WV_{LoF})/Rotation)*WD*BEF$
  - wood volume of virgin (WV_{VF}) and logged-over (WV_{LoF}) forests
  - WD wood density and BEF Biomass expansion factor (1.5 for natural forest: Ruhiyat, 1995)
- The MAI of logged-over forests for (PF+CnF), (LPF+NCF) and CF are 3.3, 1.9 and 2.5 m3/ha/year respectively. Using specific gravity of 0.6 t/m3 and expansion factor of 1.41 (Ruhiyat, 1995), the productivity for the respective forest categories would be 2.78, 1.61 and 2.11 t/ha/year.

Estimation of area of secondary forest

- Define the reference year (Indonesia case)
- Get series log production data (m^3) from production forest (not plantation forest)
- Divide the log production data with potential wood cut per ha (subtracting the volume of wood in the virgin forest and logged-over forest) to get new logged area.
- Add and subtract the area of logged over forest in reference year with estimated new logged area to develop series of logged over forest

Forest Category	Forest types by function	Area (1000 ha)		Volume (m^3/ha) dbh 20cm+	
		Virgin Forest	Logged-over forest	Virgin Forest	Logged-over forest
Lowland forest	PF+CnF	18363,7	5966,2	165,4	66,9
	LPF+NCF	23012,9	16645,3	162,0	106,8
	CF	8211,7	6711,5	141,4	56,8
Swamp	PF+CnF	1777,4	1067,9	117,6	32,1
	LPF+NCF	4224,6	3540,4	132,8	83,8
	CF	3542,2	3090,0	100,8	47,0
Mangrove	PF+CnF	904,5	194,9	115,0	-
	LPF+NCF	446,6	609,4	103,4	2,4
	CF	624,6	304,4	84,6	39,2

Calculate Carbon Foot Print for REDD

- How this group can assist the developing countries to prepare for REDD?
- Is there any simple technique but consistent with IPCC-GPG and reasonable level of accuracy?
- What type of strategies can be done to reduce the emission from DD ? Should we accommodate the inherited and delayed emissions from harvested wood product (e.g. making wood has longer lifetime will reduce the delayed emission) ?
- Capacity to calculate emission from deforestation and forest degradation is very important in setting up reference emission?

A simple approach for estimating emission from harvested wood

- Ratio between total wood consumption for the products and log production represents proportion of log becoming waste (waste proportion). As decomposition period used in this study was five years, thus carbon emissions from decomposition of woody biomass produced by past deforestation (E_{pwb}) was estimated as the following

$$E_{pwb} = \{1/5 \sum_{i=1986}^{1990} (l_w * Log_i) + (f_w * Log_i)\} * 0.5$$

l_w and f_w are waste produced during processing of log (0.61) and woody biomass left in forest after logging/deforestation (0.41) respectively. Log_i is log production in year-*i*

- Carbon emission from past forest products (E_{pfp}) was estimated as follows

$$E_{pfp} = \{1/30 * T_{wb}\} * 0.5$$

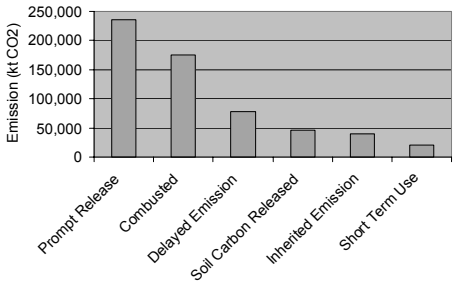
T_{wb} is total wood stored in the products in the inventory year. Value of 30 is average period of product use. Value of 0.5 is carbon content. In this analysis, total wood used for houses and buildings (T_{wbh}) was estimated from the multiplication of total area of houses and building (apartment, hotel, shops, office etc.) in the inventory year (CIC, 1995) and wood consumption per unit area (Perum Perumnas, 1996). *The longer the lifetime of forest products the less the emissions*

- Total wood stored in the form of furniture and other forest products for the inventory year was not available. The available data was only annual production of the products. Therefore, the total wood stored the products (*Twb*) in the inventory year was estimated as follows:

$$T_{wb} = T_{wbh} + (\frac{AP_f}{AP_h} * T_{wbh})$$

- AP_f is annual production of furniture and other wood products and AP_h annual production of houses and buildings. Annual production on houses and buildings in the inventory years is the difference between total wood used in the inventory years and that used in (the inventory year-1).

Emission from Deforestation and Forest Harvesting



Carbon emission from deforestation and forest harvesting

Emission Categories	Agriculture (kt C)	Pasture (kt C)	Degradation of existing forest (kt C)	Clear cutting[2] (kt C)	Selective cutting (kt C)	Forest Fire (kt C)	Total (kt C)	Total (kt CO_2)
Prompt Release	39,201	3,442	7,857	5,647	8,202	-	64,350	235,950
Soil Carbon Released[1]	3,452	303	225	4,334	4,067		12,382	45,401
Combusted	35,749	3,138	7,632			1,235	47,755	175,102
Short Term Use				1,313	4,135		5,449	19,980
Delayed Emission	10,725	942	1,018	6,255	2,297		21,236	77,865
Inherited Emission							11,065	40,572
Total	49,926	4,384	8,875	11,902	10,500	1,235	97,886	354,387

How to capture these changes of practice accurately?

Do conversion in degraded forest (e.g. palm oil)

Practice sustainable forest management

Shift from clear to selective cutting

How to reduce level of emission from DD


Thank you

Lessons Learned from GHG Inventory Preparation

-From the Point of View of External Consultants-

September 6, 2007

Takashi MORIMOTO
Takeshi ENOKI

Outline

- Introduction of MURC
- Lessons Learned from Inventory preparation in the Republic of Palau *-estimating missing activity data*
- Lessons Learned from Inventory preparation in Japan *-methods of finding data*

Introduction of MURC (1)

- Mitsubishi UFJ Research & Consulting (MURC)
  - Comprehensive think tank of the Mitsubishi UFJ Financial Group (MUFG)
  - MURC provides clients with the following services:
    - Corporate Strategy Consulting;
    - International Business Consulting;
    - Economic Research;
    - Membership Services;
    - Training & Advisory Services, and
    - Policy Research and Consulting

Introduction of MURC (2)

- Takashi MORIMOTO, Takeshi ENOKI
  - Analyst, Environmental Policy Consulting Department, Policy Research and Consulting Division
  - Cooperative Researcher, Greenhouse Gas Inventory Office of Japan (GIO/NIES)
  - UNFCCC GHG Inventory Reviewer

✓ Our firm has been contracted by the Ministry of the Environment (MOE) to compile the Japanese GHG Inventory since 2003.

✓ We have also worked on a project to support the preparation of the Second National Communication of the Republic of Palau.

Lessons Learned from Inventory Preparation of the Republic of Palau

-estimating missing activity data

Background

- Palau submitted its First National Communication (NC) in 2002, and the government of Palau has received funding from UNEP/GEF to undertake preparation of its Second NC.
- MURC was awarded the contract for assisting Palau to prepare the Second NC.
- MURC held a workshop on preparing a GHG inventory for the Second NC in Palau in December 2006.
- The team of Palauan experts developed the GHG inventory and national inventory report with the assistance of the MURC.

Background

- The MURC assisted the expert team of Palau by…
  - Presenting information on climate change and UNFCCC obligations
  - Explaining the contents of National Communication
  - Lecturing the methodologies of estimating GHG emissions using the *Revised 1996 IPCC guidelines* and *IPCC GPG*.
  - Making suggestions on the choice of methodologies
  - Sharing ideas on ways to gather activity data
  - Assisting the drafting of the national inventory report

Problems identified during inventory preparation

- Statistical system of Palau is not systematically maintained.
- The number of official statistics is limited and many statistics are not covered for the entire time series because the survey for statistics are not conducted every year.
- Some useful data and/or literature might exist, but nobody knows where they are.
- Inconsistent/conflicting datasets exist for a particular data category.

Examples of missing data

- During the GHG inventory preparation of Palau, some data that were missing had to be estimated. For example,
  - Imported fuel by type（1.A.）
  - Number of livestock（4.A. 4.B. 4.D.）
  - Soda ash consumption（2.A.4.）
  - Annual amount of MSW disposed to SWDS（6.A.）

Method for estimating missing data (1)

- Imported Fuel by type（1.A.）
  - PROBLEM: Only data for 1999 and after were available
  - SOLUTION: ***Extrapolation using drivers***
    - Data from 1994 to 1998 were estimated by assuming that they changed directly proportional to GDP growth.
- Number of livestock（4.A. 4.B. 4.D.）
  - PROBLEM: Only data from 1995 to 1998, and 2001 were available
  - SOLUTION: ***Interpolation***
    - 1994 data assumed to be same as 1995, data for 1999 and 2000 were interpolated, data after 2002 the same as 2001.

Method for estimating missing data (2)

- Soda ash consumption（2.A.4.）
  - PROBLEM: No statistics on soda ash consumption.
  - SOLUTION: ***Interview relevant organizations, Estimate using consumption unit***
    - Interviews revealed that soda ash was consumed only in the water treatment plant.
    - However annual consumption data were not available.
    - We asked the water treatment plant the weight of soda ash per bag and the number of bags used per day, and estimated the annual consumption based on consumption unit.

annual consumption of soda ash (kg) = weight of 1 bag of soda ash (kg) × number of bags used a day (number) × number of days in operation a year (number)

Method for estimating missing data (3)

- Annual amount of MSW disposed to SWDS（6.A.）
  - PROBLEM: Using population statistics in estimating the amount of MSW is not accurate because many visitors go to Palau.
  - SOLUTION: ***Estimation using information from expert judgment or other sources***
    - We estimated "revised population of Palau" including visitors in a year by adding total population of Palau to the total number of tourist for a year by multiplying the number of visitors in a year and average stay days of visitors.

revised population of Palau (persons) = Population of Palau (persons) + number tourists (number) × average stay of tourists (days/tourist) × conversion factor (year/365 days)

Lessons Learned

- Important data such as energy statistics may be missing in countries, but do not give up!
- Methods for estimating activity data are…
  - Interpolation
  - Trend extrapolation
  - Extrapolation using drivers
  - Interviewing relevant organizations
  - Estimate using consumption unit
  - Estimation using information from expert judgment or other sources
- These methods may provide "best estimations" based on the information present.
- However, steps should be taken in the future to reconsider the activity data.

Experience of Inventory Preparation of Japan

-methods for finding data

Activity data of Japanese GHG inventory

- Almost all of the activity data used in the Japanese GHG inventory are values taken from public statistics.
- However, some data can not be found.
- If statistics do not exist, MOE conducts research to find activity data in other places.
- If data is found, MOE considers if emissions should be estimated using the new data or whether the emissions should be reported as "NE".

Ways to conduct Activity data research

- Review literature
  - General newspapers
  - Trade papers
  - Magazines
  - Internet
  - Academic papers, etc.
- Conduct interviews
  - Scientists
  - Industry insiders, etc.

Important activities while conducting activity data research

- Verification of the data
  - Researcher should check the new data for its
    - Accuracy
    - Transparency
    - Consistency, etc.
- Ask for permission to use the data, if necessary
- Request data to be provided in future

Example of Activity data research (1)

- Oil cokes consumption in silicon carbide production
  - Internet search revealed that one company in Japan produces silicon carbide.
  - MOE asked the company to provide data, but was refused because of the nature of the data.
  - MOE decided that the data would be dealt as confidential (C) in the GHG inventory, and asked the company through METI (Ministry of Economy, Trade and Industry) to provide the data.
  - The company accepted the data provision.

Example of Activity data research (2)

- The number of Buffalo
  - Literature review was conducted on whether there were any buffalo as livestock in Japan or not, but the conclusions were not clear.
  - MOE asked a specialist of animal husbandry the actual condition of buffalo and received information on the area where buffalo was kept as livestock.
  - MOE asked the local government in the area for information on buffalo, and they happened to have statistics on the number of buffalo.
  - MOE requested the data to be provided and the local government accepted.

Lessons Learned

- Even if official statistics do not exist, do not give up!
- There are other sources that may collect data such as
  - Experts/Researchers
  - Businesses/Industry groups
  - Local governments
- Recommended method for finding data
  - ✓ Identify persons which may have useful information by literature review / conducting interviews.
  - ✓ Interviews appropriate experts
  - ✓ If data sources are reluctant to provide data, ensuring confidentiality may change their minds.

Thank you for your attention !!

Takashi MORIMOTO : morimoto@murc.jp
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Latest Update on non-Annex I National Communications and National Greenhouse Gas Inventories

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Financial and Technical Support (FTS) Programme
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Useful Tools for NAI GHG Inventories

- **UNFCCC Software**

http://unfccc.int/resource/cd_roms/na1/ghg_inventories/index.htm

- **GHG Inventory Experts Network** (NCSP funded)

http://www.ghgnetwork.org/

Regional Capacity Building for Sustainable GHG Management Systems in SEA

- Follow-up on 4th WGIA recommendations
- Co-organization of the "Collaborative Scoping Meeting for Sustainable National GHG Inventory Management Systems in Southeast Asia", 11 – 13 June 2007, Manila, The Philippines
- L. Buendia and M. Desai to present the follow-up activities and strategies/tools to improve GHG inventories in SEA

National Communications – Status (Quo)

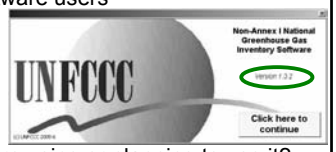
*No new national communication submitted since the 4th WGIA; but **more than 100** NAI Parties started the process of preparing for their Second National Communication.*

- **Total number of submitted national communications from non-Annex I Parties**
  - **Initial** national communications: **134** (as at 8 January 2007)
  - **Second** national communications: **3** (as at 27 March 2006)
  - **Third** national communications: **1** (as at 11 November 2006)

UNFCCC GHG Software for NAIP

- Software for NAI GHG Inventories being increasingly used
- Feedback/questions from users (computer + methods)
- Project of establishing a "Help Desk" to better address needs expressed by software users

http://unfccc.int/resource/cd_roms/na1/ghg_inventories/index.htm



- Which WGIA countries are using or planning to use it?

COP 13 / SBI 27 (Bali, Dec. 2007)

- COP 13 to decide on the mandate and terms of reference of the **CGE** (in fact **All Expert Groups**)
- Views from Parties on the **mandate and terms of reference of the CGE** (FCCC/SBI/2006/11, Para. 28), by 15 August 2007 (8 submissions, still possible)
- Views from Parties on their **current experiences with the GEF and its Implementing Agencies** (IA) in relation to the **provision of financial support for the preparation of national communications** (FCCC/SBI/2007/15, Para. 38), by 21 September 2007 (no submission yet)

COP 13 / SBI 27 (Cont.)

- Views and recommendations on the **funding available in the Climate Change focal area** (Decision 3/CP.12, Para. 5 – Additional Guidance to the GEF), one submission received
- Consideration of **information contained in national communications from NAI Parties** (agenda item held in abeyance at SBI 26).

Concluding Remarks

- Lots of activities directly linked to national communications and national GHG inventories are taking place at the moment
- Nothing is possible without **input** from NAI Parties
- Need for **submissions** as soon as possible
- Need for **feedback** on the use of the GHG Inventory **software** for NAI Parties!

Manila Scoping Meeting and Follow-up Activities

WGIA5, 6-8 September 2007
Kuala Lumpur, Malaysia

Leandro Buendia

Content

- Why the Manila meeting?
- What happened in Manila?
- Output of the meeting?
- Follow-up activities…

Background

- Experience with NC1 - need to improve the quality of the national GHG inventories
- Regional projects done in some regions; none in Asia region
- UNFCCC secretariat organised a collaborative scoping in Manila, Philippines on 11-13 June 2007
- to assess past and current activities on GHG inventories in region - towards developing a sub-regional project on sustainable national GHG inventories management systems in SEA

Participants

- 8 Southeast Asian countries: Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Singapore, Thailand and Viet Nam
- 2 country representatives each:
  - A team leader in GHG inventory for NC
  - An inventory expert with background in Agriculture, and LUCF sectors
- Inventory experts and representatives from international organizations and projects with experience and interest in regional GHG inventories capacity building

Meeting Objectives

1. Assess the status and needs of GHG inventories in the region;
2. Increase regional capacity to better manage national GHG inventories and sustain the process of their development on a continuous basis, through awareness of available tools, techniques, and strategies; and
3. Develop a capacity building programme for the region towards a sustainable national GHG inventory management system in Southeast Asia.

What transpired in Manila?

- GHG inventory management systems in the context of UNFCCC
- 8 Country Reports on National GHG Inventories
  - Brief assessment of the national system and inventories quality
  - Key category analysis
  - List of Major GHG Inventory Sectoral Issues and Concerns
- Technical findings from activities of WGIA
- Sectoral working group discussions on needs, gaps, and constraints in sustaining work on GHG inventories
  - inventory planning, preparation, and management (BOG1)
  - sector-specific issues (BOG2)

What transpired in Manila?

- Sharing of experiences, research findings, tools and techniques
  - The Workshop on Greenhouse Gas Inventories in Asia (WGIA)
  - International Rice Research Institute (IRRI)
  - U.S. Environment Protection Agency (USEPA)
  - Central American Project (represented by El Salvador)
  - The IPCC-NGGIP, Japan
  - Colorado State University, USA
  - Manila Observatory, Philippines
- Sectoral working group discussions on capacity building needs vis-à-vis available resources
- Working group discussions to develop Programme on sustainable national GHG inventory

Common problems

- lack of local or country-specific EF and appropriate AD;
- insufficient database management;
- difficulty in sustaining inventory system or inventory team;
- lack of capacity for inventory management;
- key category analysis not implemented (only Cambodia and the Philippines; others in progress);
- need for sharing information/experience and technical feedback from the secretariat; and
- lack of financial and human resources

Needs, gaps, constraints

- need to improve the planning for inventory cycle and activity data collection
- gaps in increasing awareness for policymakers
- constraints of funding and support from governments
- training needs on key category analysis (including uncertainty analysis)
- focus more on the needs to improve the activity data (AD) than the emission factors (EF) for key categories:
  - Energy sector: energy industries (1A1), manufacturing industries and construction (1A2), and transport (1A3)
  - LUCF sector: changes in forest and other woody biomass stocks (5A), forest and grassland conversion (5B), abandonment of managed lands (5C), including wild fire and peatland
  - Agriculture sector: enteric fermentation (4A), manure management (4B), and rice cultivation (4C)

International Projects

- **Workshop on GHG Inventories in Asia (WGIA)**
  - **Japan's initiative to support the improvement of GHG inventories**
  - **preliminary survey to identify category-specific needs**
- **International Rice Research Institute and its relevance to the sub-region**
  - **field measurements, network coordination, process studies, and modelling/upscaling**
- **Tools developed and lessons learned from the project on strengthening Central America's capacity to participate in the UNFCCC** (USEPA and El Salvador)
- **The Greenhouse Gas Protocol and Accounting and Reporting Standard: The Philippine Experience** (Manila Observatory)

Available methodologies and tools

- IPCC Guidelines and Guidance Reports
  - 1996 Guidelines, GPG2000, GPG-LULUCF
  - EFDB
- Central America Agriculture and Land Use tool (CAALU)
  - user-friendly interface to guide compilers through the inventory process
  - linked to a relational database
  - extends design of IPCC worksheets with data management capabilities
  - tools for livestock, rice, fertilizer use, and deforestation
  - data management can utilise GIS data derived from remote sensing imagery
  - users can develop inventory with Tiers 1 and 2 approaches
  - explicit QA/QC steps for AD entry, and EF selections and calculations
  - has self-contained dbase and institutional memory to archive all data and results
  - the software tool supports reporting to the UNFCCC

Capacity Building Needs

5 Main areas for improvement

1. Institutional arrangement
2. Institutional memory
3. Training
4. Awareness
5. Sustainability

Capacity building needs

Area	Capacity Building Needs	Suggested Programs	Priority/ Feasibility	Note
1. INSTITUTIONAL ARRANGEMENTS - establishment of inter-agency framework/ network and identification of responsible agency for each sector	- Identification and recognition of the right ministries/agencies -Assessment of existing institutional arrangements: SWOT	- Sharing of experience from Annex I countries of their institutional arrangements / - SWOT Assessment - Strengthening the capacity of already-established framework	1/3 1/1 1/1	Country-driven / Differ in each country
2. INSTITUTIONAL MEMORY - documentation of the process - data collection and archiving e.g. efficiently maintaining and managing knowledge/information	- Standardization of documentation process using templates - Maintain system at designated institution	- Training and pilot studies to adopt/ improve the templates	1/1	

Capacity building needs

Area	Capacity Building Needs	Suggested Programs	Priority/ Feasibility	Note
3. TRAINING - management training - technical /methodology training	- Familiarizing NC project managers with UNDP manuals of GHG Inventory Process - Design programs of "Training for trainers" - Training personnel of Key Category Analysis - Training personnel involved in the inventory process from each sector	- Workshops on specific needs by NCSP (Training for trainers) - Hands-on training using available software/techniques /templates (for all sectors)	1/2 1/1	
4. AWARENESS - communication to policy makers /politicians (for commitments) - private sector - general public	- SPM (packaging of key findings from NC and policy implications) established to convey message to seek for support by policy makers - Developing sector-specific outreach/information package - Develop a web-based /readily available info on GHG Inventory	- Develop common format of summary for policy maker (SPM) - Develop common format of SPM - Creating of a web-based GHG Inventory - Mass media	1/1 1/1 2/2	Content is Country-driven / Differ in each country

Capacity building needs

Area	Capacity Building Needs	Suggested Programs	Priority/ Feasibility	Note
5. SUSTAINABILITY - human resources - funding	- Identification of respective focal agencies - Identification of sectoral experts - Roster of local /country (sectoral) experts maintained/ retained - Need to secure funding (from central govt) for long-term planning - International cooperation funding	- Experts will be involved in the training need identified above - Proposal development - Proposal development for region	1/1 1/1	
Note for Priority/Feasibility: 1 = High; 2 = Medium; 3 = Low				

Capacity building needs

Sector-specific:

1. Overall Needs
   - a. Training
     - KCA (+Uncertainty)
     - Collecting Activity Data
   - b. Regional Network of experts
     - web based forum
     - workshops
   - c. Exchange of regional information
     - EFs and other parameters
     - Access to activity data
   - d. Regional EF projects
     - Peatlands – depth of burning
   - e. Regional cross-checking / review
   - f. WGIA website/exchange of information

Capacity building needs

2. LUCF
   - a. Main Issues
     - Consistent representation of Land
     - LU Data availability
     - Access to satellite data
     - GIS experts training
     - Land management
   - b. Other
     - Biomass remaining after burning
     - Soil carbon
     - Literature review of available factors to identify gaps
3. Energy
   - a.Main Issue – Activity Data
   - b. Regional networking
     - survey design, EF evaluation
     - Workshops

Capacity building needs

4. Rice cultivation
   - a. Protocol for measuring CH4 from rice
     - Documentation, Data Quality Objectives, Management etc.
   - b. Criteria for accepting emission studies
   - c. How to validate?
5. Livestock
   - a. Emission parameters specific to region
     - Data needs for IPCC Tier 2 (energy balance approach)
     - Measure region-specific parameters (too expensive?)
     - Encourage local researchers to consider CH4 emissions
6. Projections
   - a. Consistency between sectors

Issues for Regional Programme

- ✓ Assessment of existing institutional arrangements (e.g. SWOT)
- ✓ Training and pilot studies to adopt/improve the templates (such as those templates used by US EPA in Central America)
- ✓ Hands-on training using available software/ techniques//templates, including training on key category analysis
- ✓ Increase awareness of the public and the private sector by developing a common format of summary for policy makers (SPM).

Issues for Regional Programme

- ✓ focus on LULUCF sector, Energy sector, rice cultivation, and livestock emissions
- ✓ activities to include series of workshops and regional networking
- ✓ kick-off regional workshop to initiate the project activities such as key category analysis and preparation for in-country workshops
- ✓ In-country workshops to produce consistent land representation from GIS data; to introduce the SEAALU Software; and training on how to manage uncertainty
- ✓ Improvement of EF and AD (compilation of data from reports, literature, etc.)
- ✓ Regional networking to facilitate exchange of information (roster of regional experts)
- ✓ Wrap-up regional workshop to review project outcomes, lessons learned (sharing of findings, cross-checking among countries, revisiting of key category analysis, and identification of future priorities)

Follow-up activities

- ❖ Meeting Report is being finalised
- ❖ Regional Programme proposal is being drafted
- ❖ Look for funding sources (UNFCCC, USEPA, WGIA, AGO, etc.)

Strategies and Applicable Tools for Improving Greenhouse Gas Inventories in Southeast Asia

WGIA Workshops on Greenhouse Gas (GHG) Inventories in Asia Region

Mausami Desai
Climate Change Division,
Office of Atmospheric Programs
U.S. EPA

Kuala Lumpur, Malaysia
September 6, 2007

Purpose of Central America Project

- Support implementation of CONCAUSA Action Plan on Climate Change (June 2001)
  - "Strengthen the Central American countries' capacity to adapt to climate change and to mitigate greenhouse gas emissions"
- Increase regional capacity to meet international obligations under the UNFCCC
- Increase regional capacity to develop national GHG inventories and improve data and methods

USAID-EPA-NASA Work on GHG Inventory Capacity Building

Commitment from Central American governments

CCAD

Overall Funding Support for Climate Change Expert

USAID FROM THE AMERICAN PEOPLE

Greenhouse Gas Inventory Project

NASA

Remote Sensing Project

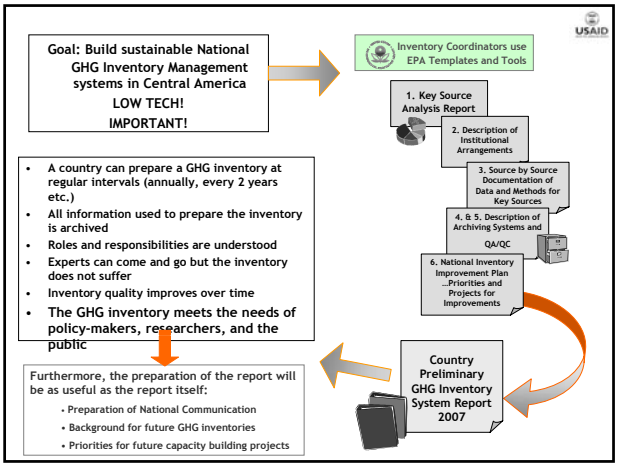
Central America Inventory Project Components (2004-2007)

Component I: ***Build sustainable national inventory systems within each country***

- **Inventory management focus areas:**
  - Key source analyses
  - Description of institutional arrangements
  - Source-by-source background document
  - QA/QC & archiving system
  - Inventory improvement plan

Component II: ***Improve GHG estimates***

- **Source/sink categories:**
  - Forest C
  - Soil C
  - Soil N_2O
  - Landfills
- Evaluate current methods and activity data
- Assist in applying the chosen methods



Why use templates?

- Focus on documenting essential information in a concise format and avoids unnecessarily long written reports;
- Standardize tasks, allowing countries within regions to compare and contrast results;
- Accommodate varying levels of national capacity;
- Provide an objective and efficient system for identifying priorities for future improvements;
- Serve as instruction manuals for future inventory teams
- Create transparency in a country's national system
- Adapt to national, regional circumstances

Key Source Category Analysis: Link to GHG Inventory Management

KCA

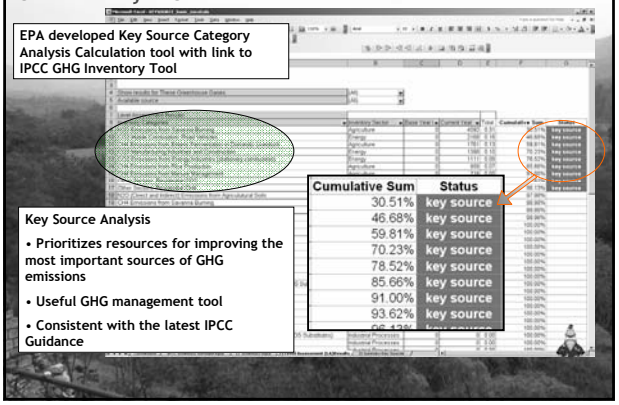
Focuses and sets priority categories and/or subcategories for improvements

Focuses inventory planning and development of National GHG Inventory Improvement Plan

- Improve Data
- Choose more advanced methods
- Focus QA/QC efforts
- Improve/establish Institutional Arrangements

National Inventory Management Tools – Key Source Analysis Software

EPA developed Key Source Category Analysis Calculation tool with link to IPCC GHG Inventory Tool

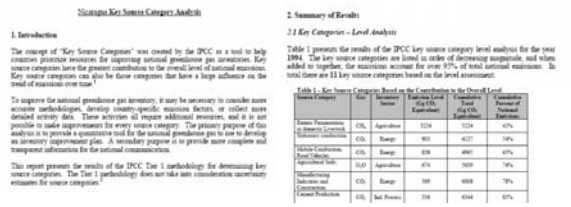


Key Source Analysis

- Prioritizes resources for improving the most important sources of GHG emissions
- Useful GHG management tool
- Consistent with the latest IPCC Guidance

Key Source Template: Summarize and Document Results

- Companion software provides tool which facilitates key source category analysis to direct/prioritize inventory improvement efforts
- Report template provides documentation/archive of analysis
- Sample report: Nicaragua



Nicaragua Key Source Category Analysis

1. Introduction

The concept of "Key Source Categories" was created by the IPCC as a tool to help countries prioritize resources for improving national greenhouse gas inventories. Key source categories have the greatest contribution to the overall level of national emissions. Key source categories can also be those categories that have a large influence on the trend of emissions over time.

To improve the national greenhouse gas inventory, it may be necessary to consider more accurate methodologies, develop country-specific emission factors, or collect more detailed activity data. These activities all require additional resources, and it is not possible to make improvements for every source category. The primary purpose of this analysis is to provide a quantitative tool for the national greenhouse gas to use to develop an inventory improvement plan. A secondary purpose is to provide more complete and transparent information for the national communication.

This report presents the results of the IPCC Tier 1 methodology for determining key source categories. The Tier 1 methodology does not take into consideration uncertainty estimates for source categories.

2. Summary of Results

2.1 Key Categories – Level Analysis

Table 1 presents the results of the IPCC key source category level analysis for the year 1994. The key source categories are listed in order of decreasing magnitude, and when added together, the emissions account for over 95% of total national emissions. In total there are 11 key source categories based on the level assessment.

Table 1 – Key Source Categories Based on the Contribution to the Overall Level

Source Category	Gas	Inventory Status	Emission Level (Gg CO_2 Equivalent)	Cumulative Total (Gg CO_2 Equivalent)	Cumulative Percent of National Emissions
Forest Conversion, or Annual Cropping	CH_4	Agriculture	3224	3224	42%
Stationary combustion	CO_2	Energy	903	4127	54%
Mobile Combustion, Road Vehicles	CO_2	Energy	838	4965	65%
Agricultural Soils	N_2O	Agriculture	474	5439	71%
Manufacturing Industries and Construction	CO_2	Energy	369	5808	76%
Cement Production	CO_2	Ind. Process	338	6144	81%

WGIA Regional Key Source Category Analysis*: Level Assessment Across Countries

CO_2 Emissions from Changes in Forest and Other Woody Biomass Stocks
CO_2 Emissions from Stationary Combustion (Energy)
CH_4 Emissions from Rice Cultivation
CO_2 Emissions from Forest and Grassland Conversion
CO_2 Emissions from Manufacturing Industries and Construction
CO_2 Emissions from Mobile Combustion
CH_4 Emissions from Enteric Fermentation
CO_2 Emissions Abandonment of Managed Lands

Institutional Arrangements Template

- Address limitations countries have noted in prior National Communications
  - *"There are no institutional arrangements nor procedures to generate, manage, and analyze the information required to systematically prepare and update the inventory."*- El Salvador First National Communications-Description of National Circumstances
- Helps inventory management teams focus systematically on institutional arrangements for the inventory process
  - Assess existing arrangements (esp. for key sources)
  - Identify and prioritize areas for improvement
  - Build continuity: provides document or "archive" of institutional history to pass on to future inventory teams

Institutional Arrangements: Costa Rica

DESCRIPCION GENERAL DEL EQUIPO QUE ACTUALMENTE GESTIONA EL INVENTARIO

Cuadro 1.a Agencia Responsable del Inventario

Agencia	Dirección
Ministerio del Ambiente y Energía (MINAE), Instituto Meteorológico Nacional (IMN)	Avenida 9 Calle 17 San José, Costa Rica

Cuadro 1.b Equipo Gestor del Inventario Nacional

Papel	Nombre	Organización	Datos de contacto	Comentarios
Director Coordinador	Roberto Villalobos Flores	IMN	rvilla@imn.ac.cr	
Responsable del Sector Energía	Ana Rita Chacón	IMN	archacon@imn.ac.cr	
Responsable del Sector Procesos Industriales	Ana Rita Chacón	IMN	archacon@imn.ac.cr	
Responsable del Sector Agricultura	Ana Rita Chacón	IMN	archacon@imn.ac.cr	Temporal mientras la persona asignada se incorpora a las actividades
Responsable del Sector Residuos	Jihad Sasa Marin	Universidad Nacional	----	Contrato por tiempo limitado
Especialista en el Sector	Susana Rojas Piedra	Consultora	----	Contrato por tiempo limitado

Cuadro 1.d Mejoras a la Gestión existente del Inventario Nacional

En general la ampliación del grupo encargado de la elaboración del inventario es una mejora que se puede hacer al sistema del inventario.
La evaluación del Sector Uso de la Tierra y Silvicultura y manejo de desechos deben ser labores permanentes de las instituciones y no contrataciones, como se realiza actualmente.

Institutional Arrangements: Strategy for Collecting Data

Nicaragua

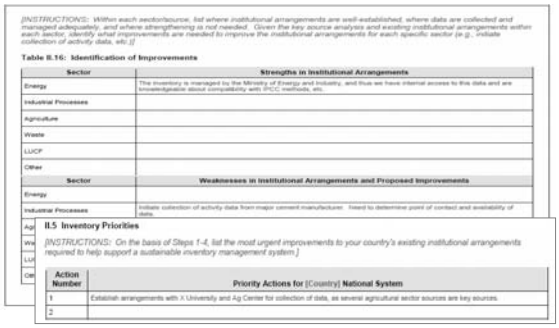
Table 2.3 Industrial Processes Institutional Arrangements

Data needs	Contacts	Organization	Contact Information (email, phone, etc.)	Comments
Industrial production statistics	Clifford Ramirez B.	Central Bank of Nicaragua (BCN)	Email: crb@bcn.gob.ni Phone: 505-2650500	
Industrial production statistics	Dulce Mayorga E.	National Institute of Statistic and Census (INEC)	Email: dulcem@inec.gob.ni Phone: 505-2682160	

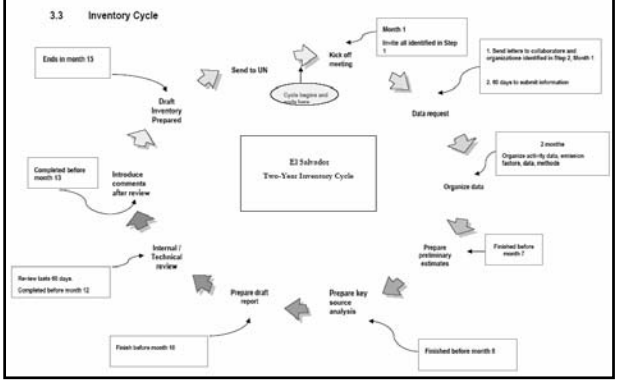
Table 2.4 Industrial Processes Description of Institutional Arrangements

Strategy and process used for collecting data
Check list preparation. Search for the contact key person within the key office in the Central Bank of Nicaragua (BCN) and the National Institute of Statistic and Census (INEC), meet the selected contact key person to discuss the check list and to know about the process to get the information, Motivation workshop, by sector GHG inventory presentation to key Staff. Official letter request to the office head, follow up meetings. Actually, there is no agreement.

Institutional Arrangements: Strengths and Weaknesses

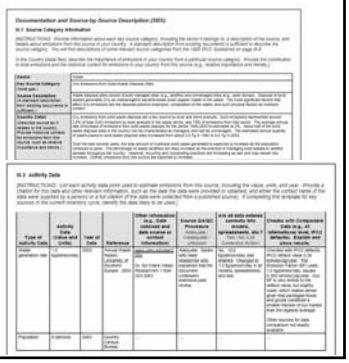


Institutional Arrangements and the Inventory Cycle



Source-by-Source Documentation Template

- Apply to key source categories at minimum
- Provide information about each: key source category including
  - Relevance of emission source in the country
  - Methodology and EF for estimating emissions
  - Document QA/QC
  - Document data limitations
- Ensures reproducible and transparent estimates
- Reference/Archive for future teams, peer review



Archive Procedures Template

- Archiving of all information used in inventory planning and preparation is essential
  - Information related to emission factors, activity data, key sources, QA/QC, uncertainty, methods used, technical review comments and response to comments should be archived
  - Archive may be electronic and/or hard copy
  - Should be located in single location
  - Need not be expensive: Simple but necessary!

Documentation and archiving is key!!

Archive Procedures Template

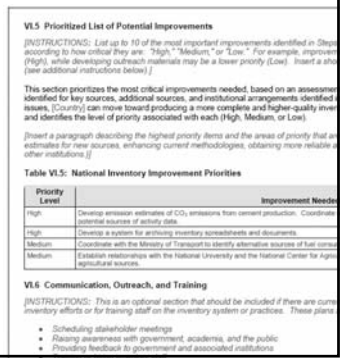
- Describe existing archive system (summarize notes form IA template)
  - Documentation checklist? Decentralized? Duplicate copies? Naming conventions? Location? Inventory archives manager?
- Develop proposed archive procedures
  - Describe roles and responsibilities
  - Overall checklist, source lead checklists (documentation requirements)
  - Archive schedule (i.e. when files must be given to archive manager)
  - Summarize storage mechanisms (i.e. location of hard and electronic file copies)

QA/QC Measures Template

- **Important to ensure consistency, transparency, and integrity of inventory**
- Describe existing procedures
- Develop a proposed QA/QC plan
  - Describe Roles and Responsibilities
  - Elaborate on procedures for communicating QA/QC Plan
  - List Minimal QC procedures that you will undertake
  - List additional (higher Tier) procedures that will be undertaken (determine criteria for use, i.e. key source)
  - Establish External Review or QA procedures (list institutions/individuals to be involved)
  - Overall Schedule (indicate more formal points for QC and QA)
- Much of the plan template is drafted – teams should customize the recommendations to their circumstances and needs

National Inventory Improvement Plan (NIIP) Template: Objective

- Synthesize findings of previous templates
- Guide and inform future efforts and teams
- Propose projects for improvements
  - Can serve as a documented proposal for funding of further inventory improvement projects (e.g., World Bank, UNDP etc.)
- Consider also linkages to other development priorities



VI.5 Prioritized List of Potential Improvements

[INSTRUCTIONS: List up to 10 of the most important improvements identified in Steps according to how critical they are: "High," "Medium," or "Low." For example, improvem (High), while developing outreach materials may be a lower priority (Low). Insert a sho (see additional instructions below).]

This section prioritizes the most critical improvements needed, based on an assessmen identified for key sources, additional sources, and institutional arrangements identified issues, [Country] can move toward producing a more complete and higher-quality inve and identifies the level of priority associated with each (High, Medium, or Low).

[Insert a paragraph describing the highest priority items and the areas of priority that a estimates for new sources, enhancing current methodologies, obtaining more reliable other institutions.]]

Table VI.5: National Inventory Improvement Priorities

Priority Level	Improvement Needed
High	Develop emission estimates of CO_2 emissions from cement production. Coordinate potential sources of activity data.
High	Develop a system for archiving inventory spreadsheets and documents.
Medium	Coordinate with the Ministry of Transport to identify alternative sources of fuel consu
Medium	Establish relationships with the National University and the National Center for Agric agricultural sources.

VI.6 Communication, Outreach, and Training

[INSTRUCTIONS: This is an optional section that should be included if there are curre inventory efforts or for training staff on the inventory system or practices. These plans

- Scheduling stakeholder meetings
- Raising awareness with government, academia, and the public
- Providing feedback to government and associated institutions

National Inventory Improvement Plan Priorities

Nicaragua NIIP

Table 5. National Inventory Improvement Priorities

Priority Level	Improvement Needed
High	Establish relationships with Agrarian National University and the Center for Research and Environmental Studies to improve the emission estimates for agriculture and waste sectors
High	Develop an inventory archiving system
Medium	Coordinate with Ministry of Transport and National Police to include in their statistics data by type and age of road vehicles
Medium	Develop a database platform to capture information from different sources

Panama's NIIP

Table 5. Potential Projects for Improving the National Inventory System

#	Potential Project	Estimated Personnel Needed	Estimated Cost ($)	Estimated Capital (equipment) Needed
1	Identify a key sub category source in LUCF sector and develop of the emission factor.	Need to hire 2 expert	$20,000.00	$20,000.00
2	Development of Institutional Arrangements memorandums.	None. Will be performed by current staff.	$2000.00	Need a few staff members
3	Emissions Factors for N2O emissions from Agricultural Soils of Central America and the applicability for the Panama conditions.	Need to hire 1 expert	$3,000.00	$3,000.00

National Inventory Improvement Plan Priorities

Costa Rica NIIP

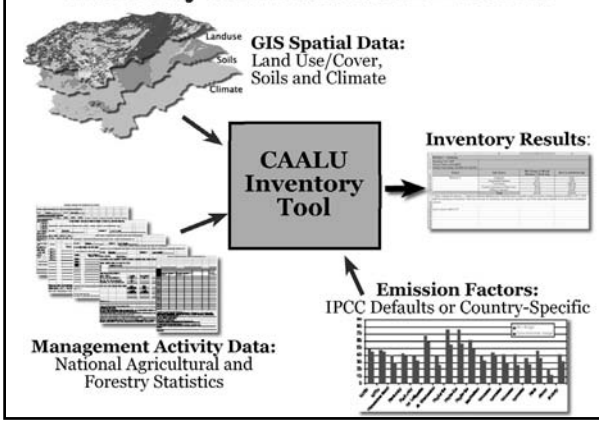
Table 22: Priorities for Improvement of the National Inventories

Priority Level	Required improvement
High	Conduct soil carbon analysis
High	Conduct an actual survey to determine in-country emission factors
High	Conduct periodic studies on the composition of solid waste that is disposed of in landfills and follow up the emission analyses for methane in the landfills.
Medium	Develop information systems with less aggregated values in order to determine emissions by type of equipment
Medium	Evaluate possibility to improve emission factors taking into consideration national surveys, age of the fleet, type of vehicles.

Central America Agriculture and Land-Use Tool (CAALU)

- State of the art database software developed by Colorado State University (CSU)
- Designers also wrote IPCC Guidelines
- Greatly simplifies task of completing a GHG inventory, but including:
  - QA/QC checks
  - Consistent use of data
  - Hard-wired for IPCC defaults
  - Options to use country-specific data
- Can handle large datasets such as satellite maps

Inventory Framework: CAALU Tool



Conclusions: EPA's experience

- A cooperative project where Central American and US experts worked together together on improving inventories
  - Each country prepared a draft National GHG Systems Report identifying priorities for the future
  - The inventory management template approach does not solve the problem of resources but can help address lack of staff continuity
  - EPA project components have enhanced institutional and technical capacity to develop accurate, consistent, and transparent inventories now and in the future
  - Central Americans have strong networks that can be further developed for more formal information sharing
  - EPA has also learned about potential improvements for the U.S. inventory through interaction with Central American experts
- Tools and lessons from Central America can be applied to improve GHG inventories in other regions

For more information

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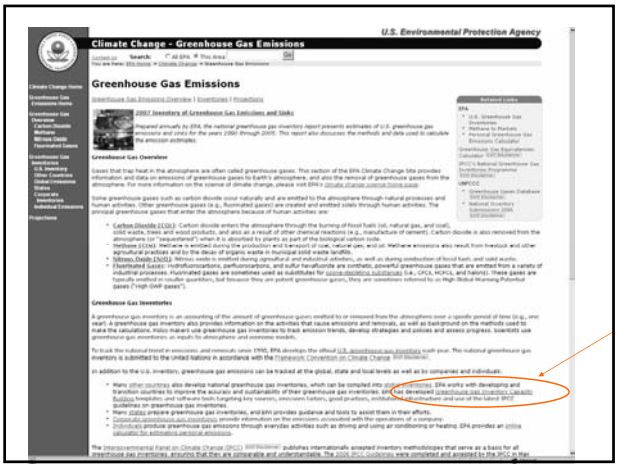
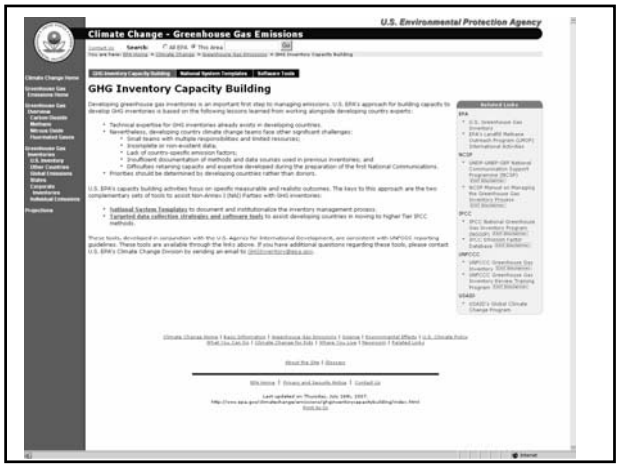
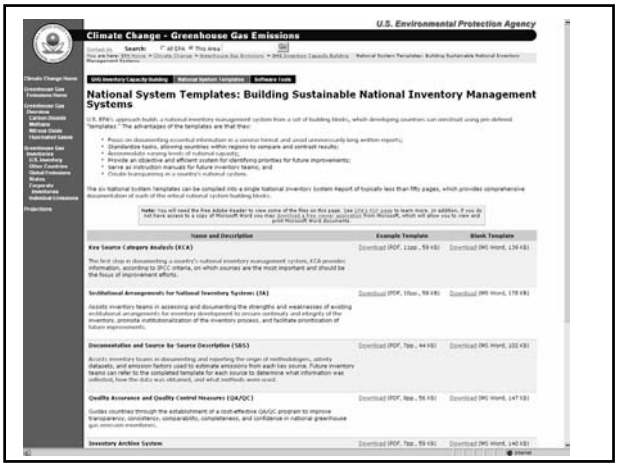
Climate Change Division
U.S. Environmental Protection Agency
desai.mausami@epa.gov or
GHGInventory@epa.gov

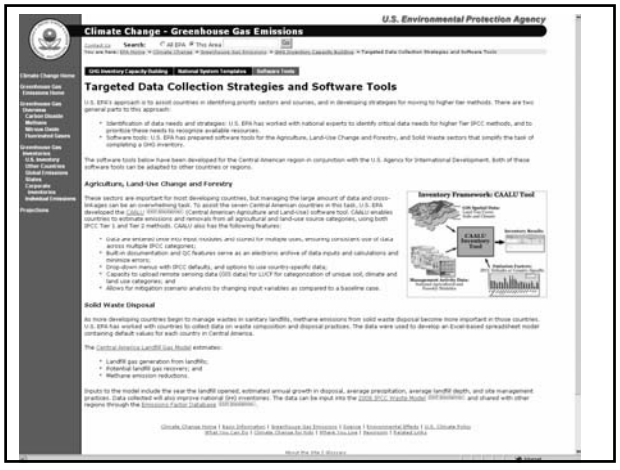
Online Resources:

- Climate Change Site - http://www.epa.gov/climatechange
- U.S. GHG Inventory - http://www.epa.gov/climatechange/emissions/
- GHG Inventory Capacity Building Tools - http://www.epa.gov/climatechange/emissions/ghginventorycapacitybuilding/

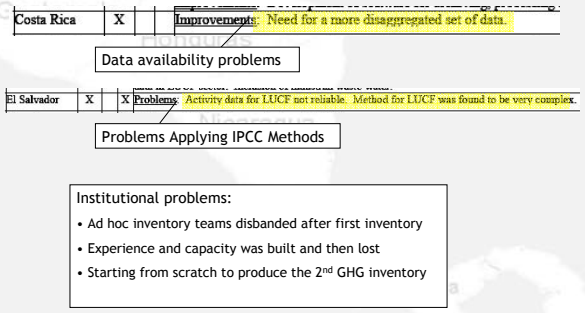








Central American countries reported problems with their first GHG inventories



Regional Challenges in SE Asia

- WGIA Synthesis Report:
  - LUCF sector – *"Frequent change of personnel working on inventories"*
  - Next steps – *"Capabilities of experts responsible for inventory development should be enhanced"*
  - Malaysia – *"…still a need to strengthen the institutional capacity for the collection and collation of GHG data"*

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

An Introduction

Masato Yamada, NIES

Organization

- Organized by National Institute for Environmental Studies (NIES), Japan
- Participants of 1st Workshop (other than Japanese)
  - Prof. Lee,Dong-Hoon (Korea)
  - Dr. Wang Qi (China)
  - Dr. Quan Hao (China)
  - Dr. Shirintornthep Towpryoon (Thailand)
  - Ms. Upik S Aslia Kamil (Indonesia)
  - Ms. Bulgamaa Densambuu (Mongolia)
  - Prof. Cao Thew Ha (Vietnum)

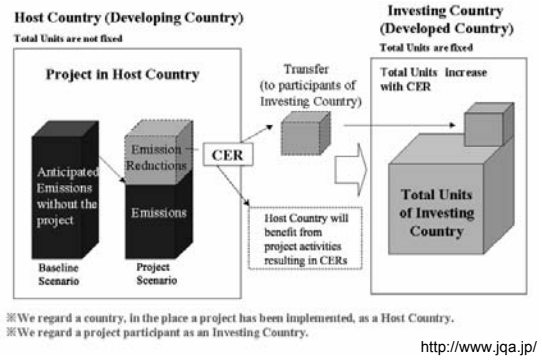
Open Dumping

- Fire
- Pest
- Odor
- Leachate
- Landslide…

Departure from open dumping is the first step for improvement.

CDM

A new investment for environmental protection.



http://www.jqa.jp/

LFG Recovery

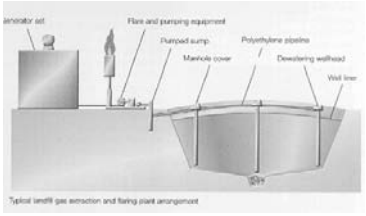
A major methodology for CDM.

Application from 1970's in western countries

LFG Recovery in 1996 (MW)

World	1385	**North America**	**730**	Mideast	0
Western Europe	**573**	Pacific	30	Asia	30
Eastern Europe	0	Mediterranean	0	South America	20
former USSR	0	Africa	2		

(ref.EU)



Example of LFG Utilization System

First Order Decay Model in 2006 IPCC guideline

LFG recovery

in situ CH_4 oxidation

CH_4 emitted in year T = $(\Sigma_x CH_4 \text{ generated}_{x,T} - R_T) \bullet (1 - OX_T)$

$CH_4 \text{ generated}_T = DDOC_{mdecomp,T} \bullet F \bullet 16/12$

$DDOC_{mdecomp,T} = DDOC_{ma\ T-1} \bullet (1 - e^{-k})$

$DDOC_{maT} = DDOC_{mdT} + (DDOC_{maT-1} \bullet e^{-k})$

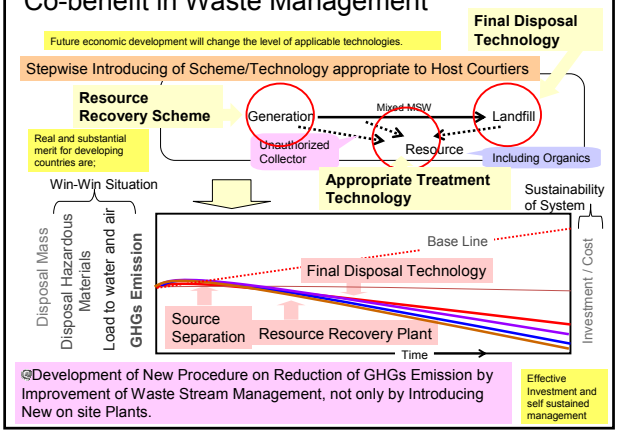
$DDOC_{md} = W \bullet DOC * DOC_f \bullet MCF$

DOC reduction along waste stream

Aerobication of landfill

There are several points of introducing technology for reduction (not only LFG recovery).

Co-benefit in Waste Management

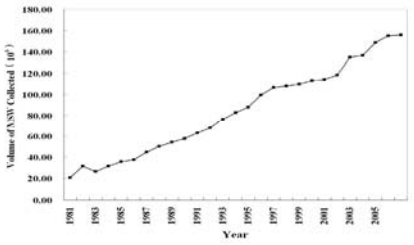


Topics

1. Is the **2006 IPCC Guidelines** applicable for the estimation of the landfill methane emissions from regional projects in Asia?
2. *What are **appropriate technologies** for waste management and GHG reduction in Asia?*
3. *How to estimate **sustainability** of waste management in Asia?*

Finding at the 1st Workshop

- Overall, waste is increasing in many Asian countries.



MSW Generation in Chinese City

Finding at the 1st Workshop

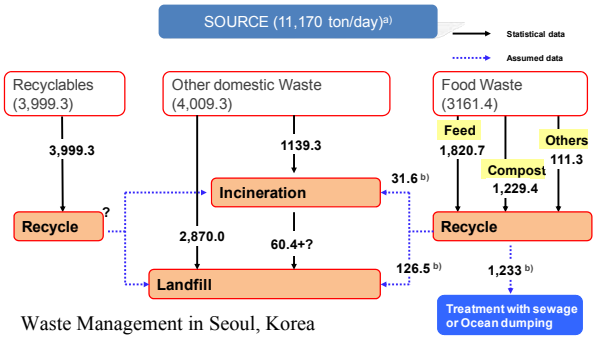
- Big cities vs. Other areas
  - Generation, composition, management of waste

Area	Population	Waste generation (tons/day)	Waste generation rate (kg/cap/day)
1Bangkok	5,844,607	9,350	1.6
2 City and Pattaya	12,203,425	14,661	1.2
2 1 Central- Western region	3,585,595	4,650	1.3
2 2Northen region	2,264,406	2,825	1.25
2 3 North-east region	3,239,281	3,134	0.97
2 4 Eastern region	1,246,151	1,901	1.53
2 4Southern region	1,867,992	2,151	1.15
3 Outside City	44,871,653	17,930	0.4
	63,665,458	41,941	0.66

Waste Generation in Thailand

Finding at the 1st Workshop

- Different status of waste management



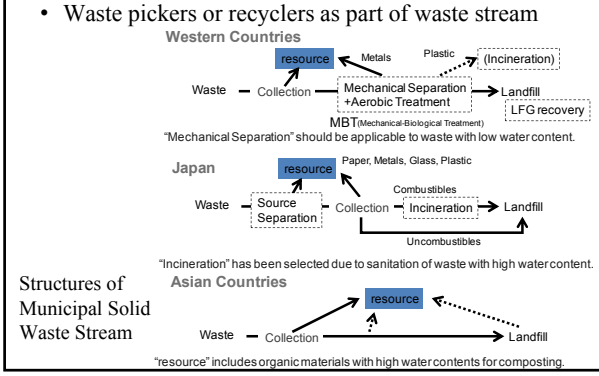
Waste Management in Seoul, Korea

Finding at the 1st Workshop

- Open dumping and improper landfills

Finding at the 1st Workshop

- Waste pickers or recyclers as part of waste stream



Structures of Municipal Solid Waste Stream

Finding at the 1st Workshop

- Statistics on waste stream (generation, composition and treatment/disposal/recovery) should be fundamental.

However,

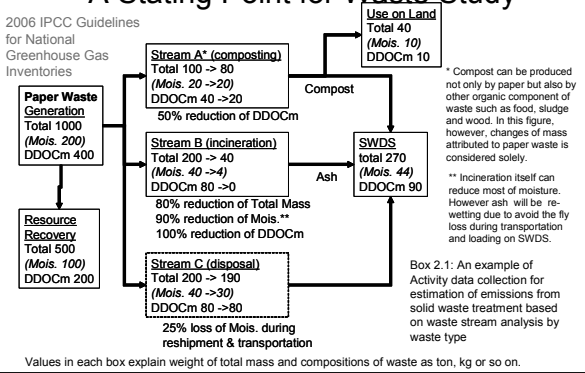
- There are no common or comparable format for waste statistics in Asia.

Construction of Asian waste statistics will be one of our major topic throughout this workshop.

Data on Solid Waste Management

- Waste Generation (weight/generator/time)
- Waste Composition (percentage of garbage, paper, plastics, metals…)
- Physicochemical Property (ex. water content/ Ignition loss/ ash content, calorific value, content of carbon/ nitrogen/ sulfur/ chlorine/ heavy metals/ dioxins…)
- **Waste Stream** (rate of collection, resource recovery, land disposal, incineration…)
- Cost/ Revenue

Waste and Substance Flow in Stream - A Stating Point for Waste Study-



Box 2.1: An example of Activity data collection for estimation of emissions from solid waste treatment based on waste stream analysis by waste type

Values in each box explain weight of total mass and compositions of waste as ton, kg or so on.

Waste Generation (Rate) - source and property of data?-

- **Method for Estimation**: Weighing every truck on a scale/ Sampling, Number of truck, or Revenue from fee…X Population, Economic Drivers or Trends…
- **Unit of Mass**: Weight or Volume (X Density)
- **Basis of Measurement**: Wet (flesh) or Dry (after pretreatment)
- **Time of Estimation**: Annual, Some years interval or Some case studies…

Waste Composition - common categories?-

2006 IPCC Guidelines for National Greenhouse Gas Inventories

- food waste — Excluding bone/ shell?
- garden (yard) and park waste — Including leave and straw for packaging?
- paper and cardboard — These should be divided for recycling management?
- wood — Including bamboo?
- textiles
- nappies (disposable diapers) — Excluding synthetic fabric?
- rubber and leather — Natural or synthetic?
- plastics — Soft or hard? Usage?
- metal — Iron/ Copper/ Alminium…?
- glass (and pottery and china)
- other (e.g., ash, dirt, dust, soil, electronic waste) — Ash is a large part in some countries.

Physicochemical Property - quality of data?-

- Method of sampling (representativeness)
- Method of pretreatment (drying, grinding, mixing, extracting…)
- Analytical method (common or experimental?)
- Statistical parameters (average, range…)
- Denominator of unit (dry/wet weight, volume, pieces…)
- Purpose of Analysis (for treatment/ disposal/ recycling, assessment of pollution/ risk/ GHG emission/ energy/ resource…)

Other factors

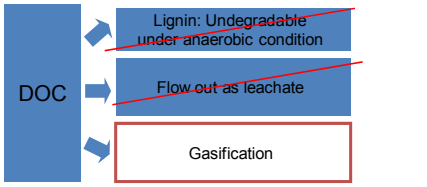
- Background information (nature, economy, industry, culture…)
- Legal/economical framework
- History of waste management
- Description of facilities and sites for waste management (transportation station, treatment plant, landfill…)

Finding at the 1st Workshop

- Applicability of the IPCC Waste Model

DOCf :Fraction of DOC that can decompose

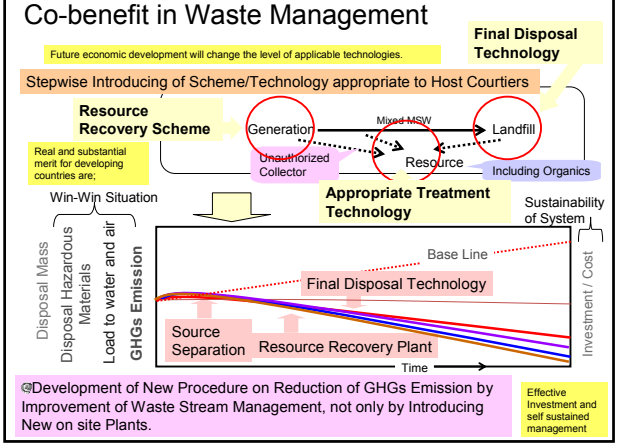
Leached out DOC is not sure.



Generally the amounts of DOC lost with the leachate are low (less than 1%) and can be neglected in the calculations. (2006 IPCC Guideline)

Is this explanation realistic in Asian Countries?

Co-benefit in Waste Management



The 2nd workshop will be held at Fukuoka in February 2008.

What are appropriate technologies for waste management and GHG reduction in Asia?

We are welcome participants from Malaysia!!

Thank you for your attention.

The 5th Workshop on GHG Inventories in Asia (WGIA5)
Kuala Lumpur, Malaysia
6-8, September, 2007

Mitigation Scenario Analysis - Asia-Pacific Integrated Models -

Tatsuya HANAOKA, Mikiko KAINUMA, Toshihiko MASUI, Junichi FUJINO, Shuichi ASHINA, Yuko KANAMORI, Takeshi IKEGAMI
National Institute for Environmental Studies

Yuzuru MATSUOKA
Kyoto University

Frequently Asked General Questions

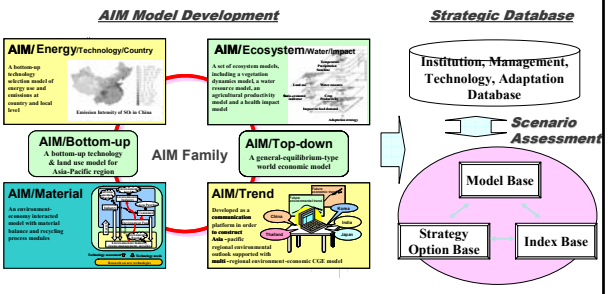
- Is there any simple method to assess future mitigation scenarios?
- What kinds of approaches / steps / methods / datasets should be considered and prepared for mitigation analysis?

Outline of presentation

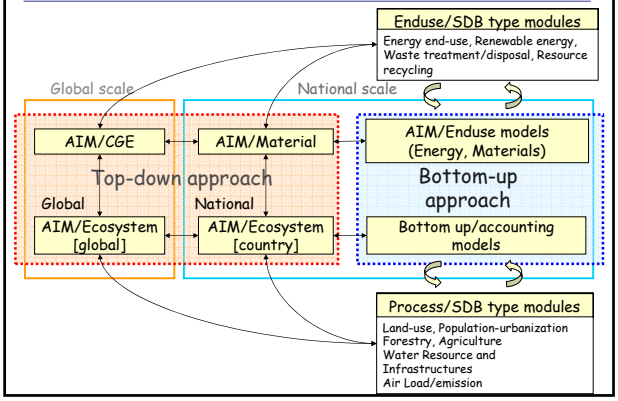
1. Overview of AIM model family
2. Approaches of mitigation scenario analysis
   - ✓ Top-down approach: AIM/CGE model
   - ✓ Bottom-up approach: AIM/Enduse model
     AIM/Energy Snapshot tool
3. Examples of mitigation scenario analysis
   - ✓ Application of AIM/Energy-snapshot tool
   - ✓ Approached of scenario analysis
   - ✓ Example results

AIM team activities

AIM = Asia-Pacific Integrated Model



AIM family for mitigation analysis



Top-down and bottom-up approach

Bottom-up approach

AIM/Enduse model
- This model can assess individual technologies under the detail technology selection framework
- This model is partial equilibrium model on energy

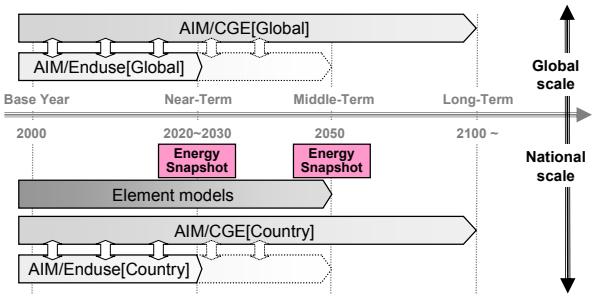
AIM/Energy-Snapshot tool
- This tool can assess energy balance and CO2 emissions among sectors simultaneously.
- This is a snapshot tool at a certain point (but not optimization model).

Top-down approach

AIM/CGE model
- This model draws the balanced macro economy, based on social conditions such as population, technology and preference, countermeasures.
- This model is a general equilibrium model.

⇨ **There are advantages/disadvantages in each approach, so target of analysis will be different depending on approaches.**

Temporal scale of mitigation analysis

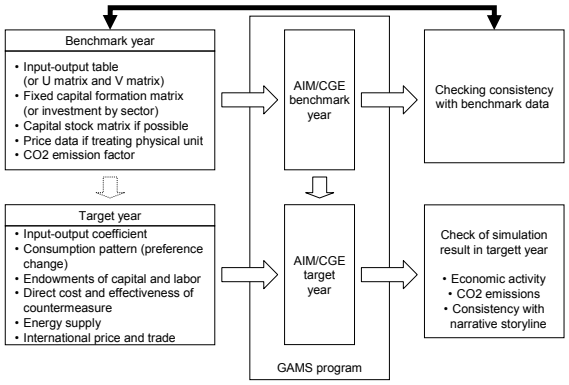


- Due to data constraints of future technology information, Enduse model analyzes scenarios with horizons of 2020~2030, and up to 2050 at most.
- CGE model deal with long-term analyses, but it needs to set assumptions on energy efficiency improvements, and macro economic parameters, etc.

Framework in AIM/CGE model

- **Type : a recursive dynamics general equilibrium model**
- **Target Gas :CO2, non-CO2(CH4, N2O etc)**
- **Commodities and activities :**
- **primary energy**
  - **coal, crude oil, natural gas, nuclear, hydro, other renewable (solar, wind, waste, biomass, ...)**
- **final energy**
  - **coal products, oil products, town gas, electricity, heat, hydrogen, biomass (solid, liquid, gas)**
- **non-energy**
  - **agriculture, forestry, fishery, foods, textile, paper, chemical, cement, other ceramic, steel, non-steel metal, machinery, other production, construction, water, whole sale & retail trade, finance & insurance, real estate, transport (passenger, freight), communication, public service, other service.**

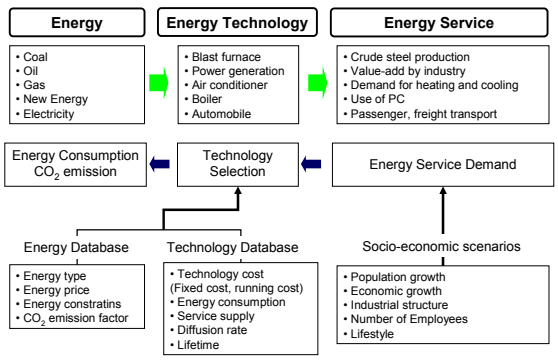
Process of model development



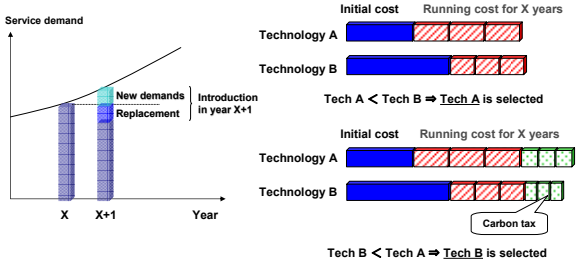
Framework of AIM/Enduse model

- **Type : a Bottom-up optimization model with detail technology selection framework**
  - **by giving energy service demand exogenously, mitigation options are selected under various carbon emission constraints**
- **Target Gas :CO2, non-CO2(SO2, NOx, N2O, CH4,etc)**
- **Target Sectors : multiple sectors**
  - **power generation sector, industry sector, residential sector, commercial sector, transport sector, agriculture sector, waste sector, other CH4 emissions sector, F-gas emissions sector**

Outline of AIM/Enduse model



Logic of technology selection

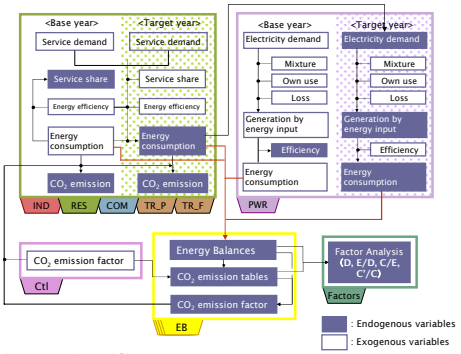


As private industries take into account high investment risk for energy conserving technologies, **a payback period of 3-years** is assumed.

Framework of AIM/Energy snapshot tool

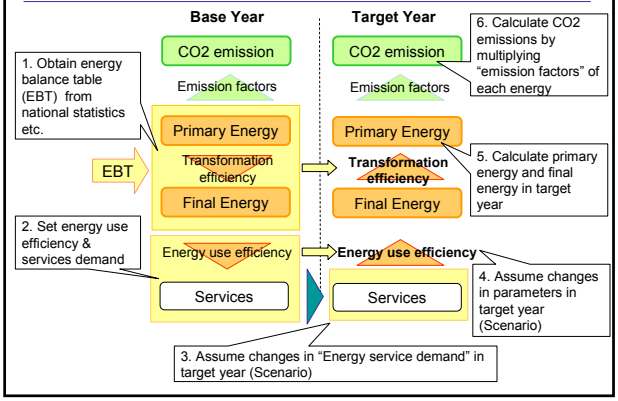
- **Type : an accounting tool to calculate the energy balance table and the CO2 emission table immediately with keeping consistency among sectors.**
  - **by giving service demand, share of energy and energy improvement by classification of service and energy in the base year and the target year**
- **Target Gas :CO2**
- **Target Sectors : multiple sectors**
  - **power generation sector, industry sector, residential sector, commercial sector, transport sector**

Outline of Energy Snapshot (ESS) tool



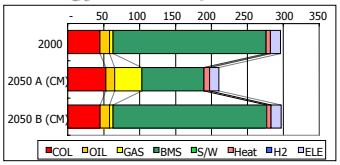
Energy Snapshot : Manual, Excel file
http://www-iam.nies.go.jp/aim/datalibrary.htm

Calculation process of ESS

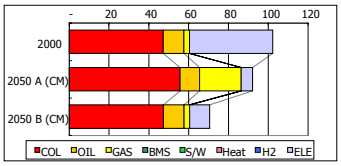


Example of result figures by ESS

Energy Consumption



CO2 Emission



Example of factor analysis by ESS

- Extended Kaya Identity

$$C = D \times \frac{E}{D} \times \frac{C'}{E} \times \frac{C}{C'}$$

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

D: Driving forces (service demand)

E: Energy Consumption

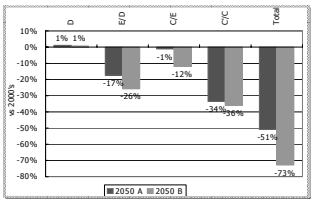
C': CO_2 emission without measures in transformation ector

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



Scenario of 2050 in China

	CM(A)	CM(B)
GDP	National planning before 2050, 7.5% from 2000 to 2010, 5.1% from 2010 to 2050.	National planning before 2050, 7.5% from 2000 to 2010, 5.1% from 2010 to 2050.
Population	National control plan, reach peak between 2040 to 2050 by around 1.6billion	National control plan, reach peak between 2040 to 2050 by around 1.6billion
Per capita GDP	11 thousand US$ by 2050(1990 price),	11 thousand US$ by 2050(1990 price),
Energy use technology progress	Fully diffusion of advanced energy use technology by 2050, technology efficiency is 30% higher than that in 2000, fuel cell vehical will be widely used by 2030	Fully diffusion of advanced energy use technology by 2050, technology efficiency is 40% higher than that in 2000, fuel cell vehical will be widely used by 2030

Note) China's GDP average annual growth rate shown as 7.5% from 2000 to 2010 is the national planning data.

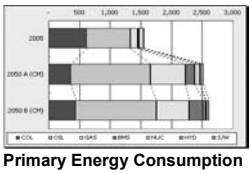
Source: Prof.Hu, Dr.Jiang (tentative results)

Scenario of 2050 in China

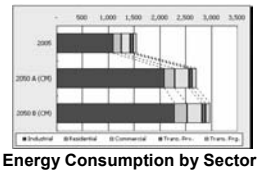
	CM(A)	CM(B)
Annual average marginal cost improvement of energy exploitation technology	Coal: 0.4% Oil: 0.8% Natural gas: 0.3%	Coal: 0.5% Oil: 0.8% Natural gas: 0.8%
Non-Conventional energy use	Non-Conventional gas is needed after 2040, small demand for non-conventional oil	Non-Conventional gas is needed after 2040, small demand for non-conventional oil
Modern renewable energy such as solar	Cost will be 0.36yuan/kWh by 2050	0.18yuan/kWh by 2050
Modern biomass utilization technology	More than 70mtce biomass is available at cost lower than US$44/tce	More than 70mtce biomass is available at cost lower than US$50/tce

Source: Prof.Hu, Dr.Jiang (tentative results)

Energy Snapshot in China in 2050



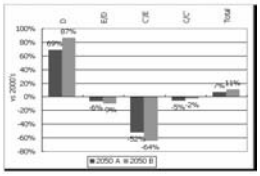
Primary Energy Consumption



Energy Consumption by Sector

Note) the primary energy consumption does not include the fuel uses for generating electricity

Source: Prof.Hu, Dr.Jiang (tentative results)



Factor analysis of CO2 Emission by Industrial sector

Low Carbon Scenario (LCS) Study in Japan - Application of AIM/Energy-snapshot tool -

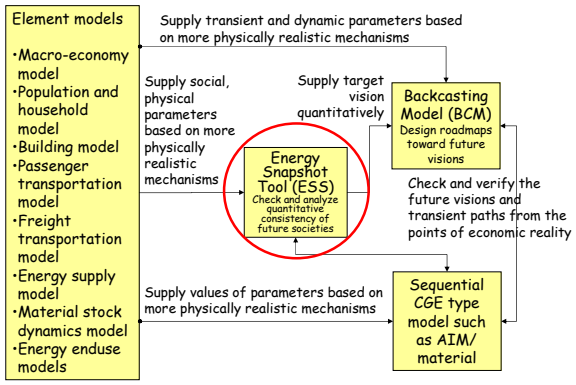
Motivation of the study:

This study assesses the possibility of achieving the Low-Carbon Society in Japan by targeting at 70% CO2 emission reduction by 2050 compared to the 1990 level, while satisfying the expected demand for energy services in 2050.

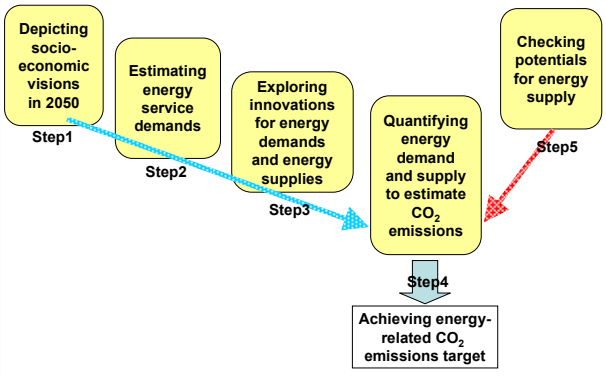
- How to achieve 70% CO2 emission reduction by 2050?
- What kinds of scenarios would be under such a target?
- How much energy reduction would be necessary from both demand side and supply side?

etc…

Relations among ESS and element models



Scenario approach toward Low-Carbon Society



Two different visions for societies in 2050 in Japan

Vision A "Doraemon"	Vision B "Satsuki and Mei"
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

©藤子プロ・小学館

Doraemon is a Japanese comic series created by Fujiko F. Fujio. The series is about a robotic cat named Doraemon, who travels back in time from the 22nd century. He has a pocket, which connects to the fourth dimension and acts like a wormhole.

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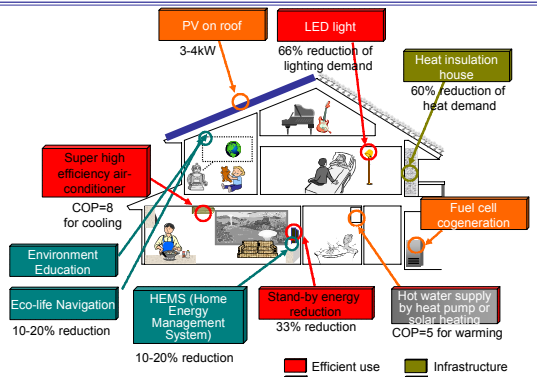
Satsuki and Mei's House reproduced in the 2005 World Expo. Satsuki and Mei are daughters in the film "My Neighbor Totoro". They lived an old house in rural Japan, near which many curious and magical creatures inhabited.

LCS Japan scenarios for economy and industry

Growth rate	• Per capita GDP growth rate:2%	• Per capita GDP growth rate:1%
Technological Development	• High	• Not as high as scenario A
Market	• Deregulation	• Adequate regulated rules apply
Primary Industry	• Declining GDP share • Dependent on import products	• Recovery of GDP share • Revival of public interest in agriculture and forestry
Secondary Industry	• Increasing add value • Shifting production sites to overseas	• Declining GDP share • high-mix low-volume production with local brand
Tertiary industry	• Increase in GDP share • Improvement of productivity	• Gradual increase in GDP share • Penetration of social activity

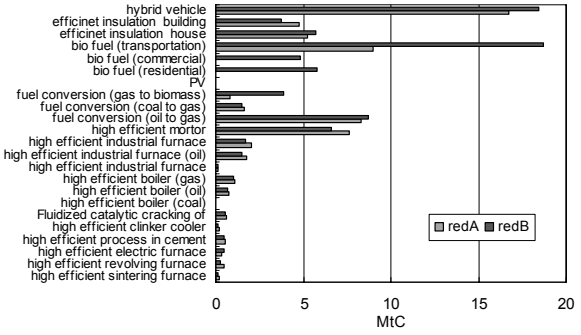
Depiction of future image: Residential sector in 2050



Step1 and Step3

Technology Development and Diffusion in Japan

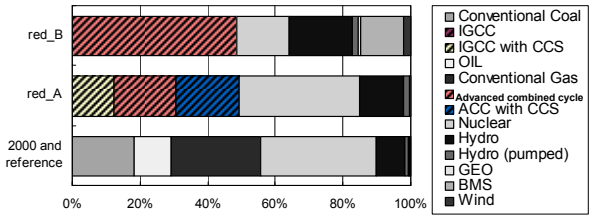
Demand side CO2 reduction by advanced technologies in 2050



PV: one million kW in scenario A; two million kW in scenario B

Technology Development and Diffusion in Japan

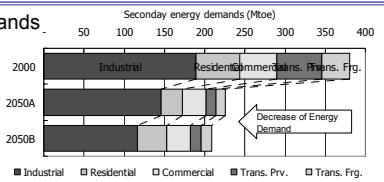
Technologies in power sector in 2050



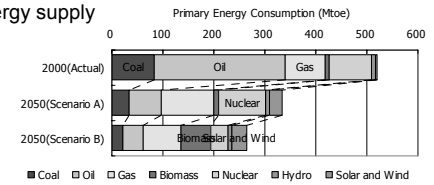
: New technology

70% reduction: combination of demand side energy reduction + low carbon energy

Final energy demands



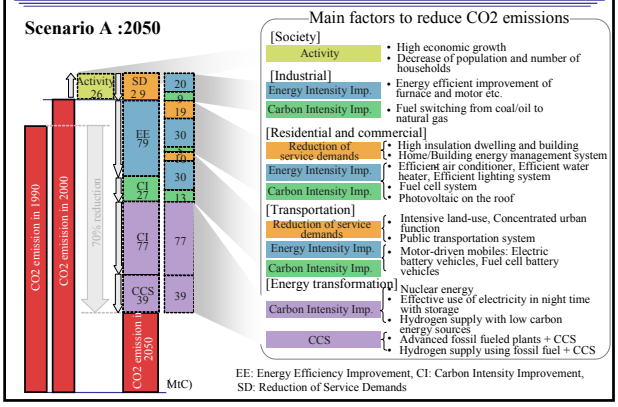
Primary energy supply



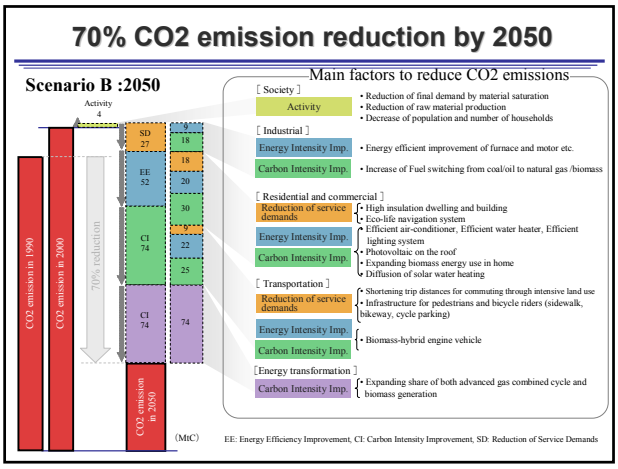
Step4 and Step5

70% CO2 emission reduction by 2050

Scenario A :2050



EE: Energy Efficiency Improvement, CI: Carbon Intensity Improvement, SD: Reduction of Service Demands



Thank You!

2050 LCS study
http://2050.nies.go.jp/index.html

The Energy Snapshot tool
http://www-iam.nies.go.jp/aim/datalibrary.htm

Session 2: Institutional Arrangements for National Inventory System

Introductory Presentation

7 September 2007, Kuala Lumpur, Malaysia
5th Workshop on GHG Inventories in Asia

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

Objectives of Session 2

- To discuss possible strategies to improve institutional arrangements for inventory preparation, and eventually to help improve the process of data collection.
- We will consider:
  - How to set up or improve the IA for SNC/TNC, by learning some countries' current IA.
  - How to enhance longer-term, inter-ministry cooperation to ensure sustainable data collection system.

From the preliminary survey …

- 6 countries have put IA into operation.
  - Cambodia, China, India, Korea, Malaysia, Viet Nam
- 4 countries give effect to IA for the SNC/TNC and beyond. (Not ad hoc for SNC/TNC only.)
  - India, Korea, Malaysia, Philippines (in preparation)
- All countries keep someone who worked for the previous NC in the current inventory team.
  - Continuity is ensured to some extent?

How to improve IA for SNC/TNC (1)

In the morning (before lunch)

- Some countries' current IA will be introduced.
  - Japan
  - Malaysia → Standing IA (Not ad hoc for SNC only)
  - Cambodia
  - Viet Nam → Ad hoc IA for SNC only
  - Korea

How to improve IA for SNC/TNC (2)

In the morning (before lunch)

- Also, sector-specific data collection system will be presented.
  - Thailand (Waste Sector)
- Discussion will follow the presentations. Available relevant tools should be also taken into consideration during the discussion.
  - UNDP Handbook (in particular Chapter 3)
  - Template for documentation developed by USEPA

For longer-term solutions … (1)

- Sustainable data collection can be realized by, for example:
  - making periodic surveys
  - developing national statistics
- Cooperation of relevant ministries/agencies is essential. → How can we motivate them?
- Note one of the conclusions of WGIA4:
  - *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.*

For longer-term solutions … (2)

In the afternoon (after lunch)

- With a view to helping further consideration, presentations will be delivered on *Original Purposes and Multi-Applications of National Statistics Used for Japan's GHG Inventory*
- These presentations will tell you:
  - What kind of data are lacked in Asia (by sector)?
  - From what national statistics are those data sourced in Japan?
  - What are the original purposes and multi-applications of those national statistics?

For longer-term solutions … (3)

- Policy-makers and relevant ministries will be motivated more easily by emphasizing the purposes/applications other than inventory preparation (like the original purposes of national statistics used in Japan's inventory).
- However, this approach may go beyond discussion on the institutional arrangement for GHG inventory system.
  - *It may well take longer time than the timeframe of SNC preparation.*
  - *Scope of discussion will inevitably become wider than that for SNC preparation.*
- Anyhow, let's consider how we can do better!!

To summarize, we will consider in this session:

- How to set up or improve the IA for SNC/TNC, by learning some countries' current IA.
- How to enhance longer-term, inter-ministry cooperation to ensure sustainable data collection system.

Thank you.

Now, let's start Session 2!!

Ministry of the Environment
Government of Japan

Japan's Institutional Arrangement for Preparation of National GHG Inventory

7 September 2007, Kuala Lumpur, Malaysia
5th Workshop on GHG Inventories in Asia

Sei Kato
Ministry of the Environment

Stop Global Warming!
Team minus 6%

Outline

- History of Japan's Institutional Arrangement
- Current Institutional Arrangement
- Inventory Improvement Process
- Inventory Compilation Process
- Strength
- Weakness – for future improvements

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History of Japan's Institutional Arrangement

- Japan's institutional arrangement has developed through four phases.
  - Phase 1 (1992-1994):
    - *Started with a small team to develop the GHG inventory for 1st NC*
  - Phase 2 (1996-1998):
    - *Convened an ad hoc expert committee to revise the GHG inventory to comply with IPCC Guidelines*
  - Phase 3 (1999-2002):
    - *Set up an enhanced expert committee to study improvements to the GHG inventory taking KP requirements into consideration*
  - Phase 4 (2002-):
    - *Set up GIO and put National System in place*

Phase 1 (1992-1994)

- Background
  - UNCED (Rio Summit) was held and UNFCCC was adopted in 1992.
  - Annex I Parties were obliged to submit their initial NCs by 21 September 1994 (6 months after UNFCCC entered into force).
- A small team with assistance from relevant ministries/agencies
  - Small team: Environmental Agency + consultants
  - No expert committee dedicated to inventory work
  - Cooperation from the other ministries/agencies by request of Environmental Agency:
    - On an ad hoc basis (When necessity arose)
    - At the level of official in charge

Phase 2 (1996-1998)

- Background
  - IPCC GLs were published in 1995, revised in 1996.
  - Recommendations from in-depth review of 1st NC were fed back to Japan.
  - Annex I Parties needed to submit 2nd NC in 1997, and to submit GHG inventories annually since 1998.
- Enhanced IA as compared to Phase 1
  - Core team: Environmental Agency + consultants
  - An ad hoc expert committee (9 members) was convened to revise the GHG inventory to comply with IPCC GLs.
  - Cooperation from ministries/agencies was enhanced.
    - Relevant ministries/agencies participated in the meetings of the ad hoc committee.
    - Request to other ministries/agencies was made by Director of Climate Change Policy Division.

Phase 3 (1999-2002)

- Background
  - Kyoto Protocol was adopted at COP3 in 1997.
  - The Global Warming Prevention Headquarters was established inside the Cabinet in 1997.
  - The *Law Concerning the Promotion of Measures to Cope with Global Warming* was made and enforced in 1998.
  - IPCC GPG was published in 2000.
- Further enhanced IA as compared to Phase 2
  - Core team: Ministry of the Environment + consultants
  - An enhanced expert committee (about 60 members) was set up to study improvements to the GHG inventory taking KP requirements into consideration.
  - Linkage between ministries/agencies was further enforced.
    - Relevant ministries/agencies participated in the meetings of the expert committee.
    - The legislation gave an impetus to cooperation among ministries.

Phase 4 (2002-)

- Background
  - The Kyoto Protocol required each Annex I Party to have its national system for GHG inventory in place by the end of 2006.
  - The Guidelines for National System was developed as part of Marrakesh Accord at COP7 in 2001.
- IA embodied as National System under KP Art 5.1
  - GIO was established in 2002.
  - Core team: MoE + GIO + consultants
  - The expert committee (about 60 members) continues playing a key role.
  - Linkage between ministries/agencies has been made more explicit and formalized.
    - Documented in the initial report submitted under KP (August 2006)

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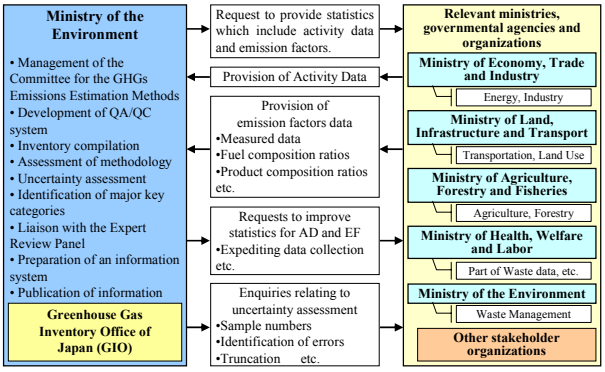
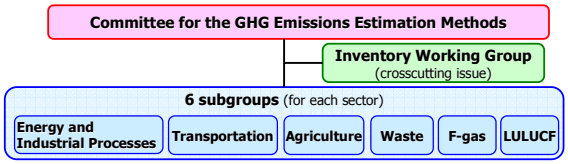
Current Institutional Arrangement (1)



➢ Based on ***the Law Concerning the Promotion of Measures to Cope with Global Warming***

Current Institutional Arrangement (2)

- "the Committee for the GHGs Emissions Estimation Methods", since 1999,
- Members: external experts, approximately 60
- The committee is in charge of methodological development of the inventory



➢ *Inventory compilation* and *inventory improvement* are implemented in close consultation with this committee.

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Stop Global Warming!
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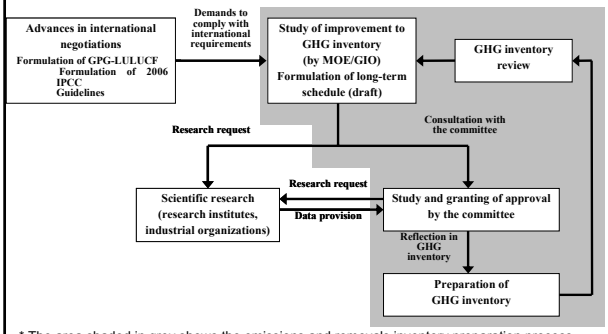
Inventory Improvement Process (1)



* The area shaded in grey shows the emissions and removals inventory preparation process.

Inventory Improvement Process (2)

- Specific issues that need to be addressed are detected through:
  - advances in international negotiations
  - technical review of GHG inventories under UNFCCC
  - experiences gained in preparation of GHG inventories
  - information provided by stakeholders
- To address those issues, studies are conducted by:
  - scientific research community; and
  - Committee for the Greenhouse Gas Emissions Estimation Methods
- The results of those studies are reflected in the next GHG inventory.

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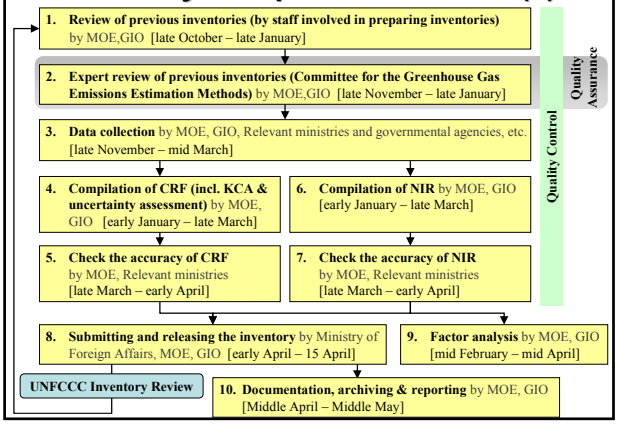
Inventory Compilation Process (1)



Inventory Compilation Process (2)

- Activity data collection
  - Data are gathered from published materials, if available, to the extent possible
  - In case published materials are not available, MOE request relevant ministries or agencies to gather data
- Choice of emissions and removals calculation method
  - Methods are chosen carefully for all sources/sinks and gases
  - Efforts are made to tailor the methods to Japan's actual conditions
- Choice of emission factors (EFs)
  - Country-specific emission factors based on the results of measurements taken within Japan
  - Default values from the Revised 1996 IPCC GLs and GPGs
- Examination and approval of methods and EF values by the Committee for the Greenhouse Gas Emissions Estimation Methods.

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Stop Global Warming!
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Strength (1)

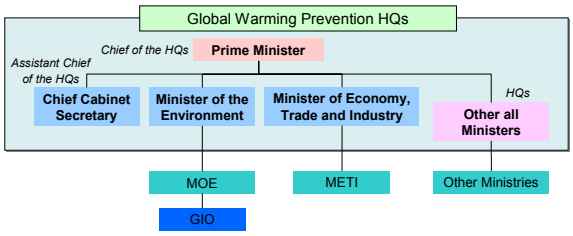
- Maintenance of institutional memory (if not entirely systematic)
  - Efforts have been made to ensure continuity of personnel engaged.
  - Important documents and materials have been continuously used and improved.
- Committee for the GHG Emissions Estimation Methods
  - Approximately 60 experts are engaged to cover all the sources/sinks and gases.

Strength (2)

- Active engagement of ministries/agencies
  - Awareness of importance of GHG inventory has been enhanced through various events.
  - Recognition has been raised about the relevance of data in GHG inventory to their policy fields.
    - Ministries/agencies are in general keen to make sure that any official announcement from government is consistent with their own policies.
    - National GHG inventory is officially reported to the world. Ministries/agencies are prompted to cooperate to ensure their own data are reflected in GHG inventories.

Strength (3)

- Active engagement of ministries/agencies
  - Legislation and top-down initiatives have promoted cooperation among ministries/agencies.
    - Global Warming Prevention HQs in the Cabinet
    - Law Concerning the Promotion of Measures to Cope with Global Warming



Strength (4)

- Mutually beneficial relationship between ministries/agencies
  - Activity data are supplied by ministries/agencies.
  - GHG inventory data are fed back to, and utilized by, ministries/agencies for their policy-making. For example:
    - Estimates of CO_2 emissions from fuel combustion (Category 1A of GHG inventory) are processed into CO_2 emissions by each economic sector which include:
      - Direct CO_2 emissions, as well as
      - "Indirect CO_2 emissions" that are attributable to electricity and heat consumption

    → These data help formulate energy-related policies for demand side management (DSM).

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Stop Global Warming!
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Weakness – For future improvements (1)

- Efforts need to be made to ensure timely completion/submission of GHG inventory.
  - It takes time for some statistics to be finalized.
    - energy consumption
    - amount of waste

    etc.
  - Coordination of various ministries/agencies takes long time.
- MOE/GIO will ask ministries/agencies to expedite the preparation of relevant statistics to meet the deadline of inventory submission.

Weakness – For future improvements (2)

- QA/QC procedure needs to be improved.
  - The setup of QC such as inputted data check, review of methodologies and data archiving is not fully systematic.
  - QA by a third party has not been in operation.
- MOE is examining the new QA/QC procedure by comparing it with other Annex I countries' QA/QC systems.

Weakness – For future improvements (3)

- Maintenance of institutional memory needs to be further promoted.
  - Know-how of inventory preparation tends to be developed and maintained by certain individuals and not efficiently or systematically shared in the institutions.
  - Personnel changes in ministries/agencies tend to hamper accumulation of know-how.
- GIO will prepare a detailed and comprehensive manual on inventory preparation describing all procedures from data collection to submission to the UNFCCC.

Ministry of the Environment
Government of Japan

Last of all

・Where there's a will, there's a way.
– Environmental Agency had the first-time meeting with the global environment issues in 1980.

・A journey of a thousand miles begins with a single step.
– Environmental Agency set up the office of global environmental protection in 1989.

・Step after step goes far.
– Environmental Agency upgraded to Ministry of the Environment in 2001 and GIO was established in 2002.

Stop Global Warming!
Team minus 6%

The 5th Workshop on GHG Inventories in Asia (WGIA5)

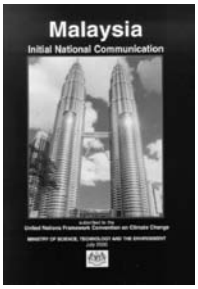
Institutional Set-Up for the Second National Communication of Malaysia

6-7 September 2007

Lavanya Rama Iyer
National Project Coordinator
SNC Malaysia

Contents

1.Background



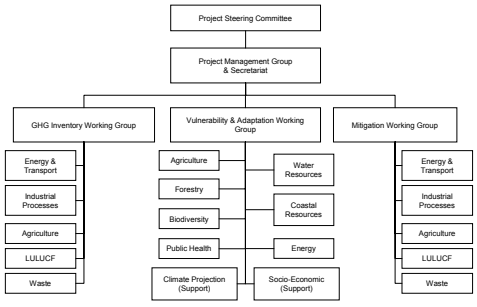
- Submitted in 2000
- Base year for GHG Inventory: 1994
- Project Manager and Technical Coordinator: Institute of Strategic and International Studies, Malaysia (ISIS)
- Stakeholders: scientists, experts, individuals from various government organisations, universities, research organisations and NGOs

Stocktaking

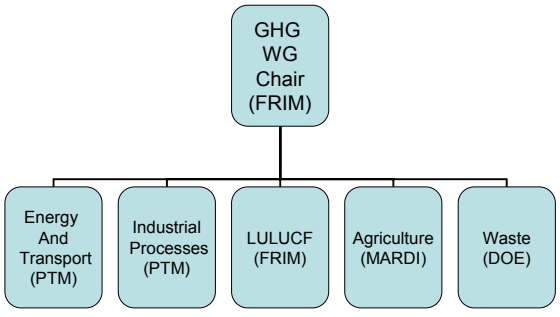
2 stocktaking workshops and consultative interviews found that:

- the institutional arrangement for the continuous reporting of national communication was recognized as a main concern area that should be addressed.

3. SNC Operational Framework



4. GHG Inventory WG



Energy

Lead Agency: Pusat Tenaga Malaysia (Malaysian Energy Agency)

- PETRONAS
- Ministry of Transport (includes Military Transport);
- KTM Bhd (Malayan Railway);
- Jabatan Laut Semenanjung Malaysia (Maritime Department, Peninsula Malaysia)
- Ministry of Agriculture Peninsular Malaysia, Sabah and Sarawak;
- Jabatan Mineral and Geosains (Mineral and Geoscience Department);
- Department of Statistics ;

Industrial Processes

Lead Agency: Pusat Tenaga Malaysia (Malaysian Energy Agency)

- PETRONAS;
- Cement & Concrete Association (C&CA);
- Malaysian Industrial Development Agency (MIDA);
- Malaysia Iron & Steel Federation (MISF);
- Department of Environment

LULUCF

Lead Agency: Forest Research Institute Malaysia

- Department of Forestry Peninsular Malaysia
- Forestry Department, Sabah
- Forestry Department, Sarawak
- Department of Agriculture, Peninsular Malaysia
- Department of Agriculture Sarawak
- Malaysian Palm Oil Board
- Malaysian Rubber Board
- University Pertanian Malaysia (Malaysian Agricultural University)

Agriculture

Lead Agency: Malaysian Agricultural Research and Development Agency

- Department of Agriculture
- Department of Agriculture, Sarawak
- Department of Agriculture, Sabah
- Malaysian Cocoa Board
- Malaysian Rubber Board
- Malaysian Palm Oil Board
- Veterinary Services Department
- Department of Statistics

Waste

Lead Agency: Department of Environment

- Town and Country Planning, Sabah
- Kota Kinabalu Dewan Bandaraya Kota Kinabalu
- Natural Resources & Environment Board Sarawak
- Sewerage Services Department
- Solid Waste Management Department
- Local Government Department,
- Malaysian Statistics Department
- Malaysian Palm Oil Board
- University Pertanian Malaysia
- FELDA
- FELCRA
- Malaysian Rubber Board
- Kualiti Alam Sdn Bhd (Solid Waste)
- Indah Water Konsortium (Sewerage)

GHG Inventory WG Main Outputs

- Database of data collected for preparation of the GHG Inventory for base year 2000 and time series of GHG inventory for years 1990 to 2004.
- The GHG Inventory Report for Base Year 2000.
- The National Communication Procedural Manual: GHG Inventory.
- The Action Plan for Improvement of the GHG Inventory.

NC Procedural Manual

- Compilation of sectoral reports on the procedures and arrangements for data collection and verification.
- List of agencies, departments and other resources consulted for data collection, including name and contact details of data sources.
- Gaps and constraints encountered.
- Recommendations for improvements.

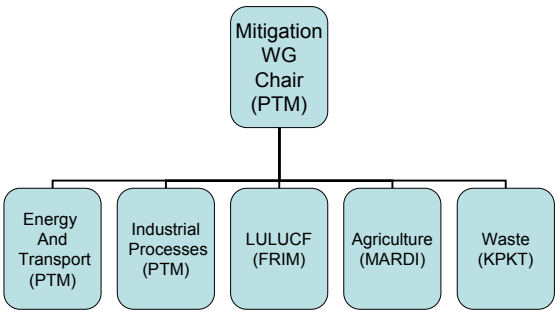
Action Plan for Improvement of GHG Inventory

- Compilation of sectoral action plans to:

1. Improve emission calculations.
2. Create a reliable data management and storage system.
3. Improving archiving and documentation.
4. Quality Assurance/Quality Control through improved verification procedures.

- Guidelines to update database continuously and integrate new features.
- Provide recommendations of activities to prepare for the application of new IPCC guidelines in future inventories.

Mitigation WG



Mitigation WG Main Outputs

- The Mitigation Assessment Report.
- The National Communication Procedural Manual: Mitigation Assessment.
- The National Action Plan to Mitigate GHG Emissions.

Mitigation Assessment Report

- Compilation of sectoral reports that

1. Gather and present information on implemented/adopted GHG reduction measures.
2. Report on progress and impact of CDM projects.
3. Identify, formulate and prioritise other potential mitigation policies and measures based on national condition and circumstances, reflecting national policies/sustainable development goals.

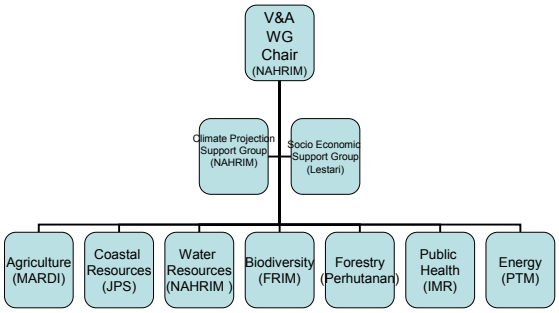
- BAU projection into 2020 using 2000 GHG Inventory.
- Develop two projections incorporating mitigation measures and analyse their cost benefit using economic tools.

The National Action Plan to Mitigate GHG Emissions

- Main improvement requirements to be identified:

1. cost analysis,
2. barriers for implementation,
3. assessment of technology options for the different mitigation options,
4. institutional capacity-building needs to sustain mitigation work,
5. legal and institutional frameworks.

V&A WG



V&A WG Main Outputs

- The V&A Assessment Report.
- The National Communication Procedural Manual: V&A.
- The National Action Plan: V&A.
- Cross sectoral analysis of V&A assessments to identify linkages.

V&A Assessment Report

- Assessment of Global Climate Model (GCM) outputs.
- Deliberate a 2 way interaction mechanism with GCM to improve climate scenario projections on a regional scale.
- Literature review of vulnerability of different sectors.
- Review, analyse and update sectoral vulnerability analysis in INC using GCM outputs and literature review.
- Analysis of socio economic impacts of sectors vulnerable to CC.
- Adaptation strategies for vulnerable sectors along with a cost analysis.
- Cross sectoral analysis of adaptation strategies to identify linkages.

National Action Plan: V&A

- Gaps and limitations in present analysis
- Improvements for future analyses
- Improving analyses based on identified synergies between sectors
- Identify technical, capacity building and financial requirements
- Identify potential barriers and risks to implementation

PMG

- National Project Director/Alternate: Head, CEMD, NRE/UNFCCC Focal Point
- Principal Assistant Secretary for Climate Change, CEMD, NRE
- Secretariat: NPC and Assistant
- UNDP-Co: Ad-hoc

PMG

- Day to day management of Project Activities

8. PSC

Chair: chaired by the Deputy Secretary-General (I) of Ministry of Natural Resources and Environment (NRE)

1. Conservation and Environment Management Division (CEMD), NRE
2. Natural Resources and Environment Section, EPU, Prime Minister Department
3. Energy Section, EPU, Prime Minister Department
4. Ministry of Energy, Water and Communication
5. Ministry of Agriculture & Agro-Based Industries
6. Ministry of Plantation Industries & Commodities
7. Ministry of Science, Technology & Innovation
8. Ministry of Transport
9. Ministry of Housing & Local Government
10. Ministry of International Trade and Industry
11. Ministry of Health
12. Ministry of Education
13. Ministry of Higher Learning
14. Malaysian Meteorological Services Department
15. Department of Statistics
16. Sabah State Economic Planning Unit
17. Sarawak State Planning Unit
18. Centre for Environment, Technology and Development Malaysia
19. Malaysia Nature Society
20. Federation of Malaysian Manufacturers
21. Institute of Strategic and International Studies Malaysia
22. UNDP representative

7. PSC

- Top Management Support and Policy Advice
- Monitor and review project progress

SNC Partners

GEF

UNDP

Thank you

Lavanya Rama Iyer
National Project Coordinator
SNC Malaysia
iyerlavanya@nre.gov.my

The 5th Workshop on GHG Inventories in Asia
Kuala Lumpur, Malaysia
September 6-8, 2007

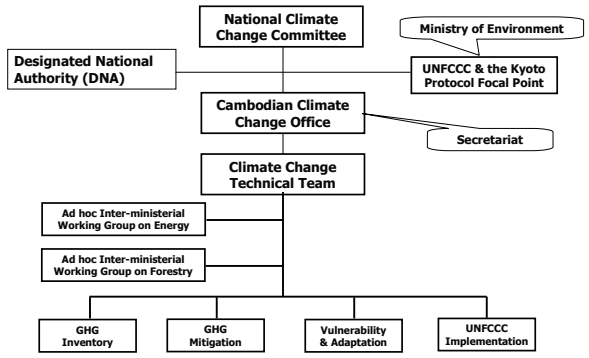
Cambodia's Institutional Arrangements for GHG Inventory for SNC

Presented by
Mr. Heng Chan Thoeun
Ministry of Environment, Cambodia

Outline of the Presentation

1. Current Climate Change Institutional Framework in Cambodia
2. National system for GHG inventory
3. Key problems/issues for GHG inventory
4. Possible strategies to remove the problem/issues

1. Current Climate Change Institutional Framework in Cambodia



1. Current Climate Change Institutional Framework in Cambodia (con't.)

The Cambodian Ministry of Environment (MoE) is the National Focal Point for the UNFCCC and the Kyoto Protocol;

The Cambodian Climate Change Office (CCCO) was established under the MoE in June 2003;

The National Climate Change Committee (NCCC) was established in April 2006 by a sub-decree. It comprises representatives from 19 concerned Government ministries and agencies.

NCCC mandate: to prepare, coordinate and monitor the implementation of policies, strategies, legal instruments, plans and programmes of the Royal Government to address climate change issues.

1. Current Climate Change Institutional Framework in Cambodia (con't.)

CCCO Roles and Responsibilities

Implement the UNFCCC and other climate change-related tasks

Provide information and advice to the Government on preparation of negotiation positions, establishment of national climate change policies, plans and legal instrument

Identify and assess new technologies appropriate for Cambodia to adapt to climate change or to mitigate GHG emissions

Organize training courses, workshops, seminars and meetings related to climate change

Liaise with relevant national and international agencies

1. Current Climate Change Institutional Framework in Cambodia (con't.)

CCCO Roles and Responsibilities

Promote research activities and human capacity building

Develop new climate change-related project proposals

Prepare progress reports to be submitted to the Ministry of Environment and other relevant agencies

Compile, manage and periodically update a database relating to the implementation of the UNFCCC in Cambodia

Act as the Secretariat of the UNFCCC, the Kyoto Protocol and the Clean Development Mechanism (CDM) Focal Points for Cambodia

Enhance cooperation with relevant governmental agencies, national and international organizations, NGOs, and local communities to promote the implementation of the national climate change policies.

1. Current Climate Change Institutional Framework in Cambodia (con't.)

Proposed Climate Change Technical Team (CCTT):

Qualification: Experience from NC1 from line ministries and institution:

- Ministry of Environment (MoE)
- Ministry of Agriculture, Forestry and Fisheries (MAFF)
- Ministry of Industry, Mines and Energy (MIME)
- Ministry of Water Resource and Meteorology (MOWRAM)
- Ministry of Public Works and Transport (MPWT)
- National Committee Disaster Management (CDMC)
- Other, if necessary

CCTT will be chaired by Chief of Climate Change Office.

1. Current Climate Change Institutional Framework in Cambodia (con't.)

For Past Experience First National Communication (NC1)

Project Steering Committee (PSC)

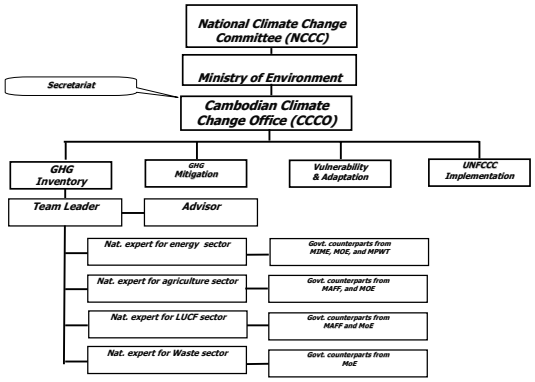
National Project Coordinator (NPC)

National Technical Committee (NTC)

Composition of from line ministries and institution: MoE, MAFF, MIME, MOWRAM, MPWT, RUPP, RUA

Mandate depend on project duration

2. National system for GHG inventory



2. National system for GHG inventory (con't.)

The first Cambodia's GHG inventory preparation was started in October 1999 under Cambodia' Initial National Communication with technical backstopping from regional consultants.

Cambodia's GHG Inventory focused on three main GHGs : CO2, CH4 and N2O.

The inventory covers five main sectors: Energy, Industrial Process, Agriculture, Waste, Land Use Change and Forestry.

The inventory was mainly based on Revised 1996 IPCC Guidelines.

3. Key problems/issues for GHG inventory

- Lack of sustainable national GHG inventory system within the country. The inventory was prepared on a project basis for including into the NC;
- Lack of activity data. e.g., energy balance sheet in the country, livestock, water management for paddy, soil carbon etc.;
- Lack of previous researches/studies related to inventory sectors;
- Lack of database management system for inventory;
- Low technical capacity of local staff;
- Limited national experts in the country;
- Lack of financial support to do researches/studies and update the inventory.

4. Possible strategies to remove the problem/issues

- Institutional strengthening of NCCC;
- CCCO managerial and technical capacity strengthening including local experts;
- Improve activity data by sector;
- Use on-the-job training approach;
- Establish Climate Change Technical Team (CCTT);
- Establish the national inventory system with the involvement of concerned government ministries;
- Establish data management systems for inventory for all sectors;
- Cooperate with the concerned government institutions/NGOs or OI to promote researches/studies for developing reliable activity data and emission factors;
- Exchange experts within the regional and international.


Thank You for Your Attention!
Please see our website:
www.camclimate.org.kh

The 5th Workshop on GHG Inventories in Asia (WGIA5)
6-8 September 2007, Kuala Lumpur, Malaysia

Country Experiences in GHG Inventory Preparetion: Viet Nam

Hoang Manh Hoa, Nguyen Chi Quang
International Cooperation Department
MONRE

Viet Nam - 2006

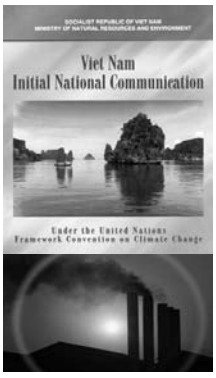
- Real GDP Growth 8.1 %
- Average last 5 years 7.5 %
- Forecast to 2010 (yoy) 8.2 %
- Industrial Production Growth 17.2 %
- Forecast Production Growth to 2010 12.7 %
- CPI 6.5%
- Export Growth last 5 years 17 %
- New FDI compared to last YTD 30%
- Ranked 3rd in global retail attractiveness
- Market and legal reform- ascension to WTO

UNFCCC
WORLD TRADE ORGANIZATION

Viet Nam - Non Annex I Country

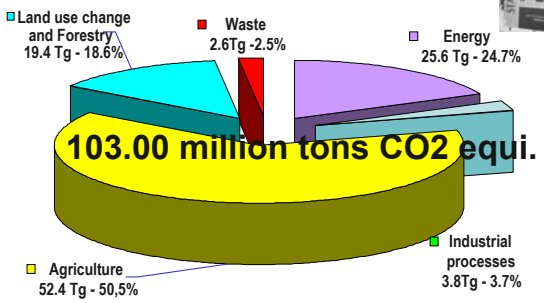
- Viet Nam signed the United Nations Framework Convention on Climate Change (UNFCCC) on 11 June 1992 and ratified it on 16 November 1994. Viet Nam also signed Kyoto Protocol (KP) on 03 December 1998 and ratified it on 25 September 2002.
- The Ministry of Natural Resources and Environment (MONRE) was assigned by the Government of Viet Nam as National Focal Agency for taking part in and implementing UNFCCC, KP and Clean Development Mechanism (CDM).
- The Initial National Communication (INC) of Viet Nam was completed and submitted to UNFCCC Secretariat in November 2003.
- Viet Nam: Preparation of Second National Communication under the UN Framework Convention on Climate Change (UNFCCC) from 2006 - 2009

The GHG Inventory Experience

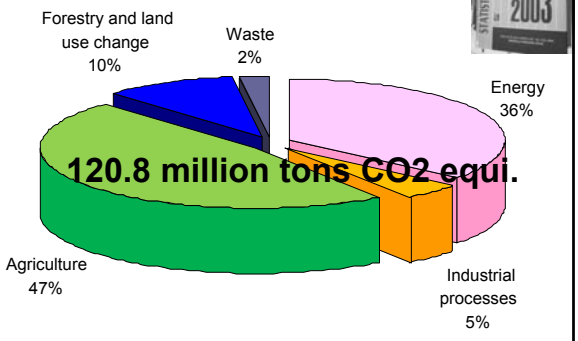


- Completed National GHG Inventories for 1990, 1993, 1994 and 1998.
- National GHG Inventories focused on CO_2, CH_4 and N_2O in: Energy, Industrial Processes, Agriculture, Land Use and Land Use Change and Forestry (LULUCF), Waste
- The Methodology of GHG emission inventory followed the guidance of the IPCC revised version 1996
- Data: The data mainly is collected from General Statistics Office, Ministries (development strategies, master plans, …), some data and information come from researches reports governance institutions.

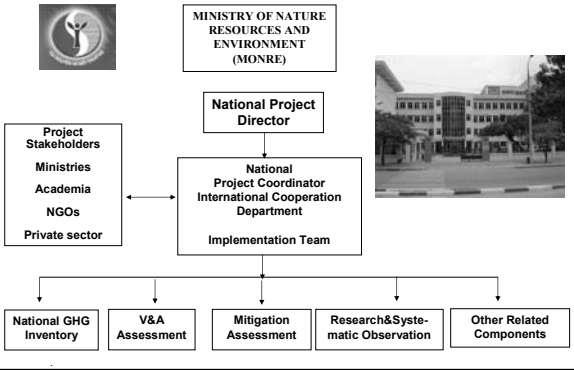
National GHG Inventory in 1994



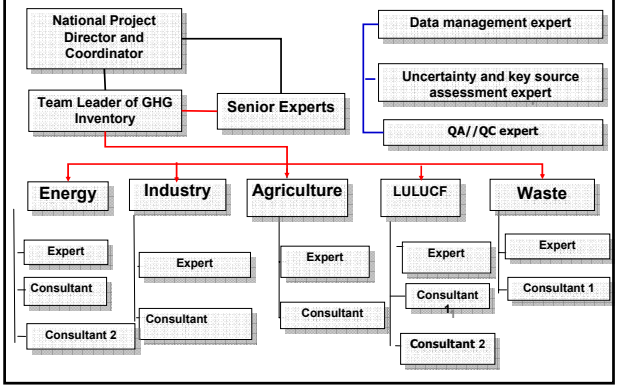
National GHG Inventory in 1998



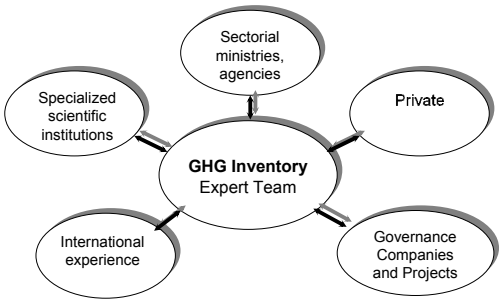
Institutional framework for the SNC



GHG Inventory - WG structure



Partnership and Knowledge sharing



National Inventory Team established and procedures for systematic inventory preparation, implementation, data processing and reporting.

Resources

- IPCC Guidelines
  - Revised 1996 IPCC Guidelines
  - IPCC Good Practice Guidance
- UNFCCC reporting guidelines
- IPCC Emission Factor Database (EFDB)
- IPCC software
- NCSP booklet on "Managing the GHG inventories process.

The GHG inventory process under the Second National Communication involved the following steps:

1. **Identification of Data Sources** (*completed*)
2. **Entering the Activity Data and Emission Factors** (*completed*)
3. Calculating the Emissions *(Ongoing)*
4. Checking and Validation of Input Data *(Ongoing)*
5. Recalculation and Validation of Emissions Estimates *(Ongoing)*
6. Key Sources Analysis *(Ongoing)*
7. Uncertainty Management *(Ongoing)*
8. National Expert and Public Review
10. Reporting the Emissions

Data Resources and Procedures

- Data sources used include Statistical Yearbooks, Development Strategies, Master Plans, Energy Balances, and related others.
- Data gathering system is regulated by government laws on statistics (e.g., law regulating collection, processing, centralization, and free access to information)
- Procedures for systematic inventory preparation, implementation, data processing and reporting were prepared and used
- Participation of the relevant institutions and, thus maintenance of an expert team that was critical for the success of this activity

GHG Inventory – *Current Institutional Arrangement*

Sector	Number of key persons	Institutions/Personnel
Energy	4	Vietnam Academy of Science and Technology; Institute of Energy; Department of Science and Technology of Ministry of Transportation; Research Center for Energy and Environment
Industry processes	2	Department of Oil and Gases (MOI); Institute of Industry and Chemical Safety Technology
Agriculture	4	Research Center for Climate Change and Sustainable Development; Hanoi Agricultural University; Institute of Agricultural Economy; Agriculture Department of MARD
LULUCF	4	Assistance for Natural Conservation and Community Development Center; Institute of Forestry Science, MARD; Research Centre for Forest Ecology and Environment, MARD; Center for Community Forestry
Waste	3	Hanoi University of Technology; Urban Environment Corporation and related others

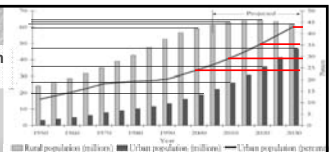
Completed Reports on Collection and Analysis of Data for GHG Inventory in 2000 and forecast to 2010, 2020, 2030

Sector	Data Index	Data Inventory
Energy		Fuel Combustion: Energy industrries, Manufacturing Industries, Construction, Transport, other sectors,… Fugtive emission from fuels: Coal, Oil and Gas, Biomass, …
Industry processes		Cement production, Lime manufacturing, Use of hydrated lime, Soda production and consumption, Steel manufacture, Paper and pulp production, Beverage and Softdrink, Food processing industries;…
Agriculture		Rice cultivation, Livestock (Enteric fermentation manure, Waste management), Agricultural soil land, Prescribed burning of Savanna, Field burning of agriculture residues
LULUCF		Forest ecosystems, Plantation forest, Plantation industry (oil palm and rubber), Protected forest, Non-forest trees/ Urban planting; Absorption by biomass growth, Land use change, Absorption by natural regeneration, Emission from soil
Waste		Solid waste disposal site, Domestic, commercial waste water, Industrial waste water, waste inceniration, Emission from human,, others … …

Data Reports for GHG Inventory

Waste Management in Vietnam at a Glance

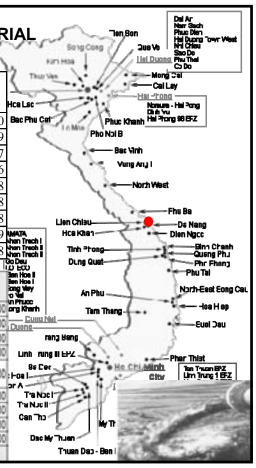
Municipal solid waste generation (tons/yr)	
• National	12,800,000
• Urban areas	6,400,000
• Rural areas	6,400,000
Hazardous waste generation by industries (tons/yr)	128,400
Non hazardous waste generation by industries (tons/yr)	2,510,000
Hazardous healthcare waste generation (tons/yr)	21,000
Hazardous waste from agriculture (tons/yr)	8,600
Amount of stockpiled agricultural chemicals (tons)	37,000
Municipal waste generation (kg/pers/day)	
• National	0.4
• Urban areas	0.7
• Rural areas	0.3
Collection of waste (% of waste generated)	
• Urban areas	71%
• Rural areas	<20 %
• Among urban poor	10-20%
No. of solid waste disposal facilities	
• Dumps and poorly operated landfills	74
• Sanitary landfills	17
Capacity for hazardous healthcare waste treatment (% of total).	50%



Region or City	Degradable Organic Component (kg BOD/1000 persons/yr)			
	2000	2010	2020	2030
Red River Delta	998.00	1497.00	2245.50	3368.25
North East Region	120.00	180.00	270.00	405.00
North West Region	5.00	6.00	7.20	8.64
North Central Coast	282.00	423.00	634.50	951.75
South Central Coast	493.50	740.25	1110.38	1665.56
Central Highlands	2.00	3.00	4.50	6.75
South East Region	1292.50	1938.75	2908.13	4362.19
Mekong River Delta	2.56	3.84	5.76	8.64

	Fraction of Wastewater Treated by the Handling System			
	2000	2010	2020	2030
Red River Delta	0.05	0.1	0.5	0.8
North East Region	0.01	0.02	0.1	0.16
North West Region	0	0.01	0.05	0.08
North Central Coast	0.02	0.04	0.2	0.32
South Central Coast	0.03	0.06	0.3	0.48
Central Highlands	0	0.01	0.05	0.08
South East Region	0.05	0.1	0.5	0.8
Mekong River Delta	0.02	0.04	0.2	0.32

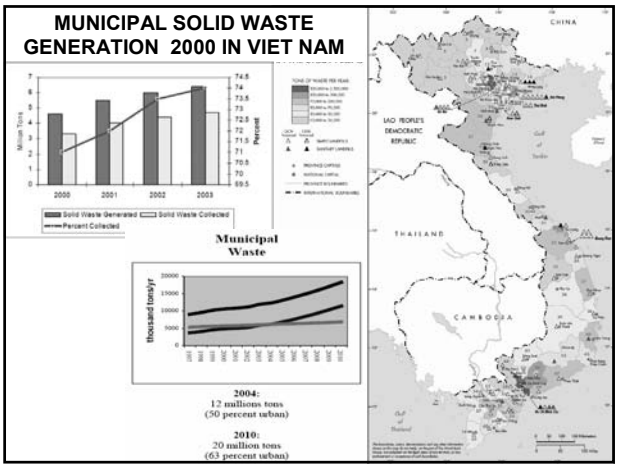
➢ METHANE EMISSIONS FROM INDUSTRIAL WASTEWATER TREATMENT

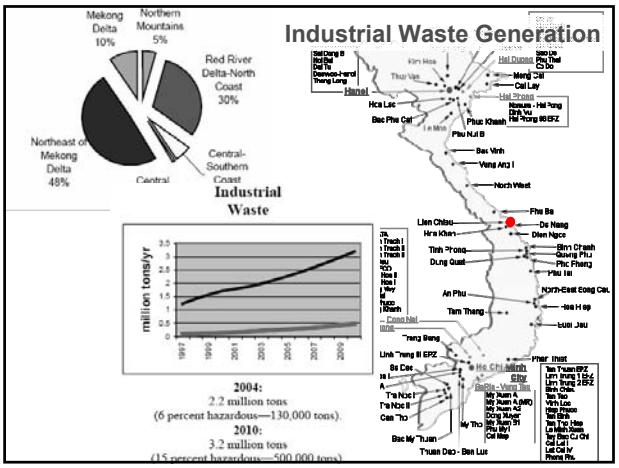


	Fraction of Wastewater Treated by the Handling System			
	2000	2010	2020	2030
Red River Delta	0.2	0.6	0.8	0.9
North East Region	0.1	0.3	0.6	0.7
North West Region	0	0.2	0.4	0.6
North Central Coast	0.2	0.4	0.6	0.8
South Central Coast	0.1	0.3	0.6	0.8
Central Highlands	0.1	0.3	0.5	0.8
South East Region	0.2	0.6	0.8	0.9
Mekong River Delta	0.1	0.3	0.5	0.8

Industry	Estimated Treatment Cost (VND)	Volume of Wastewater (m3/Year)
Pulp production	77,214,500,000	110,000,000
Textile	4,250,000,000	25,000,000
Leather production	73,500,000,000	70,000,000
Chemical industry	51,900,000,000	300,000,000
Alcohol, wine and soft-drink production	20,425,000,000	19,000,000
Sugar production	5,430,000,000	30,000,000
Aquatic product processing	70,380,000,000	92,000,000
Milk production	25,687,500,000	250,000,000
Total	328,787,000,000	896,000,000

Source: Compiled from Reports of The Ministry of Industry, 2003





GHG Inventory for the year 2000

Ongoing activities in the National GHG Inventory for the year 2000 in Viet Nam under Viet Nam SNC to UNFCCC:

- ✓ A national inventory for CO_2, CH_4, N_2O, CO, NOx, NMVOC and SO_2 will be undertaken for the year 2000 in 5 source categories: energy, industrial processes, agriculture, land-use change and forestry and waste;
- ✓ Emissions of CH_4 and N_2O from international bunkers and aviation will also be estimated for the year 2000;
- ✓ The activity data of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) will also be collected for the same base year where available;
- ✓ New emission factors for specific activities will be applied;
- ✓ The database for CO_2, CH_4, N_2O, NOx, CO, NMVOC and SO_2 will be updated and improved. New inventory data for HFCs, PFCs, SF_6 (where available) for the year 2000 will be established and used as a basis for assessment and selection of mitigation options;
- ✓ The COP8 Guidelines will be used for reporting the National GHG Inventory;

GHG Inventory Planning

Activities	June				July				August				Sept.			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1. Complete of data for GHG inventory: Energy, Industry process, Agriculture, LULUCF, Waste	■	■	■	■	■	■										
2. Survey, Calculate of EF for GHG Inventory in Agriculture, LULUCF, Energy and Waste	▒	▒	▒	▒	▒	▒										
3. Data Test and Uncertainty Analysis					▒	▒	▒	▒								
4. The Emission and Silk Estimate of GHG based on IPCC Guideline 1996									■	■	■	■				
5. Reporting GHG Inventory in 2000 for 5 sectors													▒	▒	▒	
6. Completed Inventory and Report on GHG Inventory in 2000																■

Viet Nam: Preparation of Second National Communication under the UN Framework Convention on Climate Change (UNFCCC)
International Cooperation Department
MONRE
45 Tue Tinh, Ha Noi, Viet Nam
Tel: 844 9743195/9743196; Fax: 844 9743200
Email: vnccoffice@fpt.vn

Website: www.noccop.org.vn

5th Workshop on GHG Inventories in Asia Region

Institutional Arrangements For Inventory System in Korea

Sept. 2007

By Park, Soon Chul
Korea Energy Management Corporation

Chapter .1

Overview

Legal Institution for NI

Organizational Institution for NI

Others

Overview of development on UNFCCC in Korea

2006 Establishing the Council for GHG Inventory
Establishing Energy Fundamental Law

2001 Expanding An Inter-Ministerial Committee on UNFCCC
Prime Minister Instructions

1998 Establishing an Inter-Ministerial Committee on UNFCCC

1993 Korea Joined the UNFCCC

Inter-Ministerial Committee on UNFCCC

The 3rd Comprehensive Action Plan for Climate Change

- **19 ministries working together to facilitate the action plan**
- **Consisting of 90 Projects in 3 major fields(2005 – 2007)**
  - The convention implementation projects
  - GHG reduction projects
  - Climate change adaptation projects

Chapter .2

Overview

Legal Institution for NI

Organizational Institution for NI

Others

Prime Minister Instructions (No. 422, 2001)

■ **Article 9**

" National GHG emissions statistics is estimated by the designated organization from Inter-Ministerial Committee on Climate Change "

Energy Fundamental Law (2006)

■ **Article 19, Clause 2**

"MOCIE can compile the GHG emissions on energy and industrial process annually and announce officially the results of it"

■ **Article 19, Clause 3**

"Government can announce the official results of total GHG emissions annually"

※ **MOCIE : Ministry of Commerce, Industry and Energy**

Clean Air Conservation Act

■ **Article 7, Clause 6**

"MOE can develop and manage the GHG emission factors"

※ **MOE : Ministry of Environment**

Chapter .3

Overview

Legal Institution for NI

Organizational Institution For NI

Others

Council for GHG Inventory

○ **Purpose**

- **Systematic management of National Inventory**
- **The review of National Inventory**

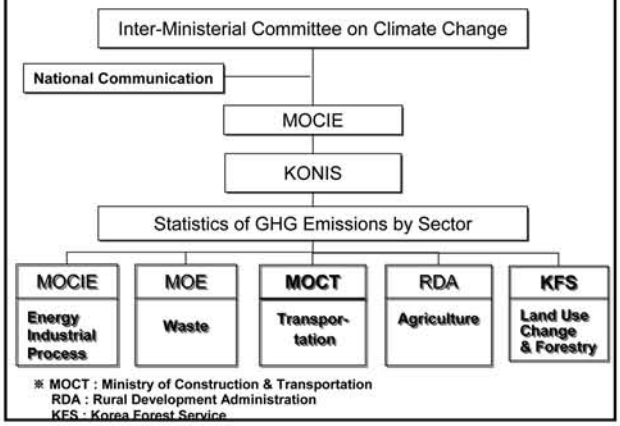
○ **The Member of Council**

- **10 Government agencies**
- **7 research institutes**

○ **The Role of Council**

- **Improvement of the Process and institution on National Inventory**
- **The Strengthening of cooperation within inter-ministries**

Council for GHG Inventory



※ **MOCT : Ministry of Construction & Transportation**
RDA : Rural Development Administration
KFS : Korea Forest Service

Chapter .4

Overview

Legal Institution for NI

Organizational Institution for NI

Others

Development of National GHG Emission Factor

Purpose

- **Reflection of specific country's conditions**
- **Reflecting to National Communication upon the approval by the government**

The Role of Ministry

- **Energy and industrial Process : Ministry of Commerce Industry and Energy**
- **Waste : Ministry of Environment**
- **Forests : Korea Forest Service**

Development of National GHG Emission Factor

Development Objects of National GHG Emission Factors (2007 : MOCIE)

Category	Source	GHG
Energy Sector	Industrial Boiler/ Utility Boiler	CH_4, N_2O
	Gas Turbine / Gas Engine	CH_4, N_2O
	Coal in Fugitive Emission	CH_4
Industrial Process	Production of Cement Production of Lime / Dolomite Lime	CO_2

National Energy & GHG Database

Purpose

- **Development of demand side statistics on energy Consumption & GHG emissions**

Scope of Database

Year	Category	The number of research
2005	Manufacturing & mining industry	110,000
2006	Household & commerce	Household : 65,000 Commerce : 35,000

National Energy & GHG Database

Year	Category	The number of research
2007	Transportation	Traffic service : **10,000** Private use : **35,000**

http://netis.kemco.or.kr

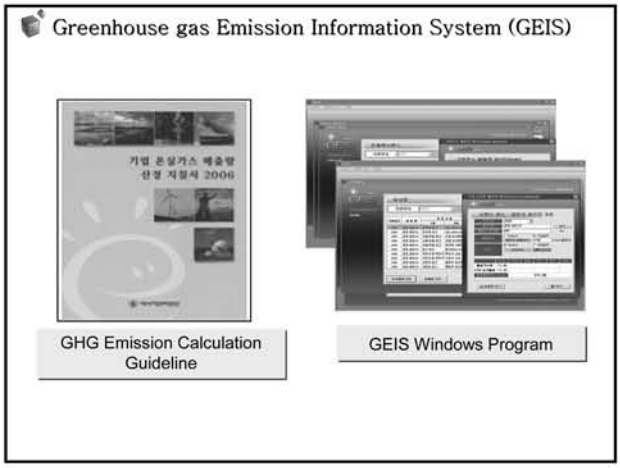
Greenhouse gas Emission Information System (GEIS)

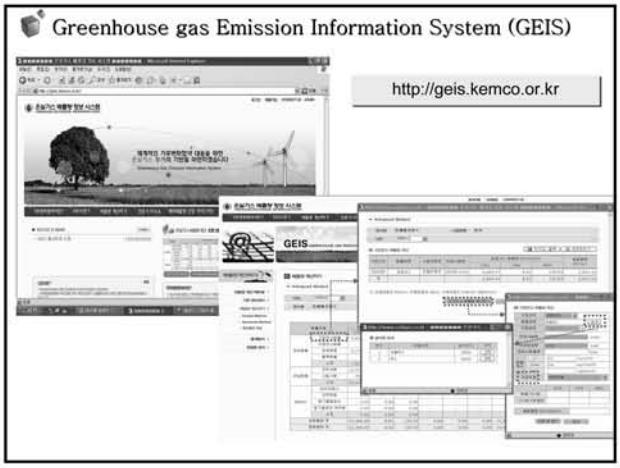
Purpose

- **GHG emissions accounting guideline on company level**
- **Web program for accounting and Registration of companies GHG emissions based on voluntary**

GHG emission accounting guideline

- **Concept : GHG Protocol (WRI), ISO14064-1**
  - **Direct emissions : stationary, mobile, industrial process, fugitive emissions**
  - **Indirect emissions : purchases of electricity and steam from other companies**
- **Methodology : IPCC 1996 guideline**
  - **Simple method (Tier 1),**
  - **advanced method (over Tier 2)**


Greenhouse gas Emission Information System (GEIS)
GHG Emission Calculation Guideline
GEIS Windows Program


Greenhouse gas Emission Information System (GEIS)
http://geis.kemco.or.kr


에너지管理公團
Thank YOU
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http://www.kemco.or.kr
http://co2.kemco.or.kr

JGSEE

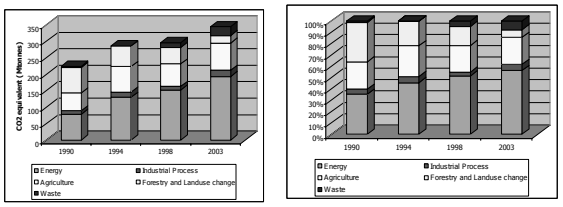
Experiences on Disaggregated Activity Data Acquisition for Greenhouse Gas Inventory in Waste and Agricultural Sector

Sirintornthep Towprayoon

The Joint Graduate School of Energy and Environment
King Mongkut's University of Technology Thonburi
Bangkok Thailand

Presented at 5th WGIA 6-7 September 2007 Malaysia

Thai National GHG Inventories



1990 : ALGAS
1994 : INC
1998 : Min. of Natural Resources
2003 : Min. of Energy

Nature of sector

Waste Sector	Agricultural Sector
■ SWDS ■ Activity data by population/ actual data at sites ■ EF : default ■ Waste model	■ Rice field emission ■ Activity data is annually reported by cultivation area ■ EF : varied by cultivation practice ■ GIS-Based

Understanding IPCC waste model

- 1996 IPCC GL : Mass balance and FOD
- 2006 IPCC GL : Combined MB and FOD
- Activity data ---MB
- Emission factor ----k value
- More convenience and more reliable
- Allow for disaggregate level of data depend on each country historical data

Waste model

- Major sheet in waste model
- Parameter
  - DOC : waste composition
  - DOCf : 0.5
  - Methane generation rate constant (k) : multiphase
  - Delay time : 6 months
  - Fraction of methane : 0.5
  - Oxidation factor : 0

Waste model

- Major sheet in waste model
- MCF
  - Unmanaged shallow : 0.3
  - Unmanaged deep : 0.8
  - Managed :1
  - Managed semi aerobic : 0.5
  - Uncategorized : 0.6

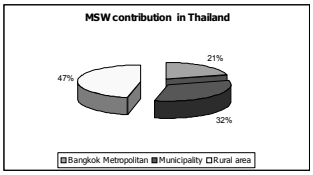
- Distribution of waste by waste management types

Waste model

- Major sheet in waste model
- Activity
  - Total MSW
    - Population
    - Waste generation rate
  - % to SWDS
  - Composition of waste go to SWDS

MSW in Thailand

- Total MSW in 2005 = 39211 TPD
  - Bangkok metropolitan = 8,201 TPD
  - Municipality = 12,685 TPD
  - Rural area = 18,205 TPD



Decrease from last year 1.8 %

MSW Treatment in Thailand

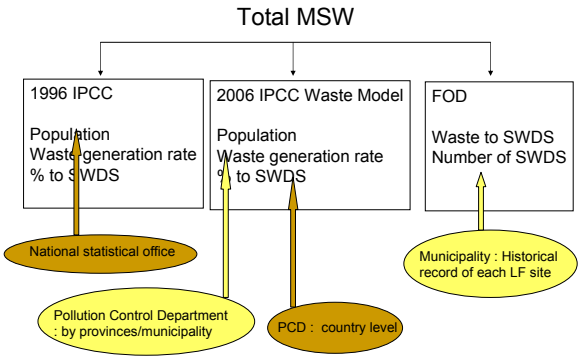
- 104 Sanitary landfills (94 in operation)
- 3 Incinerations
- 3 Combined technology
- 7 dump sites

- Coverage of 43 % of MSW treated in municipality

Characteristic of Landfill

- Size of landfill
  - 4-50 TPD = 53 sites
  - 50-100 TPD = 26 sites
  - 100-200 TPD = 9 sites
  - > 200 TPD = 6 sites
- MCF
  - 0.3 = 51 sites = 54 %
  - 0.6 = 17 sites = 18 %
  - 0.8 = 26 sites = 28 %

Source and level of Activity Data



Activity Data

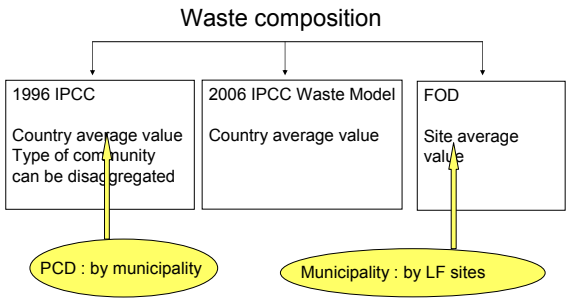


Table 4.4 Summary of input parameters for methane emission inventory

	Landfill sites	Tipping rate (tpd)	Open year	MCF	Waste characteristics (%) Food	Paper	Wood	Textiles
1	Chaingrai	80	1995	0.8	45.00	10.00	10.00	2.00
2	Huaycrai	13	1998	0.3	15.00	10.00	10.00	5.00
3	Waingphang	8	2004	0.3	33.00	17.75	11.90	3.12
4	Maehongson	15	2002	0.3	36.67	11.67	11.67	6.67
5	Phayao	35	2003	0.3	66.16	14.75	1.31	1.31
6	Phrae	35	2001	0.3	22.00	28.40	22.21	4.02
7	Sukothai	34	2001	0.3	40.00	15.10	20.20	2.00
8	Nan	38	2000	0.3	43.67	12.77	0.27	2.92
9	Utharadit	40	2003	0.8	67.33	6.20	0.66	0.55
10	Pitsanulok	91	1999	0.3	68.59	2.53	0.89	1.51
11	Pichit	26	2000	0.3	39.00	13.85	4.47	5.48
12	Nakornsawan	100	1994	0.8	54.53	10.03	4.03	1.88
13	Uthaithanee	36	2001	0.3	70.77	3.37	0.60	0.50
14	Maesod	50	1999	0.8	37.59	13.42	9.47	4.35
15	Thaklee	22	2003	0.3	54.53	10.03	4.03	1.88

Example of SWDS database

จังหวัด	ชื่อเทศบาล	องค์ประกอบของขยะมูลฝอย(ร้อยละโดยน้ำหนัก) เศษอาหาร	กระดาษ	พลาสติก	แก้ว	โลหะ	ยาง/หนัง	ผ้า	ไม้/ใบไม้	หิน/กระเบื้อ	อื่นๆ	
นครนายก	1.หมู่เมืองนครนายก	65.09	7.18	22.69	0.72	1.12	0.36	0.53	-	-	2.31	100.00
	2.ทต.ท่าช้าง	50.00	10.00	10.00	5.00	5.00	0.00	0.00	15.00	5.00	0.00	100.00
	3.ทต.บ้านนา	40.00	15.00	10.00	5.00	5.00	5.00	7.00	10.00	3.00	0.00	100.00
	4.ทต.เกาะหวาย	50.00	25.00	5.00	2.00	1.00	2.00	3.00	10.00	1.00	1.00	100.00
	5.ทต.องครักษ์	-	-	-	-	-	-	-	-	-	-	0.00
		205.09	57.18	47.69	12.72	12.12	7.36	10.53	35.00	9.00	3.31	400.00
เฉลี่ย		51.27	14.30	11.92	3.18	3.03	1.84	2.63	8.75	2.25	0.83	100.00

จังหวัด	ชื่อเทศบาล	จำนวนครัวเรือน	ประชากร (คน)	ปริมาณขยะมูล	อัตราการเกิดขยะ
นครนายก	1.หมู่เมืองนครนายก	6,062	17,564	15.46	0.88
	2.ทต.ท่าช้าง	232	915	0.56	0.61
	3.ทต.บ้านนา	1,496	6,016	6.02	1.00
	4.ทต.เกาะหวาย	559	2,165	1.36	0.63
	5.ทต.องครักษ์	*	2,691	1.61	0.60
เฉลี่ย		8,349	29,351	25.01	0.85

Example of waste composition data base

Emission factor

Methane generation rate constant

- 1996 IPCC — Mass balance
- 2006 IPCC Waste Model — Multiple phase of k value: food, paper, textile
- FOD — Single phase /multiple phase

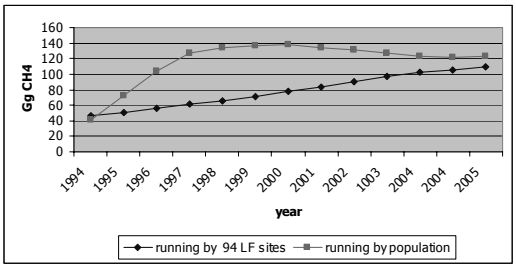
IPCC default | Research

Running Waste Model

- **Population** - 48 % rural area
- Waste generation – average 0.64 kg/cap/d
- MCF – from site information
- Waste composition – country average
- K value – IPCC defaults
- Recovery - 0

- **Actual waste in place in SWDS sites**
- MCF – from site information
- Waste composition – by each site
- K value – IPCC defaults (multi phase)
- Recovery - 0

Comparison of methane estimation



Summary for Waste Sector

- Historical data is very important the longer, the more reliable result.
- Uncertainty can be reduced by using appropriate disaggregate level of activity data

Disaggregated activity data in rice field

- Emission is estimate by area* EF
- EF are varied by type of cultivation
- Uncertainty is very high
- Plantation area can be achieved by
  - Annual national statistical report recorded by local authority collected by Ministry of Agriculture
  - GIS map

Disaggregated level of cultivation area

- Up land, low land,
- Rain fed, irrigated system
- Organic and chemical fertilizer application


Estimate by statistical report

Table 3.2 Methane Emission Factors for Different Water Ecosystem and Organic Amendment

Category	Sub-category		Scaling factors for rice ecosystem	Correction factors for organic amendment	Emission factors kg CH_4/ha/day
Major rice					
Upland	Rainfed	–	0	1	0
	Irrigated	Continuously flooded + OM	1	2	3.120
		Continuously flooded	1	1	1.560
Low land	Rainfed	Flood prone	0.8	2	1.248
		Flood prone + OM	0.8	1	2.496
		Drought prone	0.4	1	0.624
		Drought prone + OM	0.4	2	1.248
	Deep water	Water depth > 100 cm	0.6	1	0.936
Second rice	Irrigated	Continuously flooded + OM	1	2	3.120

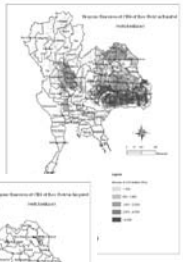
Key EF = 1.560 kg CH4/ha/day

Source : Thai NC 1994

Estimate by GIS-based

Land-use map of countries of the MRBSR (2000)

Rainfed



irrigated

Source : APN Project -Towprayoon

GIS-Based

Table 8. Estimated emission of CH_4 and N_2O from rice paddy in Thailand

Rice Field	Area ($\times 10^6$ m^2)	Emission Factor (mg/m^2/day)		Biogenic Emission from Rice Field (Ton)	
		CH_4	N_2O	CH_4	N_2O
Irrigated first crop	14,686.34	97.623	0.2937	172,046.99	517.61
Irrigated second crop	14,686.34	97.623	0.2937	172,046.99	517.61
Rain-fed	130,393.82	45.71	0.2937	715,236.19	4,595.60
	Total			1,059,330.17	5,630.82



Source : APN Project -Towprayoon


Source : APN Project -Towprayoon

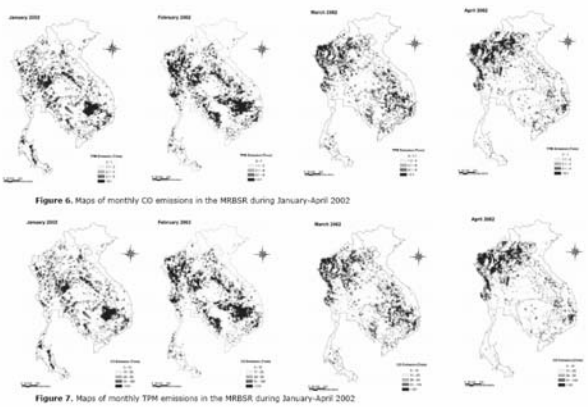


Figure 6. Maps of monthly CO emissions in the MRBSR during January-April 2002

Figure 7. Maps of monthly TPM emissions in the MRBSR during January-April 2002

Comparison

INC

- EF :
- rainfed system = 0.6-2.49 kgCh4/ha/day
- Irrigated system = 1.56-3.1 kgCh4/ha/day
- Using scaling factor and collection factor
- Total emission = 2110 Gg CH4

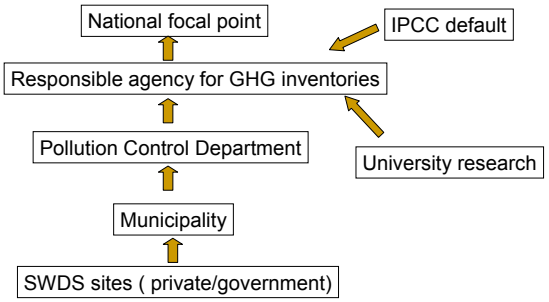
GIS base

- EF = 0.7321 kgCh4/ha/day for rainfed and 1.56 kgCh4/ha/day for irrigated
- Total emission = 1059 Gg CH4

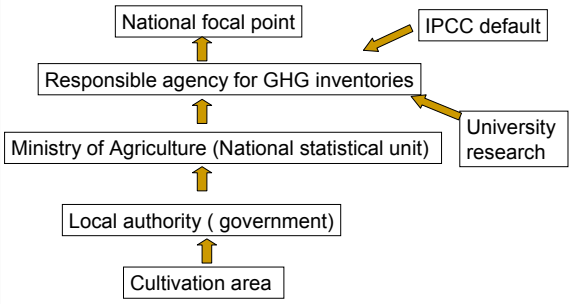
Summary of Agricultural Sector

- Disaggregated EFs are important to reduce uncertainty
- Spatial information can be used in substitute of statistical report to see the overview emission in term of area. However comparison need to be done
-

Institutional arrangement for waste sector (SWDS)

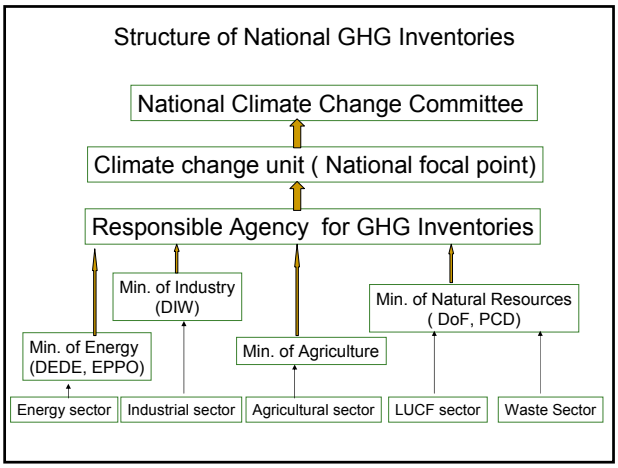


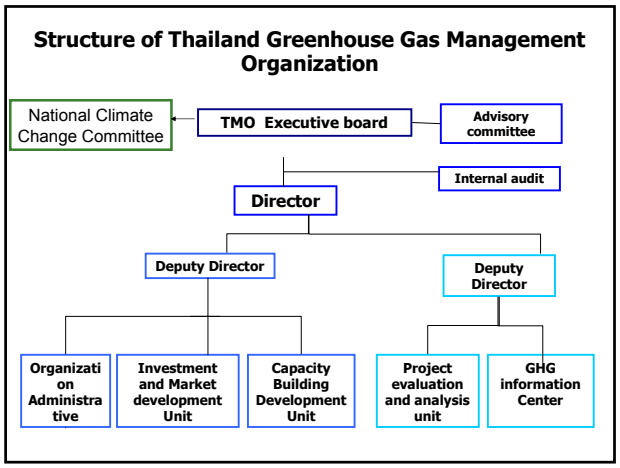
Institutional arrangement for agricultural sector (rice field)



Barrier of data acquisition

- No central unit for achieving national data
- Many Authorized institutes involved
- Reporting is not systematic
- Bureaucratic
- Personal contact


Structure of National GHG Inventories
National Climate Change Committee
Climate change unit (National focal point)
Responsible Agency for GHG Inventories
Min. of Industry (DIW)
Min. of Natural Resources (DoF, PCD)
Min. of Energy (DEDE, EPPO)
Min. of Agriculture
Energy sector
Industrial sector
Agricultural sector
LUCF sector
Waste Sector


Structure of Thailand Greenhouse Gas Management Organization
National Climate Change Committee
TMO Executive board
Advisory committee
Internal audit
Director
Deputy Director
Deputy Director
Organizati on Administra tive
Investment and Market development Unit
Capacity Building Development Unit
Project evaluation and analysis unit
GHG information Center


Thank you for your attention
JGSEE

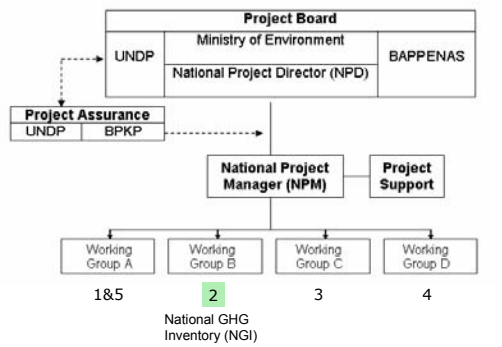
Institutional System for the Development of National GHG Inventory: Indonesia

Upik Sitti Aslia
Ministry of Environment, Republic of Indonesia

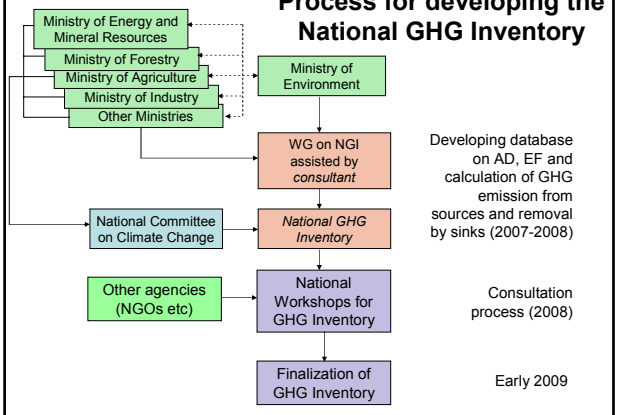
Background

- Indonesia:
  - Ratified Convention on Climate Change through Act Number 6/1994
  - Ratified Kyoto Protocol through Act Number 17/2004. The Minister of Foreign Affair has deposited an instrument of ratification to the UNFCCC secretariat in 3 December 2004
- Indonesian Progress in the Preparation of CCC and Kyoto Protocol:
  - Indonesia has submitted its Initial National Communication to the Secretariat in 1999
  - DNA for CDM is in the final stage of development. It is expected that the DNA will operate in 2005.
  - Some of related Ministries, such as Ministry of Forestry and Ministry for Energy and Mineral Resources have established National Working Group on CDM

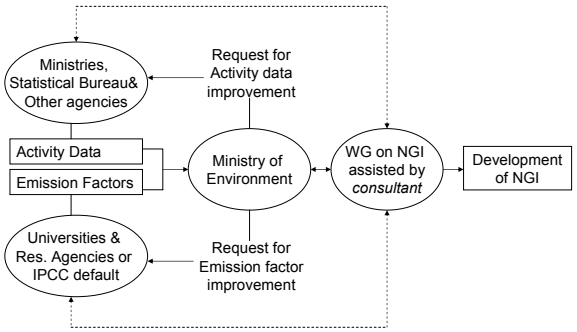
Management Arrangements for 2nd National Communication



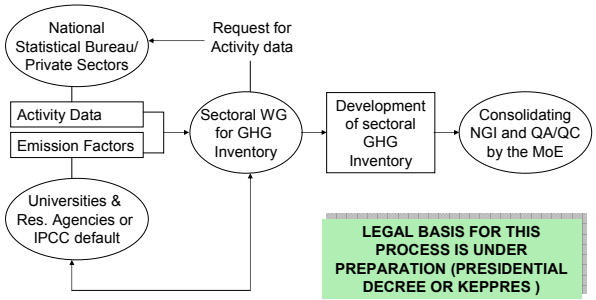
Process for developing the National GHG Inventory



Process of collecting AD and EF for GHG Inventory Development



Future Institutional Mechanisms for NGI Development




THANK YOU

Original Purposes & Multi-applications of National Statistics Used for Japan's GHG Inventory
- Energy Sector -

Yuriko HAYABUCHI

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

Major and common problem

◆ **Lack of activity data**

➢***Energy balance sheet in the country as Fuel Importation and Consumption by type of fuel***

➢***Lack of detailed data for Transport – Aviation, Road, Rail, Navigation , Agriculture/Forestry/Fishing – Stationary and Mobile sources***

➢***Lack of information on fuel consumption in order to cover each industry***

Japan's major statistics on energy sector

◆ ***Yearbook of Production, Supply and Demand of Petroleum, Coal and coke*** (Ministry of Economy, Trade and Industry)

◆ ***Survey on Transport Energy*** (Ministry of Land, Infrastructure and Transport)

Transport)

etc

etc

◆ ***General Energy Statistics***
(Ministry of Economy, Trade and Industry)

➢The supply/conversion and consumption data in General Energy Statistics use official statistics.

✓In order to report CO2 emissions in CRF, emissions reported under the sectors in Japan's Energy Balance Table (General Energy Statistics) were reported under each sector in CRF

What's the purpose of the statistical survey? -General Energy Statistics-

◆General Energy Statistics helps with planning for energy and environmental policy, and with measuring and assessing policy effectiveness

◆General Energy Statistics also helps to understand energy supply and demand and to make judgments about the situation

Basic Structure of General Energy Statistics

✓***General Energy Statistics*** **provides a comprehensive overview of domestic energy supply and demand with energy sources and sectors arranged in a matrix.**

Energy source: "Columns"

Supply and demand sectors: Rows

	Steelmaking coal	Coke	Coal tar	Coke oven gas	Electricity	Total
Primary energy supply						
Imports	Steelmaking coal(Supply +100)					
Energy consersion						
Steel coke	Steelmaking coal(Inputs −100)					Loss+2
		75	3	20		
Independent power production				−20		Loss+12
					8	
Final energy consumption					8	Total+86

Basic Policy on Preparing General Energy Statistics

◆In structuring the data, sources as well as the estimation processes and particulars are explained to the greatest possible extent.

◆For the basic statistics of the consumption sector, General Energy Statistics wherever possible uses statistics which are indicative of consumption, based on international provisions such as the IPCC and UNFCCC guidelines.

Summary

- The major problem is lack of activity data

  Necessity of basic statistics

- The statistical surveys Japan's major statistics on energy sector are conducted by
  - Ministry of Economy, Trade and Industry
  - Ministry of Land, Infrastructure and Transport
- The practical use of statistical data are
  - to develop the basis for economic system, thus to contribute to economic policy of own country
  - and to develop the basis safety transport system

Thank you for your attention

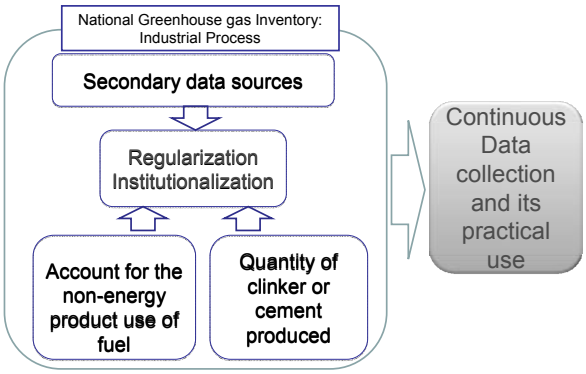
Original Purposes & Multi-applications of National Statistics Used for Japan's GHG Inventory -Industrial Sector-

WGIA in Malaysia

7th September 2007

Rikiya MATSUMOTO
matsumoto.rikiya@nies.go.jp

Numerous Problems from Asian Countries



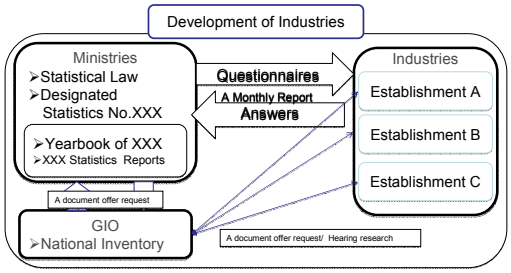
Statistics published by Japan's Ministry/Agency

Name of Statistics/Survey	Ministry/Agency in Charge
Yearbook of Ceramics and Building Metarials Statistics	Ministry of Economy, Trade and Industry (METI)
Yearbook of Chemical Industries Statistics	METI
Yearbook of Minerals and Non-ferrous Metals Statistics	METI
Yearbook of Mineral Resources and Petroleum Products Statistics	METI
Yearbook of The Current Survey of Energy Consumption	METI
Yearbook of Chemical Industries Statistics	METI
Yearbook of Production, Supply and Demand of Petroleum, Coal and Coke	METI
General energy statistics	METI

The statistics used in Japan and their practical use

Data Provided by Japanese Ministries	Aim of the Statistics	Methods of data collection	Practical use of the statistics by the country
Yearbook of The Current Survey of Energy Consumption	To clarify the current consumption of petroleum and other types of energy	Conducted under METI's regulations for the Statistical Survey of Energy Consumption	To make policies concerning the consumption of petroleum
Yearbook of Ceramics and Building Materials Statistics	To clarify the result of research on chemical industries	Conducted in conformity with the Regulation of METI based on Statistics Law.	To make policies concerning the chemical industries.

Continuous Data Collection -The Organizational Transaction-



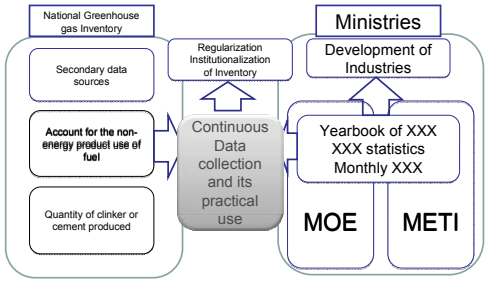
1) Primary data are captured.
2)Continuous Q&A is inevitable.
3)Cooperative Relationships between Ministries and Industries are desirable.

Points of the Reflection to the policies

Data Provided by Ministries	Examples of the Reflection to the policies
Yearbook of The Current Survey of Energy Consumption	➢To grasp a business establishment, energy, a product item, and plan the advancement of industries. a) The consumption on an establishment basis stands for total energy consumed by the whole establishment. b) Product item show the total energy consumed by the surveyed establishments for manufacturing product. c) Results of the monthly survey are published as 'Monthly Report '.
Yearbook of Ceramics and Building Materials Statistics	➢ To grasp a product, raw materials, labor, production capacity . a) Production includes manufacturing under contract to another enterprise or establishment. b) Fiber, yarn, cloth, and other raw materials actually used in plants for production of surveyed item. c) Labor represent the number of regular employees engaged in production, management, or other operations. d) All equipment actually held as of the end of the survey period, of production capacity

Summary and Conclusion

Continuous Data collection and its practical use are benefit able of the current development of industries.



Original Purposes & Multi-applications of National Statistics Used for Japan's GHG Inventory

- Agriculture Sector -

Kohei Sakai

Greenhouse Gas Inventory Office of Japan (GIO)
National Institute for Environmental Studies (NIES)
Sakai.kohei@nies.go.jp

In Workshop on GHG Inventories in Asia (WGIA), September 6-7, 2007, Kuala Lumpur

1. Major Problems for Developing Inventory Data on Agriculture Sector in Asia

Activity data for agriculture soils emissions are expected particularly related to animals excretion and synthetic fertilizer N applied.

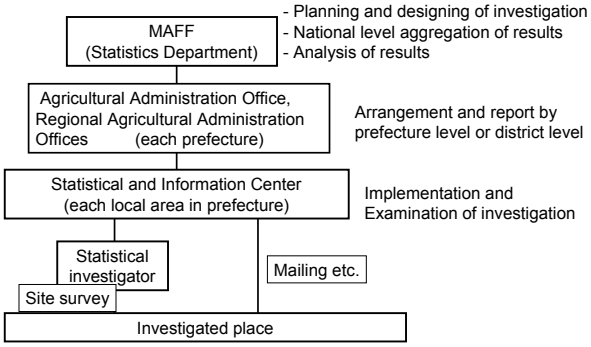
Lack of activity data: livestock, water management for paddy, Area of Burned Grassland

Lack of activity data for the estimation of emissions of some source categories in agriculture

2. Japan's major statistics for Activity Data on Agriculture Sector

Cate-gory	Activity Data	Statistics	Ministry
4A, 4B	*Livestock population*	Livestock Statistics (Key sub-category)	MAFF(Ministry of Agriculture, Forestry and Fisheries)
		FAO statistics (Non-key sub-category)	-
4C	*rice field area*	1. Statistics of Cultivated and Planted Area 2. Crop Statistics	MAFF
4D,4F	*crop field area*		
4D	*animals excretion*	Report of the research on the state of wide-range movement and cyclical use of wastes (the volume on cyclical use)	MOE
4D	*synthetic fertilizer N applied*	Yearbook of Fertilizer Statistics (Pocket Edition)	MAFF

3. Japan's Institutional Arrangement for Major Agricultural Statistics



4. Statistics Merits for Developing statistics on Agriculture Sector

Overall MERIT

- Promotion of agricultural policy (Stabilizing foodself-sufficiency)
- Stabilization of agricultural products and livestock product price
- Reduction of rice area (adjustment of rice cultivation)

Each statistics MERIT

- ***Crop field area*** : Food self-sufficiency rate
- ***Livestock population*** : Promotion of livestock administration (grasp present condition , improvement of circulation, epidemic control, accident compensation)
- ***Synthetic fertilizer*** : N applied contributes to applying amount of proper
- ***Animals excretion*** : Promotion of waste administration

5. Summary

- In some Asian countries, problem is **Lack of activity data.**
- In Japan, **MAFF** produces the main agricultural statistics (livestock statistics, crop area statistics)
- In Japan, **MOE** produces waste statistics (livestock excretion)
- In Japan, agricultural statistics by government are improved for many years, and reliable institutional arrangement has been made.
- **Merits** which produces agricultural statistics are **grasp present condition, improvement of circulation, stabilization of food self-sufficiency ratio**, grasp and compensation of epidemic and disaster etc…

Thank you!

Original Purposes & Multi-applications of National Statistics Used for Japan's GHG Inventory - LULUCF Sector -

Takako Ono

Responsible for LULUCF Sector
Greenhouse Gas Inventory Office of Japan (GIO)
National Institute for Environmental Studies (NIES)
cgergio@nies.go.jp

In Workshop on GHG Inventories in Asia (WGIA), September 6-7, 2007, Kuala Lumpur

Outline of this Presentation

1. Major Problem for Developing Inventory Data on LULUCF Sector in Asia

– Examples of lacked data (from questionnaires)
- Forest land area data
- Biomass consumption data
- Commercial harvest according to ecosystem type
- Status of abandoned managed land
- Land use data of converted forests
- Historic soil data
- Activity data for the time series

➢ Major Problem: Lack of sufficient activity data on LULUCF sector

1-2. Main Cause of the Difficulty of Collecting Activity Data

- **Main Cause:** Lack of well-developed institutional arrangement and sufficient cooperative relationships between national administrative agencies
  – Developing LULUCF data is time- and cost-consuming.
  – It is difficult for an agency responsible for developing an inventory to solely develop such statistics.
  – Institutional arrangement and cooperative relationships between national administrative agencies are indispensable.
- **Solution:** to consider **what benefits other agencies can receive from statistics necessary for inventory development.**
- **Recommendation:** to develop **Multipurpose statistics**

2. Successful Example of Developing the Institutional Arrangement between National Agencies - Japan

- Japan uses mainly **4 multipurpose statistics** for developing data on LULUCF sector.
- Agencies responsible for developing the existing statistics are not the Ministry of the Environment (MOE) of Japan **but other national agencies**.
- In cooperation with other national agencies, the MOE is responsible for compiling inventory data.
- **Original purposes of these statistics are not inventory development but other purposes.**

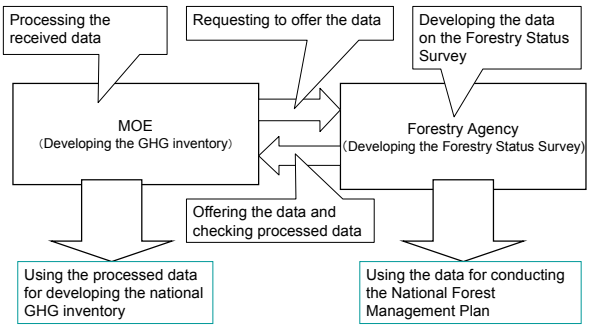
2-2. Features of the Statistics used for Inventory Data in LULUCF Sector in Japan

Name of Statistics	Land-Use Categories in LULUCF	Responsible Agency	Original Purposes of each Statistic
Forestry Status Survey	Forestland	Forestry Agency	Providing fundamental data for developing the **National Forest Management Plan**.
Statistics of Cultivated and Planted Land	Cropland Grassland	Ministry of Agriculture, Forestry, and Fishery (MAFF)	Providing data for developing the National Basic Plan for Food, Agriculture, and Rural Areas.
World Census of Agriculture and Forestry	Meadow and Pasture in Grassland	MAFF	Providing information fundamentally necessary for developing policies of agriculture and forestry.
Land Use Status Survey	Wetland Settlement	Ministry of Land, Infrastructure, and Transport (MLIT)	providing fundamental data for developing a national land utilization plan and urban-area utilization plans.

2-3. Example – Original Purposes of Forestry Status Survey and the National Forest Management Plan

- Original Purposes of the Forestry Status Survey
  - Comprehending the major trends of national forest resources and forestry industries,
  - Providing fundamental quantitative data for developing the **National Forest Management Plan**.
- Purposes of the National Forest Management Plan
  - Conducting sustainable timber production,
  - Protecting forest ecosystem services for public welfare.
  - ➢ Collecting and aggregating data on forestland in LULUCF Sector is **an ancillary purpose**.

2-4. Flowchart of Using the data on the Forestry Status Survey



2-5. Benefits of Developing the Data on the Forestry Status Survey

- In Japan, the benefit that the Forestry Status Survey can offer data as the activity data of forestland in LULUCF Sector is **an ancillary benefit**.
- **The principal benefit** of the data in the Forestry Status Survey is to provide **fundamental data** for developing **quantitative targets** in order to conduct Japan's integrated National Forest Management Plan.
  - The quantitative data collected from each site have abilities
    - To correctly conduct integrated national forest management from national through regional to site levels, and
    - To monitor site-level forest utilization and detect unplanned deforested areas.

4. Summary

1. The major problem on LULUCF sector in Asia is **lack of sufficient activity data.**
2. The main issue seems to be the lack of **proper institutional arrangement and cooperative relationships between national agencies.** If a country desire to collect activity data, they are indispensable.
3. Japan has succeeded by allowing existing statistical data to have **multipurpose applications**, which are beneficial both for the MOE and for other national agencies.
4. The agency responsible for developing the national GHG inventory need to **consider and provide benefits for other interested national agencies**, which come to actually develop statistical data necessary for the inventory.

Thank you!

For the details of GIO activities, please visit our website at
http://www-gio.nies.go.jp/

(Reference1-1) The Current Status of Japan's Activity Data (1)

	Living Biomass	DOM	Soils
5.A.1 Forest land remaining Forest land	●	NA	NA
5.A.2 Land converted to Forest land	●	NA	●
5.B.1 Cropland remaining Cropland	NA	NE	NA
5.B.2 Land converted to Cropland	●	NE	●
5.C.1 Grassland remaining Grassland	NA	NE	NA
5.C.2 Land converted to Grassland	●	NE	●
5.D.1 Wetlands remaining Wetlands	NO, NE	NO, NE	NO, NE
- Organic soils managed for peat extraction	NO	NO	NO
- Flooded land remaining flooded land	NE	NE	NE
5.D.2 Land converted to Wetlands	●	NE	NE
5.E.1 Settlements remaining Settlements	●	NE	NE
5.E.2 Land converted to Settlements	●	NE	NE
5.F.1 Other land remaining Other land	–	–	–
5.F.2 Land converted to Other land	●	NE	●

Note: ● = Activity data that Japan has already prepared.

(Reference1-2) The Current Status of Japan's Activity Data (2)

	CH_4	N_2O	Carbon
5(I) Direct N_2O emissions from N fertilization			
Forest land	-	IE	-
5(II) N_2O emissions from drainage of soils			
Forest land, Wetlands – Organic soil	-	NO	-
Forest land, Wetlands – Mineral soil	-	NE	-
5(III) N_2O emissions from disturbance associated with LU conversion to cropland			
Lands converted to Cropland – Organic soils	-	NO	-
Lands converted to Cropland – Mineral soils	-	●	-
5(IV) Carbon emissions from agricultural lime application	-	-	NE
5(V) Biomass burning			
Forest land remaining Forest land – controlled burning	IE	IE	-
Forest land remaining Forest land – wildfires	●	●	-
Land converted to Forest land – controlled burning	IE	IE	-
Land converted to Forest land – wildfires	IE	IE	-
Non-Forest land remaining Non-Forest land – controlled burning	NE	NE	-
Non-Forest land remaining Non-Forest land – wildfires	NE	NE	-
Land converted to Non-Forest land – controlled burning	●	●	-
Land converted to Non-Forest land – wildfires	NE	NE	-

(Reference 2) Structure of Japan's National Forest Management Planning System

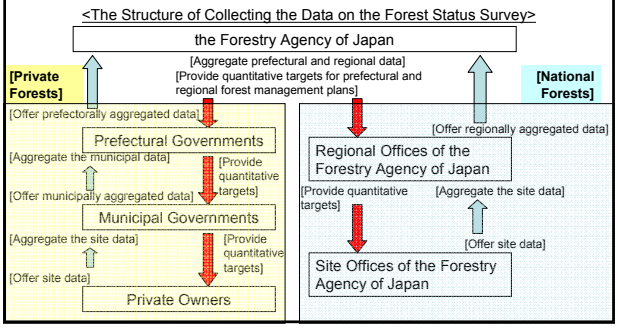
- Japan uses the data for conducting the Japan's National Forest Management Planning System.

<The Structure of the Japan's National Forest Management Planning System>

(Reference 3) Method of Collecting the Data on the Forest Status Survey

- Forestry Agency of Japan collects the data along with the structure of the Japan's National Forest Management Planning System.

<The Structure of Collecting the Data on the Forest Status Survey>



(Reference 4) Forest Ecosystem Services

- Forest Ecosystem Services defined by the United Nations Millennium Ecosystem Assessment
  - Food, Timber, Fresh water, Fuelwood, Flood regulation, Disease regulation, Carbon sequestration, Local climate regulation, Medicines, Recreation, Aesthetic values, Spiritual values.

  Retrieved from UN Millennium Ecosystem Assessment, *Living beyond Our Means: Natural Assets and Human Well-being: Statement from the Board* (Publication Draft), online: MA <http://www.millenniumassessment.org/proxy/document.444.aspx>

- Forest Ecosystem Services for Public Welfare defined under Article 25 of the Forest Act of Japan (Japan expresses these services as "public functions".)
  - Headwater conservation, Soil run-off prevention, Landslide prevention, Shifting sand prevention, Windbreak, Flood damage prevention, Tidal wave and salty wind prevention, Drought prevention, Snow drift prevention, Fog inflow prevention, Avalanche prevention, Rock-fall prevention, Fire prevention, Fish breeding, Navigation Landmarks, Public health, Scenic site conservation.

Original Purposes & Multi-Applications of National Statistics Used for Japan's GHG Inventory -Waste Sector-

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5th Workshop on Greenhouse Gas Inventories in Asia (WGIA5)
6-8 September, 2007
Kuala Lumpur, MALAYSIA

Outline of the Presentation

1. Main Issues Related to Activity Data in Waste Sector
2. Common Sources for Activity Data
3. Major Statistics for Waste Sector in GHG Inventory of JAPAN
4. How the Statistical Surveys are Conducted
5. Multiple Use of Statistical Data
6. Estimation of Non-Available Data Using Available Statistics

1. Main Issue Related to Activity Data

- *Lack of Data*
  - A common and major problem in many countries
  - Preliminary survey for WGIA5 showed that the countries are lacking in activity data on:
    - Solid waste disposal on land
    - Waste management practices
    - MSW generation
    - Waste water handling

2. Common Sources for Activity data

- Statistics Data
  - National statistics
  - International statistics
- Other Data
  - Data provided by ministries
  - Data provided by industrial groups and private firms
- Default Data
  - Revised 1996 IPCC Guidelines for National GHG Inventories
  - GPG and Uncertainty Management in National GHG Inventories (GPG2000)

3. Major Statistics (Waste Sector in GHGI of JAPAN)

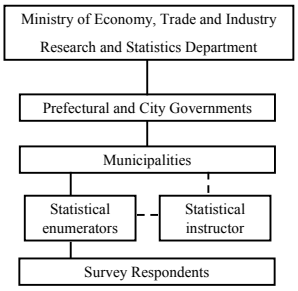
- Results of Study on Municipal Solid Waste Disposal (Ministry of the Environment)
- Report of the Research on the State of Wide-range Movement and Cyclical Use of Wastes (Ministry of the Environment)
- Waste Treatment in Japan (Ministry of the Environment)
- Study on the Control of Burdens Generated (Ministry of the Environment)
- Chemical Industry Statistical Yearbook (Ministry of Economy, Trade and Industry)
- Textiles and Consumer Goods Statistics (Ministry of Economy, Trade and Industry)
- Table of Industrial Statistics - Land and Water (Ministry of Economy, Trade and Industry)
- Trade Statistics of Japan (Ministry of Finance)
- Sewage Statistics, Admin.Ed., (Japan Sewage Works Association)
- Cement Handbook (Japan Cement Association)

4. How the Statistical Surveys are Conducted

- *Table of Industrial Statistics**
  - Main purpose:

To elucidate current status of manufacturing industry and to provide basic data/information for country's and local governments' administration such as industrial policy and small and medium enterprises policy, and to develop the basis for economic statistics system and to provide data for economic analysis and various economic indicators

  - The survey flowchart



*http://www.meti.go.jp/statistics/index.html

5. Multiple Use of Statistical Data

● *Table of Industrial Statistics**

➢ Economic and industrial policy

- ✓ Basic materials for industrial measures and policies
- ✓ Understanding of actual status of the usage of industrial water and application in drafting of an demand and supply plan
- ✓ Industrial complex development plan and business enterprises measures and policies
- ✓ Mining and manufacturing indices
- ✓ Inter-industry table and national accounts estimates

➢ White paper

- ✓ White paper on small and medium enterprises in Japan
- ✓ White paper on metropolitan area
- ✓ White paper on manufacturing
- ✓White paper on the national lifestyle

5. Multiple Use of Statistical Data

● *Table of Industrial Statistics**

➢ Other statistics: Basic information for implementation of various statistical survey

- ✓ Survey on food distribution structure

➢ Business enterprises, universities, research institutes and international organizations

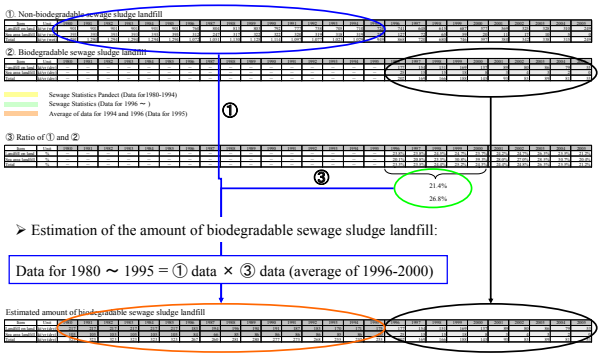
- ✓ Basic information for various analysis such as market forecast, learning material for social science and regional industrial analysis
- ✓ Provide data to Organization for Economic Co-operation and Development (OECD)

➢ GHG Inventory

- ✓ 6.B.1. Industrial wastewater

6. Estimation of Non-Available Data

● **6.A. 1. Emissions from controlled landfill sites**



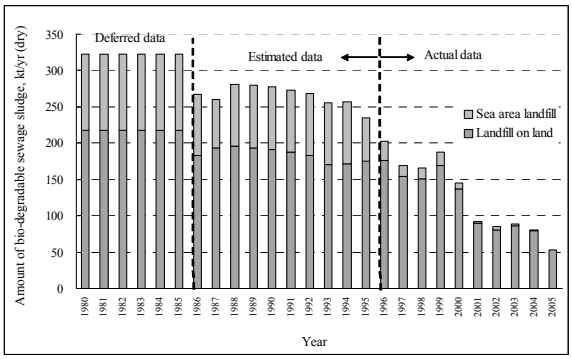
➢ Estimation of the amount of biodegradable sewage sludge landfill:

Data for 1980 ～ 1995 = ① data × ③ data (average of 1996-2000)

Estimated amount of biodegradable sewage sludge landfill

6. Estimation of Non-Available Data

● ***Amount of biodegradable sewage sludge landfill***



Summary

● Possible Solutions to Improve Data Collection

➢ Effective use of available data sources

➢ To take statistics to make consistent data over a time series

- ✓ Recognition of additional benefits of taking statistics (multiple use of statistical data)

➢ To gain the cooperation of relevant ministries and agencies in collection and producing of inventory data

- ✓ To enhance awareness of the importance of GHG inventory

Thank you

Session III
Networking Experts in the Region

Introductory Presentation

Presented by
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1. Introduction: Networking – why?

- Importance of networking has been emphasized on many occasions.
  - WGIA4 (February 2007) agreed upon the importance of effective use of GHG inventory experts in the region to **enhance (policy-makers') awareness of significance of inventory.**
  - Manila meeting (June 2007) highlighted regional network of experts (web based forum) as the overall needs of inventory compilers in the SEA countries to **exchange regional information (EF, AD, other parameters).**

1. Introduction: Why not existing ones?

- Inventory-related networks already exist.
  - e.g., Greenhouse Gas Experts Network (http://www.ghgnetwork.org)
- However, apparently those networks are little used by experts in Asian region.
  - According to the questionnaire about Greenhouse Gas Experts Network, almost all WGIA5 participants have never used it.
- Why…? Some problems make Asian country experts keep away from existing networks, presumably?

Overview

1. Introduction
2. Case Examples
   - 2-1. GHG Experts Network
   - 2-2. Climate-L
   - 2-3. Electric Discussion Group
3. Advantages and Disadvantages by Each Item in Formation of Network Platforms
4. Discussion Points

1. Introduction: What is the way forward?

- Given some difficulties Asian country experts are facing, it will be helpful for WGIA to establish a new regional on-line network.
- To this end, let's consider:
  - What are the problems Asian country experts might be seeing in the existing networks?
  - What features need to be sought when we design the new regional on-line network?

2-1. Case Example 1: GHG Experts Network

-On the web

-Information is open

- Offering all information collectively

-You can take contact directly with a specialist

http://www.ghgnetwork.org/

2-2. Case Example 2: Climate-L

-Mailing List

-Register to this, contribution mail is distributed to your E-mail address.

-Contribution mails are stocked on the web

http://www.iisd.ca/email/climate-L.htm

2-3. Case Example 3: Electronic Discussion Group

-On the web

-Restricted person only (Need password)

- Offering information by topics

http://www.ipccnggip.iges.or.jp/edg/edg.htm

3. Advantages and Disadvantages by Each Item in Formation of Network Platforms

- Items for Our Discussion
  1. Participants
  2. Information Browse
  3. Mailing List & Message Board
  4. Information to be Offered
  5. Contents of Information
  6. Methods of Posting Information
  7. List of Experts

3-1. Advantages and Disadvantages in Each Item – (1) Participant

Choice 1: Unrestricted
- Advantages
  - Wide range of participants
  - Various perspectives different from inventory development but related to climate change issues
- Disadvantages
  - Too much information straying off inventory development

Choice 2: Restricted
- Advantages
  - Providing information focused only on inventory development
- Disadvantages
  - Difficulty to decide the range of participants related to inventory development
  - Possibility of excluding external cooperation

3-2. Advantages and Disadvantages in Each Item – (2) Information Browse

Choice 1: Open without Password
- Advantages
  - None
- Disadvantages
  - Too difficult to control information offering and browse

Choice 2: Open with Password
- Advantages
  - Promoting the understanding of inventory development
- Disadvantages
  - Causing unexpected use of information

Choice 3: Close and allowing only limited Participants
- Advantages
  - Preventing misunderstanding and unexpected use of information
- Disadvantages
  - Excluding persons less relevant to inventory but interested in climate change policy

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3-3. Advantages and Disadvantages in Each Item – (3) Mailing List & Message Board

Choice 1: Mailing List & Message Board
- Advantages
  - Providing various choices on the network
- Disadvantages
  - Increasing tasks for moderators to manage the network

Choice 2: Mailing List Only
- Advantages
  - Less tasks for moderators to manage the network
- Disadvantages
  - Decreasing variety of choices on the network

Choice 3: Message Board Only
- Advantages
  - Avoiding offering unnecessary information to each participant's mailbox
- Disadvantages
  - Needing to access the network to browse information

3-4. Advantages and Disadvantages in Each Item – (4) Information to be offered

Choice 1:
Information offering Only
- Advantages
  - Decreasing the number of moderators' tasks
  - Preventing discussions unnecessary for all participants
- Disadvantages
  - Losing the chances to discuss about inventory development in detail

Choice 2:
Allowing to post questions and discussions
- Advantages
  - Offering the chances to discuss about inventory development in detail
- Disadvantages
  - Providing discussions necessary for **not** all participants
  - Increasing the number of moderators' tasks

3-5. Advantages and Disadvantages in Each Item – (5) Contents of Information

Choice 1:
Every information relevant to climate change
- Advantages
  - Offering information not only inventory development but also other issues relevant to climate change
- Disadvantages
  - Making vague the original purpose of offering information for improving inventory development

Choice 2:
Information directly relevant to inventory development only
- Advantages
  - Offering information focused on inventory development
- Disadvantages
  - Making impossible to receive other information relevant to climate change

3-6. Advantages and Disadvantages in Each Item – (6) Methods of Posting Information

Choice 1:
Offering all information collectively
- Advantages
  - Providing various information to all participants
- Disadvantages
  - Causing to offer information unnecessary for receivers who are interested in a particular topic

Choice 2:
Offering information by topics
- Advantages
  - Providing information necessary for each receiver
- Disadvantages
  - Preventing participants from browsing various information

3-7. Advantages and Disadvantages in Each Item – (7) List of Experts

Choice 1:
Posting the list on the website
- Advantages
  - Participants can ask questions by their choices and every time they want.
- Disadvantages
  - Experts receive unexpected tasks.

Choice 2:
Not posting the list on the website
- Advantages
  - Experts can avoid unexpected tasks.
- Disadvantages
  - Participants cannot choose experts who they want to ask their questions.
  - It takes time for participants to receive answers.

4. Discussion Points

Item	Choice 1	Choice 2	Choice 3
Participant	Unrestricted	Restricted	
Information Browse	Open with password	Open with password	Close and allowing only limited participants
Mailing List & Message Board	Mailing List & Message Board	Mailing List only	Message Board only
Information to be offered	Information offering only	Allowing to post questions and discussion	
Contents of Information	Every information relevant to climate change	Information directly relevant to inventory development	
Methods of Posting Information	Offering all information collectively	Offering information by topics	
List of Experts	Posting the list on the website	Not posting the list on the website	

Thank you!

We hope our following discussion comes to be very fruitful.

Reference 1: GHG Experts Network

Item	Characteristics
Participant	Unrestricted
Information Browse	Open
Mailing List & Message Board	Mailing List & Message Board
Information to be offered	Allowing to post questions and discussions
Contents of Information	Every information relevant to climate change
Methods of Posting Information	Offering all information collectively
List of Experts	Posting the list on the website

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Reference 2: Climate-L

Item	Characteristics
Participant	Unrestricted
Information Browse	Mailing list
Mailing List & Message Board	Mailing List only
Information to be offered	Information offering only
Contents of Information	Every information relevant to climate change
Methods of Posting Information	Offering all information collectively
List of Experts	Not posting the list on the website

Reference 3: Electronic Discussion Group

Item	Characteristics
Participant	Restricted
Information Browse	Close
Mailing List & Message Board	Message Board only
Information to be offered	Permitting question posting and discussion
Contents of Information	Information directly relevant to inventory development
Methods of Posting Information	Offering information by topics
List of Experts	Not posting the list on the website

Annex I: Agenda

Day 1, Thursday 6th September		
8:30~9:00		**Participant Registration**
9:00~10:00	**Opening Session** *Master of Ceremonies: Ms. Norhara Binti Hussein*	
9:00~9:05	Mr. Sei Kato	Welcome Address
9:05~9:10	Mr. Azhar Bin Noraini	Welcome Speech
		Group Photo
9:10~9:30	All	Introduction of Participants
9:30~9:45	Dr. Jamsranjav Baasansuren	Overview of WGIA5
9:45~10:00	All	Q&A
10:10~10:25		***Tea Break (Ballroom, Room 1 on the Level 2)***
10:25~12:30	**Session I: Country's Experience of Inventory Preparation/Development** *Chair: Dr. Damasa Macandog* *Rapporteur: Ms. Raquel Ferraz Villanueva*	
10:25~10:40	Mr. Kiyoto Tanabe	Introductory Presentation
10:40~10:50	Dr. Abdul Rahim Nik	GHG Inventory in Malaysia
10:50~11:05	Ms. Radin Diana Radin Ahmad	GHG Inventory in the Energy Sector and Industrial Processes
11:05~11:20	Dr. Elizabeth Philip	GHG Inventory of LULUCF Sector in Malaysia
11:20~11:35	Dr. Jeongho Seo Mr. Kyeonghak Lee Mr. Raehyun Kim	Overview of Present GHG Inventory on LULUCF Sector in Korea
11:35~11:50	Mr. Byong-Bok Jin Mr. Cheon-Hee Bang	Recent Development on Korea's Inventories With Regard to Waste
11:50~12:05	Dr. Qingxian Gao	Chinese Second National Communication (SNC) GHG Inventory of Waste Sector
12:05~12:20	All	Discussion

12:20~14:00		***Lunch Time (Maya Brasserie, Level 1)***
14:00~16:00	**Session I (continuation)**	
14:00~14:15	Dr. Batiimaa	Key Category Analysis: Mongolia
14:15~14:25	Punsalmaa	Discussion
14:25~14:40	All	Philippine Experience in GHG Inventory
14:40~14:55	Dr. Jose Ramon T	Preparation
	Villarin	Developing CH_4 Emission Factors from Rice
14:55~15:10	Dr. Sumana	Cultivation in India - Triumphs and Challenges
	Bhattacharya	LULUCF GHG Inventories: Indonesia
	Dr. Rizaldi Boer	
	Ms. Upik Sitti Aslia	
15:10~15:25	Mr. Takashi Morimoto	Lessons Learned from GHG Inventory Preparation:
	Mr. Takeshi Enoki	From the Point of View of External Consultants
15:25~16:00	All	Discussion
16:00~16:15		***Tea Break (Ballroom, Room 1 on the Level 2)***
16:15~18:00	**Special Session** *Chair: Dr. Yukihiro Nojiri*	
16:15~16:35	Mr. Dominique Revet	Latest Update on non-Annex I National Communications and National Greenhouse Gas Inventories
16:35~16:55	Mr. Leandro Buendia	Manila Scoping Meeting and Follow-up Activities for Sustainable GHG Inventory Management Systems in Southeast Asia
16:55~17:15	Ms. Mausami Desai	Strategies and Applicable Tools for Improving GHG Inventories in Southeast Asia
17:15~17:35	Dr. Masato Yamada	The Workshop on Improvement of Solid Waste Management and Reduction of GHG Emissions in Asia (SWGA)
17:35~17:55	Dr. Tatsuya Hanaoka	Mitigation Scenario Analysis: Asia-Pacific
	Dr. Mikiko Kainuma	Integrated Models (AIM)
	Dr. Toshihiko Masui	
	Dr. Junichi Fujino	

Dr. Shuichi Ashina
Dr. Yuko Kanamori
Dr. Takeshi Ikegami

18:00~18:45 ***Cultural show provided by the Tourism Malaysia***

19:30~ ***Reception hosted by the organizers (Maya Brasserie, Level 1)***

Day 2, Friday 7th September		
9:00~12:00	**Session II: Institutional Arrangements for National Inventory System** *Chair: Dr. Abdul Rahim Nik* *Rapporteur: Dr. Elizabeth Philip and Dr. Gary W. Theseira*	
9:00~9:15	Dr. Yukihiro Nojiri	Introductory Presentation
9:15~9:35	Mr. Sei Kato	Japan's Institutional Arrangement for Preparation of National GHG Inventory
9:35~9:55	Ms. Lavanya Rama Iyer	Institutional Set-up for the Second National Communication of Malaysia
9:55~10:10	Mr. Heng Chan Thoeun	Cambodia's Institutional Arrangements for GHG Inventory for SNC
10:10~10:30		***Tea Break (Ballroom, Room 1 on the Level 2)***
10:30~10:45	Mr. Hoang Manh Hoa Mr. Nguyen Chi Quang	Country Experiences in GHG Inventory Preparation: Vietnam
10:45~11:00	Mr. Soon-Chul Park	Institutional Arrangements for Inventory System in Korea
11:00~11:20	Dr. Sirintornthep Towprayoon	Experiences on Disaggregated Activity Data Acquisition for GHG Inventory in Waste and Agricultural Sector
11:20~11:35	Ms. Upik Sitti Aslia	Institutional System for the Development of National GHG Inventory: Indonesia
11:35~12:00	All	Discussion
12:00~14:30		***Lunch Time (Maya Brasserie, Level 1)***

14:30~15:45	**Session II (continuation)**	
14:30~15:15		Original Purposes and Multi-applications of National Statistics Used for Japan's GHG Inventory
	Dr. Yuriko Hayabuchi	
	Dr. Rikiya Matsumoto	- Energy Sector
	Mr. Kohei Sakai	- Industrial Processes Sector
	Ms. Takako Ono	- Agriculture Sector
	Dr. Jamsranjav	- LULUCF Sector
	Baasansuren	- Waste Sector
15:15~15:45	All	Discussion
15:45~16:00		***Tea Break (Ballroom, Room 1 on the Level 2)***

16:00~17:00	**Session III: Networking Experts in the Region** *Chair: Mr. Leandro Buendia* *Rapporteur: Dr. Sirintornthep Towprayoon*	
16:00~16:20	Mr. Kohei Sakai Ms. Takako Ono	Introductory Presentation
16:20~17:00	All	Discussion

17:00~17:40	**Wrap-up Session** *Chair: Dr. Shuzo Nishioka*	
17:00~17:30	All	Overall Discussion and Wrap-up
17:30~17:35	Dr. Yukihiro Nojiri	Closing Remarks
17:35~17:40	Dr. Abdul Rahim Nik	Closing Remarks

Day 3, Saturday 8th September	
8:00~17:00	**Excursion (Optional):** **Tour of the Forest Research Institute Malaysia (FRIM) and Kuala Lumpur organized by FRIM and the Pacific World Destination East Malaysia Sdn Bhd (PWDEM)**

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Annex III: Results of preliminary survey for WGIA5

COUNTRY	Preparation of GHG Inventory for SNC (*TNC)	Key Category Analysis	Establishment of Institutional Arrangements for Inventory System
CAMBODIA	○	○	○
CHINA	○	○	○
INDIA	○	○	○
INDONESIA	△	△	△
KOREA*	○	△	○
LAO P.D.R.	△	-	△
MALAYSIA	○	-	○
MONGOLIA	-	○	△
PHILIPPINES	△	○	○
SINGAPORE		△	△
THAILAND	○	△	△
VIETNAM	○	○	○

○ It is ongoing (For KCA, it has been perfomed for INC)

△ Will soon start (we are planning)

- Not yet started (performed)

COUNTRY	UNFCCC non-Annex I GHG Inventory Software	UNDP Handbook on National GHG Inventory	IPCC Emission Factor Database (EFDB)	GHG Experts Network
CAMBODIA	○	○	○	△
CHINA	○	○	-	-
INDIA	-	△	-	△
INDONESIA	-	△	-	△
KOREA	-	-	-	-
LAO P.D.R.	○	-	○	△
MALAYSIA	△	-	-	△
MONGOLIA	-	-	○	-
PHILIPPINES	-	△	△	-
SINGAPORE	○	○	○	○
THAILAND	○	○	-	-
VIETNAM	○	△	○	△

○ Yes, we use it

△ No, we were not aware of this

- No, we were aware of this, but have never used it

Annex IV: Original Purposes and Multi-applications of National Statistics Used for Japan's GHG Inventory

Energy Sector

Source/Sink Category		Activity Data	Ministry/Agency in Charge	Name of Statistics/Survey	Periodicity	Type	Objectives/Relevance to Other Policies/Uses
1.A.1; 1.A.2; 1.A.4	Energy Industries, Manufacturing Industries and Construction and Other Sectors	Energy consumption and non-energy product use of fossil fuels (Public Electricity, Iron and Steel etc.)	Ministry of Economy, Trade and Industry	General Energy Statistics	Annual	Official statistics	To clarify current status of manufacturing industry, to develop the basis for economic statistical system, thus to contribute to economic policy of own country
1.A.1.a	Public Electricity and Heat Production	Fuel consumption for power generation	Ministry of Economy, Trade and Industry	General Energy Statistics	Annual	Official statistics	To clarify current status of manufacturing industry, to develop the basis for economic statistical system, thus to contribute to economic policy of own country
1.A.1.b	Petroleum Refining	Own use, Oil Refinery	Ministry of Economy, Trade and Industry	General Energy Statistics	Annual	Official statistics	To clarify current status of manufacturing industry, to develop the basis for economic statistical system, thus to contribute to economic policy of own country
1.A.1.c	Manufacture of Solid Fuels and Other Energy Industries	Own use, Steel Coke	Ministry of Economy, Trade and Industry	General Energy Statistics	Annual	Official statistics	To clarify current status of manufacturing industry, to develop the basis for economic statistical system, thus to contribute to economic policy of own country
1.A.2.a	Iron and Steel	Iron and Steel	Ministry of Economy, Trade and Industry	General Energy Statistics	Annual	Official statistics	To clarify current status of manufacturing industry, to develop the basis for economic statistical system, thus to contribute to economic policy of own country
1.A.2.b	Non-Ferrous Metals	Non-Ferrous Metals	Ministry of Economy, Trade and Industry	General Energy Statistics	Annual	Official statistics	To clarify current status of manufacturing industry, to develop the basis for economic statistical system, thus to contribute to economic policy of own country
1.A.2.c	Chemicals	Chemical Textiles	Ministry of Economy, Trade and Industry	General Energy Statistics	Annual	Official statistics	To clarify current status of manufacturing industry, to develop the basis for economic statistical system, thus to contribute to economic policy of own country
1.A.2.d	Pulp, Paper and Print	Final Energy Consumption, Pulp & Paper	Ministry of Economy, Trade and Industry	General Energy Statistics	Annual	Official statistics	To clarify current status of manufacturing industry, to develop the basis for economic statistical system, thus to contribute to economic policy of own country
1.A.2.e	Food Processing, Beverages and Tobacco	Final Energy Consumption, Food	Ministry of Economy, Trade and Industry	General Energy Statistics	Annual	Official statistics	To clarify current status of manufacturing industry, to develop the basis for economic statistical system, thus to contribute to economic policy of own country
1.A.3.a	Civil Aviation	Jet fuel	Ministry of Land, Infrastructure and Transport.	Statistical Yearbook of Air Transport	Annual	Official statistics	To develop the basis safety aviation system, to provide data for economic analysis and various economic indicators
1.A.3.b	Road Transportation	Running mileage by each category of vehicle and by each type of fuel	Ministry of Land, Infrastructure and Transport	Statistical Yearbook of Motor Vehicle Transport	Annual	Official statistics	To clarify vehicle type by each type of fuel, to provide data for economic analysis and various economic indicators
1.A.3.c	Railways	Coal consumption by steam locomotives	Ministry of Land, Infrastructure and Transport	Statistical Yearbook of Railway Transport	Annual	Official statistics	To provide basic data in order to promote railways systems, to provide data for economic analysis and various economic indicators
1.A.3.d	Navigation	Consumption of each fuel type in internal navigation	Ministry of Economy, Trade and Industry	General Energy Statistics	Annual	Official statistics	To develop the basis safety internal navigation system, to provide data for economic analysis and various economic indicators
1.B.1	Solid Fuels	Coal Mining and Handling, Solid Fuel Transformation	Ministry of Economy, Trade and Industry	Yearbook of Production, Supply and Demand of Petroleum, Coal and Coke and Yearbook of Mineral Resources and Petroleum Products Statistics	Annual	Official statistics	To clarify current status of production on coal mining and handling, solid fuel transformation
1.B.2	Oil and Natural Gas	Oil, Natural Gas, Venting and Flaring	Natural Gas Mining Association	Natural Gas Annual Report	Annual	Official statistics	To clarify basic data on oil, natural gas, venting and flaring, to provide data for economic analysis

Note: The information of this table is taken from original Japanese documents and should not be considered official translations. In the case of a discrepancy, the Japanese documents prevail.

Industrial Processes Sector

Source/Sink Category		Activity Data	Ministry/Agency in Charge	Name of	Periodicity	Type	Objectives/Relevance to Other Policies/Uses
2.A.1	Cement Production	Clinker Production	Ministry of Economy, Trade and Industry	The Japan Cement Association/ Yearbook of Ceramics and Building Metarials Statistics	Annual	Official statistics required by law	To clarify a change of the industrial production, and get basics of measure document about Industry and the mining industry.
2.A.2	Lime Production	Both of high-calcium lime and dolomitic lime Production	Ministry of Economy, Trade and Industry	Yearbook of Chemical Industries Statistics	Annual	Official statistics required by law	To clarify a change of the industrial production, and get basics of measure document about the mining industry.
2.A.3	Limestone and Dolomite Use	Iron and Steel production, Soda / Glass Production	Ministry of Economy, Trade and Industry; Agency for Natural Resources and Energy	Yearbook of Minerals and Non-ferrous Metals Statistics/ Yearbook of Mineral Resources and Petroleum Products Statistics	Annual	Official statistics required by law	To clarify the actual situation of the supply and demand such as the nonferrous metal/ Clarify the actual situation of the supply and demand of oil products.
2.A.4	Soda Ash Production and Use	Soda ash shipment / soda ash imported / sodium carbonate imported	Japan Soda Industry Association / Japan Tariff Association Jtrade /	GPG (2000)	Annual	Cooperate presentation	To understand an overseas trend greatly, and to always reinforce competition in the international market.
2.A.4-	Soda Ash Production						
2.A.4-	Soda Ash Use						
2.B.1	Ammonia Production	Consumption of Naphtha / Consumption of LPG	Ministry of Economy, Trade and Industry	Yearbook of The Current Survey of Energy Consumption	Annual	Official statistics required by law	To clarify the actual situation of the supply and demand of oil products.
2.B.2	Nitric Acid Production	Production of Nitric Acid	Ministry of Economy, Trade and Industry	Yearbook of Chemical Industries Statistics	Fiscal Year Basis	Official statistics required by law	To clarify a change of the industrial production, and get basics of measure document about the mining industry.
2.B.3	Adipic Acid Production	Production of Adipic Acid	Ministry of Economy, Trade and Industry	Hearing	Annual	Cooperate presentation	To enrich the National Inventory.
2.B.4	Carbide Production	Carbide Production	Confidential				
2.B.4-	Silicon Carbide						
2.B.4-	Calcium Carbide						
2.B.5-	Carbon Black	Carbide Production	Ministry of Economy, Trade and Industry	Yearbook of Chemical Industries Statistics	Annual	Official statistics required by law	To clarify a change of the industrial production, and get basics of measure document about the mining industry.
2.B.5-	Ethylene	Production of Ethylene	Ministry of Economy, Trade and Industry	Yearbook of Chemical Industries Statistics	Annual	Official statistics required by law	To clarify a change of the industrial production, and get basics of measure document about the mining industry.
2.B.5-	1,2-Dichloroethane	Ethylene dichloride Production	Ministry of Economy, Trade and Industry	Yearbook of Chemical Industries Statistics	Annual	Official statistics required by law	To clarify a change of the industrial production, and get basics of measure document about the mining industry.
2.B.5-	Styrene	Styrene Production	Ministry of Economy, Trade and Industry	Yearbook of Chemical Industries Statistics	Annual	Official statistics required by law	To clarify a change of the industrial production, and get basics of measure document about the mining industry.

Source/Sink Category		Activity Data	Ministry/Agency in Charge	Name of	Periodicity	Type	Objectives/Relevance to Other Policies/Uses
2.B.5-	Methanol	Production of Methanol	Methanol - Formaldehyde Association	Because, after 1996, there is not production in Japan; "NO"	Fiscal Year Basis	Cooperate presentation	
2.B.5-	Coke	Production of Coke	Ministry of Economy, Trade and Industry	Yearbook of Production, Supply and Demand of Petroleum, Coal and Coke	Annual	Official statistics required by law	To clarify a change of the industrial production, and get basics of measure document about the mining industry.
2.C.1	Iron and Steel Production	IE (cf. refer to Energy sector)					
2.C.1-	Steel						
2.C.1-	Pig Iron						
2.C.1-	Sinter						
2.C.1-	Coke						
2.C.1-	Use of Electric Arc Furnances in Steel Production	Production of Carbon Electrodes	Ministry of Economy, Trade and Industry	General energy statistics	Annual	Official statistics required by law	To clarify the energy source that it is imported in Japan, and how it is produced, and is supplied and clarify that it is finally used with any kind of form by which section and a purpose.
2.C.2	Ferroalloys Production	Furnaces	Ministry of Economy, Trade and Industry	General energy statistics	Annual	Official statistics required by law	To clarify the energy source that it is imported in Japan, and how it is produced, and is supplied and clarify that it is finally used with any kind of form by which section and a purpose.
2.C.3	Aluminium Production	Aluminium Production	Ministry of Economy, Trade and Industry	Yearbook of Minerals and Non-ferrous Metals Statistics	Annual	Official statistics required by law	To clarify the actual situation of the supply and demand such as the nonferrous meta.
2.C.4	SF6 Used in Alminium and Magnesium Foundries	Consumption of SF_6 / Molten Magnesium	Ministry of Economy, Trade and Industry	METI material of Industrial Structure Council	Ad hoc	Ministry of Economy, Trade and Industry setting method Article 6	To discuss a chemical substance management policy and an important matter about the ideal method of the biopolicy.
2.D.1	Pulp and Paper	According to the CRF, it is requred to report on emissions of nitrogen oxides (NOx), carbon monoxide (CO), non-metane vlatile organic compounds (NMVOC), and sulfur dioxide (SO_2).					
2.E	Production of Halocarbons and SF6	Discharge of vice-life HFC -23 with the production of HCF-22	Ministry of Economy, Trade and Industry	METI material of Industrial Structure Council	Ad hoc	Ministry of Economy, Trade and Industry setting method Article 6	To discuss a chemical substance management policy and an important matter about the ideal method of the biopolicy.
2.E.1-	By-producto Emissions: Production of HCFC-22						
2.E.2	Fugitive Emissions	Production of HFCs, PFCs and SF_6	Japan Chemical Industry Association	Hearing	Annual	Cooperate Presentation	To perform the plan of production about the chemical industry, the circulation, investigation / studies such as the consumption and technology about the chemical industry, labor, environment, investigation / the study of many problems to modify security and measures and the promotion.
2.F.1.	Refrigeration and Air Conditioning Equipment / Domestic Refrigeration	1) Fugitive refrigerant ratio from production, 2) fugitive refrigerant ratio from use, 3)refrigerant contained at the time of disposal, separately, based on production and shipment volumes and refrigerant contained.	Ministry of Economy, Trade and Industry	METI material of Industrial Structure Council	Ad hoc	Ministry of Economy, Trade and Industry setting method Article 6	To discuss a chemical substance management policy and an important matter about the ideal method of the biopolicy.
2.F.1.-							

Source/Sink Category		Activity Data	Ministry/Agency in Charge	Name of	Periodicity	Type	Objectives/Relevance to Other Policies/Uses
2.F.1.-	Commercial Refrigeration	1) manufacturing, 2) operation, 3) maintenance, 4) accident, 5) disposal	Ministry of Economy, Trade and Industry	METI material of Industrial Structure Council	Ad hoc	Ministry of Economy, Trade and Industry setting method Article 6	To discuss a chemical substance management policy and an important matter about the ideal method of the biopolicy.
2.F.1-	Stationary Air-Conditioning (Household)	1) Manufacturing, 2) Operation, 3) Accident, 4) Disposal	Ministry of Economy, Trade and Industry	METI material of Industrial Structure Council	Ad hoc	Ministry of Economy, Trade and Industry setting method Article 7	To discuss a chemical substance management policy and an important matter about the ideal method of the biopolicy.
2.F.1-	Mobile Air-Conditioning (Car Air Contitioners)	1) manufacturing, 2) operation, 3) maintenance, 4) accident, 5) disposal	Ministry of Economy, Trade and Industry	METI material of Industrial Structure Council	Ad hoc	Ministry of Economy, Trade and Industry setting method Article 8	To discuss a chemical substance management policy and an important matter about the ideal method of the biopolicy.
2.F.2	Foam Blowing	HFC-134a Use, HFC-152a Use	Urethane foam industry society / Urethane raw materials industry society	Hearing	Annual	Cooperate Presentation	To disclosure / the spread of applied situation in the field of each industry of the polyurethane resin product (a soft form, a half rigid form, a hard form, an RIM product / reaction ejection cast, elastomer, hides, paint, adhesive, fiber).
2.F.2-	Hard Form						
2.F.4	Aerosols/Metered Dose Inhalers	Emission of HFC-134a and HFC-152a	Aerosol Industry of Japan	Hearing	Annual	Cooperate Presentation	To plan healthy development of the aerosol industry.
2.F.4-	Aerosols						
2.F.4-	Metered Dose Inhalers	Emission of HFC-134a and HFC-227ea	Federation of Pharmaceutical Manufacturer's Associations of Japan	Hearing	Annual	Cooperate Presentation	To work hard to gather the fair opinion of the industry for the realization and measure the friendship of member aspect each other, communication and enlightenment, and increase the profit that is common to the business of the participation group member.
2.F.5	Solvents	Use of solvents, washing, and etc.	Ministry of Economy, Trade and Industry	METI material of Industrial Structure Council	Ad hoc	Ministry of Economy, Trade and Industry setting method Article 11	Discuss a chemical substance management policy and an important matter about the ideal method of the biopolicy.
2.F.7	Semiconductors	Emission of PFCs and HFC-23	Ministry of Economy, Trade and Industry	METI material of Industrial Structure Council	Ad hoc	Ministry of Economy, Trade and Industry setting method Article 11	To discuss a chemical substance management policy and an important matter about the ideal method of the biopolicy.
2.F.7-	Semiconductors	Emission of PFCs and HFC-23	Ministry of Economy, Trade and Industry	METI material of Industrial Structure Council	Ad hoc	Ministry of Economy, Trade and Industry setting method Article 12	To discuss a chemical substance management policy and an important matter about the ideal method of the biopolicy.
2.F.7-	Liguid Crystals	Emission of PFCs, HFC-24 and SF_6	Ministry of Economy, Trade and Industry	METI material of Industrial Structure Council	Ad hoc	Ministry of Economy, Trade and Industry setting method Article 13	To discuss a chemical substance management policy and an important matter about the ideal method of the biopolicy.
2.F.8	Electrical Equipment	Emission of PFCs and SF_6	Ministry of Economy, Trade and Industry	METI material of Industrial Structure Council	Ad hoc	Ministry of Economy, Trade and Industry setting method Article 14	To discuss a chemical substance management policy and an important matter about the ideal method of the biopolicy.

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Agriculture Sector

Source/Sink Category		Activity Data	Ministry/Agency in Charge	Name of Statistics/Survey	Periodicity	Type	Objectives/Relevance to Other Policies/Uses
4.A; 4.B; 4.D.3	Enteric Fermetation, Manure management, Direct Soil Emissions by Organic Fertilizer	Livestock Population of Dairy Cattle, Non-dairy Cattle, Swine and Poultry	Ministry of Agriculture, Forestry and Fisheries	Livestock Statistics	Annual	Official statistics requiered by low	To understand of animal industry and to provide the data of animal industry to public administration
4.C; 4.D.1	Rice Cultivation, Direct Emissions from Agricultural Soils	Area of Paddy field, grains, Fruits, Tea, Pulse, Other crop field	Ministry of Agriculture, Forestry and Fisheries	Statistics of Cultivated and Planted Area	Annual	Official statistics requiered by low	Understanding circumstances, measure against production and promotion of agricultural administration, such as a measure against supply and demand
4.D.1	Direct Emissions from Agricultural Soils	Amount of Nitrogenous Fertilizer used in Rice Field (per 10a)	Ministry of Agriculture, Forestry and Fisheries	Yearbook of Fertilizer Statistics (Pocket Edition)	Annual	Official statistics	Basic statistics for fertilizer
4.D.1; 4.D.2; 4.F.1	Direct Emissions from Agricultural Soils, Emissions from Pasture, Range and Paddock Manure ,Field Burning of Agricultural Residues	Area of Tabacco, Crop Area except for Vegetables	Ministry of Agriculture, Forestry and Fisheries	Crop Statistics	Annual	Official statistics requiered by low	Understanding and measure of crop production, promotion of agricultural administration for measure against supply and demand, proper management of a mutual aid project (accident compensation etc.)
4.D.1; 4.F.1	Direct Emissions from Agricultural Soils, Emissions from Field Burning of Agricultural Residues	Area of Potatoes, Vegetables	Ministry of Agriculture, Forestry and Fisheries	Vegetable Production and Shipment Statistics	Annual	Official statistics requiered by low	To make basic data about measures against production, measures against supply and demand, measurement against circulation improvement
4.D.1	Organic Fertilizer(Application of Animal Waste)	Amount of nitrogenous fertilizer derived from organic materials used in each crop field (per 10a)	Ministry of Agriculture, Forestry and Fisheries	Report of Survey on Method of Quantifying Reduction of Emissions of Greenhouse Gases (2000 FY)	Ad hoc		Ad hoc for preparation of national GHG inventories (to work on estimation of N2O emission and reduction of N2O production)
4.A; 4.B; 4.D.3	Enteric Fermetation, Manure management, Indirect Emissions from Soil	Livestock Population of Sheep, Goats and Horses	FAO (FAOSTAT)	FAOSTAT Database	Annual	—	—
4.A; 4.B; 4.D.3	Enteric Fermetation, Manure management, Indirect Emissions from Soil	Livestock Population of Buffalo	Okinawa prefecture	Livestock statistics of Okinawa	Annual	Official statistics	Understanding of resource utilization and production
4.D.3	Indirect Emissions from Soil	Amount of manure filled in	Ministry of the Environment, Waste Management and Recycling Department	Report of the research on the state of wide-range movement and cyclical use of wastes (the volume on cyclical use)	2001, 2002, 2003, 2004	Official statistics (estimation from the existing statistics data)	To choose a method with socially little load by each kind of waste
4.D.3	Indirect Emissions from Soil	the number of people that apply feces and urine to agricultural soils	Ministry of the Environment, Waste Management and Recycling Department	Waste Treatment in Japan	Annual	Official statistics	To obtain basic data for promotion of wastes administration

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LULUCF Sector

Source/Sink Category		Activity Data	Ministry/Agency in Charge	Name of	Periodicity	Type	Objectives/Relevance to Other Policies/Uses
5	Overall LULUCF	Area Converted to Other Categories (Mainly used for the Cropland category)	Ministry of Agriculture, Forestry, and Fishery	Moving and Conversion of Cropland	Annual	Official statistics required by law	Obtaining data of the actual performance of permission, notification, and information on moving or converting cropland to other land categories.
5	Overall LULUCF	Area Converted to Other Categories (Mainly used for the Cropland and Grassland categories)	Ministry of Agriculture, Forestry, and Fishery	Statistics of Cultivated and Planted Land	Annual	Official statistics required by law	Surveying the current status of cultivated and commercially planted lands which are agricultural production base, and providing information necessary for promoting the agricultural administration relevant to measures for agricultural production, demand and supply, and administrative structure and for developing a National Basic Plan for Food, Agriculture, and Rural Areas
5	Overall LULUCF	Area Converted to Other Categories (Mainly used for Meadow and Pasture in the Grassland category)	Ministry of Agriculture, Forestry, and Fishery	World Census of Agriculture and Forestry	Every 5 years	Official statistics required by law	Obtaining data of conditions which are bases of agricultural and forestry production structures, clarifying the current status and trends of agriculture and forestry, and then providing necessary fundamental information for developing poilcies of agriculture and forestry.
5	Overall LULUCF	Classification of Land Use (Mainly used for the Wetland and Settlement categories)	Ministry of Land, Infrastructure and Transport	Land Use Status Survey	Annual	Official statistics required by law	Figuring out the status of national land utilization and providing fundamental data for developing a national land utilization plan and urban-area utilization plans.
5	Forest Land Converted to Other Categories	Area of Forest Land Converted to Other Categories	Ministry of Agriculture, Forestry, and Fishery (Forestry Agency)	Survey on Converted Areas of Private Forests in the Permission System of Forestland Conversion	Annual	Voluntary in-house survey	Checking the implementation of the permission system of forestland conversion.
5.A.1	Forest Land Remaining Forest Land	Area of Forest Land Remaining Forest Land	Ministry of Agriculture, Forestry, and Fishery (Forestry Agency)	Forestry Status Survey	Every 5 years (With respect to forestry, every 10 years)	Official statistics required by law	Comprehending the major trends of national forest resources and industries, and providing fundamental quantitative data for developing the National Forest Management Plan.
5.A.1	Forest Land Remaining Forest Land	Area of Forest Land Remaining Forest Land	Ministry of Agriculture, Forestry, and Fishery (Forestry Agency)	National Forestry Project Survey	Annual	Official statistics required by law	Figuring out the status of national foresetry projects.
5.D.2	Land Converted to Wetland	Area of Land Converted to Wetland	Japan Dam Foundation	Dam Yearbook	Annual	Voluntary reporting by companies	Figuring out the status of national dams, and providing data as a references for considering integrated river management.
5.D.2	Land Converted to Wetland	Area of Land Converted to Wetland	Ministry of Internal Affairs and Communications	Housing and Land Survey of Japan	Every 5 years	Official statistics required by law	Obtaining basic information necessary for housing and land-related policy formulation by investigating the actual conditions of dwellings and their occupying households, and clarifying their present situation and change.
5.E.1	Settlement remaining Settlement	Urban Green Area	Ministry of Land, Infrastructure and Transport	Urban Parks Status Survey	Annual	Official statistics required by law	Figuring out the status of urban parks, and providing fundamental data for developing urban park projects.

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Waste Sector

Source/Sink Category		Activity Data	Ministry/Agency in Charge	Name of Statistics/Survey	Periodicity	Type	Objectives/Relevance to Other Policies/Uses
6.A.1; 6.C	CH_4 emissions from controlled landfill sites (kitchen garbage, waste paper, natural fiber, waste wood and sludge); CH_4 and N_2O emissions from MSW incineration, CO_2 iemission from MSW incineration (plastic and synthetic fiber)	Percentage of MSW landfill sites; percentage of incineration facilities by type and incineration amount of MSW by type of incineration facilities,	Ministry of the Environment	Results of Study on Municipal Solid Waste Disposal	Annual	Official Statistics	To provide basic data for promotiom of MSW administration
6.A.1; 6.A.3; 6.C	CH_4 emissions from controlled landfill sites, CH_4 and N_2O emissions from composting of organic waste, CO_2, CH_4 and N_2O emissions from MSW and ISW incineration	Amount of directly landfilled MSW and ISW (kitchen garbage, waste paper, waste wood, waste natural textile), amount of livestock waste treated and landfilled, landfilled and treatment amount of human waste and septic tank sludge of MSW, amount of livestock manure of ISW treated and landfilled; percentage of constituents of MSW in rapid composting facilities; incineration volume by waste type for MSW and ISW, percentage of solid content in MSW, amount of waste oil and waste wood of ISW used as raw materials and fuel	Ministry of the Environment	Report of the Research on the State of Wide-range Movement and Cyclical Use of Wastes	Annual	Official Statistics	To clarify GHG emissions by waste type, recycling amount, collection and disposal amount for the purpose of choosing appropriate way/solution with least social burden to restrain wide area movement of the waste and analyze the situation from a viewpoint of combating global warming
6.A.3; 6.B.2	CH_4 and CO_2 emissions from composting of organic waste; CH_4 and N_2O emissions from domestic and commercial wastewater treatment (septic tank and human waste treatment facilities) and CH_4 and N_2O emissions from degradation of domestic wastewater in nature	Amount of MSW in rapid composting facilities; annual treatment population by type of domestic sewage treatment plant, total volume of human waste and septic tank sludge processed at human waste treatment plants, amount of human waste dumped in ocean, and amount of human waste generated per day and per person	Ministry of the Environment	Waste Treatment in Japan	Annual	Official Statistics	Compilation of results of the Study on MSW Disposal
6.B.1	CH_4 and N_2O emissions from industrial wastewater treatment	Amount of industrial wastewater by type of treatment	Ministry of the Environment	Study on the Control of Burdens Generated	Annual	Official Statistics	To promote water pollution prevention measures
6.D	CO_2 emissions from the decomposition of petrolium-derived surfactants	Amount of surfactants used (by category)	Ministry of Economy, Trade and Industry	Chemical Industry Statistical Yearbook	Monthly / Annual	Official Statistics	To provide data on chemical industry dynamics in order to clarify current status of industrial activities and production for mining and manufacturing industries, and to obtain bacis materials for mining and manufacturing policies

Source/Sink Category		Activity Data	Ministry/Agency in Charge	Name of Statistics/Survey	Periodicity	Type	Objectives/Relevance to Other Policies/Uses
6.A.1; 6.C	CH_4 emissions from controlled landfill sites (natural fiber); incineration of municipal solid waste (synthetic fiber)	Demand and supply amount for fiber	Ministry of Economy, Trade and Industry	Textiles and Consumer Goods Statistics	Monthly / Annual	Official Statistics	To provide data on production of textiles and consumer goods to identify the monthly trends in industrial production and obtain basic material for mining and manufacturing policies
6.B.1	CH_4 and N_2O emissions from industrial wastewater treatment	Amount of water used for treatment of products (by use) and water used for washing	Ministry of Economy, Trade and Industry	Table of Industrial Statistics-Land and Water	Annual	Official Statistics	To elucidate current status of manufacturing industry and to provide basic data/information for country's and local goverments' administration such as industrial policy and small and medium enterprices policy, to develop the basis for economic stastistical system and to provide data for economic analysis and various economic indicators
6.D	CO_2 emissions from the decomposition of petrolium-derived surfactants	Export and import amount of surfactants	Ministry of Finance	Trade Statistics of Japan	Monthly / Annual	Official Statistics	To get a clear grasp of current status of commerce and make easy a comparicon of countries' foreign trade, thus to contribute to economic policy of country and public institution, and economic activities of private enterprises
6.A.1; 6.A.3; 6.B.2	CH_4 and CO_2 emissions from controlled landfill sites (sludge); CH_4 and N_2O emissions from composting of organic waste; CH_4 and N_2O emissions from municipal and commercial wastewater treatment	Landfilled sewage sludge amount; amount of composted industrial waste; annual volume of water treated (by treatment facilities) and amount of primary wastewater	Japan Sewage Works Association	Sewage Statistics (Admin.Ed.)	Annual	Official Statistics	To reveal current status of sewage treatment system and management
6.C	Emissions from ISW used as raw materials (waste oil and waste plastic)	Amount od waste plastics pumped into firing furnace and amount of waste oil used in cement industry	Japan Cement Assocoation	Cement Handbook	Annual	Official Statistics	To contribute to society, addressing global warming and building up the resource-recycling society

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