The 3rd Workshop on Greenhouse Gas Inventories in Asia Region

23-24 February 2006, Manila, Philippines

Proceedings

Ministry of the Environment, Japan
National Institute for Environmental Studies (NIES), Japan

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Preface

The Workshop on GHG Inventories in Asia Region (WGIA) was first held in Phuket, Thailand in 2003, followed by the second, held in Shanghai, China in 2004. To maintain the momentum of those meetings, on 23 and 24 February 2006 the third WGIA was held in Manila, the Philippines. There are now 12 countries participating in this network, mostly non-Annex I countries under the UN Framework Convention on Climate Change.

At the workshops, governmental and scientific experts responsible for the development of greenhouse gas emissions inventories in their respective countries gather together to exchange and discuss information and experiences regarding various aspects of inventory development. We have discovered great value in these exchanges, as various countries in the region share many similarities and regionally-unique characteristics that affect GHG emissions, so experiences in one country can often be a tremendous help to others.

These kinds of exchanges are even more relevant than before, as all participating countries have completed at least one national communication to fulfill their commitments under the Climate Convention, and are already or will soon be working on their next communication. All countries are seeking greater accuracy and reduced uncertainty in their inventories, and to accomplish this, many are moving from the default emission factors offered by the Intergovernmental Panel on Climate Change to region-specific or country-specific emission factors. To respond to this situation, this time, besides hearing the annual updates on national circumstances, participants divided into four working group sessions for more detailed technical discussions in the sectors of: energy; agriculture; land use, land-use change and forestry (LULUCF); and waste.

We sincerely hope that the WGIA meetings and network will continue to be valuable in helping countries improve the quality of GHG emissions inventories in the Asian region.

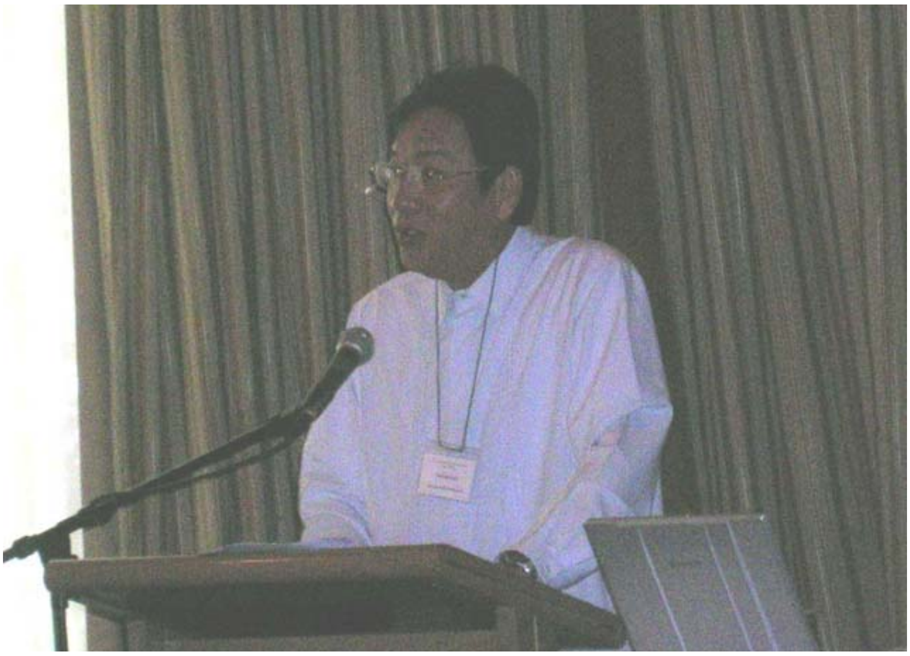
Dr. Shuzo Nishioka
Executive Director
National Institute for Environmental
Studies (NIES), Japan

Mr. Yasuhiro Baba
Deputy Director
Climate Change Policy Division,
Global Environment Bureau
Ministry of the Environment, Japan


The 3rd Workshop on GHG Inventories in Asia Region

Opening Remarks

Dr. Shuzo NISHIOKA (Japan)

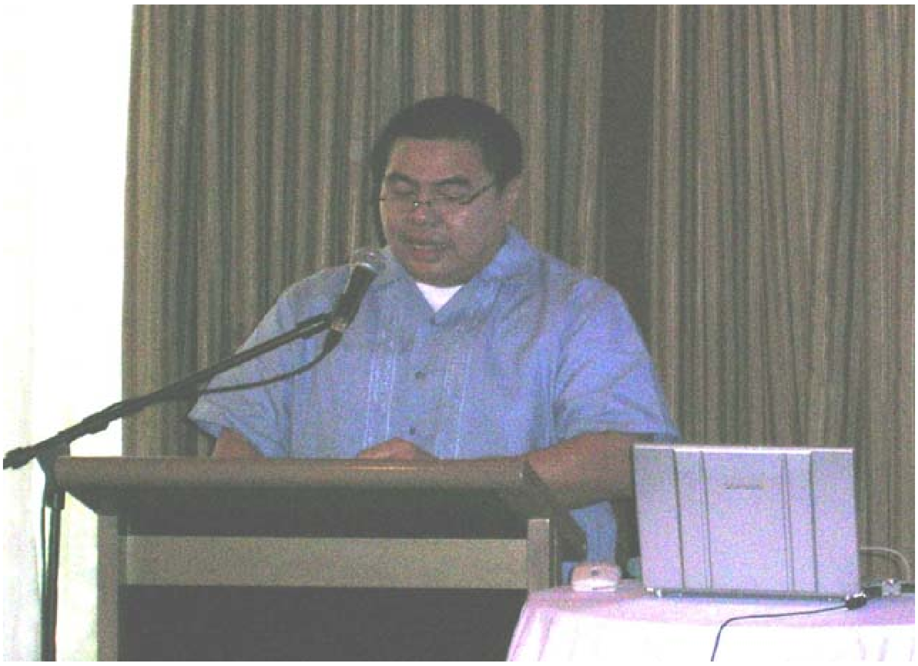


Dr. Enrico P. SUPANGCO (Philippines)

Opening Remarks

Mr. Hon. Demetrio L.IGNACIO (Philippines)

Closing Remarks



Atty. Fernandino Y. CONCEPCION (Philippines)

Chair & Co-Chairs

Dr. Damasa Magcale MACANDOG (Philippines)

Mr. Tomoyuki AIZAWA (Japan)

Mr. Yasuhiro BABA (Japan)
Mr. Tomoyuki AIZAWA (Japan)

Dr. Shuzo NISHIOKA (Japan)

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Executive Summary

The 3rd Workshop on GHG Inventories in the Asia Region
23 – 24 February 2006, Manila, Philippines
EXECUTIVE SUMMARY

The Third Workshop on GHG Inventories in Asia Region (WGIA) was attended by governmental officials and scientists from 12 countries and a representative of the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat.[1] It was organized by the Ministry of the Environment (Japan) and the National Institute for Environmental Studies (NIES) of Japan, and hosted by the Department of Environment and Natural Resources of the Philippines (DENR) and the University of the Philippines at Los Banos. Objectives of the meeting were to (1) update each other on the status of GHG inventory development in Asia, (2) specify the features of GHG inventory development, sector by sector, and (3) identify the next steps for the WGIA.

During the first session of the workshop, participants presented updates on the status of GHG inventories in their countries since the last WGIA meeting, in Shanghai in 2005. Selected points of these updates are as follows:

- Countries are all making progress in improving the quality of their GHG inventories.
- Most are either already working on or planning to start work on their Second National Communication (SNC) soon, and aim to complete the work within two or three years.
- Countries vary widely in institutional resources available for GHG inventories.
- Most countries are not yet satisfactorily using UNFCCC software/manuals/guidebooks for their inventories.
- Many countries plan to develop or refine their own national emission factors (EFs).

The representative of the UNFCCC Secretariat presented information on "sectoral features of GHG inventories from non-Annex I Parties." He summarized GHG emissions data for members of WGIA based on their national communications to the Secretariat. He pointed out that the UNFCCC Secretariat provides many information resources (downloadable) that can save countries time and money, and improve their inventories, including, among others:

- the UNFCCC "User Manual" (explains new guidelines for national communications)[2]
- the CGE hands-on training materials on GHG inventories[3]
- UNFCCC software for national GHG inventories[4] (solves problems of previous IPCC software, and add new features, such as GPG, GPG for LULUCF, and a key categories analysis tool, as well as the required two tables for UNFCCC reporting [included in Decision 17/CP.8]).
- new guidelines for national communications (decision 17/CP.8).[5]

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[1] Participants in WGIA include Cambodia, China, India, Indonesia, Japan, Korea, Lao PDR, Malaysia, Mongolia, Philippines, Singapore, Thailand, and Viet Nam. Singapore was unable to attend this time.

[2] http://unfccc.int/files/essential_background/application/pdf/usermanu_nc.pdf

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

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

[5] http://unfccc.int/resource/docs/cop8/07a02.pdf#page=2

He reminded participants that it would be beneficial to first check the IPCC Emission Factor Database (EFDB) to see if emission factors already registered in the database can be applied.[6] If countries do decide to develop their own emission factors, they are encouraged to submit them to IPCC's EFDB to be verified and then shared for the benefit of others. He informed participants that Non-Annex I countries are not required to use the new IPCC 2006 GHG inventory guidelines when they come out, and in fact they should use the 1996 IPCC Revised Guidelines, as they will be much easier to use.

During the second session, participants met in four separate sectoral working groups (energy; agriculture; land use, land-use change and forestry; and waste) to discuss issues relating to GHG emissions inventories. They started with presentations, and were followed by a discussion, with the aim of identifying good practices, challenges and possible solutions (including within WGIA network), and other topics. During the third session (second day), rapporteurs presented the findings. Key points of their presentations and the discussions are as follows:

- Countries are all making steady progress in quality of GHG inventories. Needs are becoming more specific and specialized. Countries are starting to realize that they have solutions to share, and realize the value of continuing the meetings and activities of the WGIA.
- Now that most member countries are between their Initial and Second National Communications to the UNFCCC, the timing is good for this type of more detailed discussion in sectoral groups in the Asia region. There was good discussion on the technical and specific issues in each sector in the four working groups.
- Countries have different situations, but there is much value in sharing emission factors, estimation methodologies, measurement methodologies, etc. Many good practices were identified and there must be many more to share.
- Some of the sectoral groups are planning to communicate during the next year, and compile information before next WGIA meeting.
- WGIA outputs should be made available more broadly, in order to promote/enhance activities of scientists/experts, for the benefit of policy makers, and for governments and funding agencies, and for sharing of WGIA efforts in Asia and experience with UNFCCC and IPCC and the international community. The idea of a creating a website for this purpose was raised.

The meeting agreed with the idea of preparing a "WGIA Activity Report," in the format proposed by the WGIA Secretariat, to present a list of action items to improve GHG emissions inventories in Asia, to compile information that has been presented and discussed in WGIA to date, and to document the history of WGIA activities. Some constructive comments were made on the outline. The Japanese Ministry of the Environment announced that it was willing to organize the fourth WGIA one year from now.

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[6] www.ipcc-nggip.iges.or.jp/EFDB/main.php

Background paper

Background Paper

for the 3rd Workshop on GHG Inventories in Asia Region (WGIA)
23-24 February, 2006 (Manila)

1. Introduction

To help guide policies and strategies of countries around the world to reduce greenhouse gas (GHG) emissions, inventories that provide accurate knowledge of GHG emissions and trends are critically important. To discuss this topic in the Asian region, a 1st Workshop on GHG Inventories in Asia Region (WGIA) was held in Phuket, Thailand in November 2003, followed by the 2nd WGIA in Shanghai, China in February 2005. The workshops revealed varying degrees and types of efforts by countries to improve the accuracy of their GHG inventories, with the differences depending mostly on national priorities, institutional and technical capacity, and experience related to GHG inventory development. The participants of the 1st and 2nd WGIAs recognized the importance of this regional forum to share information and agreed to cooperate on the effective use of the forum in the future, including the holding of a 3rd WGIA.

2. Purpose and scope of this paper

This paper, prepared by the WGIA Secretariat, serves as a provisional background paper for the 3rd WGIA. It indicates the proposed objectives and expected outcomes of the workshop, as well as the details of each session. Based on this paper, prospective participants are invited to provide the WGIA Secretariat with suggestions on additional information to be considered for inclusion in the workshop. The Secretariat would highly appreciate your active input to help prepare for the workshop. It is hoped that this paper will also help participants prepare themselves for the workshop.

3. Objectives and expected outcomes of the 3rd WGIA

3.1. Workshop objectives

- To exchange information on GHG inventory development, sector by sector
- To update each other on the state of GHG inventories, particularly in the Asia region
- To add to the body of knowledge about GHG inventory development

3.2 Expected outcomes of the workshop

- Identification of specific issues that are important for the improvement of GHG inventories, by sector
- Determination of the current status of GHG inventory development in each country
- Identification of ways the WGIA network can help to improve GHG inventories in Asia in the future
- Enhancement of cooperative relationships within the WGIA community

4. Diagram of workshop flow

The diagram below shows the planned flow of the workshop sessions.

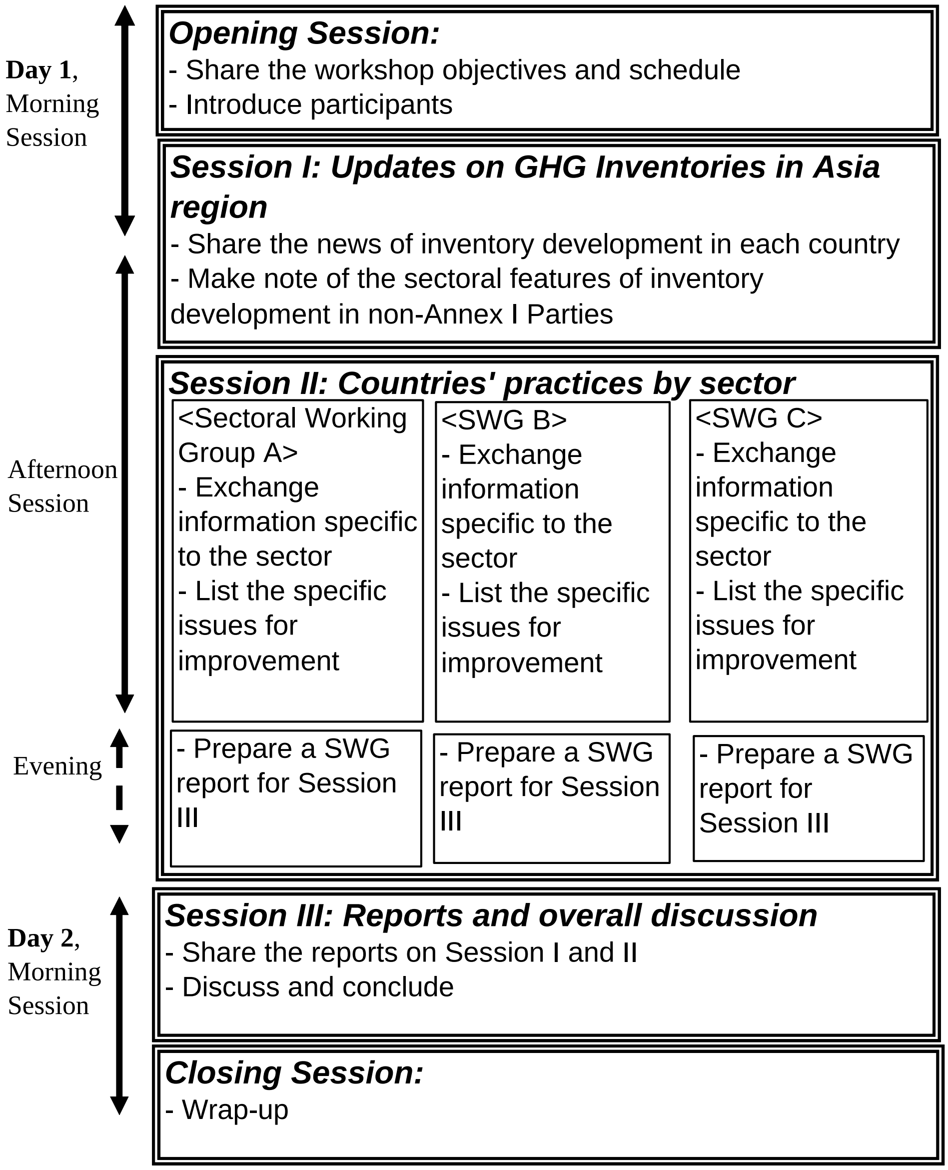

Figure. Flow chart of the sessions in the 3rd WGIA

5. Proposed details of each session

5.1 Session I: Updates on GHG inventories in Asia region

5.1.1 Overview

The 3rd WGIA will be held almost one year after the previous workshop. In this first session of the workshop, a representative of each participating country will speak about activities and progress made for the development of its GHG inventories, particularly since the 2nd WGIA. In addition, a presentation from the UNFCCC Secretariat will feature the sectoral characteristics of inventory development in non-Annex I Parties. This presentation will be a preliminary talk for the next session: "Session II: Countries' practices, by sector." In Session I, participants are expected to gain a general and shared understanding of the current state of inventory development in Asia and be aware of the sectoral features of inventory development in non-Annex I Parties.

5.1.2 Structure

First, brief presentations will be made by all participating countries on the state of the GHG inventory development in their countries, particularly focusing on the period after the 2nd WGIA. The presentation from the UNFCCC Secretariat will then be given.

5.1.3. Items to be included in the presentations

(a) Presentations from participating countries

Any activities and progress made, particularly since the 2nd WGIA, for the development of GHG inventories, such as:

- Policy framework to support the management of GHG inventory preparation
- Research projects to improve the accuracy of activity data and emission factors
- Collaborative research activities with other countries in Asia or other regions, for the improvement of inventories

(b) Presentation from the UNFCCC Secretariat

- What are the sectoral features of GHG inventories from non-Annex I Parties inside and outside Asia?
- What kinds of sector-specific issues have been identified in those GHG inventories? Have any practices been developed to address these issues?
- What kinds of requests has the UNFCCC Secretariat received from non-Annex I Parties to help improve GHG inventories in any given sector? How has the UNFCCC Secretariat responded and what suggestions has it made?
- From the UNFCCC Secretariat's point of view, what effective measures could be taken to improve GHG inventories in Asia, in specific sectors?

5.2 Session II: Countries' practices by sector

5.2.1 Overview

Through the past 1st and 2nd WGIAs, researchers and government officials from Asian countries shared information and experiences, from a wide range of areas of expertise, related to GHG inventory development in each country. It is hoped that at the 3rd WGIA, discussion will became more concrete, (i.e., more technical and sector-specific). Sectoral working groups (SWGs) will be set up in this session to provide an opportunity for more detailed discussion of the GHG inventory development in certain sectors, among people with similar interests and background. The aim is that by the end of this session, participants will have identified the sector-specific needs and potential solutions for the improvement of GHG inventories in the region.

5.2.2 Structure

Three or four SWGs will be set up in separate rooms. The intention is for the WGIA Secretariat to assign participants to SWGs based largely on the results of questionnaires distributed to participants before the workshop. For each SWG, a chair and session reporter will be nominated. Participants will be able to take part in more than one SWG if they wish.

Each SWG session will begin with presentations about two or three countries' practices for preparing the GHG inventories in a certain sector, followed by an active round-table discussion among the session members.

5.2.3 Details to be included in presentations and discussions in each SWG

- What are similarities and differences among countries' practices in Asia in terms of the development of GHG inventories in a specific sector? Result: Understand the state of the sectoral inventories in the region.
- What are the technical constraints for the development of GHG inventories in a specific sector in a country? Do other session members recognize the same constraints in their countries? Result: Identify commonalities in data or technical capacity gaps, by sector, in Asia.
- Are there any data or relevant methodologies that can be applied in other countries? Result: Increase technical capacity by learning from other countries' practices.
- How can the WGIA network be utilized to improve inventories in a specific sector in the Asia region? Result: Explore next steps to make improvements.

5.3 Session III: Reports and overall discussion

5.3.1 Overview

Following the completion of the Sessions I and II, participants will review the outcomes of those sessions, further discuss them, and make conclusions of the workshop. In this process, participants can also hear the outcomes of discussions of the other SWGs. By the end of Session III, it is expected that all participants will share a common understanding of the workshop outcomes, and have a shared vision for the future activities of the WGIA community.

5.3.2 Structure

The rapporteur of Session I and the session reporters of three SWGs will summarize their presentations and discussions. Questions and suggestions will be then actively shared and discussed by all.

5.3.3 Examples of expected results of discussion in Session III

The WGIA Secretariat envisions that some of the major results of the discussion could be as follows:

- Lists of sectoral good practices in one country in the region, which could be implemented in others, related to the development of local emission factors or good data acquisition systems. The practices may include, for example, research work or the use of publicly-available information sources.
- Lists of data gaps that are common in the region (e.g., local emission factors, estimation methods, etc.). Potential solutions with the use of the WGIA network could be also proposed, including the sharing of specific information and research-related collaboration in the future.
- Lists of the strengths of inventory development of a certain sector in the region. Ways to contribute to the international community could be identified.
- Directions as well as concrete future plans on the above points, based on the WGIA network.

- This paper was prepared by the National Institute for Environmental Studies in Japan, the WGIA Secretariat on September 13, 2005.
- If you have any questions, concerns, or comments regarding this paper, please do not hesitate to contact the WGIA Secretariat by e-mail at any time.

Chairperson's Summary

Attachment I： Agenda

Attachment II： Working Group Guidance

Attachment III： List of Participants

The 3rd Workshop on GHG Inventories in Asia Region
23–24 February 2006
Manila, Philippines

Chairperson's Summary

Background

1. The Third Workshop on Greenhouse Gas (GHG) Inventories in Asia Region (WGIA) was held in Manila, the Philippines, on 23 and 24 February 2006. It was organized by the Ministry of the Environment (Japan) and the National Institute for Environmental Studies (NIES) of Japan, and hosted by the Department of Environment and Natural Resources of the Philippines (DENR) and the University of the Philippines Los Banos.

2. The workshop was attended by participants from 12 countries (Cambodia, China, India, Indonesia, Japan, Korea, Lao PDR, Malaysia, Mongolia, Philippines, Thailand, and Viet Nam), and a representative of the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat. A list of participants is attached.

Opening Session

3. The opening session was chaired by Dr. Damasa Magcale Macandog of the University of the Philippines Los Banos. In a welcome address, Dr. Shuzo Nishioka of NIES gave a short history of the WGIA and outlined the structure of the workshop. In a welcome speech, Dr. Enrico P. Supangco, Vice-Chancellor for Research and Extension, University of the Philippines Los Banos, pointed out that participation in this workshop was a sign of commitment to a better environment and quality of life for people. In the second welcome speech, Mr. Hon. Demetrio L. Ignacio, Undersecretary for Policy and Planning, Environmental Management Bureau, DENR, put this meeting into the context of national commitments under the UN Framework Convention on Climate Change to prepare inventories of greenhouse gas emissions to help combat climate change. Participants then introduced themselves to the group. Ms. Chisa Umemiya of the Greenhouse Gas Inventory Office of Japan then gave a detailed outline of the workshop, and stated the workshop's three goals: (1) updating each other on the status of GHG inventory development in Asia, (2) specifying the features of GHG inventory development, sector by sector, and (3) identifying the next steps after this, the third WGIA. She also pointed out that with the addition of Malaysia and Singapore recently, the number of participating countries in the WGIA network had grown to thirteen (although Singapore was not able to

attend this time).

Session I: Updates on GHG inventories in Asia region

4. Session I was chaired by Mr. Tomoyuki Asizawa of NIES. In this session, participants provided an updates on the status of GHG inventories in their countries since the last WGIA meeting (Shanghai, 2005). All non-Annex I countries in WGIA have completed their INC[1] under the UNFCCC, and have started or plan to start work on their SNC.[2] A selection of points from their presentations is provided below (more detail is available in their presentation materials).

- For China, Prof. Huaqing Xu, of the Center for Energy, Environment and Climate Change Research, Energy Research Institute, reported that his country was making preparations for its SNC, this time to include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6) along with the three gases reported in the INC. A proposal seeking funding for this work has been submitted to the Global Environment Facility (GEF). Prof. Xu listed the details of specific improvements that are planned for the each sector: energy; industrial processes; agriculture; LULUCF;[3] and waste.
- For Indonesia, Mr. Dadang Hilman, of the Sub-Division of Adaptation to Climate Change, Office of Deputy III to the Minister, Ministry of the Environment, reported that his country planned to start work on its SNC in 2006, covering a reporting period up to 2002. Features include improvement of emission estimates from the forestry sector, and encouragement of relevant/responsible sectors to be actively involved in development of the inventory. Indonesia has a “National Team for GHG Inventories,” under the “Inter-Ministerial Team for National Communications.” Participants were interested to hear that in the INC, Indonesia had included emissions projections up to 2025 in three sectors (energy, forestry, agriculture).
- For Japan, Mr. Yasuhiro Baba, of the Climate Change Policy Division, Global Environment Bureau, Ministry of the Environment, presented several graphs to show how emissions data is being used to carefully track each type of emissions in each sector in Japan. He described the “Kyoto Protocol Target Achievement Plan,” established in April 2005 to help Japan achieve its emissions reductions commitment during the first commitment period of the Protocol.
- For the Republic of Korea, Dr. Kyoungsik Choi, Global Environment Team, Environmental Management Corporation, reported on his country’s integrated approach for management of air pollutants and GHG emissions; the use of telemetric systems (TMS) installed by the government (in 1,841 stacks in 317 installations) as an efficient way to verify industry’s self-reporting of emissions; and the government’s practice of providing guidance to specific industry sectors for reporting of emissions (in some cases, industries are required to develop

[1] INC = Initial National Communication under the UNFCCC
[2] SNC = Second National Communications under the UNFCCC
[3] LULUCF = Land use, land cover-use change and forestry

their own emission factors).[4]

- For Lao PDR, Mr. Syamphone Sengchandala, of the Environment Impact Assessment Division, Science Technology and Environment Agency, reported on plans to start work on the SNC during the second half of 2006. His country is maintaining GHG inventories in four sectors: energy, agriculture, forestry, and waste. Challenges faced by Lao PDR include limited involvement of experts on climate change, and development of country-specific emission factors.
- For Malaysia, Ms. Siti Indati Mustapa, of Pusat Tenaga Malaysia (PTM), reported that a national team was formed in June 2004 to prepare the SNC, and inventory work was assigned to four agencies (PTM for energy and industrial processes, Forest Research Institute of Malaysia for LULUCF, University of Putra Malaysia for waste, and Department of Agriculture for agriculture sector), with the target completion by June 2006. It will cover five sectors (energy, industrial processes, agriculture, LULUCF, waste,). In the future, Malaysia plans to extend the reporting period, improve accuracy, and systematically update the inventory.
- For Mongolia, Ms. Bujidmaa Borkhuu, of the Institute of Meteorology and Hydrology, reported that her country was planning to start work on its SNC in mid-2006, with the aim of completing it in 2008. It would cover emissions from 1999 to 2001. She also mentioned that her country was involved in a regional project (June 2003 to June 2006) funded by the United Nations Development Programme (UNDP) and Global Environment Facility (GEF), entitled "Capacity Building for Improving the Quality of Greenhouse Gas Inventories" (involving 12 countries: Albania, Armenia, Azerbaijan, Croatia, Georgia, FYR Macedonia, Moldova, Mongolia, Solvenia, Tajikistan, Turkmenistan, Uzbekistan).[5] The goals are to strengthen technical and institutional capacity and to improve the quality of data inputs to national GHG inventories. Main outputs of the project will be (1) national manuals of procedures, (2) improvements in data collection, (3) regional key sources documented and archived, (4) quality assurance/quality control plans, (5) outline of an awareness campaign, and (6) long term/short term strategies to improve national inventories. A key part of the project's strategy was to use the time between the first and second national communications of participating countries to enhance their technical capacity. She also mentioned that in 2005, some recalculations were performed on emission factors in preparation for Mongolia's SNC, and gave detailed examples of how they improved on the accuracy over that of the IPCC default emission factors.
- For the Philippines, Ms. Raquel Ferraz Villanueva, of the Environmental Management Bureau, DENR, stated that her country had an Intern-Agency Committee on Climate Change (IACCC), through which the National Action Plan on Climate Change was created in 1997. She also

[4] The Republic of Korea submitted its SNC in December 2003.
[5] http://www.rec.org/REC/programs/undp-GHGinventories/default.html

provided some statistics on her country's emissions. The Philippines has developed a plan for its SNC, which includes not only updating its GHG inventories, but also a GHG protocol, developed in partnership with another organization, for industries that are willing to voluntarily develop their own emissions inventories.

- For Thailand, Ms. Aree Wattana Tummakird, Measures Analysis Section, Office of Natural Resources and Environmental Policy and Planning, reported that her country has submitted a proposal to UNEP/GEF for development of its SNC, which will use 2000 as the base year. She also provided detailed emissions statistics for 2003, stating that these relatively newer numbers are available thanks to work in preparation of data required for a CDM project.
- For Viet Nam, Mr. Hoang Manh Hoa, National Office for Climate Change and Ozone Protection, International Cooperation Department, Ministry of Natural Resources and Environment, reported that his ministry had organized a national workshop in mid-January to develop a plan for the SNC. He enumerated areas where major improvements are needed in his country's GHG inventory compared to the INC. He stated that Viet Nam would submit a proposal to UNEP/GEF in March to fund work on the SNC, which is scheduled to start in May and continue for three years.

5. Mr. Dominique Revet, of the UNFCCC Secretariat, presented information on "sectoral features of GHG inventories from non-Annex I Parties." He summarized GHG emissions data for non-Annex I Parties based on their national communications to the Secretariat, particularly the regional features for 12 countries participating in WGIA. He pointed out that the UNFCCC Secretariat provides many information resources (downloadable) that can save countries time and money, and improve inventories, including, among others, (1) the UNFCCC "User Manual" (explains new guidelines for national communications),[6] (2) the CGE hands-on training materials on GHG inventories,[7] and (3) UNFCCC software for national GHG inventories[8] (which solves many problems of previous IPCC software, and add new possibilities, such as GPG, GPG for LULUCF, and a key categories analysis tool, as well as the required 2 tables for UNFCCC reporting purposes [included in Decision 17/CP.8]). He also encouraged everyone to refer to the new guidelines for national communications (decision 17/CP.8) as they prepared their SNC.[9] As some countries had indicated they were planning to develop their own national emission factors in some sectors, he reminded participants that it would be beneficial to first check the IPCC Emission Factor Database (EFDB) to see if emission factors already registered

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[6] http://unfccc.int/files/essential_background/application/pdf/usermanu_nc.pdf
[7] http://unfccc.int/resource/cd_roms/na1/ghg_inventories/index.htm
[8] http://unfccc.int/resource/cd_roms/na1/ghg_inventories/index.htm
[9] http://unfccc.int/resource/docs/cop8/07a02.pdf#page=2

in the database can be applied.[10] If countries do decide to develop their own emission factors, they are encouraged to submit them to IPCC's EFDB to be verified and then shared for the benefit of others. He referred to the project entitled "Capacity Building on Greenhouse Gas Inventories," involving 12 Europe/CIS countries (including Mongolia) as a good model of regional cooperation, funded by over US$2 million by the GEF for cooperative work to improve the quality of national GHG inventories. He also stated that Non-Annex I countries in different regions (particularly in Asia, Africa, South America) share similar challenges and could benefit by sharing information. Having heard that some countries were planning to use the new IPCC 2006 GHG inventory guidelines when they come out, he emphasized that Non-Annex I countries are not required to use them. In fact they should use the 1996 IPCC Revised Guidelines, as they will be much easier to use.

Session II: Countries' practices, by sector

6. During the afternoon, participants met in four separate sectoral working groups to discuss issues relating to GHG emissions inventories in more detail. They started with presentations, and were followed by a discussion, with the aim of identifying good practices (particularly in relation to the development of GHG inventories), challenges and possible solutions (including within the WGIA network), and other topics. The working group sectors and chairpersons were as follows: (1) Energy (Mr. Tomoyuki Aizawa, Japan), (2) Agriculture (Dr. Batimaa Punsalmaa, Mongolia), (3) Land Use, Land-Use Change and Forestry (Dr. Rizaldi Boer, Indonesia), and (4) Waste (Dr. Sirintornthep Towprayoon, Thailand).

Session III: Reports and overall discussion

7. This session, held on the morning of the second day, was chaired by Dr. Shuzo Nishioka. First, Ms. Villanueva reported on Session I. Next, rapporteurs reported on the discussions of the four sectoral working groups that had met during Session II. Summaries of their reports are provided below.

(a) Energy Sector Working Group (Rapporteur: Ms. Aree Wattana Tummakird, Thailand)

Experts from India, Malaysia, and Japan made presentations. The working group session was attended by participants from China, India, Indonesia, Japan, Malaysia, Philippines, Thailand, and Viet Nam. Good practices that were identified included the following: (1) India—establishment of a National Inventory Management System; data collection from three important sectors (power plants, transport, iron/steel); adoption of Tier 2 methodology; and use of plant-specific emission factors; (2) Malaysia—establishment of a group to work on SNC;

[10] www.ipcc-nggip.iges.or.jp/EFDB/main.php

data collecting methodology (e.g., approach stakeholders in many ways); and passion to improve inventory; and (3) Japan—good collaboration between the agency responsible for energy and the Ministry of the Environment (the inventory agency); balance approach (for mass, energy, carbon); institutionalizing the country's inventory program. The group felt that in Asia it would be worthwhile to share experiences regarding collecting data in three specific areas: transportation (regarding traveling distance), power plants, and heavy industry. They intend to continue working through the year on these specific points, and prepare a document before the next WGIA. They also felt it would be worth creating a table to share information on their country-specific emission factors showing basic assumptions and authors.

During the discussion in plenary following the Energy working group report, a suggestion arose to create a website to enter and share country-specific emission factors and contact information for experts (it was felt that this could have a different function compared to the IPCC EFDB, which involves a more formal review process), existing designs/plans for surveying emissions (e.g., in transport sector), and other information.

(b) Agriculture Sector Working Group (Rapporteur: Mr. Syamphone Sengchandala, Lao PDR)

Experts made presentations from the Philippines (agroforestry), Thailand (rice paddies), and Japan (animal manure treatment). The working group session was attended by participants from Cambodia, Lao PDR, Japan, Mongolia, Philippines, and Thailand. From the presentations, a number of good practices were identified: (1) detailed data collection from experiments; (2) very comprehensive measurements; (3) the use of well-designed experiments and simple, portable equipment for measurements of CH_4, N_2O, NH_3 emissions; (4) the application of water management and fertilization strategies to reduce CH_4 and N_2O emissions from agricultural system in Asian countries; and (5) composting of livestock manure reduces N_2O and CH_4 emissions. A number of challenges were identified: (1) development of regional-specific emission factors for the Asian region; (2) establishing networks of monitoring stations for GHG emissions; and (3) obtaining funding for research and capacity building in the region. A number of solutions were identified: (1) develop and implement a regional research project; (2) collaborate among experts; (3) share databases and expertise. During discussion, many points arose. If livestock is a key source of GHG emissions in a country, it is especially important to improve emission factors and data collection for CH_4 from enteric fermentation from livestock. The agriculture sector is important in Asia, as it is one of the main contributors to GHG sources (CH_4 and N_2O) in this region. To improve GHG inventories in this sector, we need to collect more data, expand experiments, establish monitoring networks, and develop region-specific emission factors. Collaboration among experts in this region could be very beneficial (for example, paddy field agriculture is unique to Asian countries; Mongolia and India share similar topics with enteric fermentation of livestock: agroforestry in Asia also has some special characteristics in Asia compared to other regions).

(c) Land Use, Land-Use Change and Forestry (LULUCF) Sector Working Group (Rapporteur: Ms. Chisa Umemiya, Japan)

The working group session was attended by participants from Cambodia, Indonesia, Japan, Malaysia, and the Philippines. Experts from Malaysia, Cambodia, and Japan made presentations on (1) various improvements between First and Second National Communications (Malaysia), (2) direct measurement of removal factors for major forest categories (Cambodia); (3) experience from preparing inventories with the IPCC's Good Practice Guidance (GPG) for LULUCF compared to previous inventories (Japan). A number of good practices were identified by the group: (1) use a statistical approach to define land-use categories under the GPG for LULUCF; (2) develop removal factors for major forest categories; and (3) implement data verification through personal consultation. A number of challenges were identified: (1) different levels of detail of forest categories and strata between states/provinces; (2) difficulty in the defining appropriate (i.e., cost-effective) number of destructive sampling tests; (3) frequent changes of personnel working on inventories. The group felt that the creation of stable institutional arrangements and continued information sharing at the regional level are key to help improving the quality of GHG inventories in Asia. A few other points that could improve data availability include (1) enhancing national level to local level coordination and sector-to-sector coordination; (2) enhancing official support from national governments for GHG inventory work; and (3) sharing data among countries in the region. It was found that there was some duplication of efforts in country-to-country collaboration in Asia, which could be rectified by better communication.

In plenary, participants expressed the need for a regional emission factor database dedicated for countries to share data within the Asia region. It was pointed out the IPCC's EFDB is also a valuable resource, with set procedures for submitting emission factors and a formal review process by experts. It was also pointed out that when WGIA discusses "good practices," for example, in the WGIA Activity Report proposed later, it is important to agree on and state a clear definition of what is meant by good practices (i.e., for GHG inventories, climate change mitigation, or whatever).

(d) Waste Sector Working Group (Rapporteur: Dr. Qingxian Gao, China)

The working group heard three reports, on waste activity data in China, on waste flows in Japan, and on waste disposal in Korea. The working group session was attended by participants from China, Japan, Korea, Mongolia, the Philippines, and Thailand. This working group focused mainly on landfills, although it did slightly discuss waste to energy, recycling and reuse, but did not discuss composting, incineration, and waste water. It produced a number of suggestions and conclusions: (1) they would like to set up a network to share expertise on waste issues in this region to work on activity data, emission factors, site measurements, treatment technology, etc.; (2) waste stream analysis should be done for each country (and sub-region in large countries); (3) measurements are needed in site for each country or region; (4) when doing measurements, it is important to use standard operation procedures (SOP) for landfills, so it was recommended to set up a work group to provide same guidance on this; (5) it is important to clarify "co-benefit" issues as a practical strategy to address GHG emissions. (On the topic of "co-benefits," GHG emissions from the waste sector are generally not considered an important topic in developing countries, so it is important to look for other benefits of GHG emissions reduction, such as environmental and health benefits, and to cooperate with environmental scientists, governments, and others to achieve common goals.) In conclusion, although waste management systems differ greatly country to country in Asia, common problems do exist, like the issues associated with measurement of GHG emissions from landfill areas. Waste flows are Asia-specific or country-specific issue so countries here cannot rely too much on other countries' emission factors or estimation methods.

8. Some members of the sectoral working groups were keen to continue detailed discussions that were started here, and indicated that they would make an effort to communicate and work together during the coming year on some of the actions recommended above.

9. WGIA Activity Report: The Secretariat presented a proposal for the preparation of a WGIA Activity Report. The stated purposes of the report are (1) to present a list of action items to improve GHG emissions inventories in Asia, (2) to compile information that has been presented and discussed in WGIA to date, and (3) to document the history of WGIA activities. Potential readers for the report are GHG inventory developers particularly in the Asia region (but also elsewhere in the world) and possible sponsors (for funding, etc.) etc. The outline of the report was discussed, with the conclusion that a possible outline could be as follows: (1) executive summary, (2) background, (3) introduction to WGIA, (4) GHG inventory development in Asia - good practices and barriers (giving considerable detail on emission factors, methodologies, etc., in each country) (5) energy sector, (6) agriculture sector, (7) LULUCF sector, (8) waste sector, (9) Asian regional characteristics of GHG emissions inventories, (10) recommendations for next steps, and (11) appendix (participants agreed to discuss further after the third WGIA). All

participants in WGIA are invited to contribute text and ideas. It was suggested that the report be presented at the Sixteenth Asia-Pacific Seminar on Climate Change, scheduled for September 2006. To be ready for that event, the proposed time line for work is as follows: contributors submit text that was assignment (by early May), circulate to all for review (June), edit and print (by end of August). During the discussion, it was agreed that recommendations from each sector (i.e., the four working groups) can go into each sector report (i.e., Chapters 5 to 8) and will be summarized in Chapter 10 (Recommendations). It was also agreed that the report could include documentation from past WGIA workshops. The meeting agreed to go ahead with the plan as discussed above.

Closing Session

10. The closing session was co-chaired by Mr. Yasuhiro Baba and Mr. Tomoyuki Aizawa of Japan. Randal Helten of the WGIA Secretariat summarized the morning's discussions. Atty. Fernandino Y. Concepcion, Officer-in-Charge and Assistant Director, Environmental Management Bureau, DENR, the Philippines, made closing remarks. Mr. Baba also offered his closing remarks, thanking all participants for their contributions to the discussion and the Philippine host organizations and personnel for their warm hospitality and support for the workshop. He announced that Japan's Ministry of the Environment was willing to organize the fourth WGIA in 2007. The meeting thanked the hosts from the Philippines for their kind hospitality in Manila.

The 3rd Workshop on GHG Inventories in Asia Region (WGIA)
23-24 February 2006, Manila, Philippines

Day 1, Thursday 23rd February

9:00~9:30		**Participant Registration (30 min.)**
9:30~10:20		**Opening Session (50 min.)**
		Chair: Ms. Macandog, Philippines
9:30~9:35	Dr. Nishioka, Japan	Welcome address (5 min.)
9:35~9:38	Dr. Supangco, Philippines	Welcome speech from host country (3 min.)
9:38~9:41	Mr. Ignacio, Philippines	Welcome speech from host country (3 min.)
9:41~ 9:55	All	Introduction of participants (14 min.)
9:55~10:10	Ms. Umemiya, Japan	Overview of workshop and explanation of schedule (13 min.+ 2 min. for Q&A)
10:10~10:20	All	Questions (10 min.)
10:20~10:35		***Tea Break (15 min.)***
10:35~12:00		**Session Ⅰ: Updates on GHG inventories in Asia region (85 min.)**
		Chair: Mr. Aizawa, Japan
		“News from All”
10:35~10:42	Prof. Xu, China	China’s News (5 min. + 2 min. for Q&A)
10:42~10:49	Mr. Hilman, Indonesia	Indonesia’s News (5 min. + 2 min. for Q&A)
10:49~10:56	Mr. Baba, Japan	Japan’s News (5 min. + 2 min. for Q&A)
10:56~11:03	Dr. Choi, Republic of Korea	Korea’s News (5 min. + 2 min. for Q&A)
11:03~11:10	Mr. Sengchandala, Lao PDR	Lao PDR’s News (5 min. + 2 min. for Q&A)
11:10~11:17	Ms. Mustapa, Malaysia	Malaysia’s News (5 min. + 2 min. for Q&A)

11:17~11:24	Ms. Borkhuu, Mongolia	Mongolia's News (5 min. + 2 min. for Q&A)
11:24~11:31	Ms. Villanueva, Philippines	Philippine's News (5 min. + 2 min. for Q&A)
11:31~11:38	Ms. Tummakird, Thailand	Thailand's News (5 min. + 2 min. for Q&A)
11:38~11:45	Mr. Hoa, Viet Nam	Viet Nam's News (5 min. + 2 min. for Q&A)
11:45~12:00	All	Questions and discussions (15 min.)
12:00~13:30		***Lunch Time (90 min.)***
13:30~14:15		**Session I (continued) (45 min.)**
13:30~13:50	Mr. Revet, UNFCCC	Sectoral features of GHG inventories from non-Annex I Parties (17 min. + 3 min. for Q&A)
13:50~14:05	Ms. Umemiya, Japan	Overview and schedule for Session II (13 min. + 2 min. for Q&A)
14:05~14:15	All	Questions and discussions (10 min.)
14:15~14:40		***Tea Break (25 min.)***
14:40~18:30 (until WG finishes work)		**Session Ⅱ: Countries' practices, by sector (230 min.)** *Chair for Energy WG: Mr. Aizawa, Japan* *Chair for Agriculture WG: Dr. Punsalmaa, Mongolia* *Chair for LULUCF WG: Dr. Boer, Indonesia* *Chair for Waste WG: Dr. Towprayoon, Thailand* *< Please see individual sectoral guidance for the details of each WG agenda and other relevant information>*

Day 2, Friday 24th February

9:00~11:30		**Session Ⅲ: Reports and overall discussion (150 min.)** *Chair: Dr. Nishioka, Japan*
9:00~9:10	Rapporteur: Ms.	Report on the Day 1 (10 min.)

	Villanueva, Philippines	
9:10~9:20	Ms. Tummakird, Thailand	Report from Energy WG (7 min. + 3 min. for Q&A)
9:20~9:30	Mr. Sengchandala, Lao PDR	Report from Agriculture WG (7 min. + 3 min. for Q&A)
9:30~9:40	Ms. Umemiya, Japan	Report from LULUCF WG (7 min. + 3 min. for Q&A.)
9:40~9:50	Dr. Gao, China	Report from Waste WG (7 min. + 3 min. for Q&A)
9:50~11:30	All	Overall discussion (100 min.) - Sectoral features of GHG inventory development - Future Activities (e.g. WGIA Activity Report etc.)
11:30~11:45		***Tea Break (15 min.)***
11:45~12:10		**Closing Session (25 min.)** *Co-chairs: Mr. Baba and Mr. Aizawa, Japan*
11:45~12:00	Dr. Nishioka, Japan	Wrap-up (15 min.)
12:00~12:05	Mr. Concepcion, Philippines	Closing remarks (5 min.)
12:05~12:10	Mr. Baba, Japan	Closing remarks (5 min.)

Energy Working Group Session (Session 2)

The 3rd Workshop on GHG Inventories in Asia Region (WGIA)

23-24 February, 2006, Manila, the Philippines

14:40 ~ 18:30 (230 min.)

Session Guidance

1. Objectives of this session (joint tasks for all the group members)

- To specify the features of the Energy GHG inventory development in Asia by creating the lists of country's good practices and challenges
- To prepare one presentation on the summary of discussion made in the group (this presentation will be delivered by the nominated reporter of the group in the Session 3 of the following day)

2. Group members (as of preparing this paper)

- Mr. Tomoyuki Aizawa (Chair; Japan)
- Ms. Aree Wattana Tummakird (Reporter; Thailand)
- Mr. Huaqing Xu (China)
- Dr. Sumana Bhattacharya (India)
- Mr. Dadang Hilman (Indonesia)
- Ms. Siti Indati Mustapa (Malaysia)
- Mr. Hoang Manh Hoa (Viet Nam)

3. General Agenda (time is only as a guide!!)

14:40~14:50	By All	Introduction of members
<Part A: Introduction of Country's Good Practices> *Listeners, please fill the provided worksheet for each of the presentations to extract essential information for following discussion.*		
14:50~15:10 (approx. 20 min. including 5 min. for Q&A)	Ms. Siti Indati MUSTAPA (Malaysia)	"The Development of GHG Inventory for Energy Sector and Industrial Processes - Malaysia"
15:10~15:30 (approx. 20 min. including 5 min.	Mr. Tomoyuki AIZAWA (Japan)	"Japan's country-specific emission factors for the emissions from fuel combustion"

for Q&A)		
15:30~15:50 (approx. 20 min. including 5 min. for Q&A)	Dr. Sumana BHATTACHARYA (India)	"GHG Emission Factors Developed for the Energy Sector in India"
15:50~16:15	By All	Question and discussion
<Part B: Round-table discussion for "Challenges to be tackled and possible solutions">		
16:15~17:15	By All	*Discussion for challenges to be tackled and possible solutions. Some discussion topics were already raised by the group members (see the below section 5).* *- what are the challenges that you have faced?* *- do you have any ideas to solve the challenges raised by your colleague? Or do you also have the same challenge?* *- what does the regional network such as WGIA could do to help solving the challenges?*
<Part C: Summary and Completion of Presentation for Session 3>		
17:15~18:30	By All	*Please summarize the overall discussion your group has created and make the presentation for the group. The worksheets that the group members filled out in Part A can be used for the discussion. The outline of the discussion will be:* *- overview of the presentation* *- list of good practices and their features* *- list of challenges and possible solutions* *- other things that were discussed* *- summary/conclusion*

4. Descriptions of the Presentations for Part A

Speaker	Title	Description
Ms. Siti Indati MUSTAPA (Malaysia)	The Development of GHG Inventory for Energy Sector and Industrial Processes -	This presentation provides overview on the development of GHG Inventory for Energy Sector and Industrial Processes in Malaysia. This presentation will first discuss on the choice and

	Malaysia	structure of methodology in estimating the GHG emission particularly on CO_2, CH_4 and N_2O. Then highlights on the calculation of emissions from all sources of combustion and processes on the basis of the quantities of fuel consumed and average emission factors using the Tier 1 Methodology of Revised IPCC 1996 Guidelines. Country-specific emission factors may also be discussed for industrial sector especially in Chemical (Tier 3) sectors. The presentation will emphasized the experience and practice of Malaysia in updating and compiling our GHG inventory for the National Communication 2 of which could possibly be applied to other Asian countries. These include the following: 1) Approach and estimation used in the GHG Inventory for energy sector (sectoral and Reference approach) and Industrial Processes 2) Data collection methodology and experience (categorization of sectors, etc) 3) Emission calculation methodology used in the inventory (Tier 1, Tier 2 and Tier 3) 4) Issues and challenges faced in the development of the inventory, which can be shared by other Asian countries 5) Recommendations to improve GHG inventory preparation This presentation will focus on our effort to provide better estimation on GHG inventories for the National Communication 2.
Mr. Tomoyuki AIZAWA (Japan)	Japan's country-specific emission factors for the emissions from fuel combustion	In Japan, the technology to utilize the by-product gases from fuel combustion has been improved in the iron and steel sector. Therefore, technical discussion on how to estimate the emission factors for those gases with consideration to the purpose of application of those emission factors are being conducted in the country. The presentation will talk

		about the overview of this discussion.
Dr. Sumana BHATTACHARYA (India)	GHG Emission Factors Developed for the Energy Sector in India	Emissions due to combustion of coal in the thermal power plants, the rapidly growing industries of steel and cement, emission due to combustion of gasoline and diesel in the ever-burgeoning road transport sector and fugitive emissions from coal mining together constitute over 76 per cent of the total GHG emissions from the energy sector in India. Efforts in India are on to reduce the uncertainties associated with the GHG emission from these key source categories by determining the country specific emission factors. This paper presents a summary of the emissions distribution from the energy sector in India, the rationale for choosing these sectors, the approach and methodology for determining the emission factors and results and impacts of the uncertainty reduction efforts on the national GHG emission inventory estimates.

5. List of submitted discussion topics for Part B

Proponent (alphabetical order)	Discussion topics
Mr. Tomoyuki AIZAWA (Japan)	1. Methodology to develop the Energy Balance Tables and the uncertainty in those tables 2. How to estimate the travel distance of automobiles 3. Comparison between Reference Approach and Sectoral Approach
Ms. Siti Indati MUSTAPA (Malaysia)	1. Technical skills on each methodology Tier 1, 2 and 3 for estimating emissions of CO_2, CH_4, NO_2, based on the availability of data sources from each energy sector (Sectoral approach) particularly for Transport, Residential & Commercial, Industry, Agriculture and Non-energy sectors. 2. Topic on quality assurance/control procedure for the inventory. 3. Topic on uncertainty assessment (calculation and reporting) and key sources analyses.

Agriculture Working Group Session (Session 2)

The 3rd Workshop on GHG Inventories in Asia Region (WGIA)

23-24 February, 2006, Manila, the Philippines

14:40 ~ 18:30 (230 min.)

Session Guidance

1. Objectives of this session (joint tasks for all the group members)

- To specify the features of the Agriculture GHG inventory development in Asia by creating the lists of country's good practices and challenges
- To prepare one presentation on the summary of discussion made in the group (this presentation will be delivered by the nominated reporter of the group in the Session 3 of the following day)

2. Group members (as of preparing this paper)

- Dr. Batimaa Punsalmaa (Chair; Mongolia)
- Mr. Syamphone Sengchandala (Reporter; Lao P.D.R.)
- Mr. Chan Thou Chea (Cambodia)
- Dr. Shuzo Nishioka(Japan)
- Dr. Takashi Osada (Japan)
- Ms. Bujidmaa Borkhuu (Mongolia)
- Dr. Damasa Magcale Macandog (Philippines)
- Dr. Amnat Chidthaisong (Thailand)

3. General Agenda (time is only as a guide!!)

14:40~14:50	By All	Introduction of members
<Part A: Introduction of Country's Good Practices> *Listeners, please fill the provided worksheet for each of the presentations to extract essential information for following discussion.*		
14:50~15:10 (approx. 20 min. including 5 min. for Q&A)	Dr. Amnat CHIDTHAISONG (Thailand)	"Methane emission from Thai paddy fields by using the sensor technique"
15:10~15:30 (approx. 20 min.	Dr. Damasa Magcale MACADOG	"Nitrous oxide and methane emissions from agroforestry systems in upland areas"

including 5 min. for Q&A)	(Philippines)	
15:30~15:50 (approx. 20 min. including 5 min. for Q&A)	Dr. Takashi OSADA (Japan)	"Better evaluation system for N_2O and CH_4 emission from composting (and wastewater purification) of Livestock waste"
15:50~16:15	By All	Question and discussion
<Part B: Round-table discussion for "Challenges to be tackled and possible solutions">		
16:15~17:15	By All	*Discussion for challenges to be tackled and possible solutions. Some discussion topics were already raised by the group members (see the below section 5).* *- what are the challenges that you have faced?* *- do you have any ideas to solve the challenges raised by your colleague? Or do you also have the same challenge?* *- what does the regional network such as WGIA could do to help solving the challenges?*
<Part C: Summary and Completion of Presentation for Session 3>		
17:15~18:30	By All	*Please summarize the overall discussion your group has created and make the presentation for the group. The worksheets that the group members filled out in Part A can be used for the discussion. The outline of the discussion will be:* *- overview of the presentation* *- list of good practices and their features* *- list of challenges and possible solutions* *- other things that were discussed* *- summary/conclusion*

4. Descriptions of the Presentations for Part A

Speaker	Title	Description
Dr. Amnat CHIDTHAISONG	Methane emission from Thai paddy field by using the sensor	Methane sensor was obtained from NIES in 2005 and has been used to measured methane and carbon dioxide emission from irrigated and rainfed rice field

(Thailand)	technique	in Thailand since then. It has been proved very useful and efficient approach. This presentation is intended to show these measurement results as well as some technical issues that arise when applying the sensor unit.
Dr. Damasa Magcale MACADOG (Philippines)	Nitrous oxide and methane emissions from agroforestry systems in upland areas	Her study conducted field experiments and made measurements on tree and crop growth and biomass, tree litterfall, crop harvest and crop residues, litterfall and crop residue decomposition. It also made an inventory survey of livestock holdings in the smallholder farms in the community that was studied. Its major findings include: the major sources of N inputs in the different hedgerow systems are the maize crop residues and synthetic fertilizer nitrogen; nitrogen from animal manure and tree leaf litter are other sources of nitrogen input into the systems; availability of litter nitrogen would depend on the quality of the litter (high N and low lignin content) and the rate of litter decomposition; the major source of N20 emissions from the agroforestry systems studied is the direct N2O emissions form soil; maize monocropping system had higher N2O emissions than hedgerow systems; and enteric fermentation is the major source of methane emissions from domestic livestock in Claveria.
Dr. Takashi OSADA (Japan)	Better evaluation system for N_2O and CH_4 emission from composting (and wastewater purification) of Livestock waste	Proper recycling of nutritive salts from livestock waste cannot be completed only by circulation in an area where the livestock density per unit area is especially high just like Japan. Thus, livestock excrement can be made more manageable through the composting process, and the resulting product can be distributed over a wide area. Since a large amount of livestock waste is processed, GHG generation is recognized to be substantial. However, few experiments to quantitatively measure the amount of GHG generation from the pile type composting

		process, the most widely used composting system, have been carried out.

5. List of submitted discussion topics for Part B

Proponent (alphabetical order)	Discussion topics
Dr. Takashi OSADA (Japan)	1. Classification of livestock waste treatment plants in Japan and Asia
Dr. Batima PUNSALMAA (Mongolia)	1. Country-specific emission factor in livestock sector - whether it is very useful to develop country-specific emission factors in developing countries where most of the time use tier I method

LULUCF Working Group Session (Session 2)

The 3rd Workshop on GHG Inventories in Asia Region (WGIA)

23-24 February, 2006, Manila, the Philippines

14:40 ~ 18:30 (230 min.)

Session Guidance

1. Objectives of this session (joint tasks for all the group members)

- To specify the features of the LULUCF GHG inventory development in Asia by creating the lists of country's good practices and challenges
- To prepare one presentation on the summary of discussion made in the group (this presentation will be delivered by the nominated reporter of the group in the Session 3 of the following day)

2. Group members (as of preparing this paper)

- Dr. Rizaldi Boer (Chair; Indonesia)
- Ms. Chisa Umemiya (Reporter; Japan)
- Mr. Heng Chan Thoeun (Cambodia)
- Mr. Atsushi Sato (Japan)
- Mr. Lip Khoon Kho (Malaysia)

3. General Agenda (time is only as a guide!!)

14:40~14:50	By All	Introduction of members
<Part A: Introduction of Country's Good Practices> *Listeners, please fill the provided worksheet for each of the presentations to extract essential information for following discussion.*		
14:50~15:10 (approx. 20 min. including 5 min. for Q&A)	Mr. KHO Lip Khoon (Malaysia)	"Development inventory of the country-specific activity data and estimation methods for forests ecosystems and land-use change in Malaysia"
15:10~15:30 (approx. 20 min. including 5 min. for Q&A)	Mr. Heng CHAN THOEUN (Cambodia)	"Development of the LULUCF's GHG Inventories of Cambodia"
15:30~15:50	Mr. Atsushi SATO	"Experience learned by using the IPCC's Good

(approx. 20 min. including 5 min. for Q&A)	(Japan)	Practice Guidance on Land Use, Land-Use Change and Forestry in developing Japan's GHG inventories”
15:50~16:15	By All	Question and discussion
<Part B: Round-table discussion for “Challenges to be tackled and possible solutions”>		
16:15~17:15	By All	*Discussion for challenges to be tackled and possible solutions. Some discussion topics were already raised by the group members (see the below section 5).* *- what are the challenges that you have faced?* *- do you have any ideas to solve the challenges raised by your colleague? Or do you also have the same challenge?* *- what does the regional network such as WGIA could do to help solving the challenges?*
<Part C: Summary and Completion of Presentation for Session 3>		
17:15~18:30	By All	*Please summarize the overall discussion your group has created and make the presentation for the group. The worksheets that the group members filled out in Part A can be used for the discussion. The outline of the discussion will be:* *- overview of the presentation* *- list of good practices and their features* *- list of challenges and possible solutions* *- other things that were discussed* *- summary/conclusion*

4. Descriptions of the Presentations for Part A

Speaker	Title	Description
Mr. KHO Lip Khoon (Malaysia)	Development inventory of the country-specific activity data and estimation methods for forests ecosystems	This second national inventory of GHG emission is being rigorously analysed and extrapolated to ensure higher accuracy in estimation. Currently, the inventory adopts higher tier level approach of I and II. However, the working group entrusted to carry out this work has been enthusiastic and ambitious to

	and land-use change in Malaysia.	work at Tier III in the near future. Forest inventory data is important to keep track of the activity within 10 – 20 years (as recommended in the IPCC guidelines). The national activity data is being compiled by separate sector as in Peninsular Malaysia, Sabah and Sarawak. Thus, this is highly relevant and reflective to each sector. In addition, the forestry reporting systems by each sector are quite different with additional new categories and sub-categories. This presentation will highlight current activities and initiatives taken by the LULUCF working group with various stakeholders in preparing an improved and comprehensive GHG inventory for the Second National Communication. The presentation will include issues pertaining to the relevancy of practices to neighboring countries and the role of regional network in addressing problems encountered.
Mr. Heng CHAN THOEUN (Cambodia)	Development of the LULUCF's GHG Inventories of Cambodia	His presentation includes: (i) Direct measurement of biomass of the major forest type, (ii) Conversion (or "Translation") of measured biomass values into values in carbon pools under the GPGLULUCF, (iii) Development of activity data for 2000 including assumptions made to estimate land areas which went through land use conversion.
Mr. Atsushi SATO (Japan)	Experience learned by using the IPCC's Good Practice Guidance on Land Use, Land-Use Change and Forestry in developing Japan's GHG inventories	The latest Japan's GHG inventories submitted in 2005 was developed by using the IPCC's Good Practice Guidance on Land Use, Land-Use Change and Forestry. The presentation will introduce Japan's experience particularly focusing on the comparison with the previous inventories that were developed following the Revised 1996 IPCC Guidelines. The presentation is expected to be useful for countries in Asia which could possibly employ the GPG-LULUCF in future.

5. List of submitted discussion topics for Part B

Proponent (alphabetical order)	Discussion topics
Mr. KHO Lip Khoon (Malaysia)	1. In order to work at higher level of tier, each country is required to generate its own default data (aboveground biomass, annual growth rate, and etc.). This is imperative to obtain accurate estimation. ・One area of experimental plots often represents a national-scale default data. How can we assure this extrapolation of default data comply with IPCC guidelines or even GPG2000? ・What is the duration for such analysis? ・Specific methods to be adopted for Asian region? ・Standard or guide for estimations? 2. This is the main sector that determines emission of land-use changes. Malaysia is currently adopting the “zero conversion’ policy. It suggested that the forested areas would not be converted for agricultural, pasture or developmental purposes. ・Is non-conversion of forest applicable in the inventory? ・Abandoned managed land being calculated based on converted forest area? ・Not many countries keep good record of such category (abandoned managed land). How is the best method to justify this category? ・Shifting cultivation comes into which sector? 3. Definitions subjected to each country needed in terms of soil activity (high activity, low activity). ・How to differentiate the two categories? ・Estimation of activity data based on crops or land use? ・Issue pertaining to the availability of activity data according to land use classes is the major limiting factor. 4. GPG2000 is recommended for the inventory. Key categories as drawn out and suggested are comprehensive. ・How can we incorporate into the inventory? ・Is there model software for GPG2000 itself? ・The application and development of EFDB.
Mr. Atsushi SATO	1. National system and institutional arrangement for periodical

(Japan)	preparation of GHG inventories 2. How should we define each inventory (land use) categories? 3. Desired level of accuracy of GHG inventories
Ms. Chisa UMEMIYA (Japan)	1. Degree of dependence of Asian countries on the internationally-available data such as those of FAO in developing GHG inventories. How do we consider the uncertainty of those data? 2. Links with country's forest inventory data which were developed for different purposes. 3. Institutional arrangement for collecting and arranging necessary data. What is the key to establish good cooperative network among different national agencies?

Waste Working Group Session (Session 2)

The 3rd Workshop on GHG Inventories in Asia Region (WGIA)

23-24 February, 2006, Manila, the Philippines

14:40 ~ 18:30 (230 min.)

Session Guidance

1. Objectives of this session (joint tasks for all the group members)

- To specify the features of the Waste GHG inventory development in Asia by creating the lists of country's good practices and challenges
- To prepare one presentation on the summary of discussion made in the group (this presentation will be delivered by the nominated reporter of the group in the Session 3 of the following day)

2. Group members (as of preparing this paper)

- Dr. Sirintornthep Towprayoon (Chair; Thailand)
- Dr. Gao Qingxian (Reporter; China)
- Mr. Yasuhiro Baba (Japan)
- Dr. Kyoung-sik Choi (Korea)
- Dr. Masato Yamada (Japan)
- Ms. Raquel Ferraz Villanueva (Philippines)

3. General Agenda (time is only as a guide!!)

14:40~14:50	By All	Introduction of members
<Part A: Introduction of Country's Good Practices> *Listeners, please fill the provided worksheet for each of the presentations to extract essential information for following discussion.*		
14:50~15:10 (approx. 20 min. including 5 min. for Q&A)	Dr. GAO Qingxian (China)	"The Estimate Model of MSW Production in China"
15:10~15:30 (approx. 20 min. including 5 min. for Q&A)	Dr. Kyoung-sik CHOI (Korea)	"Estimation and Uncertainty Analysis of CH_4 Emissions from Landfills"

15:30~15:50 (approx. 20 min. including 5 min. for Q&A)	Dr. Masato YAMADA (Japan)	"Organic and fossil carbon flow analysis of waste streams: A good practice for solid waste sector"
15:50~16:15	By All	Question and discussion
<Part B: Round-table discussion for "Challenges to be tackled and possible solutions">		
16:15~17:15	By All	*Discussion for challenges to be tackled and possible solutions. Some discussion topics were already raised by the group members (see the below section 5).* *- what are the challenges that you have faced?* *- do you have any ideas to solve the challenges raised by your colleague? Or do you also have the same challenge?* *- what does the regional network such as WGIA could do to help solving the challenges?*
<Part C: Summary and Completion of Presentation for Session 3>		
17:15~18:30	By All	*Please summarize the overall discussion your group has created and make the presentation for the group. The worksheets that the group members filled out in Part A can be used for the discussion. The outline of the discussion will be:* *- overview of the presentation* *- list of good practices and their features* *- list of challenges and possible solutions* *- other things that were discussed* *- summary/conclusion*

4. Descriptions of the Presentations for Part A

Speaker	Title	Description
Dr. GAO Qingxian (China)	The Estimate Model of MSW Production in China	Based on the historical statistical data of municipal solid waste in China, several driving factors of municipal solid waste were analyzed, such as GDP, urban population, the ratio of treatment etc. The results can be used as tool to estimate future

		municipal solid waste production and can also be used as to recalculate historical MSW production. This analysis may be used in most developing countries and it is a good practice for future GHGs inventory.
Dr. Kyoung-sik CHOI (Korea)	Estimation and Uncertainty Analysis of CH_4 Emissions from Landfills	- Estimation of CH_4 emissions by using Tier 2 methodology - Uncertainty analysis with the Monte Carlo Simulation - Standard measurement method for the GHG emissions in landfills
Dr. Masato YAMADA (Japan)	Organic and fossil carbon flow analysis of waste streams: A good practice for solid waste sector.	Organic and fossil carbon content in solid waste should change according to activities in waste streams, such as volume reduction, detoxification, or resource recovery. Case studies on carbon flow analysis of waste streams at Japan and some other Asian countries will be introduced.

5. List of submitted discussion topics for Part B

Proponent (alphabetical order)	Discussion topics
Dr. GAO Qingxian (China)	1. IPCC methodology issues for methane emission from MSW, especially in new development 2. How can get more accurate or reasonable activity data in developing country? 3. New treatment technique and its effects on GHGs emission 4. The potential value of MSW treatment under Kyoto Protocol (CDM project).
Dr. Masato YAMADA (Japan)	1. Impact of 3R activity on waste composition. 2. Good landfill management practices for methane reduction. 3. Realistic k value or half life for the first decay model in Asian countries.

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23-24 February 2006, Manila, Philippines

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DOCUMENTS

ｉ）　Presentations

Opening Session

Session Ⅰ：Updates on GHG inventories in Asia region

Session Ⅱ：Countries’ practices, by sector

Session Ⅲ：Reports & overall discussion

ⅱ）　Other documents

ⅲ）　Appendix

i) Presentations

Opening Session

Overview of workshop and explanation of schedule

Prepared by the WGIA Secretariat

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Greenhouse Gas Inventory Office of Japan (GIO)

National Institute for Environmental Studies (NIES)

GIO Greenhouse Gas Inventory Office of JAPAN

Joint Hosting Organisations

- Ministry of the Environment of Japan
- National Institute for Environmental Studies
- Department of Environment and Natural Resources of the Philippines (Local Host)
- The University of the Philippines Los Banos (Local Host)

National Institute for Environmental Studies Center for Global Environmental Research http://www-cger.nies.go.jp

GIO Greenhouse Gas Inventory Office of JAPAN

Participants

	No. of nations/ organisations	No. of participants
Asian countries	13 (2 are new!)	36
International organisation	1 (= UNFCCC Secretariat)	1

(As of February 17, 2006)

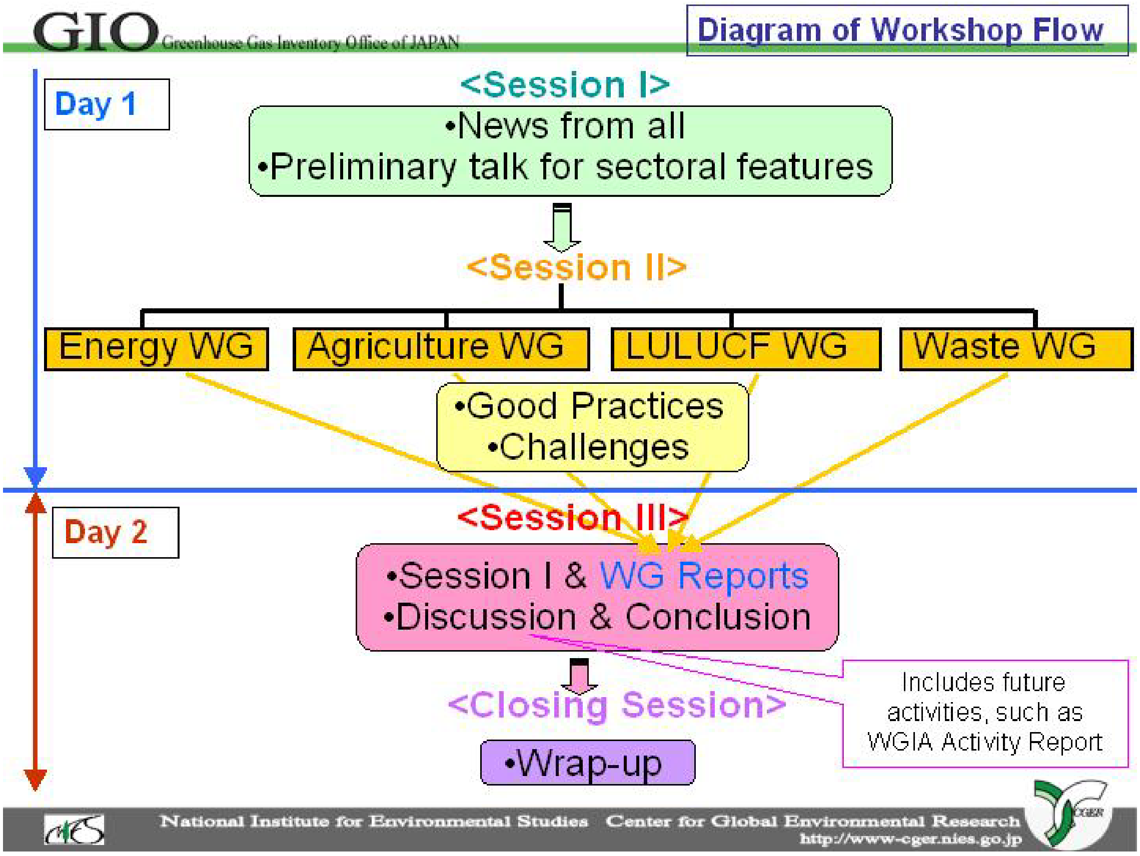
National Institute for Environmental Studies Center for Global Environmental Research http://www-cger.nies.go.jp

GIO Greenhouse Gas Inventory Office of JAPAN

Goals

1. Updating each other on the status of GHG inventory development in Asia
2. Specifying the features of GHG inventory development, sector by sector
3. Finding steps to be followed after the 3rd WGIA

National Institute for Environmental Studies Center for Global Environmental Research http://www-cger.nies.go.jp



In the End…

- Updated information for the status of GHG inventory development in Asia
- Clear understanding of good practices and challenges related to the GHG inventory development of 4 sectors
- Common views and understanding for the subsequent activities of WGIAs

Thank you.
Let us make this workshop fruitful!

ⅰ) Presentations

Session I

The 3rd Workshop on GHG Inventories in Asia Region

China's News on the Development of GHG Inventories

Xu Huaqing
Energy Research Institute, NDRC, China
Feb. 23, 2006, Manila, the Philippines

The key new activities under SNC

- China is required to prepare its SNC based on the revised Guidelines for the Preparation of National Communications from Parties not Included in Annex I to the Convention.
- The Revised Guidelines call for a national GHG emissions inventory for 2000, and encourage the provision of information on anthropogenic emissions by sources of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF6).

The key new activities under SNC

- Quality control of databases that are relevant to the accounting of GHG emissions;
- System for collection, processing, and periodic measurement of energy activity and emissions factors data;
- CH_4MOD and IAP-N agricultural models;
- Remote sensing of data to continuously monitor the changes in forestry area and land use;
- Research on the soil carbon change for different land categories.

Energy sector: Gaps

- Higher tier methods will be adopted under the SNC, where applicable, to estimate GHG emissions in this sector, and compared with results estimated by other methods;
- Through the use of larger sample sizes and improved measurement techniques, emissions factors for methane from small and medium coal mines and cook stoves will be improved;
- Activity data on transportation, building materials, and other sectors will be collected through sample surveys;
- Activity data will be collected for transportation in the industrial sector through separate surveys so as to be able to distinguish energy use in industrial production from ancillary activities.

Industrial Processes: Gaps

- The coverage of source categories will be improved, and, where applicable, GHG emissions in this sector will be estimated at the provincial level;
- Additional sectors, nitric acid, non-ferrous metals, and building materials will be included and additional industrial gases (HFCs, PFCs and SF6) will be added;
- Uncertainties noted in the estimation of activity data and emissions factors will be calculated, and those contributing to the largest error in GHG emissions will be targeted for improvement through either increased sampling of activity data, and measurements of appropriate emissions factors.

Agriculture sector: Gaps

- Adopt higher tier methods to estimate GHG emissions from the agricultural and compare the estimated results from different methods;
- Indirect emissions of nitrous oxide from croplands and residue burning will be measured for use as substitutes for IPCC default factors;
- Model used for the calculation of emissions factors from rice paddy fields will be modified and improved to accommodate different types of rice, and application regimes;
- IAP-N model will be converted to a process model to provide greater spatial resolution and allow temperature and precipitation impacts to be modeled;
- Actual observations will be used to estimate activity data and emissions factors for methane and nitrous oxide emissions from enteric fermentation.

Land-use change and forestry: Gaps

- SNC will seek to apply new methods contained in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories to estimate GHG emissions;
- Rather than use national average values for activity data and emissions factors, values will be measured and/or estimated by province, tree species, and/or forest type;
- SNC will use purchased remote sensed Landsat TM images. These will be combined with the National Land Use pattern Monitoring System to develop a tool for accounting of changes in forests and land use.

Waste treatment: Gaps

- The SNC project will seek to adopt Tier 2 approach and estimate GHG emissions at the provincial level;
- Uncertainties will be reduced through use of measured data on degradable organic carbon and methane release for municipal solid waste and the former for wastewater treatment.


Thanks!

Indonesia's plan of GHG inventories development

Dadang Hilman
Climate Change Division
Ministry of the Environment - Indonesia

The 3rd Workshop on GHG Inventories in Asia Region (WGIA)
23-24 February 2006, Manila, Philippines

Outline

- Experience from the FNC
- Latest and relevant studies
- SNC (Proposal)

2

First National Communication (FNC)

- Estimates of GHG emissions and removals from all sectors from 1990-1994
- Methodology : Revised 1996 IPCC;
- Gases covered: CO_2, CH_4, N_2O, CO, NOx, CF_4, C_2F_6.
- Projection of emissions up to 2025 :
  - three sectors (energy, forestry and agriculture)
  - CO_2, CH_4, N_2O
  - key category analysis were not performed
- Uncertainty : considerably high for all sectors, particularly forestry sector.
- Involvement of sectors in the development of GHG inventories for the INC was also very limited.

3

Latest and Relevant Studies

- **Sectors: Agriculture and Forestry**
  - **Boer *et al.*, 2001, Suryahadi *et al.*, 2001; Setyanto *et al.*, 2001; MoE, 2001; Hendri et al., 2001; Palm et al., 1999; Murdiyarso and Rosalina, 2000, Susandi, 2004**
  - **Important results: developed a number of local emission factors particularly on mean annual biomass increment, above and below ground biomass for a number of sites, and methane emission factors for rice paddy and livestock.**
- **Sector: Energy industry and waste sector**
  - **the improvement were very lacking.**

4

Second National Communication: Proposal

Status:

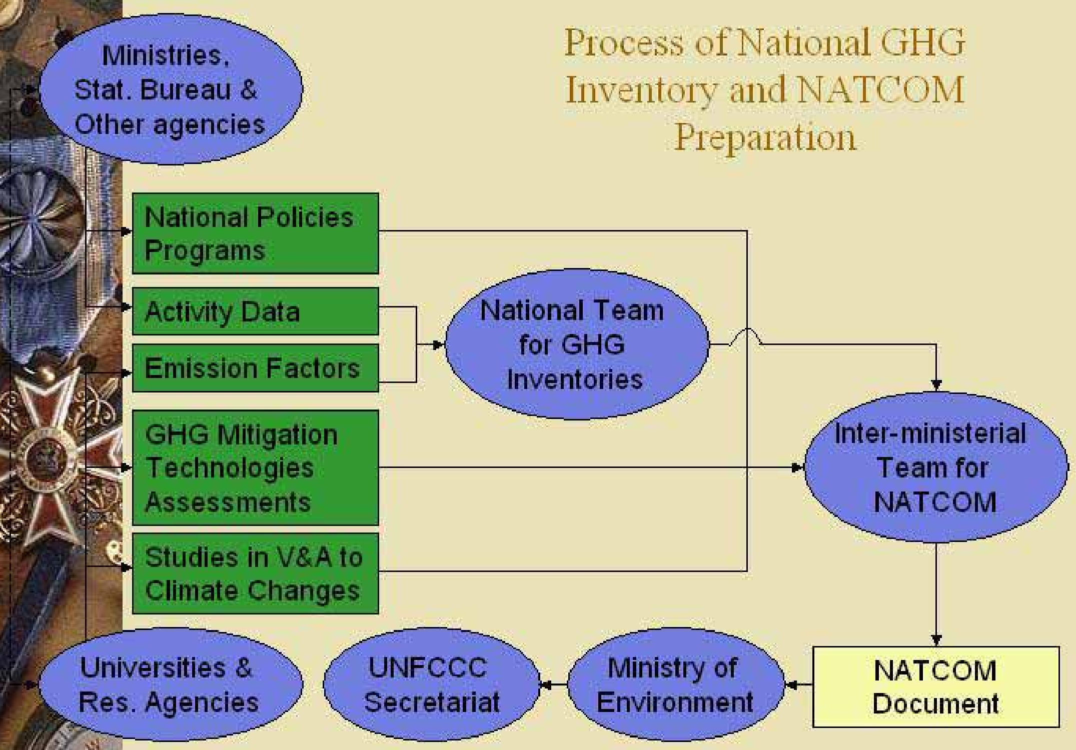
- Expectedly started 2006 (Stocktaking Exercise: Final stage)

Proposal of improvement:

- The reporting period will be extended up to 2002
- improvement of emission estimates from forestry sector (As contribution of forestry sector to the total emissions was significant)
- Encouragement of relevant/ responsible sectors to be actively involve in development of the inventory

5

Process of National GHG Inventory and NATCOM Preparation



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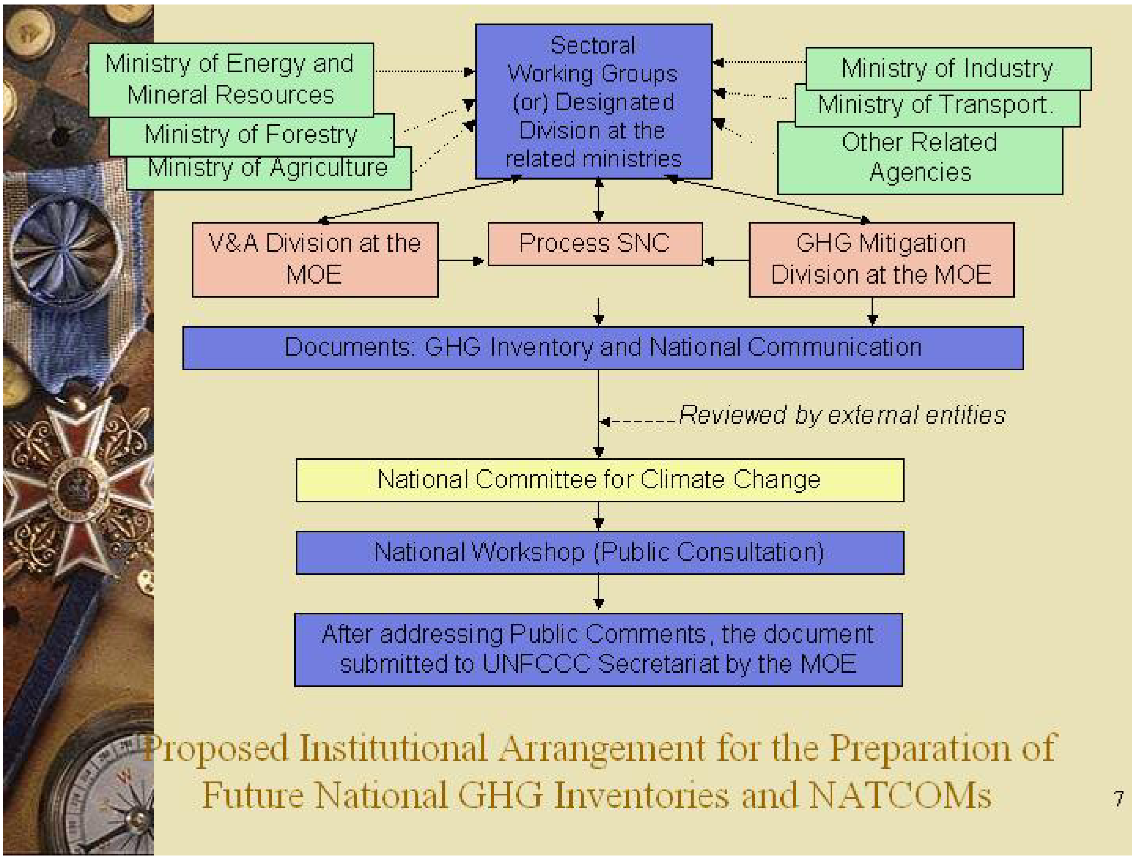

Ministry of Energy and Mineral Resources
Ministry of Forestry
Ministry of Agriculture
Sectoral Working Groups (or) Designated Division at the related ministries
Ministry of Industry
Ministry of Transport.
Other Related Agencies
V&A Division at the MOE
Process SNC
GHG Mitigation Division at the MOE
Documents: GHG Inventory and National Communication
Reviewed by external entities
National Committee for Climate Change
National Workshop (Public Consultation)
After addressing Public Comments, the document submitted to UNFCCC Secretariat by the MOE
Proposed Institutional Arrangement for the Preparation of Future National GHG Inventories and NATCOMs
7

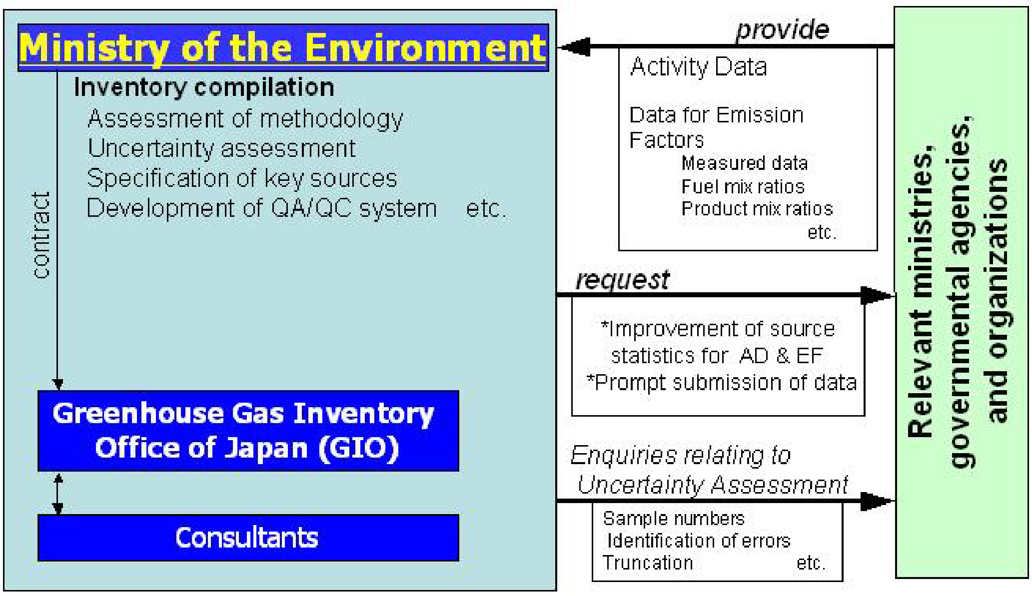

LINGKUNGAN HIDUP
Thank You
8

Japan's News on the development of GHG inventories

Yasuhiro Baba
Deputy Director
Climate Change Policy Division
Global Environment Bureau
Ministry of the Environment

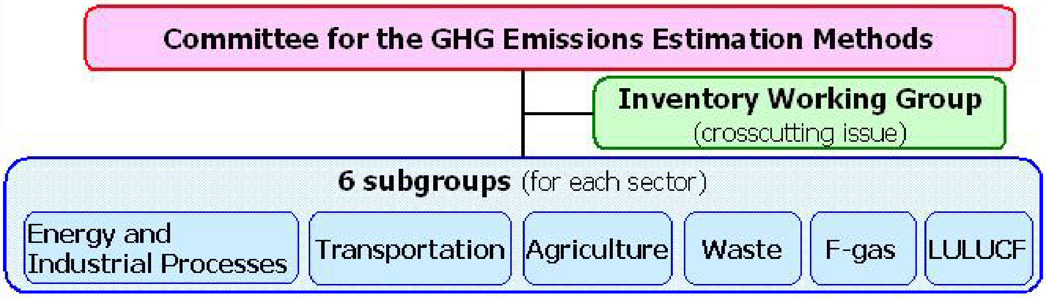
Workshop on GHG Inventories in Asia Region
February 23-24, 2006

Current Institutional Arrangement



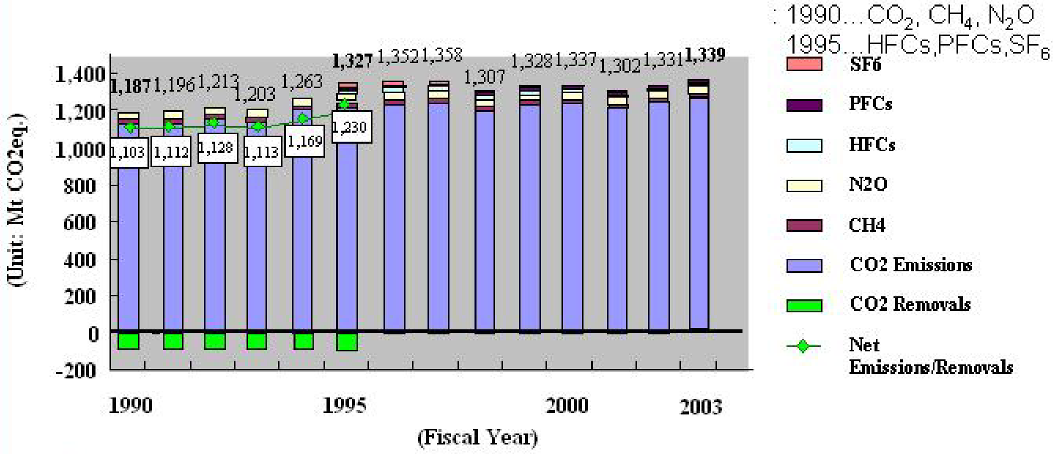
Current Institutional Arrangement

- "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



Trends in overall emissions and removals

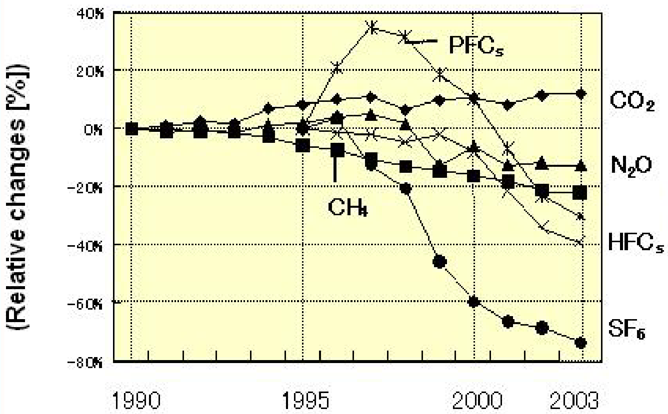
- Overall emission of GHGs:
  - 1,339 [Mt CO_2 eq.] in 2003 (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6)
- Increased by 8.3% since KP's Base Year

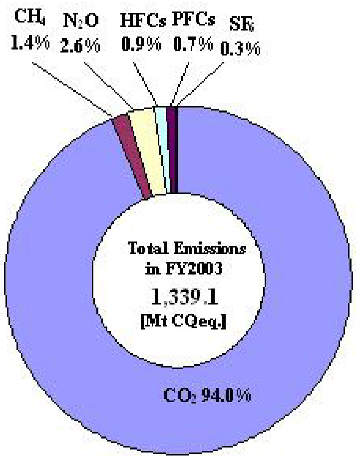


環境省 Ministry of the Environment

Trends in overall emissions

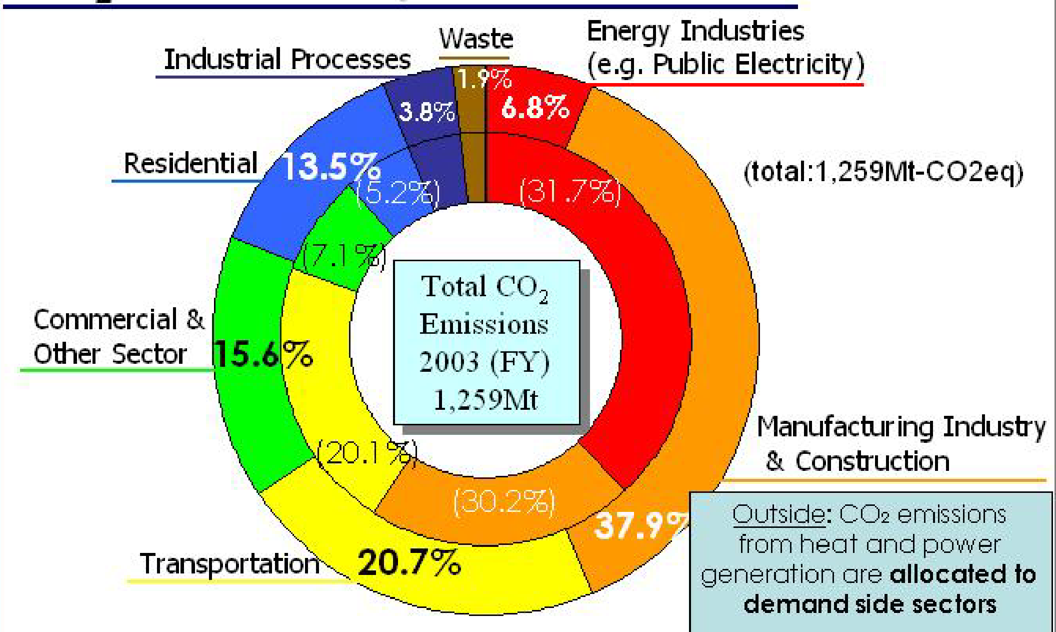
- CO_2 +12.2%, CH_4 -22.1%, N_2O -13.9% (since 1990)
- HFCs -39.2%, PFCs -28.2%, SF_6 -73.6% (since 1995)
- Share of CO_2 amounts to 94.0%





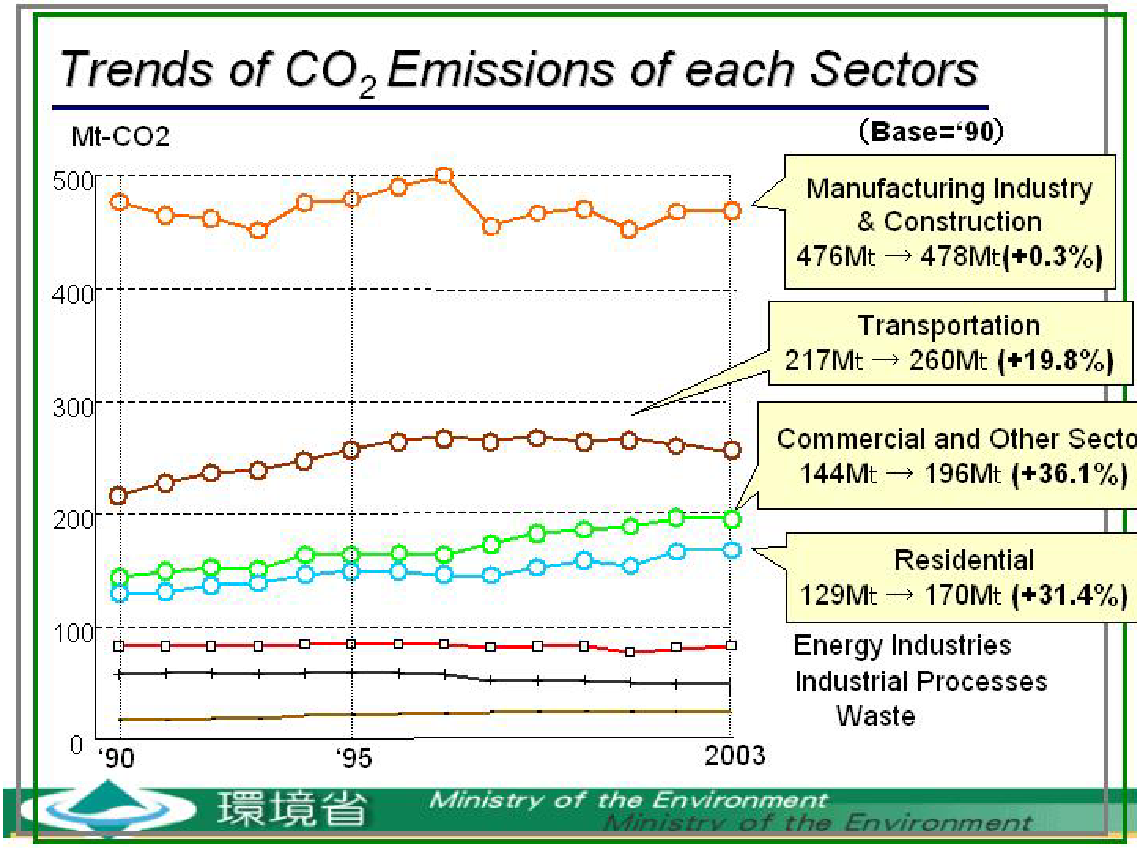
環境省 Ministry of the Environment

CO_2 Emissions by Sectors in 2003

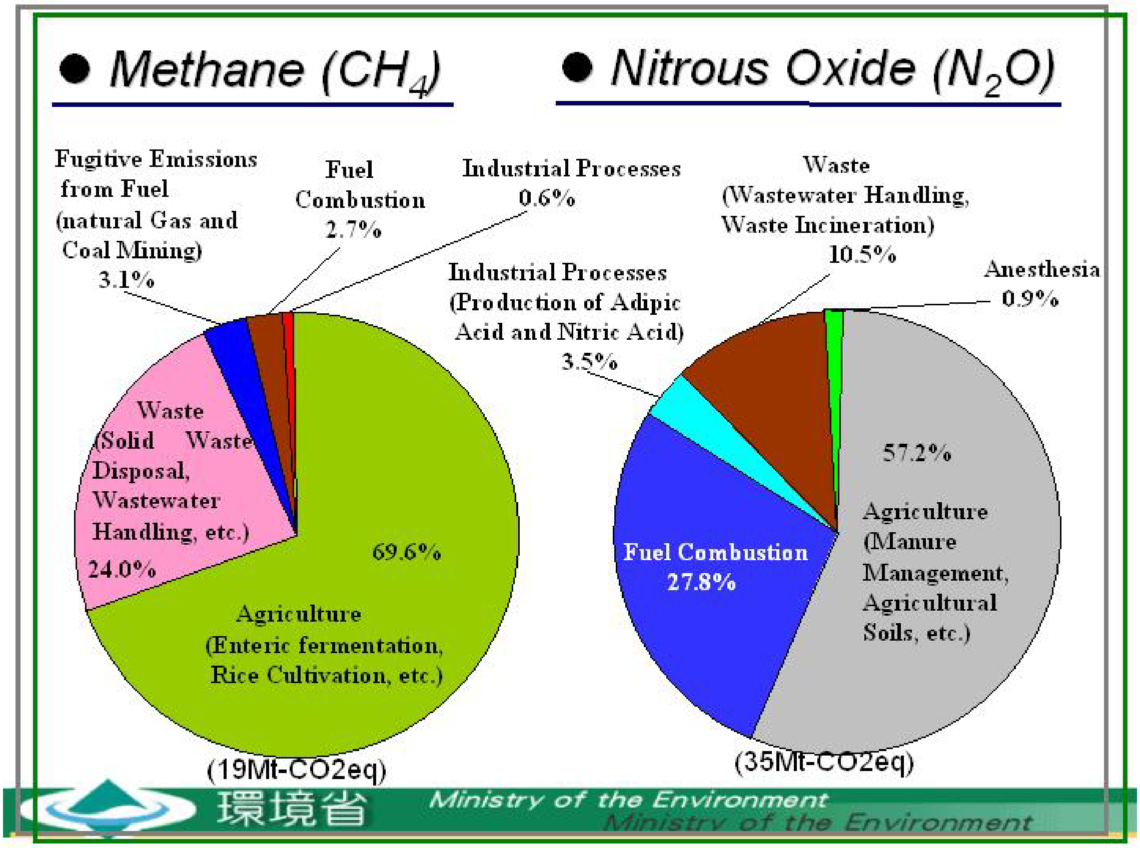


※Because of the round off, the total may not be 100%.

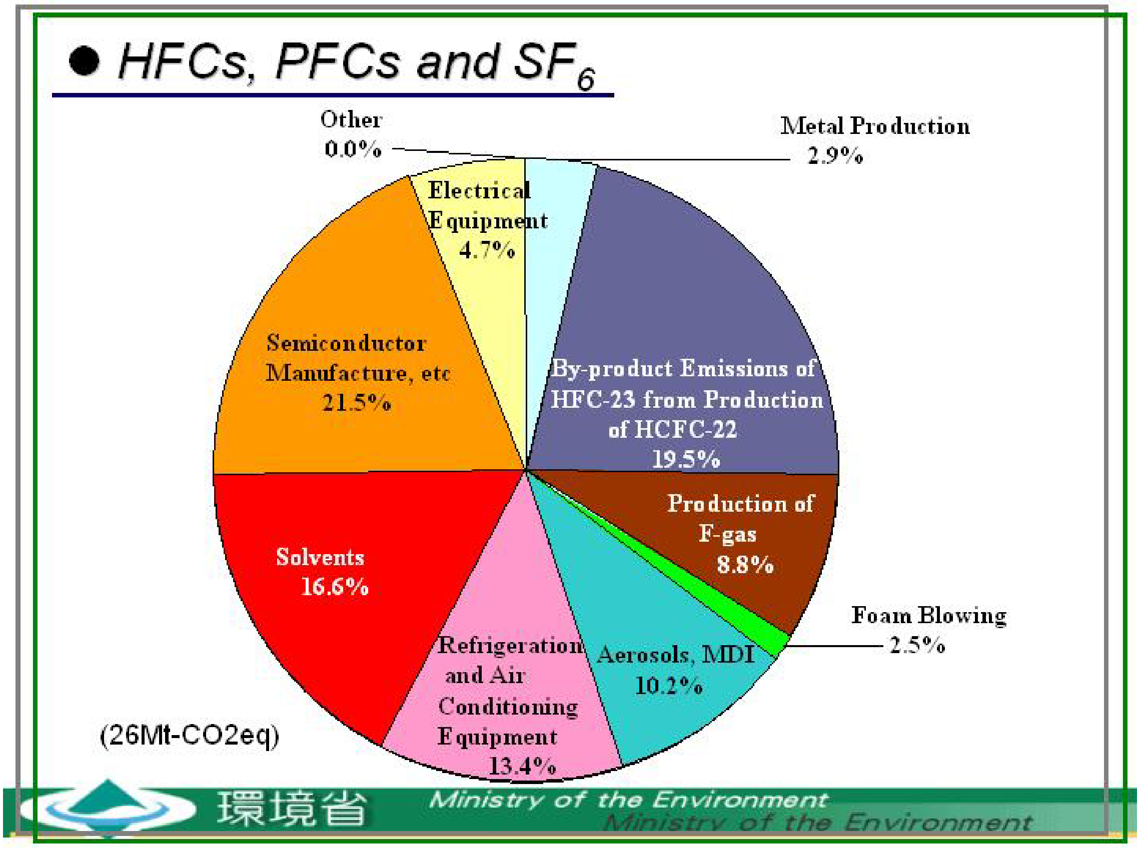
環境省 Ministry of the Environment



Trends of CO_2 Emissions of each Sectors
Mt-CO2
(Base='90)
500
400
300
200
100
0
'90
'95
2003
Manufacturing Industry & Construction
476Mt → 478Mt(+0.3%)
Transportation
217Mt → 260Mt (+19.8%)
Commercial and Other Secto
144Mt → 196Mt (+36.1%)
Residential
129Mt → 170Mt (+31.4%)
Energy Industries
Industrial Processes
Waste
環境省
Ministry of the Environment



● Methane (CH_4)
● Nitrous Oxide (N_2O)
Fugitive Emissions from Fuel (natural Gas and Coal Mining) 3.1%
Fuel Combustion 2.7%
Industrial Processes 0.6%
Waste (Solid Waste Disposal, Wastewater Handling, etc.) 24.0%
69.6%
Agriculture (Enteric fermentation, Rice Cultivation, etc.)
(19Mt-CO2eq)
Waste (Wastewater Handling, Waste Incineration) 10.5%
Anesthesia 0.9%
Industrial Processes (Production of Adipic Acid and Nitric Acid) 3.5%
57.2%
Agriculture (Manure Management, Agricultural Soils, etc.)
Fuel Combustion 27.8%
(35Mt-CO2eq)
環境省
Ministry of the Environment



Kyoto Protocol Target Achievement Plan

- **Established on April 2005**
- **Based on the review of Existing Countermeasures and Future Outlook**
- **Consist of various Policies and Countermeasures**

Future outlook

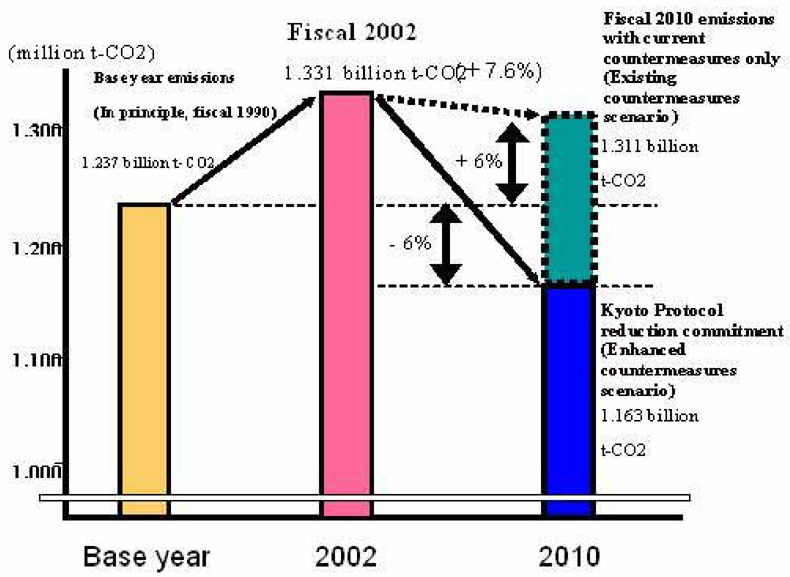


Figure Japan's six percent Reduction Commitment under the Kyoto Protocol and Japan's Greenhouse Gas Emissions

(Unit : Million t-CO_2)

	Base year	fiscal 2002		Existing countermeasures scenario in fiscal 2010		Enhanced countermeasures scenario in fiscal 2010	
	Million t-CO_2	Million t-CO_2	Ratio to base year total emissions	Million t-CO_2	Ratio to base year total emissions	Million t-CO_2	Ratio to base year total emissions
Energy-originated CO_2	1,048	1,174	10.2%	1,115	5.4%	1,056	0.6%
Non-energy-originated CO_2	74	73	-0.1%	74	0.0%	70	-0.3%
CH_4	25	20	-0.4%	20	-0.3%	20	-0.4%
N_2O	40	35	-0.4%	35	-0.4%	34	-0.5%
HFC	20	13	-0.6%	46	2.1%	34	1.1%
PFC	13	10	-0.2%	9	-0.3%	9	-0.3%
SF_6	17	5	-0.9%	12	-0.4%	8	-0.7%
Greenhouse gas emissions	1,237	1,331	7.6%	1,311	6.0%	1,231	-0.5%

Source of Greenhouse Gas Absorption -3.9%

Utilization of the Kyoto Mechanism -1.6%

Total -6.0%


Thank you !!
環境省
Ministry of the Environment

Status on the development of GHG Inventories in Korea

February 23rd 2006
Dr. Kyoung-Sik Choi
Environmental Management Corporation

Contents

- Integrated management of Air pollutants and GHG
- verification plan by using TMS
- Guidance for the estimation of sectoral emissions

❖ Integrated management of Air pollutants and GHG

- ❖ verification plan by using TMS
- ❖ Guidance for the estimation of sectoral emissions

Integrated management of air pollutants & GHG

Clean Air Conservation Act amended on Dec. 2005.

❖ Establishment of comprehensive measures for Air quality improvement (Article 7-5)

2. Status and prospect of GHG emission concentration

4. Establishment for GHG reduction target and measures by sectoral approach

5. Impact assessment and adaptation measures due to Climate Change

6. Integrated air quality management scheme for air pollutants and GHG

7. International cooperation concerning climate change

❖ Development of GHG emission factor and management (Article 7-6)

- Minister of MoE can develop GHG emission factor and manage it to make out official GHG emissions

❖ Integrated measurement for Air pollutants and GHG

❖ **verification plan by using TMS**

❖ Guidance for the estimation of sectoral emissions

Verification plan by using TMS

- Stack TMS Control Center-

❖ As of January '04, TMS installed in 1841 stacks in 317 installations

❖ Target Plants

- Large scale plants generating large amount of air pollutants(1^{st}-3^{rd} grade industries in size)

❖ Objective

- To use the collected data for environmental policies such as total pollutant load management, emission trading, environmental impact assessment etc.

- To determine violation of the emission standard and estimation of the emission charge, etc

Verification plan by using TMS

- Stack TMS Control Center-

❖ System Composition

❖ Functions

- Inspection of plants, Alarm, System management, Remote control, Data analysis & statistics

Verification plan by using TMS

- Verification -

❖ Main target line of business : Power plant, Iron and Steel, Petroleum, Cement, Paper, Petrochemical plant and etc

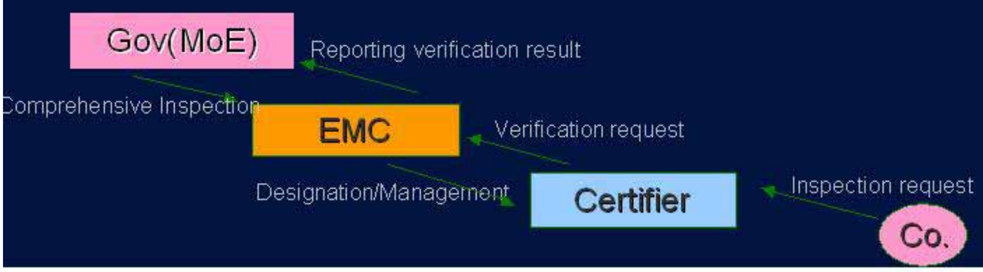
❖ Several methods of verification by using TMS

- Regular measurement using CO2-sensor attached TMS

- Automatic calculation for CO2 by use of O2 concentration & flow rate measured with the TMS system

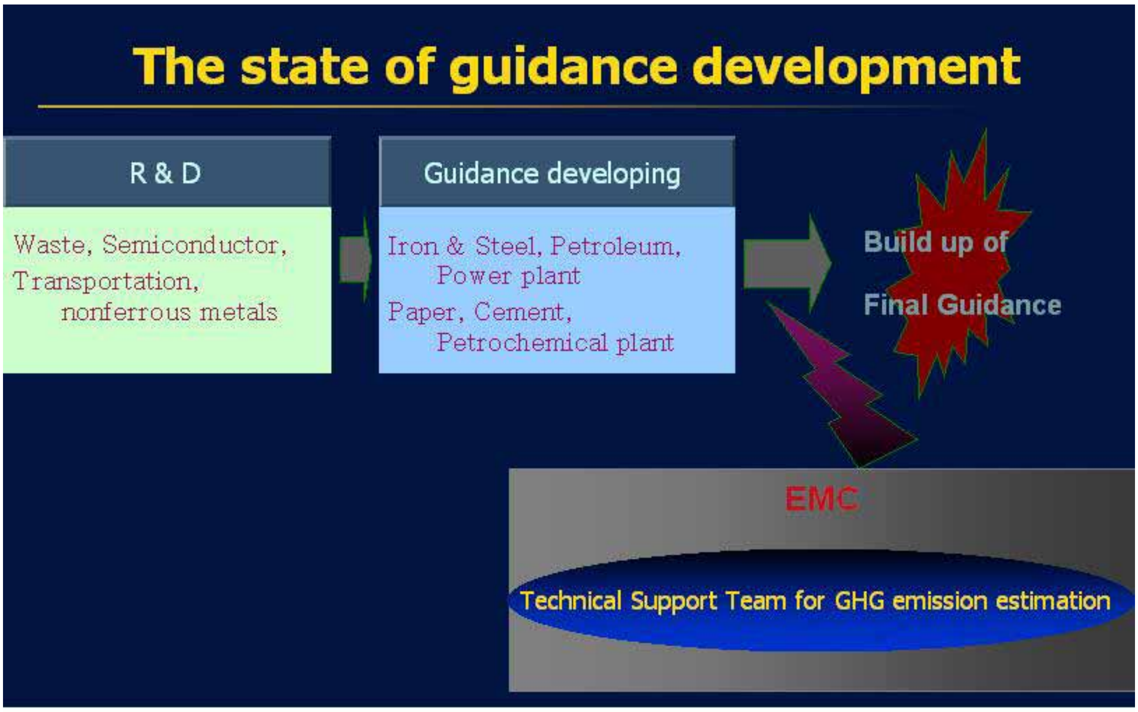
Verification plan by using TMS

- 2006 Project outline
  - Targets : Major GHG emissions industry
  - 20 installations in voluntary plants
  - Automatic emissions calculation and emission factor derivation through CO_2 sensor attachment
- Verification Scheme



- Integrated management of Air pollutants and GHG
- Verification plan by using TMS

Guidance for the estimation of sectoral emissions


The state of guidance development
R & D
Waste, Semiconductor, Transportation, nonferrous metals
Guidance developing
Iron & Steel, Petroleum, Power plant
Paper, Cement, Petrochemical plant
Build up of
Final Guidance
EMC
Technical Support Team for GHG emission estimation


Thank you

The 3rd Workshop on GHG Inventories in Asia Regional (WGIA)
23-24 February 2006, Manila, Philippines

Laos's News on GHG Inventories

Syamphone Sengchandala
Department of Environment
Prime Minister's Office, Science Technology and Environment Agency

1

Outline of presentation

- Background information
- Completed activities
- Ongoing activities
- Challenges experienced
- Activities need to be undertaken.

2

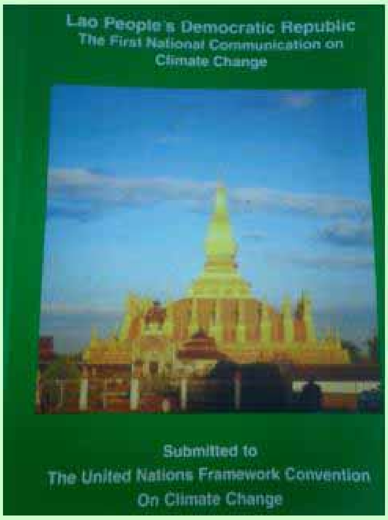
Background information

- Ratified the UNFCCC on 4 April 1995 and Ratified the Kyoto Protocol on 6 February 2003.
- The Science Technology and Environment Agency (STEA), is assigned by the Government to be a UNFCCC National Focal Point and CDM Designated National Authority (DNA).
- Established a National Climate Change Committee on climate change (Chair by STEA), composed 8 members from difference line ministries
- Established Technical Working Group on climate change (Head by STEA), composed 21 members from difference institutions.

3

Completed activities

- Completed and submitted the Initial National Communication on Climate Change in November 2000, which included:
  - ➢ Greenhouse gases inventory-1990
  - ➢ Identification of mitigation options.
  - ➢ Strategies
  - ➢ Measurement
- Assessed the technology needs and its priorities for mitigating greenhouse gases.
- Public awareness on climate change (Brochures, leaflets, Meetings/Workshops…)



4

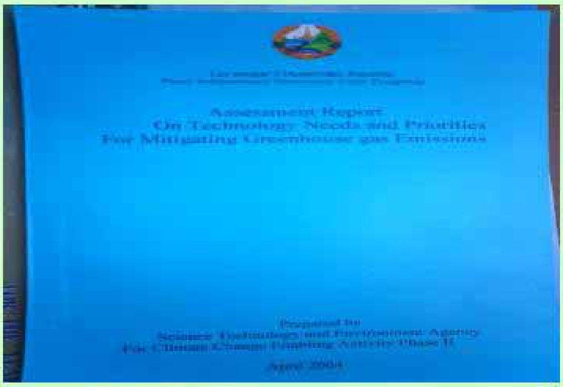
GHG Inventory

National Greenhouse Gas Inventory in 4 Sectors:

1. Energy sector:
   - Fossil fuel consumption
   - Traditional biomass burned for energy

2. Agriculture sector:
   - Enteric fermentation
   - Manure management
   - Rice cultivation

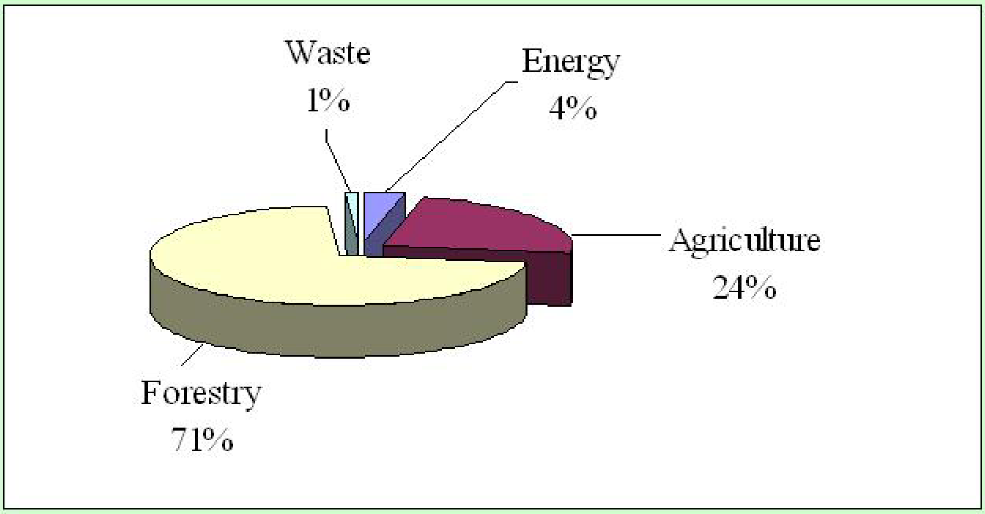
GHG Inventory [Cont.]



3. **Forestry sector:**
   - Change in forest and woody biomass
   - Forest conversion: Aboveground CO_2 released from on-site burning
   - Forest conversion: Aboveground CO_2 released from off-site burning
   - Aboveground CO_2 release from decay
4. **Waste:**
   - Landfills

❖ Lao PDR is a net emitter

Summary GHG Emission by sector (%) in equivalent CO_2



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Ongoing activities

- In the process preparing National Adaptation Programmes of Action (NAPA). The *main objective of NAPA:*

  To develop a country-driven program of action for adaptation to address immediate and urgent needs related to current and projected adverse effects of climate change in key sectors as:
  - Agriculture,
  - Forestry,
  - Water resources and
  - Human health.

8

Challenges

- Data on existing impacts and strategies to overcome climate change issues both national and local levels,
- Limited experts on climate change involved during the consultation meetings/workshops,
- Country-specific Emission Factor (EF)

9

Activities need to be undertaken

- Update and the GHG inventories regularly including upgrade knowledge on how to use the IPCC software for GHG inventories by training.
- To continue public awareness on Climate Change including CDM issues.
- To Continued cooperation and exchanging information from network should be also undertaken regularly at national, regional and global levels.
- To continue develop NAPA document, which expect finalize in June 2006.
- To prepare and submit the Second National Communication expected start second half 2006.

10

Further information:

Prime Minister's Office, Science Technology and Environment Agency, Department of Environment

Nahaidoi Rd, Ban Sisavad, P.O Box: 2279, Vientiane, Laos

Tel/Fax: (856-21) 218712

Fax: (856-21) 213472

Email: syamphone_sengchandala@yahoo.com

Thank you for your kind attention

11

Mongolia's News on the development of GHG inventories

Bujidmaa Borkhuu*,
Dr. Dagvadorj Damdin**
* Institute of Meteorology and Hydrology, Mongolia
** Deputy Director-General, NAMHEM, Mongolia

23-24 February, 2006

The 3rd Workshop on GHG Inventories in Asia Region (WGIA), Manila, Philippines.

Contents

1. Preparation for next inventories
2. UNDP-GEF REGIONAL PROJECT
3. Research program implemented for the improvement of GHG inventories.

23-24 February, 2006

The 3rd Workshop on GHG Inventories in Asia Region (WGIA), Manila, Philippines.

1. Preparation for next inventories

- Preparation of second national communication starting up from mid 2006 to 2008 in which will be covered GHG emission inventory from 1999-2001 of Mongolia.
- The project is funded by UNEP/GEF.
- Short-term and Long-term Strategies for Improvement of GHG Inventories are developed.
- National Manual of Procedures of Preparation of GHG Inventories is developed.
- QA/QC Plan is developed.

23-24 February, 2006

The 3rd Workshop on GHG Inventories in Asia Region (WGIA), Manila, Philippines.

2. UNDP-GEF REGIONAL PROJECT

"Capacity building for improving the quality of Greenhouse Gas inventories" (Europe/GIS region)

Details of the project

Goals: To strengthen technical and institutional capacity and to improve the quality of data inputs to national GHG inventories.

Duration: June 2003-June 2006

Inventory team used the time between the Initial and second national communication to enhance their technical capacity within the framework of this project.

Countries: Albania, Armenia, Azerbaijan, Croatia, Georgia, FYR Macedonia, Moldova, Mongolia, Slovenia, Tajikistan, Turkmenistan and Uzbekistan.(12)

23-24 February, 2006

The 3rd Workshop on GHG Inventories in Asia Region (WGIA), Manila, Philippines.

continue

Main outputs:

- National manual of procedures
- Improvement of data collection
- Regional key sources documented and archived
- QA/QC plan
- *Outline of awareness campaign*
- LT/ ST Strategies to improve the national inventory

Developed

will be carried out in 2nd national communication

3. Research program implemented for the improvement of GHG inventories

In 2005, some recalculations were performed for the Second National Communication under the Project for "Capacity Building for Improving National GHG Inventories in Eastern Europe and CIS" (RER/01/G31).

1. **Transportation sector**
   - Fuel combustion activities:_The main changes in estimated emissions due to methodological changes were made in the Fuel Combustion Activities (Sectoral Approach). **Gasoline and diesel fuels used** in the Residential sector (Other Sectors) are also included in the Transport sector
2. **Waste sector**
   - Recalculation was done for **solid waste section** and estimated by the general methodology provided by IPCC, however, there were adjusted statistical data and other parameters appropriate for Mongolian condition.

1. Improvement of emissions from mobile sources

The following activities have been carried out with a purpose to improve estimations of GHG emissions from mobile sources.

- Current condition and feasibilities of road transport sector in Mongolia;
- Emission factors of mobile source engines;
- Comparison of calculated emission factors with IPCC default values ;
- Estimation of liquid fuel consumption in road transportation, railway, energy, mining and arable farming separately;
- Estimation of GHG emission from diesel fuel burning

continue

Study on CO_2 and CO content in smog gas of mobile sources in Mongolia.

$$E_{CO_2} = M \cdot Q \cdot EF \cdot ce \cdot \frac{44}{12} = GgCO_2$$

Country specific mass emission factor

OR

$$E_{CO_2} = m_{CO_2} \cdot M = GgCO_2$$

Where: M – Fuel consumption, kg; Q-heating value, GJ/kt; EF-emission factor, GgC/GJ;
ce- combustion efficiency; mco_2 - mass emission factor, kg CO_2/kg oil

23-24 February, 2006

The 3rd Workshop on GHG Inventories in Asia Region (WGIA), Manila, Philippines.

continue

- ***Comparison of CO_2 emissions estimated by the IPCC and country specific mass emission factors***

	Fuel type	By IPCC emission factor	By IPCC mass emission factor	By Country Specific mass emission factor	Difference
1	Petrol	717.9 Gg CO_2	714.17 Gg CO_2	634.0 Gg CO_2	-11.2 %
2	Diesel	513.33 Gg CO_2	507.73 Gg CO_2	466.0 Gg CO_2	-8.2%

gasoline

diesel

Conclusion from transport sector:

- Almost most of the diesel engines used in sectors of Railway, Mining, Agriculture and Energy are running for too many years and very old. So far, for the estimations of their GHG emission, it is optional to use Emission factor that we developed.
- Therefore, it seems that CO_2 emission value is decreasing by 9-11% from previous inventory calculation, but the same time consumption gasoline and diesel increasing due to old engine of old cars.
- Also CO emission is increasing which is not included in GHG inventory estimation.

Country specific

2. Improvement of inventories from solid waste in Mongolia

Estimation made by the general methodology provided by IPCC, however there were adjusted some statistical data and other parameters appropriate for Mongolian condition.

No	Parameter	Data	1995		2004		[illegible]
			Value	references	Value	[illegible]	
1	GR	Waste coefficient (Gg/ million people/ year)	182 0.498 (kg /people day)	IPCC guideline	122.2 0.334 (kg /people day)	[illegible]	[illegible] resources
2	MSW_F	Fraction of MSW disposed to solid waste disposal sites	0.40	IPCC guideline	0.61	Calculated	Data were calculated on the base of domestic resources
3	DOC	degradable organic carbon (fraction) (kg C/ kg SW)	0.15	IPCC guideline	0.202	Calculated on the base of Table 4.4, ME-SWM book,2004	Data were calculated on the base of domestic resources
4	DOC_F	Fraction of degradable organic carbon dissimilated	0.77	IPCC guideline	0.77	IPCC guideline	Data were taken from IPCC guideline
5	F	fraction of CH4 in landfill gas	0.25		0.5	IPCC guideline	Data were taken from IPCC guideline
6	MCF	Methane correction factor	-	No information	0.4	IPCC guideline	Data were taken from IPCC guideline

Data were calculated on the base of domestic sources

23-24 February, 2006

The 3rd Workshop on GHG Inventories in Asia Region (WGIA), Manila, Philippines.

Great success to 3rd WGIA!
Thank you for your attention

23-24 February, 2006

The 3rd Workshop on GHG Inventories in Asia Region (WGIA), Manila, Philippines.

DEVELOPMENT OF GHG INVENTORIES IN THE PHILIPPINES

- The Philippine Government has consistently participated in the worldwide conferences and ratified agreements arising from these.
- The Philippines has also formed the Inter-Agency Committee on Climate Change (IACCC) through Executive Order 220 in 1991 – tasked to provide government with technical support on matters concerning climate change.
- Through the IACCC, the National Action Plan on Climate Change was created in 1997. The plan aims to integrate concerns on climate change into the mainstream processes of development planning by the various agencies of the government.

- There are also various laws that aim to protect the environment and help reduce emission of greenhouse gases. One of these is Republic Act 8749 otherwise known as "The Clean Air Act" of 1999.

- At the national level, the government, private sector and non-government organizations are continuously exerting efforts to ease up the heavy dependence on oil and other fossil fuels by harnessing new and renewable sources of energy and waste products to generate energy.

- The Philippines, its government and its people has made initial steps. Still, the facts and figures speak of the poor state of our ecology.

- The last decade of the 1900's has witnessed a series of more devastating and more frequent occurrences of typhoons, rains, landslides, drought and warmer weather.

- The effects of these prolonged and extreme climatic occurrences have cost the country several billions of pesos in damages on its economy and infrastructure, and aggravated the sufferings of millions of poor Filipinos.

- The increase in devastating climatic occurrences, and the damages and sufferings brought about by these were also experienced in other parts of the world.

- The preparation of the 1994 inventory was made possible under project PHI/97/G31 entitled "Enabling the Philippines to Prepare Its First National Communication in Response to its Commitment to the UNFCCC", funded by the Global Environment Facility (GEF) through the United Nations Development Programme. Following Decision 10/CP2 (Annex, no. 14), the country adopted 1994 as the national baseline for its GHG emissions inventory.

- In 2002, the Environmental Management Bureau of the Department of Environment and Natural Resources through its regional offices began preparing their inventory of greenhouse gas emissions for base year 1999 followed by base year 2000 in the year 2003 and base year 2001 in the year 2004.

Researches and tests were being conducted to come up with products and practices that will lessen greenhouse gas emissions and protect the Earth's environment.

New and renewable sources of energy and waste products were harnessed to generate energy. These are the following:

- Biomass

Bagasses, and coconut husks and shells accounted for 12 percent of the nation's energy supply, making biomass the country's largest source of indigenous energy. An estimated 16 million tons of agricultural residue is produced annually.

Biogas

Animal wastes from poultries, piggeries and cattle farms are converted into energy.

Geothermal

The Philippines is currently producing some 1,093.7 MW from its geothermal plants. This output ranks second in the world in terms of geothermal energy generation which represents only 18% of the total geothermal resources that can be harnessed.

- Hydro-power

  There are 42 mini-hydro electric plants with a total capacity of 77.39 MW already operating in the country.

- Wind

  A wind turbine system was already pilot-tested in a small town in Pagudpud, Ilocos Norte for their power needs. The National Power Corporation has identified the islands of Cuyo, Catanduanes, Basco, Guimaras and Romblon as ideal sites for harnessing wind energy.

- The Philippine National Standards is setting the trend for more eco-efficient practices in the industry sector. PNS 1701 is the local name of ISO 14001, the first standard in the ISO 14000 series. Its intention is to provide all industries, whether in manufacturing or services, with a structure for an environmental management system (EMS).

Thailand's News On The Development of GHG Inventories

Office of Natural Resources and Environmental Policy and Planning

Ministry of Natural Resources and Environment

The Royal Thai Government

1

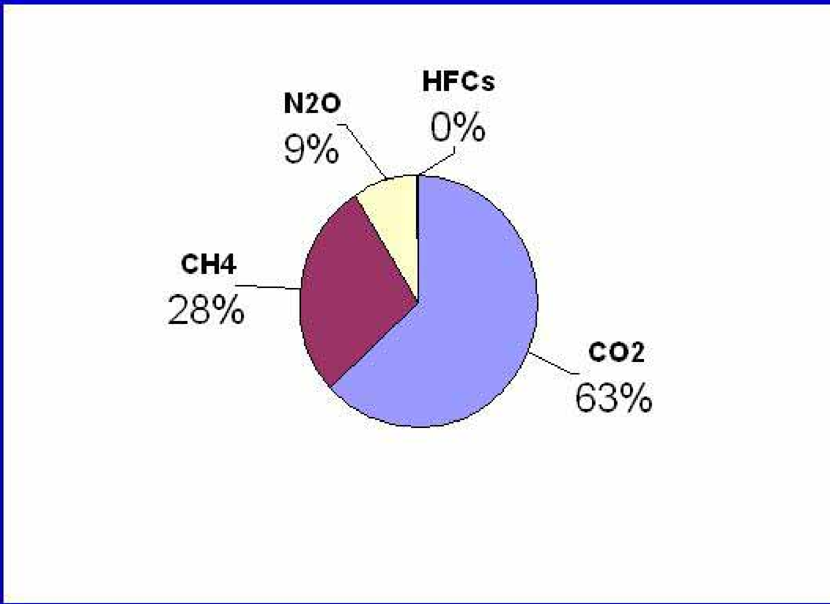
Thailand Total Net National Greenhouse Gas Emission, 2003

Greenhouse Gas	Emission Mt CO_2	%of Total
CO_2	218.4	63.4%
CH_4	95.3	27.7%
N_2O	29.7	8.6%
HFCs	0.8	0.2%
Total	**344.2**	**100%**

Source: ERM,2008

2

Constribution to Total CO2-equivalent Emissions by Gas, 2003



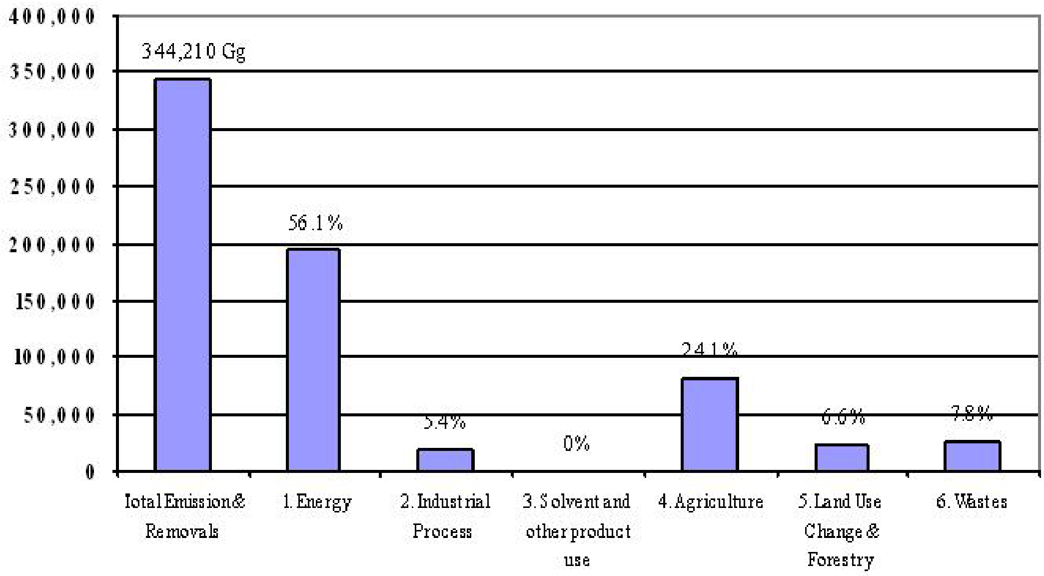
Source: ERM,2005 3

Greenhouse Gas Emission by Sector, Thailand, 2003

Greenhouse Gas Source and Sink Categories	CO_2-equivalent Emission (Gg)					% Total Net Emission
	CO_2	CH_4	N_2O	HFCs	Total	
Total Emission & Removals	218,360	95,346	29,713	791	344,210	100%
1. Energy	178,945	11,522	2,737	–	193,204	56.1%
A. Fuel Combustion	178,945	1,837	2,737	–	183,519	53.3%
B. Fugitive Emissions	–	9,685	–	–	9,685	2.8%
2. Industrial Process	17,904	42	–	791	18,737	5.4%
3. Solvent and other product use	–	–	–	–	–	0.0%
4. Agriculture	–	56,811	25,977	–	82,788	24.1%
5. Land Use Change & Forestry	21,511	998	101	–	22,610	6.6%
6. Wastes	–	25,973	897	–	26,870	7.8%

Source:ERM,2005

Constribution to Total CO2-equivalent Emission by Sector, 2003



Source: ERM,2006

5

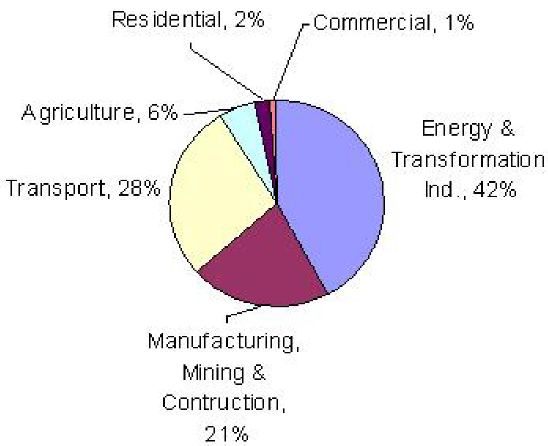
Energy Sector CO2-equivalent Emission, 2003

Source: ERM,2009

6

Greenhouse Gas Source and Sink Categories	CO_2-equivalent Emission (Gg)					% Total Net Emission
	CO_2	CH_4	N_2O	HFCs	Total	
Total Emission & Removals	218,360	95,346	29,713	791	344,210	100 %
1. Energy	**178,945**	**11,522**	**2,737**	**0**	**193,204**	**56.2%**
A. Fuel Combustion	178,945	1,837	2,737	0	183,519	53.4%
Energy & Transformation Ind.	75,497	45	1,381	–	76,924	22 %
Manufacturing, Mining & Contruction	37,293	439	154	–	37,886	11%
Transport	51,272	152	874	–	52,298	15%
Commercial	1,892	6	138	–	2,036	1%
Residential	2,810	1,165	6	–	3,981	1%
Agriculture	10,181	29	184	–	10,394	3%
B.Fugitive Emissions	–	9,685	–	–	9,685	3%
Solid Fuels	–	331	–	–	331	0%
Oil and Natural Gas	–	9,353	–	–	9,353	3%

Share of Activities in the Fuel Combustion, 2003

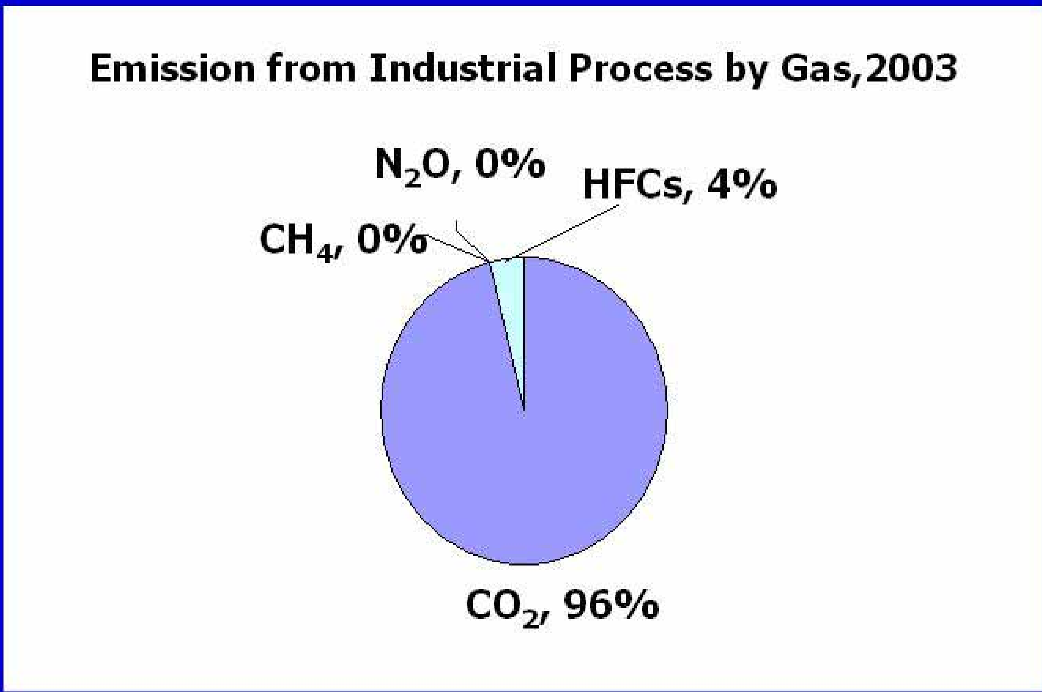


Source: ERM,2006 8

Industrial Processes Sector
CO2-equivalent Emission,2003

Source: ERM,2009 9

Greenhouse Gas Source and Sink Categories	CO_2-equivalent Emission (Gg)					% Total Net Emission
	CO_2	CH_4	N_2O	HFCs	Total	
Total Emission & Removals	218,360	95,346	29,713	791	344,210	100%
2. Industrial Process	**17,904**	**42**	**-**	**791**	**18,737**	**5.5%**
A.Mineral Products	17,904	–	–	–	17,904	5.2%
B.Chemical Industry	–	42	–	–	42	0.0%
C.Metal Production	–	–	–	–	–	0.0%
D.Other Production	–	–	–	–	–	0.0%
E.Production of halocarbons and sulphur hexafluoride	–	–	–	–	–	0.0%
F.Consumption of halocarbons and sulphur hexafluoride	–	–	–	791	791	0.2%
G.Others	–	–	–	–	–	0.0%

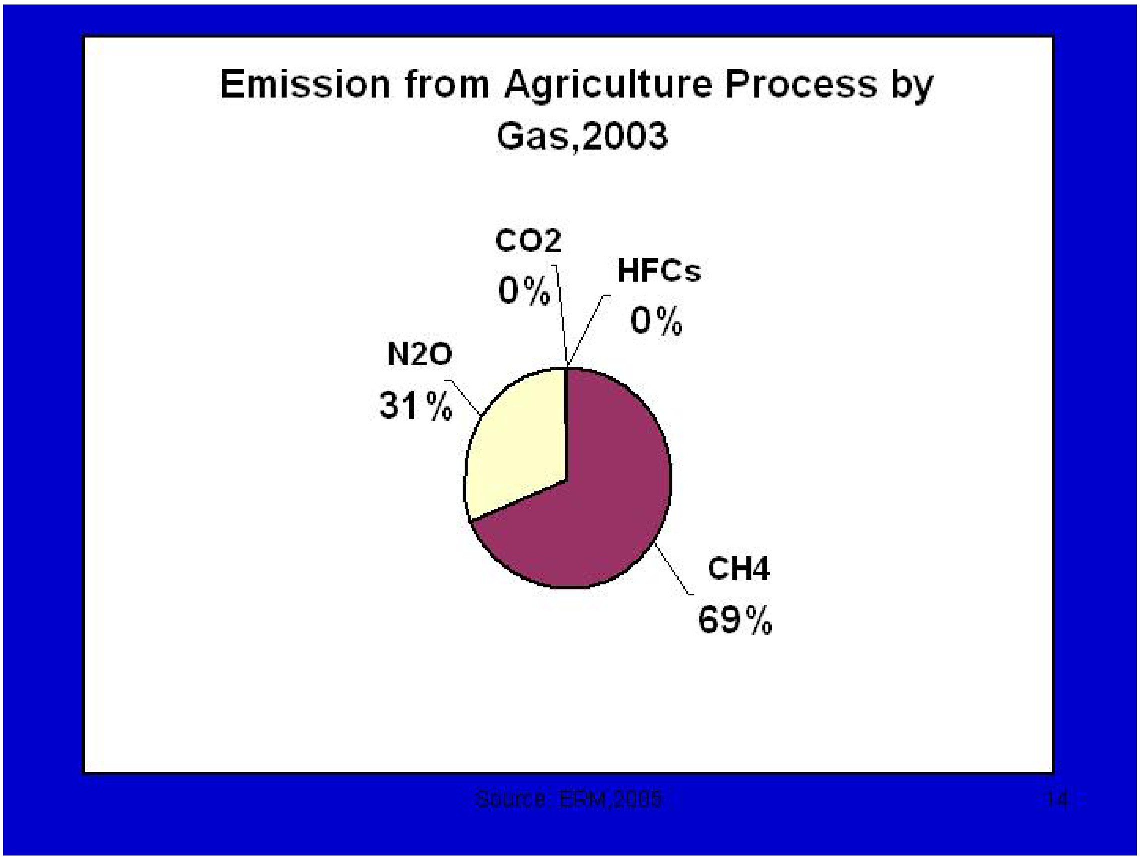


Source: ERM,2003 11

Agriculture Sector
CO2-equivalent Emission, 2003

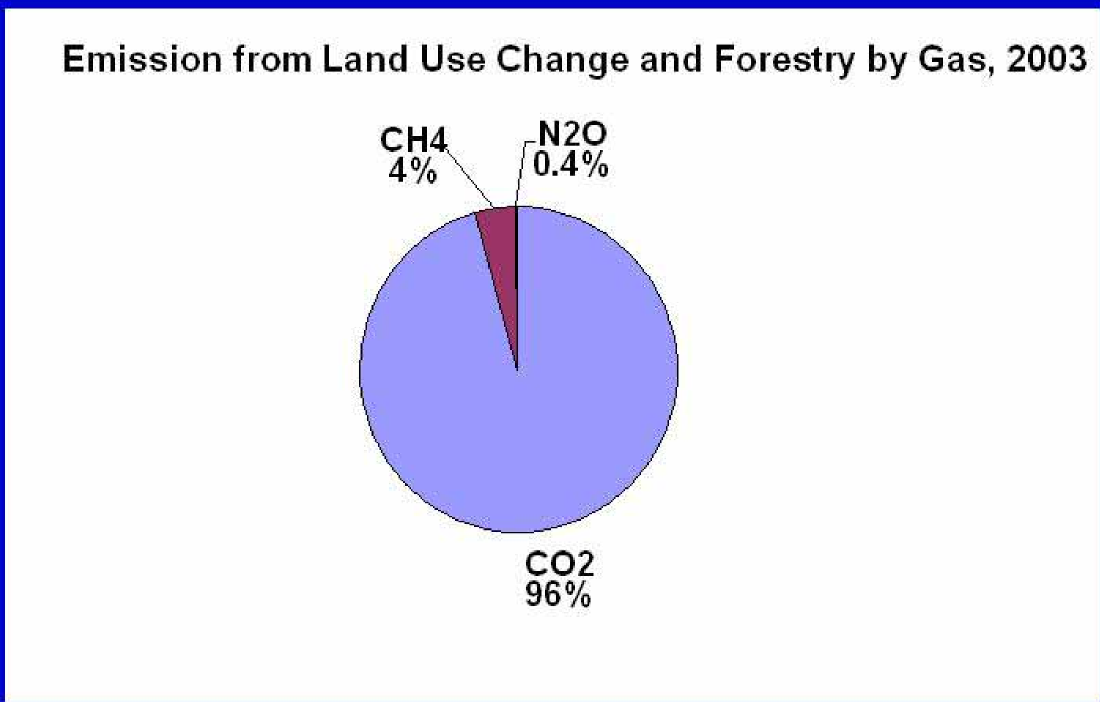
Source: ERM,2003 12

Greenhouse Gas Sources and Sink Categories	CO_2-equivalent Emissions (Gg)					
	CO_2	CH_4	N_2O	HFCs	Total	% Total Net Emission
Total Emissions & Removals	218,360	95,346	29,713	791	344,210	100%
4.AGRICULTURE	**-**	**56,811**	**25,977**	**-**	**82,788**	**24.1%**
A.Enteric Fermentation	–	8,163	–	–	8,163	2.4%
B.Manure Management	–	1,742	2,180	–	3,922	1.1%
C.Rice Cultivation	–	46,467	–	–	46,467	13.5%
D.Agricultureal Soil	-	-	23,674	-	23,674	6.9%
E.Prescribed Burning of Savannas	–	–	-	–	-	0.0%
F.Fild Burning of AgricultureResidues	–	439	123	–	562	0.2%



Land Use Change and Forestry CO2-equivalent Emission, 2003

Greenhouse Gas Sources and Sink Categories	Emissions (Gg)		$CO_{2\text{-equivalent}}$			% Total Net Emission
	CO_2	CH_4	N_2O	HFCs	Total	
Total Emission & emovals	218,360	95,346	29,713	791	344,210	**100%**
5.LAND USE CHANGE & FORESTRY	**21,511**	**998**	**101**	**-**	**22,610**	**6.6%**
A.Changes in Forest & Other Woody Biomass Stock	21,240	–	–	–	21,240	6.2%
B.Forest and Grassland Conversion	29,826	998	101	–	30,926	9.0%
C.Abandon of Managed Land	-29,556	–	–	–	-29,556	-8.6%

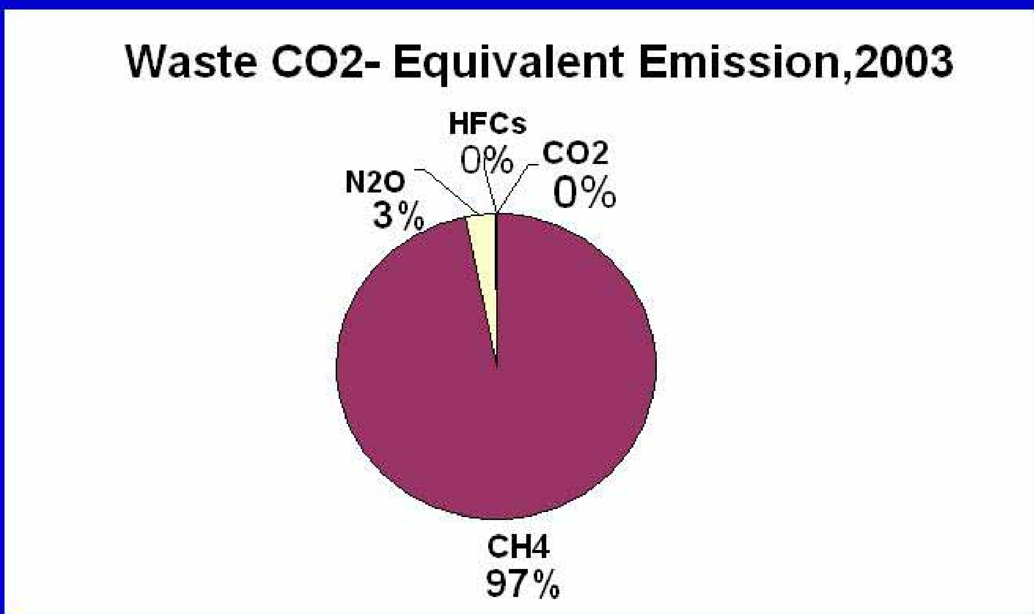


Source: ERM,2009 16

Waste CO2-equivalent Emission, 2003

Greenhouse Gas Sources and Sink Categories	CO_{2}-equivalent Emissions (Gg)					%Total Net Emission
	CO_2	CH_4	N_2O	HFCs	Total	
Total Emission & Removals	218,360	95,346	29,713	791	344,210	100%
6.WASTES	**-**	**25,973**	**897**	**-**	**26,870**	**7.8%**
A.Solid Waste Disposal	–	20,146	–	–	20,146	5.9%
B.Wastewater Treatment	–	5,827	–		5,827	1.7%
C.Human Sewage	–	–	897	–	897	0.3%

Waste CO2-equivalent Emission, 2003



Thank you

AREE WATTANA TUMMAKIRD

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The 3rd Workshop on GHG Inventories in Asia Region (WGIA)

23-24 February 2006, Manila, Philippines

Preparation of National GHG Inventory for the year 2000 in Viet Nam under Viet Nam Second National Communication to UNFCCC

Hoang Manh Hoa,
Senior Expert on Climate Change,
National Office for Climate Change and Ozone Protection,
International Cooperation Department,
Ministry of Natural Resources and Environment of Viet Nam

Content

A. Previous activities in the National GHG Inventory for the year 1994 in Viet Nam under Viet Nam Initial National Communication (INC) to UNFCCC

B. Proposed activities in the National GHG Inventory for the year 2000 in Viet Nam under Viet Nam Second National Communication (SNC) to UNFCCC

C. Conclusions

A. Previous activities in the National GHG Inventory for the year 1994 in Viet Nam under Viet Nam INC to UNFCCC

- The results of 1994 National GHG Inventory in Viet Nam were presented at the Workshop of GHG Inventories in Asia Region, 13-14 November 2003, Phuket, Thailand
- The methodology of Inventory: IPCC 1996 revised Guidelines for National GHG Inventories

- In the INC, Viet Nam has undertaken a National GHG Inventory for direct GHGs carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and indirect GHGs nitrogen oxides (NOx), carbon monoxide (CO) and non-methane volatile organic compound (NMVOC) and sulphur dioxide (SO_2) for the base year 1994 in 5 source categories: Energy, Industrial processes, Agriculture, Land-use Change and Forestry and Waste
- Based on this inventory, projections of national GHGs emissions to 2020 had been made and the options for mitigation of GHGs emissions have been identified and developed for the energy, land-use change and forestry and agriculture sectors

- **Major gaps:**
  - ✓ CO_2, CH_4 and N_2O, NOx, CO, NMVOC and SO_2 data in the 5 source categories need to be updated and extended based on the COP8 Guidelines and to be stored in the existing GHG database;
  - ✓ Inventory was not extensive and comprehensive due to the lack of data or poor data quality in certain source categories (e.g., not all industries and industrial processes were considered; data quality in agriculture and forestry sectors are not as good as those in fuel combustion sector);
  - ✓ Emissions from energy consumption in different sectors are calculated using the reference approach only and there is a need for the sectoral or bottom-up approach for emission estimation;
  - ✓ The role of savannas and abandonment lands in CO_2 uptake needs to be studied;
  - ✓ Activity data for solvent and other product use sector have not been collected and hence emission from this sector was not estimated;
  - ✓ Lack of country-specific emission factors (e.g., coal, gas, and mining, soils, etc);
  - ✓ Uncertainties for sources and sinks were not estimated;
  - ✓ User-friendly software for GHG emission projection is needed;
  - ✓ Capacity-building in IPCC methodologies for GHG inventory is still very much needed.

B. Proposed activities in the National GHG Inventory for the year 2000 in Viet Nam under Viet Nam SNC to UNFCCC

- With the financial and technical support from UNEP/GEF, Viet Nam have been implementing the stocktaking and stakeholder consultations for the preparation of SNC to UNFCCC
- A national workshop for stocktaking and stakeholder consultations was organized by Ministry of Natural Resources and Environment (MONRE) of Viet Nam, 18-19 January 2006, Ha Noi, Viet Nam before the preparation of this project proposal. This workshop identified the above-mentioned gaps in the National GHG Inventory in Viet Nam for the year 1994

- In March 2006, the proposal of Viet Nam SNC project will be submitted to UNEP/GEF for approval. This project will start in May 2006 with a duration of 3 years
- Proposed activities:
  - ✓ 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 (fuel combustion, energy industries, transport, commerce, residence, solid fuels, etc), industrial processes, agriculture (enteric fermentation from domestic livestock, manure management, rice cultivation, agricultural soils and field burning of agricultural residues, etc), land-use change and forestry (changes in forest and other woody biomass stock, forest and grassland conversion, abandonment of managed lands, etc) and waste (solid waste disposal on land, wastewater handling, human sewage, etc);

- ✓ 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;
- ✓ Appropriate national or regional emission/sink factors will be used to estimate GHG emissions/sinks where available;
- ✓ 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 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;

- ✓ 2006 IPCC guidelines for National GHG Inventories will be used when it becomes available in 2006;
- ✓ Top-down and bottom-up approaches will be used;
- ✓ New emission factors for specific activities will be applied;
- ✓ All concerned data will be collected, analysed and managed;
- ✓ The GHG inventory team based on the INC project will be reconstituted;
- ✓ A long-term programme on the improvement of future GHG inventories will be developed.

C. Conclusions

- A National GHG Inventory in Viet Nam for the year 2000 is an important component of Viet Nam SNC to UNFCCC, as it forms the basis for mitigation measures
- A reliable and accurate GHG inventory would also be very useful for the formulation of any projects
- Viet Nam hope to receive the assistance from other International organizations and countries in carrying out a National GHG Inventory for the year 2000 in Viet Nam under Viet Nam SNC for the period 2006-2009

Thank you very much for your attention

Sectoral features of GHG inventories from non-Annex I Parties

Manila, Philippines, 23-24 February 2006

Dominique Revet
FTS programme
UNFCCC secretariat
(DRevet@unfccc.int)

The 6th Compilation & Synthesis (C&S)

Introduction

- FCCC/SBI/2005/18 and Add.1-6
- **122** submitted NAI national communications (out of 148), i.e.**82%**
- 83% of the Africa region, **77% of the Asia-Pacific region**, 94% of the Latin America and the Caribbean region, and 70% of the "Other" region.

Reporting

- Methodological issues
- Activity data
- Emission factors.
- Reporting tables

- The case of 12 countries involved in the 3rd WGIA

Overview of GHG data submitted

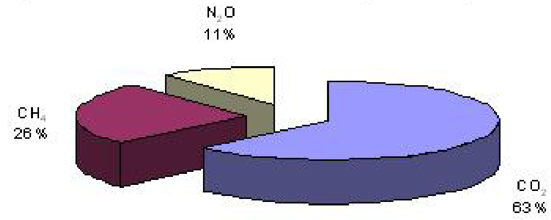
General overview

- Decision 10/CP.2
- 1994 or closest year reported
- When needed, estimates provided by Parties have been converted into CO2 equivalent, using 1995 IPCC GWPs, in order to facilitate comparison of results

- On-line database: http://ghg.unfccc.int/tables/queries.html
- "Key GHG Data - 2005": http://unfccc.int/essential_background/background_publications_htmlpdf/items/2625.php

Total GHG emissions from 122 NAI Parties, excluding LUCF (1994 or closest year)

	CO_2	CH_4	N_2O
Total (Gg)	7 402 705	144 028	4 220
Total (Gg CO_2 equivalent): 11 735 437 (i.e. 11.7 billion tonnes)	7 402 705	3 024 590	1 308 142



Aggregate emissions and removals of CO_2, CH_4 and N_2O in CO_2 equivalent by major source/sink category, including and excluding land-use change and forestry (Gg and percentages of total by Party)

Party	Year	Energy		Industrial processes		Agriculture		Waste		Total (without LUCF)	LUFC	Total (with LUCF)	Percentage of LUCF in total GHG
		Gg	%	Gg	%	Gg	%	Gg	%	Gg	Gg	Gg	%
ASIA AND THE PACIFIC													
Cambodia	1994	1 881.11	14.7	49.85	0.4	10 559.05	82.7	272.37	2.1	12 762.38	- 17 907.69	- 5 145.31	- 140.3
China	1994	3 007 780.00	74.1	282 630.00	7.0	604 776.00	14.9	162 120.00	4.0	4 057 306.00	- 407 479.00	3 649 827.00	- 10.0
India	1994	743 820.00	61.3	102 710.00	8.5	344 485.00	28.4	23 233.00	1.9	1 214 248.00	14 292.14	1 228 540.14	1.2
Indonesia	1994	222 102.37	68.7	8 212.92	2.5	84 506.61	26.1	8 440.32	2.6	323 262.22	164 118.32	487 380.54	50.8
Lao People's Democratic Republic	1990	929.85	13.5	-	-	5 696.67	83.0	240.03	3.5	6 866.55	- 104 303.83	- 97 437.28	- 1 519.0
Malaysia	1994	97 861.23	71.8	4 973.00	3.6	6 932.04	5.1	26 596.50	19.5	136 362.77	- 61 077.96	75 284.81	- 44.8
Mongolia	1994	9 791.30	64.6	95.00	0.6	5 184.90	34.2	88.20	0.6	15 159.40	400.00	15 559.40	2.6
Philippines	1994	50 040.33	49.6	10 602.93	10.5	33 128.57	32.8	7 094.78	7.0	100 866.61	- 126.49	100 740.12	- 0.1
Republic of Korea	1990	248 546.00	85.9	17 617.00	6.1	12 889.00	4.5	10 406.00	3.6	289 458.00	- 26 235.00	263 223.00	- 9.1
Singapore	1994	26 647.92	99.2	-	-	-	-	211.16	0.8	26 859.08	-	26 859.08	-
Thailand	1994	129 867.65	58.0	15 976.91	7.1	77 398.30	34.6	739.62	0.3	223 977.48	61 853.82	285 831.30	27.6
Viet Nam	1994	25 632.69	30.4	3 807.19	4.5	52 444.90	62.1	2 565.02	3.0	84 449.80	19 384.78	103 834.58	23.0
Total Asia and the Pacific		5 657 176.98	71.3	509 466.78	6.4	1 467 163.21	18.5	295 882.72	3.7	7 929 689.69	- 315 618.12	7 614 071.57	- 4.0
Total 122 non-Annex I Parties		7 501 148.06	63.9	708 503.83	6.0	3 033 040.59	25.8	497 744.42	4.2	11 735 436.90	196 058.95	11 931 495.85	1.7

Total aggregate emissions and removals of CO_2, CH_4 and N_2O in CO_2 equivalent excluding and including land-use change and forestry (Gg)

Party	Total (without LUCF)	Total (with LUCF)
ASIA AND THE PACIFIC		
Cambodia	12 762.38	-5 145.31
China	4 057 306.00	3 649 827.00
India	1 214 248.00	1 228 540.14
Indonesia	323 262.22	487 380.54
Lao People's Democratic Republic	6 866.55	- 97 437.28
Malaysia	136 362.77	75 284.81
Mongolia	15 159.40	15 559.40
Philippines	100 866.61	100 740.12
Republic of Korea	289 458.00	263 223.00
Singapore	26 859.08	26 859.08
Thailand	223 977.48	285 831.30
Viet Nam	84 449.80	103 834.58
Total Asia and the Pacific	7 929 689.69	7 614 071.57
Total 122 non-Annex I Parties	11 735 436.90	11 931 495.85

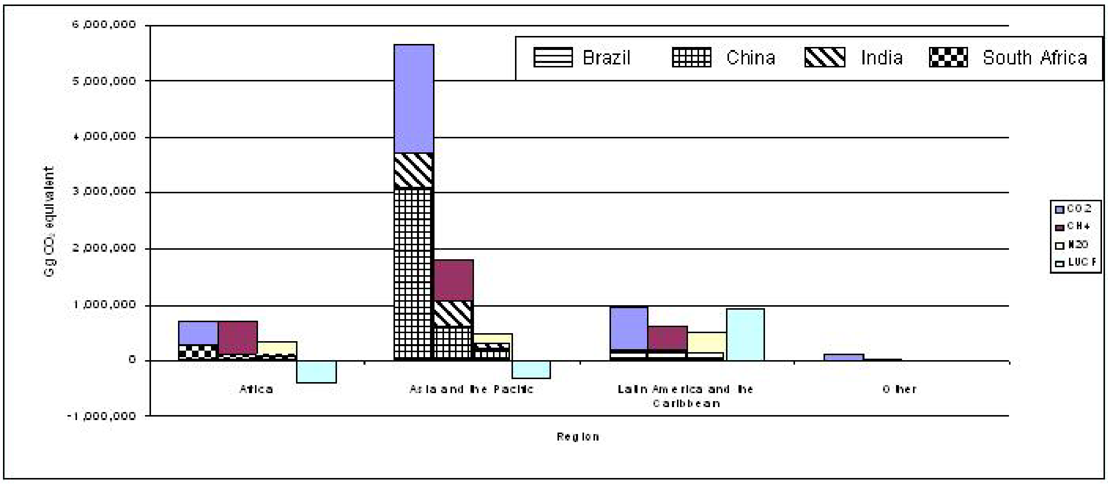
UNFCCC UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE 7

Emissions (excluding LUCF) for three gases

Party	CO_2	CH_4	N_2O
		Gg	
ASIA AND THE PACIFIC			
Cambodia	1 321.93	370.15	11.83
China	3 073 469.00	34 287.00	851.00
India	779 348.00	18 076.00	178.40
Indonesia	178 215.42	6 041.96	58.60
Lao People's Democratic Republic	414.90	305.45	0.12
Malaysia	89 388.00	2 230.93	0.40
Mongolia	9 479.40	269.00	0.10
Philippines	57 932.00	1 377.71	45.17
Republic of Korea	256 514.00	1 361.80	14.02
Singapore	26 800.18	-	0.19
Thailand	141 453.20	3 111.18	55.45
Viet Nam	25 382.79	2 328.29	32.82
Total Asia and the Pacific	5 661 993.80	85 242.75	1 540.64
Total 122 non-Annex I Parties	7 402 705.22	144 028.08	4 219.81

UNFCCC UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE 8

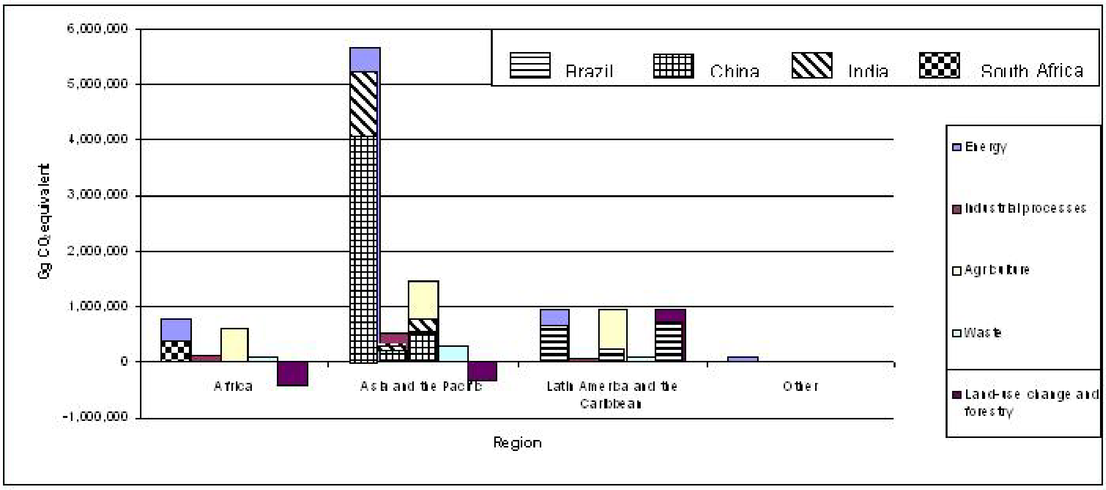
Aggregate GHG emissions and removals by gas by region (Gg CO_2 equivalent)for the year 1994 or the closest year reported



UNFCCC UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE 9

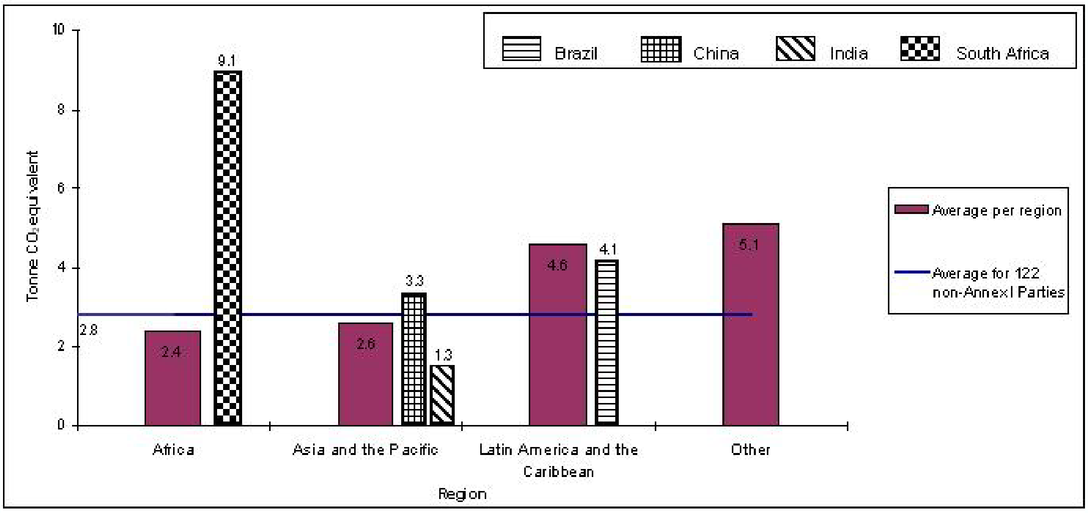
Aggregate GHG emissions and removals by sector by region (Gg CO_2 equivalent)

for the year 1994 or the closest year reported



UNFCCC UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE 10

Per capita GHG emissions (tonnes CO_2 equivalent (excluding LUCF)) for the year 1994 or the closest year reported



Conclusion

- New guidelines for national communications (decision 17/CP.8) http://unfccc.int/resource/docs/cop8/07a02.pdf#page=2
- The UNFCCC "User Manual" explaining the new guidelines for national communications http://unfccc.int/files/essential_background/application/pdf/userman_nc.pdf
- The CGE hands-on training material on GHG inventories http://unfccc.int/resource/cd_roms/na1/ghg_inventories/index.htm
- The UNFCCC software for national GHG inventories http://unfccc.int/resource/cd_roms/na1/ghg_inventories/index.htm
- The CGE report to be presented at SBI 24

Overview and Schedule for Session II

Prepared by the WGIA Secretariat
umemiya.chisa@nies.go.jp

The 3rd Workshop on GHG Inventories in Asia Region

Manila, Feb. 23-24, 2006

Working Group Info.

WG	# of Participants*	Chair / Reporter	Room
Energy	8	Mr. Aizawa / Ms. Tummakird	Here: *Rigodon* / *Recto* (2F)
Agriculture	8	Dr. Punsalmaa / Mr. Sengchandala	
LULUCF	5	Dr. Bore / Ms. Umemiya	*Hernandez* (2F)
Waste	6	Dr. Towprayoon/ Dr. Gao	*Sionil Jose* (2F)

(As of Feb. 20, 2006)

Objectives

1. To specify the features of inventory development of the specific sector in Asia, by creating the list of country's good practices and challenges
2. To prepare one presentation on the summary of discussion made in that group

To be presented in the Session III tomorrow by the WG Reporter

Basic Structure

Part A	•Presentations on the country's good practices, as indicated on the guidance •Listeners will fill the worksheet for each
Part B	•Discussion challenges to be tackled and possible solutions •Some discussion topics were submitted earlier
Part C	•Summary of discussion •Completion of a presentation material

Based on the worksheets filled

Expected Output

- One 7-minute presentation on the summary of discussion, outlined like:
  - ✓Overview
  - ✓List of good practices and their features
  - ✓List of challenges and possible solutions
  - ✓Other things discussed
  - ✓Summary/Conclusion

If possible, please submit the presentation file to me after the session today

Thank you!

Rooms are as follows:

WG	Room
Energy	Here (Rigodon I)
Agriculture	Recto (2F)
LULUCF	Hernandez (2F)
Waste	Sionil Jose (2F)

ⅰ) Presentations

Session Ⅱ

Pusat Tenaga Malaysia

Sustainable Energy Development

The Development of GHG Inventory for Energy Sector & Industrial Processes - Malaysia

by Siti Indati Mustapa
Pusat Tenaga Malaysia

Manila, Philippines
23 March 2006

Save Energy for Our Future Generation

Outline

- Background of the Study
- Data collection methodology
- Discussion by Sectors
  - Approach and estimation used in the GHG Inventory
  - Emission calculation methodology used in the inventory (Tier 1, Tier 2 and Tier 3)
  - Issues and challenges faced in the development of the inventory
- Recommendations to improve GHG inventory preparation

Pusat Tenaga Malaysia

National Communication 2 (NC2)

- Under the NRE obligations
  - Sets out national inventory of GHGs and the assessment of the possible impacts of climate change, and makes suggestions for possible initiatives to address this issue.

- Members for NC2 is MEWC, MITI, MOA,DOS, FRIM, DOE, PTM, MARDI,UPM etc.

MEWC – Ministry of Energy, Water and Communications
MITI – Ministry of International Trade and Industry
MOA – Ministry of Agriculture
DOS – Department of Statistic
FRIM – Forest Research Institute
DOE - Department of Environment
PTM – Pusat Tenaga Malaysia
MARDI – Malaysian Agricultural Research and Development Institute
UPM – University Putra Malaysia

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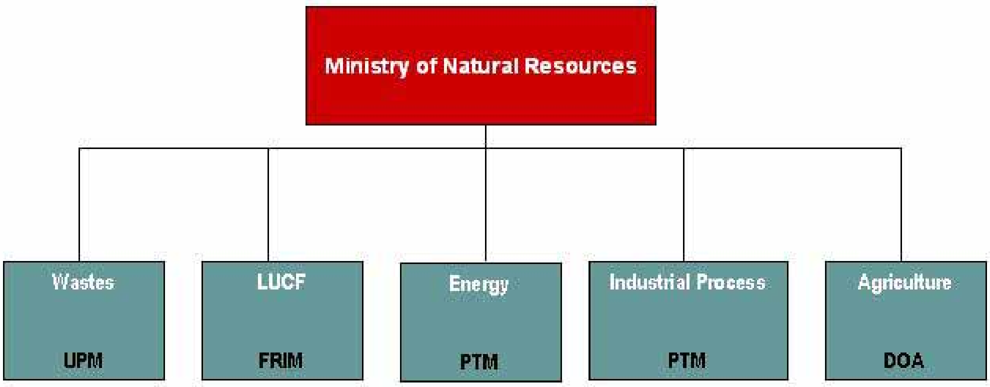
Country's Structure



UPM – Universiti Putra Malaysia
FRIM – Forest Research Institute
PTM – Pusat Tenaga Malaysia
DOA – Department of Agriculture

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GHG Inventory Project

- PTM has been assigned to undertake the inventory part for energy and industrial processes
- In line with the 1996 IPCC guidelines, emissions are estimated from major sources of the following categories:
  - Energy – fuel combustion
  - Industrial processes
- Three priority GHGs will be estimated, namely carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O).

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Objective of the Study

Principle Objective:

- To assess the current status and develop the GHG inventories in Malaysia energy sector

Other Objectives:

- In support of the Second National Communication development
- Emission baseline for energy sector
- Establish GHG database management system

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Scope of the Inventory

The scope of the study shall include:

i. Inventories in Energy Sector i.e. Power, Transport (Aviation, Road, Rail, Navigation) Industry, Residential, Commercial and Non-energy

ii. Inventories in Industrial processes (metal, chemical & mineral)

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Project Output

- Report on the GHGs Inventory in the energy sector in Malaysia
  - Development of data collection method (base year 2000)
  - Input to IPCC Guideline
  - Development of GHG Inventory
- Suggestions for areas of improvement in the preparation of the GHG Inventory

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Project Activities

1. Establishing methodology to be used
   - Review of data requirement (Revised 1996 IPCC Guidelines)

2. Data listing and data collection
   - Development of GHG database
   - Development of data collection method
   - Data collection activities

3. Data input in IPCC Worksheet
   - Analyze data based on data input

4. Analyses & Recommendation
   - Areas of improvement in the preparation of the GHG Inventory

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Establishment of Methodology

- Review of 3 different methodologies have been undertaken
  - Tier 1, Tier 2 and Tier 3
- The Tier 1 Methodology Revised IPCC 1996 Guidelines was chosen based on study conducted with DANIDA
- Review of NEB has been made – to find out the level of detail of data available to be used in the GHG Inventory
  - NEB data used for the Reference Approach
  - No details on each of the end-use sectors e.g. for transport, no indication if the fuel is for road transport or rail transport

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Methodological Framework

PTM Malaysia Energy Centre

- Tier 1 methods rely on widely available fuel data
- Tier 2 methods may be regarded as those dividing fuel consumption on the basis of sample or engineering knowledge between technology types which are sufficiently homogenous to permit the use of representative emission factors
- Tier 3 methods generally estimate emissions from activity figures (km travelled or ton x km carried, not fuel cons.) and specific fuel efficiency or fuel rates or, alternatively, using an EF expressed directly in terms of a unit of activity.

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Data Collection Strategy

PTM Malaysia Energy Centre

- Initial contact with data provider
- Follow up with written data request – example: table with indication of default value
- Follow up with telephone call, visit

Support data collection with

- letter explaining GHG-inventory
- Supporting letter from NRE

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ENERGY SECTOR

Identification of GHG Sources

Malaysia Energy Centre

- For the inventory, emissions from energy sector are estimated from the following categories/sources:
  - Fuel Combustion
  - Fugitive Emissions from Coal Mining
  - Fugitive Emissions from Oil and Gas System
  - Burning of biomass fuel in energy industries sector
  - GHGs that need to be addressed are CO_2, CH_4 and N_2O

Structure of Methodology

Ptm Malaysia Energy Centre

- Tier 1 structure is used which relies on widely available fuel data
  - Reference Approach
    - Top down approach
    - Fundamental: overall energy balance
  - Sectoral Approach
    - Bottom up approach
    - Fundamental: energy consumption for sectors
    - Default Emission Factors or national/sector specific Emission Factors
- **Base year : 2000**

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Structure of Methodology (Cont'd)

Ptm Malaysia Energy Centre

- Reference Approach/Sectoral Approach (CO_2)
  - Step 1: Estimate apparent/sectoral fuel consumption in original unit
  - Step 2: Convert to a common energy unit
  - Step 3: Multiply by emission factors to compute the carbon content
  - Step 4: Compute carbon stored
  - Step 5: Correct for carbon un-oxidised
  - Step 6: Convert carbon oxidised to CO_2 - emissions

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Structure of Methodology (Cont'd)

- Sectoral approach (Tier 1: CH_4, N_2O, NOx, CO, NMVOC and SO_2)
  - Step 1: Estimate annual fuel consumption per sector in energy units
  - Step 2: Estimate emission factors for each gas
  - Step 3: Estimate the emission for each gas
  - Estimate EF for SO_2 from S-content of fuel

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Data Requirement

Tier 1

- Fuel consumption based on type of fuel
- Fuel consumption aggregated (coal, natural gas, oil, etc.)
- Default Emission Factors (IPCC 1996 Guidelines)

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Preliminary Result

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ENERGY SECTOR

		1994	2000	Increase (%)
GDP at 1987 prices	million RM	153,881	209,365	36%
Population	'000	20,112	23,275	16%
Apparent energy consumption	ktoe	31,858	54,135	70%
CO_2 emission per capita	ton/capita	4.195	5.782	38%
CO_2 emission (Reference approach)	Gg CO_2	84,415	140,110	66%

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Result from NC1

Ptm Malaysia Energy Centre

Sources & Sinks	1994					
	CO_2		CH_4		N_2O	
Categories	Gg	%	Gg	%	Gg	%
Total National Emissions	**144,314**					
a.Fuel Combustion	84,415	86.7				
b. Fugitive Emissions from Fuel			593	26.6		
c. Fugitive Emission from Biomass Fuels			42	1.9	0.35	86.4

% derived from total emissions by total categories in NC1

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Preliminary Result (NC2)

PTM Malaysia Energy Centre

Sources	2000		
	CO_2	CH_4	N_2O
Categories	**Gg**	**Gg**	**Gg**
Total National Emissions	**140,110**		
Reference Approach	140,110		
Sectoral Approach	130,747		
a. Fuel Combustion	130,747		
b. Fugitive Emissions from Fuel		1,199	
c. Fugitive Emission from Biomass Fuels			8.12

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Issues & Challenges

PTM Malaysia Energy Centre

Energy Sector (esp. for Sectoral Approach)

1. Unavailability of relevant data e.g. data for fuel consumption in transport, agriculture sector
2. Data are scattered around in many organizations; hence, time-consuming to compile the data
3. Delays in receiving data from relevant agencies
4. Further info required, that include:
   - Fuel Consumption for domestic/international aviation and maritime (navigation)
   - Fuel Consumption for railways, pipeline transport
   - Fuel Consumption for agriculture/forestry/fishery sector segregation between mobile and stationary sources

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Sustainable Energy Development

INDUSTRIAL PROCESSES

Save Energy for Our Future Generation

Identification of GHG Sources

- Emissions from industrial processes are identified from the following sources:
  - Mineral Production and Use
  - Chemical Production and Use
  - Metal Production
  - Halocarbons (e.g. HFCs, PFCs) Production and Use
  - Others sources (e.g. Pulp & Papers, Food & drink production)
- Data required for inventory
  - The GHGs that need to be addressed are CO_2, CH_4 and N_2O
  - Encouraged to report the halocarbons emissions
  - Optional to address other GHG emissions depending on availability of data

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Structure of Methodology

- The Tier 1 Methodology of Revised 1996 IPCC Guidelines will be used
  - based on recent PTM/DANIDA study on GHG Inventory - Industrial Processes
- Review of publications has been made – to assess the availability of data to be used in the inventory
- Surveys on industries are necessary to support the readily available data from publications or studies
- Assumptions will be made depending on the processes in the relevant industries

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Data Sources

Sources	Necessary data required	Comments
Department of Statistics	•Statistics of production, import and export data of minerals •Information on production of specific chemical substances	•Dept. of Statistic doesn't cover all the products
Department of Minerals & Geosciences	•Information on extraction of minerals •Information on consumption of minerals •Production of metals	Mineral Yearbooks and other relevant publications available
Ministry for International Trade and Industry	Statistics imports and export •HFCs/PFCs/SF6 •Chemicals	Statistics are in RM value
Department of Environment	•Production/Import/Export of HFCs/PFCs •Producers of HFCs/PFCs •Legal requirements to producers •Information on products containing halocarbons	Any studies in DOE for past 15 years may help to get the relevant data
Companies producing the minerals, metals, chemicals, halocarbons and others e.g. PETRONAS	Processes in the plant to get the most relevant data	

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Issues & Challenges

PTM Malaysia Energy Centre

Industrial Processes

- Lack of information on industrial processes relevant to GHG emissions
- Delays in receiving data from relevant agencies
- Data are scattered around in many organizations; hence, time-consuming to compile the data
- The published data are different from one source to another for the same year

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Sustainable Energy Development

Conclusions

Save Energy for Our Future Generation

PTM

Conclusions

Ptm Malaysia Energy Centre

- Fundamental issues on data collection still to be addressed
- Need to establish effective networking with data/information providers
- Capacity building for data providers
- Need to establish a central data repository, specifically to cater to GHG inventory needs

Notwithstanding the abovementioned, much progress has been made in the GHG inventory exercise

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Recommendations

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- Focal point for data collection/collation
  - Energy Databank – PTM
  - Other Data – Statistics Department, Counterparts involved
  - Establish cooperation with data providers
  - Establish format (methodology) of data sheet for data collection
- Implementing Authority
  - Providing info is made mandatory
  - Use existing regulations from authorities e.g. Dept. of Environment, Statistics department to add in extra info required in the IPCC guidelines
- Regular Updates
  - Required to ensure sustainability of GHG Inventory
  - Monitoring of emissions level in Malaysia

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Thank You

Ptm
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Japan's country-specific EFs for the CO_2 emissions from fuel combustion

Energy Breakout Group
#3 WGIA: Workshop for GHGs Inventories in Asia
2006. Feb. 23

Tomoyuki AIZAWA
GHGs Inventory Office of Japan (GIO)
National Institute for Environmental Studies (NIES)

1

Outline

GHGs Inventory Office of Japan
Center for Global Environmental Research

1. The Most Important GHGs Source in Japan
2. History of Methods Development 1A CO_2
3. Collaboration between Energy Agency and Inventory Agency
4. Case of Oil Refinery
5. Case of Iron & Steel
6. Summary of the cases
7. Conclusions

2

1. The Most Important GHGs Source in Japan (1)

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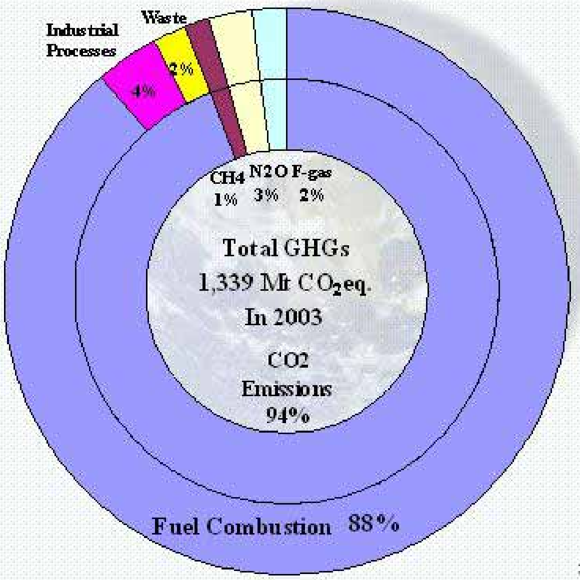
Center for Global Environmental Research

- Japan's GHGs Emissions in 2003
- CO_2 is the largest GHGs
- Regarding to CO_2 , the largest source is Fuel Combustion



3

1. The Most Important GHGs Source in Japan (2)

GHGs Inventory Office of Japan
Center for Global Environmental Research

- CO_2 from fuel combustion is only one increasing source

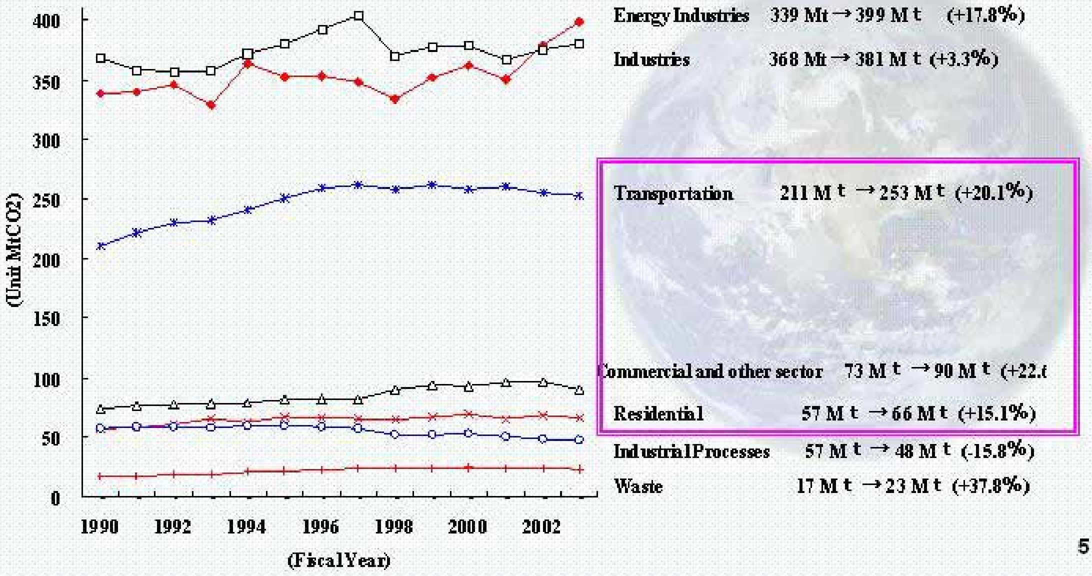
		Base Year of KP	2003	vs B.Y.
Total		1,237.0	1,339.1	(+8.3%)
CO_2	Fuel Combustion	1,048.3	1,188.1	(+13.3%)
	other than F.C.	73.9	71.3	(-3.5%)
CH_4		24.8	19.3	(-22.3%)
N_2O		40.2	34.6	(-13.9%)
HFCs		20.2	12.3	(-39.2%)
PFSs		12.6	9.0	(-28.2%)
SF_6		16.9	4.5	(-73.6%)

4

1. The Most Important GHGs Source in Japan (3)

GHGs Inventory Office of Japan
Center for Global Environmental Research

➢ CO_2 emissions by sector



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1. The Most Important GHGs Source in Japan (4)

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Center for Global Environmental Research

➢ CO_2 Emissions from Fuel Combustion is the most important source

➢ Accurate and Transparent Inventory is needed

- Accurate estimation
  - knowing effect of each counter measure
  - reviewing the effort of each stakeholder
- Making with Transparent manner
  - having Accountability
  - establishing the basis of burden sharing among domestic stakeholders

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2. History of Methods Development 1A CO_2

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Year	Event	EF	Activity Data		Uncertainty	
			Calorific Value	Energy Stats	Total	Sector
1992	MOE study on CO_2 emissions	EF ver'92	CV ver'75	former EB	3%	over 10%
1994	#1 National Communications	↓	↓	↓	↓	↓
1997	#2 National Communications	↓	↓	↓	↓	↓
	COP3+KP	↓	↓	↓	↓	↓
2000	Revision of CV by Energy Agency	↓	CV ver'00	↓	↓	↓
2001	Revision of Energy Stats by EA	↓	↓	new EB ver'00	1%	under 10%
2002	(MOE study on EF)	(EF ver'02)*not to be addopted		↓	↓	↓
	Japan's acception of the KP	↓	↓	↓	↓	↓
2003	In Country Visit (Review)	EF ver'92	CV ver'00	↓	↓	↓
2004	Revision of Energy Stats by EA	↓	annual CV	new EB ver'01	↓	under 5%
2006	EA & MOE study on EF	EF ver'06	↓	↓	↓	↓

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3. Difficulties of Methodology Development in CO_2 from Fuel Combustion

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Center for Global Environmental Research

- **EF (Emission Factor)**
  - Representativeness: difficulties of sampling (especially coal)
- **AD (Activity Data)**
  - Resolution of Statistics
  - Mass Balance, Energy Balance, Carbon Balance
  - Off gas, by-product gas
    in Japan, many kind of by-products are used as fuel or feedstocks
    for effective use of natural resources,
    so called *CASCADE ENERGY USE*
- **Estimation**
  - Sectoral Approach vs. Reference Approach

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4. Collaboration between Energy Agency and Inventory Agency

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Center for Global Environmental Research

- In 2002 MOE's study,
  Unbalance of Energy Balance Table was found.

- These unbalance was observed in 2 processes;
  1. Oil Refinery, 2. Solid Fuel Transformation.
  This assessment was based on material balance.

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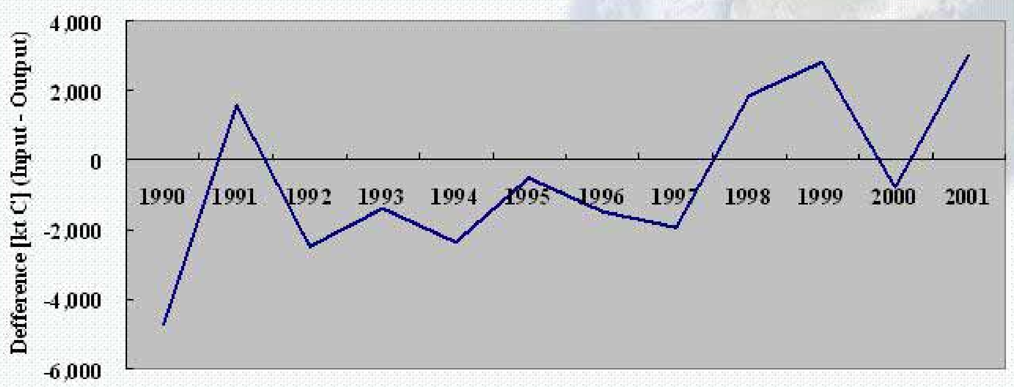
5. Case of Oil Refinery (1)

GHGs Inventory Office of Japan
Center for Global Environmental Research

- In Oil Refinery sector of new EB ver.0,
  yield ratio (Products / Feedstocks) was fluctuated.
- Positive value means carbon production more than carbon contained in crude oil input.



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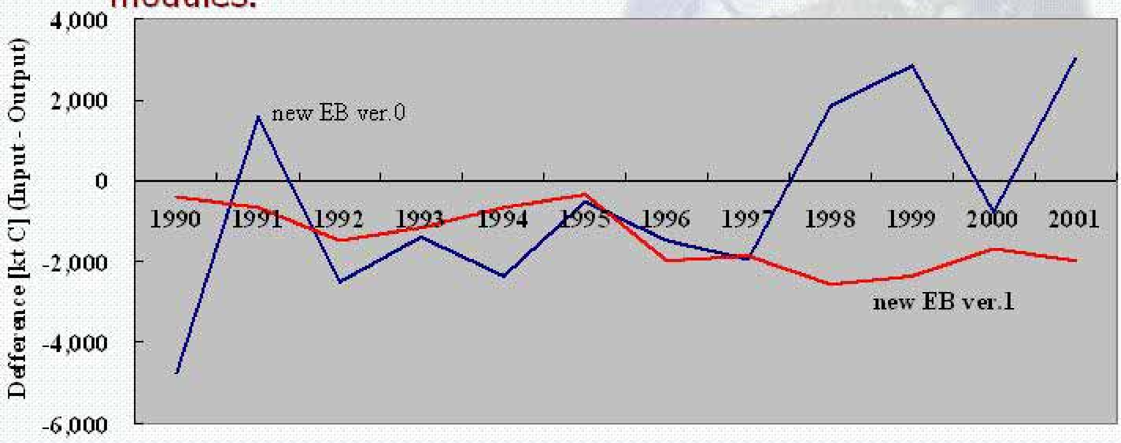
5. Case of Oil Refinery (2)

GHGs Inventory Office of Japan
Center for Global Environmental Research

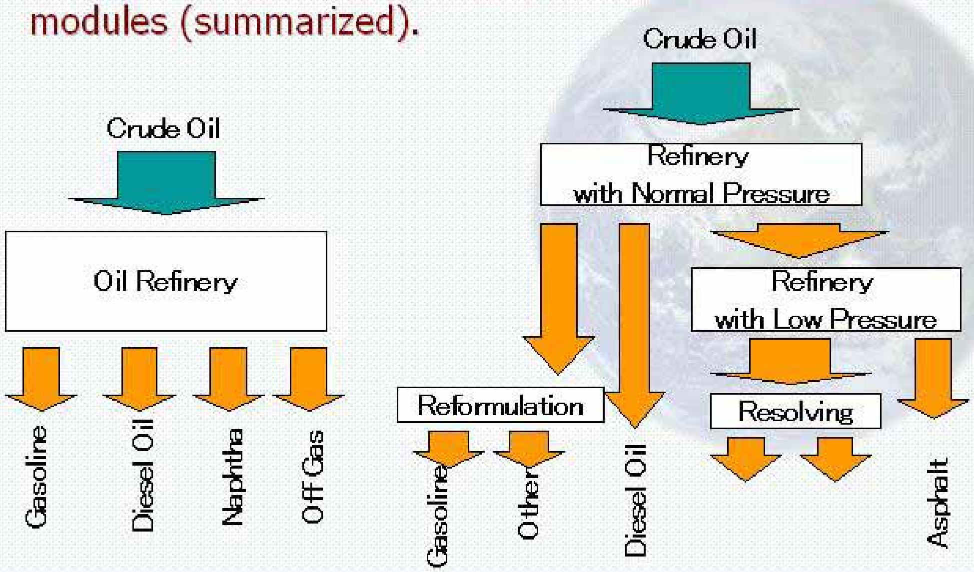
- Committee of MOE pointed out this point, and Energy Agency revised their stats to new EB ver.1.
- EA modified their model from 1 module to 4 deferent modules.



5. Case of Oil Refinery (2)

GHGs Inventory Office of Japan
Center for Global Environmental Research

- EA modified their model from 1 module to 4 deferent modules (summarized).



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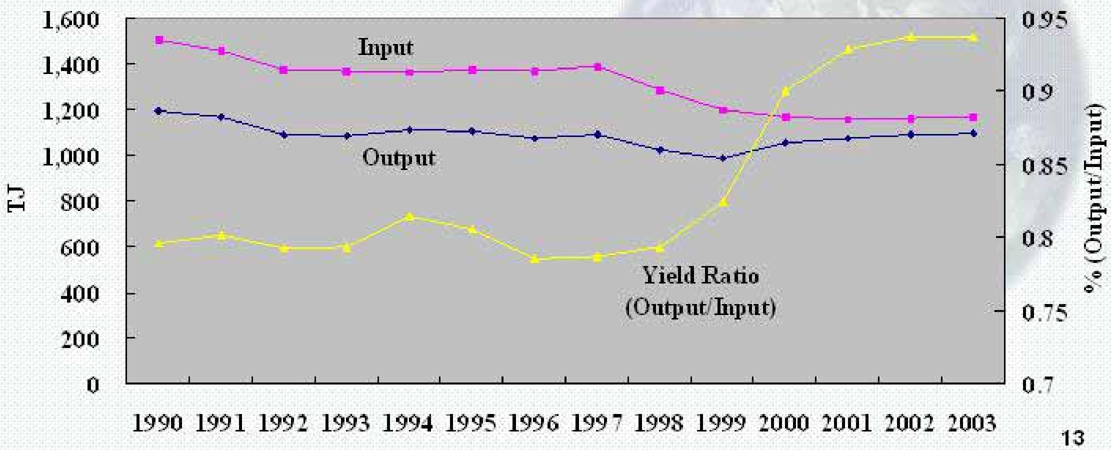
6. Case of Iron & Steel (1)

GHGs Inventory Office of Japan
Center for Global Environmental Research

- In Iron & Steel sector (coke production & BFG production) of new EB ver.0, yield ratio was too low in early years.



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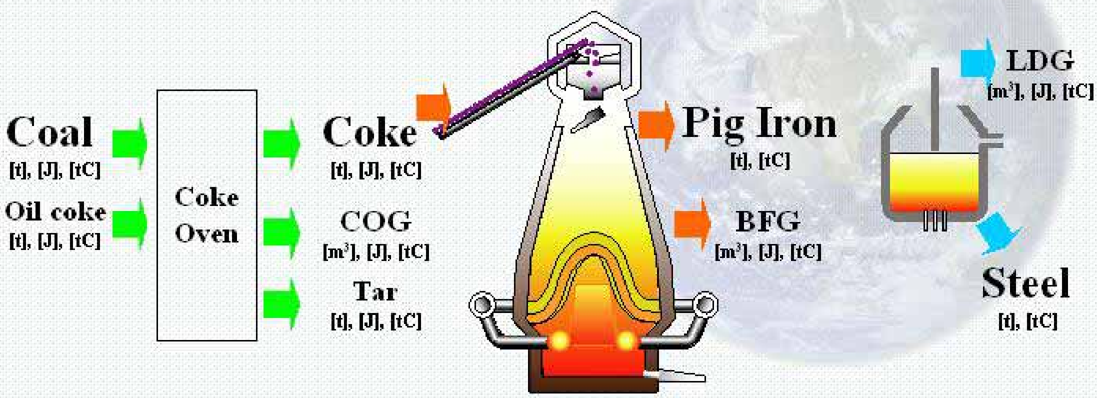
6. Case of Iron & Steel (2)

GHGs Inventory Office of Japan
Center for Global Environmental Research

- In Iron & Steel sector, Fate of Carbon is complicated.
- This issue is still under consideration.



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7. Summary of the cases

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Center for Global Environmental Research

- Assessment by deferent entities are effective
- Based on balance approach,
  1. Mass should be balanced
  2. Carbon should be balanced
  3. Energy almost be balanced ex. Energy-losses.

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7. Conclusion

GHGs Inventory Office of Japan
Center for Global Environmental Research

- In the sector "CO_2 from fuel combustion", methodology development EF and AD, one after the other
- Assessment by deferent entities are effective
- These processes enhanced understanding scientific aspects of GHG inventories.
- These processes made good and strong relationship among stakeholders.

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Thank you for your attention !!
http://www-gio.nies.go.jp/
17

GHG Emission Factors Developed for the Energy Sector in India

Energy Breakout Group

3rd WGIA: Workshop for GHG Inventories in Asia

February 23-24, Manila. Phillipines

Sumana Bhattacharya

National Communication Project Management Cell

Ministry of Environment and Forests,

Government of India

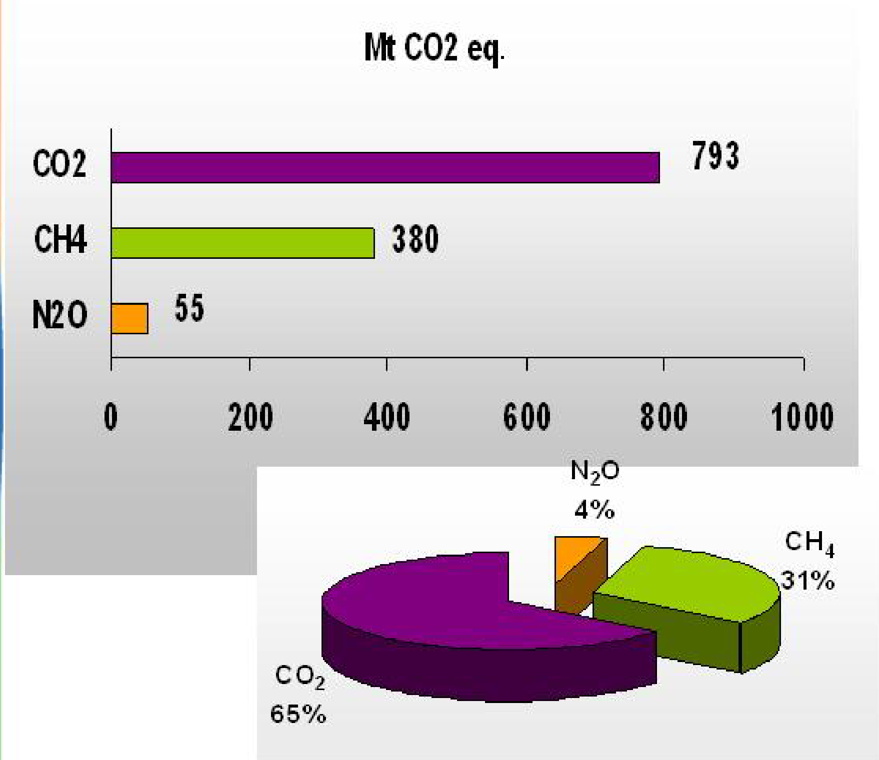
Natcom

GHG Emissions from Sources and Removals by Sinks

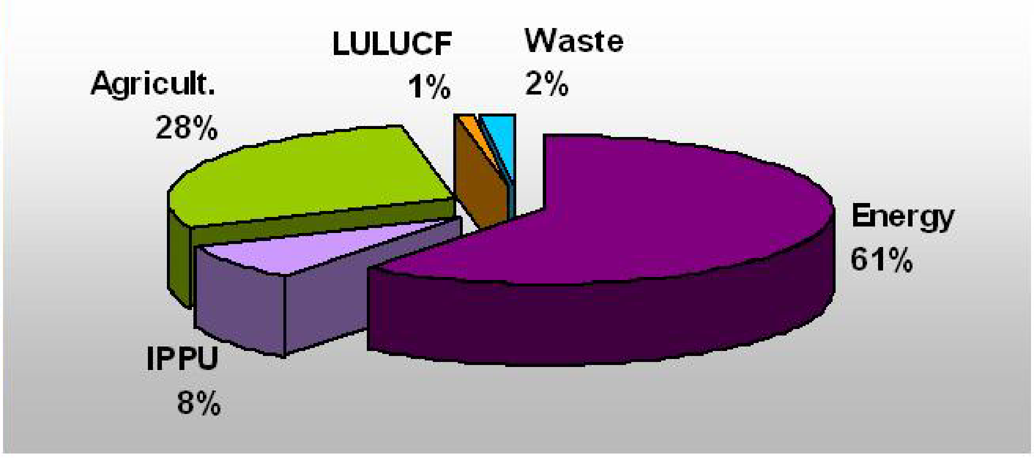
Total National Emissions (Gg/yr)	CO2 Emissions	CO2 Removals	CH4	N2O	CO2-eq.
All Energy	679470		2896	11.4	743820
Industrial Processes	99878		2	9	102710
Agriculture			14175	151	344485
LULUCF	37675	23533	0.04		14292
Waste			1003	7	23233
Bunker fuels	3373				3373
Total Emissions	817023	23533	18083	178	1228540

Natcom

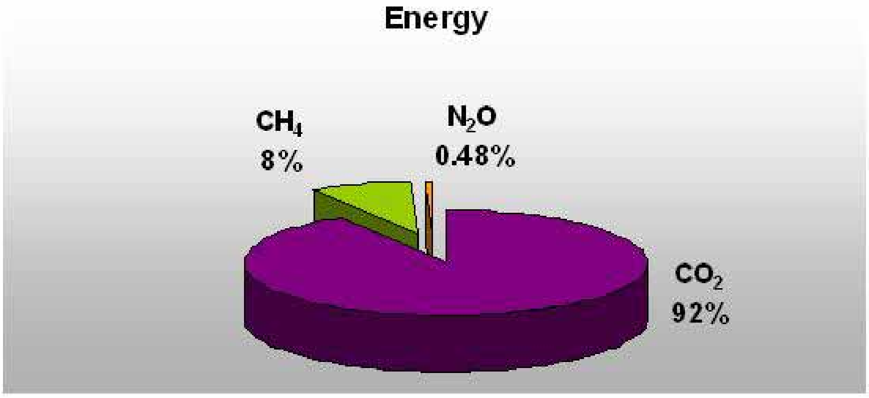
GHG Emission Distribution in India



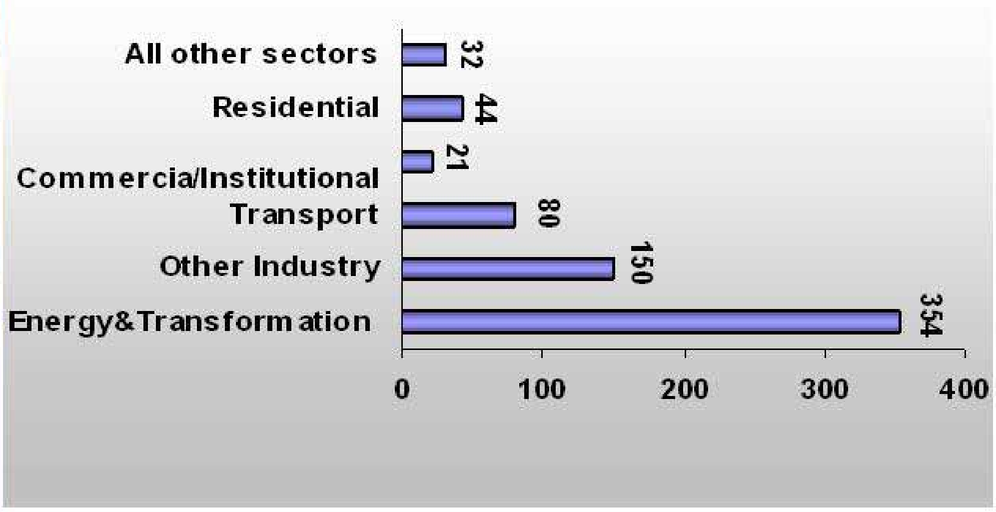
Sectoral GHG Emissions Distribution



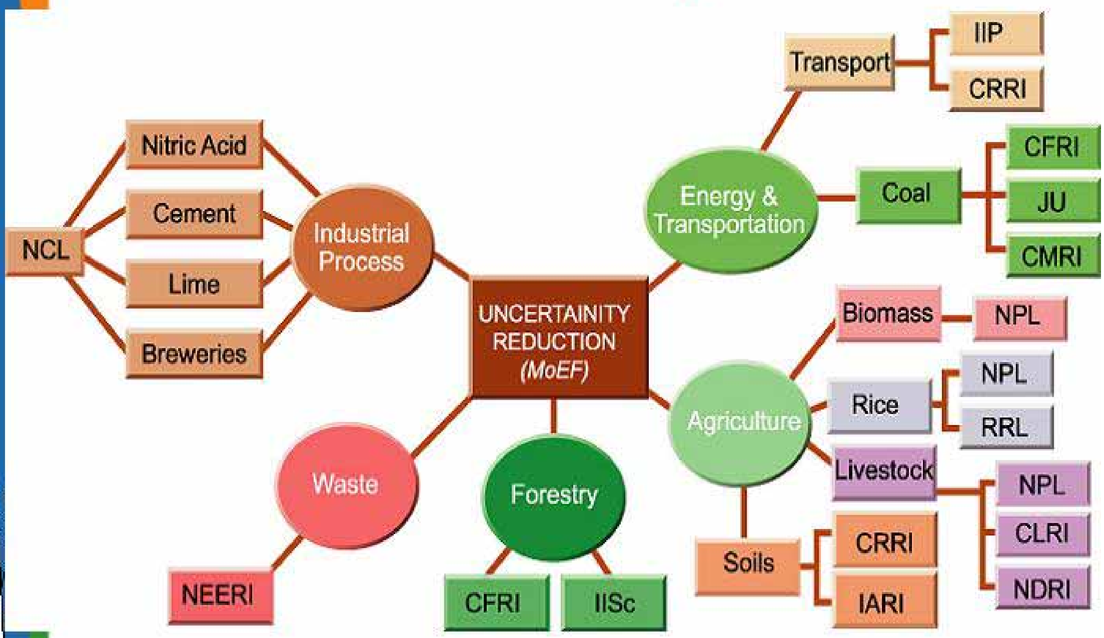
GHG Emission Distribution within Energy Sector



CO2 Emissions by Categories in the Energy Sector (Mt)



Institutional Arrangement



17 Institutions

Some of the proposed activities for developing GHG inventories in the Energy Sector

Development of an energy balance matrix to ascertain energy flow across sectors

Measurement of Plant specific CO2 EF

Refine NCV of coking, non coking and lignite consumed in thermal power plants

Refine the GHG emission estimates from the road transport sector

Develop methodology to generate data related to oil and natural gas venting, flaring, transmission and distribution

Key Category Analysis – Level Analysis

Sources of emission	CO_2 equivalent (Gg)	Percentage of total emissions	Cumulative emission (Gg)	Cumulative emission vs total emission (%)	Tier used	EF used
Energy and transformation industries	355,037	28.9	355,037	28.9	Tier II	CS
Enteric fermentation	188,412	15.3	543,449	44.2	Tier III	CS
Fossil fuel combustion in industry	150,674	12.3	694,123	56.5	Tier I	D
Rice cultivation	85,890	7.0	780,013	63.5	Tier III	CS
Transport	80,286	6.5	860,299	70.0	Tier II	CS
Emission from soils	45,260	3.7	905,559	73.7	Tier I	D
Iron and steel production	44445	3.6	950,004	77.3	Tier I	D
Energy use in residential sector	43,918	3.6	993,922	80.9	Tier I	D
Biomass burnt for energy	34,976	2.8	1,028,898	83.7	Tier I	D
All other energy sectors	32,087	2.6	1,060,985	86.4	Tier I	D
Cement production	30,767	2.5	1,091,752	88.9	Tier II	CS
Energy consumed in commercial-institutional	20,571	1.7	1,112,323	90.5	Tier I	D
Manure management	20,176	1.6	1,132,499	92.2	Tier I	D
Ammonia production	14,395	1.2	1,146,894	93.4	Tier I	D
Land use, land-use change and forestry	14,292	1.2	1,161,186	94.5	Tier II	CS

Key Sectors identified in the Energy Sector*

Category	Level analysis	EF Used in INC	SNC Improvement envisaged
Energy and transformation industries	29%	CS	R
Transport	6.5%	CS	R
Iron and steel	3.6%	D	CS

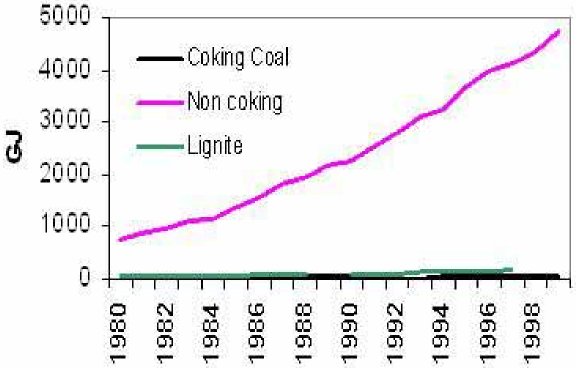
*Considering their high rates of growth in production in the last decade

Coal Consumption

Coal Consumption:

Coal Shall Remain India's Primary Energy Source till 2031-32,

Coal accounts for over 50% of India's commercial energy consumption and some 78% of domestic coal production is dedicated to power generation



It is recommended, to increase coal use efficiency in power generation from the current average of 30.5 percent to 39 percent for all new plants.

Introduction of clean coal technologies, improving energy efficiency, Renewable energy resources, hydro power, and various other measures is bringing down the CO2 emission intensity from this sector.

Country specific EF Developed for Indian Coal

		Emission Factor (EF)	Reference
Indian Coal	NCV TJ/Kt	t CO_2/TJ	Choudhury et al., 2004
Coking coal	24.18±0.3	25.53	
Non-coking coal	19.63±0.4	26.13	
Lignite	9.69±0.4	28.95	

Source of Uncertainties in estimation of CO2 EF from coal combustion

Activity Data

Carbon emission factor

- variation with the rank and type of coal
- Contribution from carbonates in high ash coals

Basis of CO2 emission – NCV/GCV

- assumption of NCV being 5% less than GCV for any coal may not be correct. Variation can be 2% for anthracite to 10% for Lignite.
- may lead to underestimate of CO_2 from low rank and overestimate of CO_2 from high rank coals

Fraction of carbon oxidised

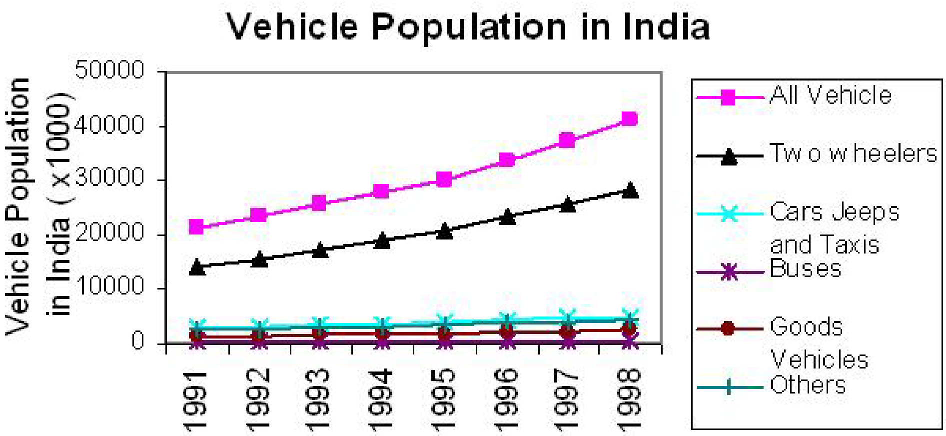
- coal & plant dependent.

Refinement Being Considered for SNC-Combustion of Coal

Category	EF Used in INC	SNC Improvement	Activities proposed	Rationale
Coal	CS	R	Refinement of NCV	Inadequate sample size
Power Plant	-	CS	Determine point source specific CO2, NOX and CO EFs	Thermal power plants- key source

Transport Sector

India has seen a rapid growth in the vehicle population



Transport Sector – e.g. of growth rates in Delhi

S.No.	Category	Vehicles registered (In lakh) 1993-94	Vehicles registered (In lakh) 2003-04	Decadal growth rate % (1993-94 to 2003-04)	Annual Compound Growth rate %
A.	**Private Vehicles**				
	Four wheelers (Cars, Jeeps,St.Wagon)	5.22	12.68	142.92	9.27
ii.	Two wheelers				
	(Scooter, Motorcycle)	14.92	26.50	77.61	5.91
	Sub-Total	20.14	39.18	94.54	6.64
B.	**Commercial Vehicles**				
iii.	Auto-Rickshaw	0.72	0.75	4.17	0.38
iv.	Taxis	0.12	0.16	33.33	3.09
v.	*Buses	0.24	0.39	62.50	4.84
vi.	Goods Vehicle	1.17	1.36	16.24	1.55
	Sub- Total	2.25	2.66	18.22	1.69
	Total	22.39	41.84	86.87	6.45

Country specific EF Developed for Road Transport Sector

		Emission Factor (EF)	Reference
Road Transport sector		TCO/Tj	
Gasoline	2W/3W	43.9 ± 7.3	Singh et al., 2004a, Singhal et al, 2004
	Car/Taxi	61.5 ± 4.0	
Diesel Oil	MCV/HCV	71.4 ± 0.55	
	LCV	71.4 ± 0.5	

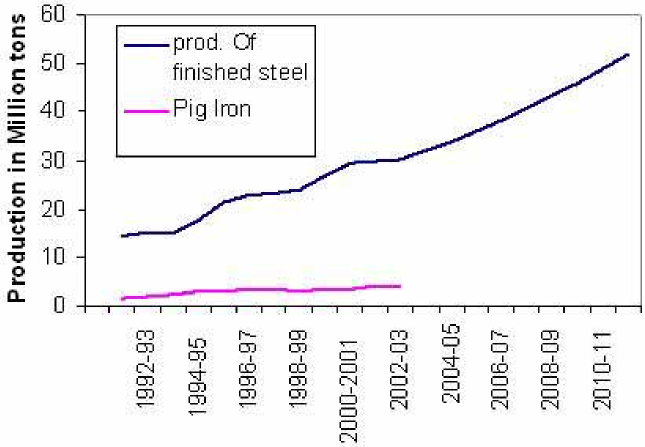
Sources of Uncertainty in the Road Transport Sector

- Activity data
  - The vehicle population by type
  - Diesel/petroleum consumed by each vehicle type
  - Details of other fuel consumed
  - Kilometer traveled by each type of vehicle (reflecting the driving cycle)

Refinement Being Considered for SNC-Transport Sector

Category	EF Used in INC	SNC Improvement	Activities proposed	Rationale
Transport		CS	Surveys to apportion fuel used in various types of vehicles	Reconcile the top down with the bottom up approach
	CS Fuel based	CS	EFs using driving cycle	

Steel Sector



Between 1990-1991, steel prod. Grew by 7.6 % and it is expected to grow by 6.5% per annum upto 2012

However, considering a boom in infrastructure, the prod. Capacity is likley to increase with mega steel prod. Projects coming up

Sources of uncertainty in estimating CO2 EF from steel sector

Emission from reducing agent (coal, coke) in blast furnace (BF), EAF, Sinter Strand

CO2 emission from calcinations of carbonate fluxes in BF, EAF, SS

CO2 emission from steel production in Basic oxygen furnace (BOF) or EAF - Plant specific technologies

Emission from on site combustion of carbon bearing products – Coke oven Gas/ Blast Furnace Gas

Emission due to combustion of other fossil fuel (e.g. from on site power production)

Activities planned for developing CS EF of CO2 from Iron and Steel Sector

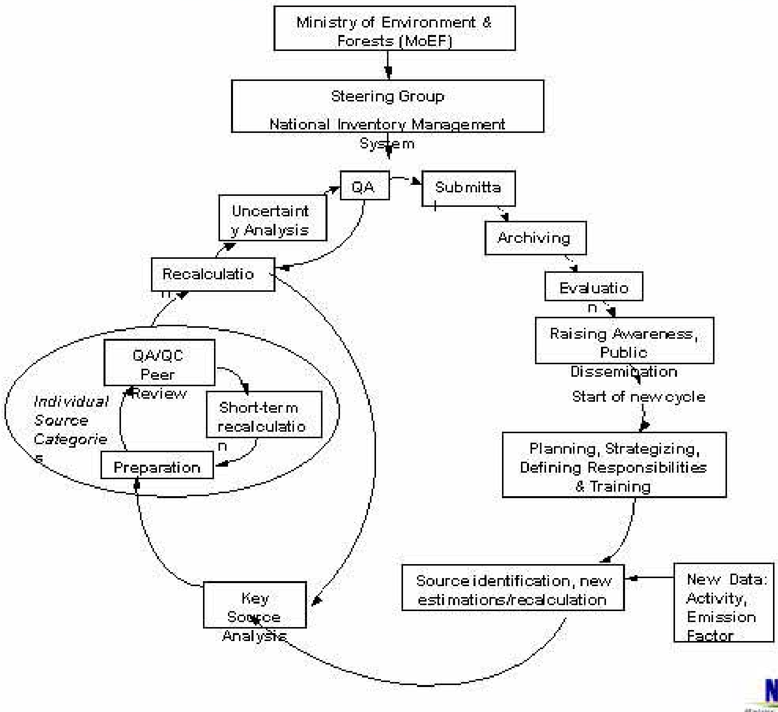
Separate out emissions from

- reducing agent
- calcination of carbonate fluxes
- CO2 emission from technology specific steel production – BOF/ EAF
- Assess emission from on site combustion of carbon bearing products – Coke oven Gas/ Blast Furnace Gas
- Assess emission due to combustion of other fossil fuel (e.g. from on site power production)

Refinement Being Considered for SNC-Iron and Steel Sector

Category	EF Used in INC	SNC Improvement	Activities proposed	Rationale
Iron and Steel	D	CS	Plant specific CO2 EF assessment Assessment of Carbon content of Coke CO2 EF measurement	It is a fast growing sector of the economy in addition to being a major source of CO2 emission

National Inventory Management System



National Inventory Management System

NIMS will address the requirements of documentation, archiving and continuous updating of the databases as well as the QA/QC and uncertainty management issues of the inventory. A separate steering group will be instituted to oversee the operations of the NIMS and provide technical guidance.

- Develop systemic tools and procedures
  - procedures for documenting methodologies,
  - creating a database of emissions factors, activity data and assumptions;
  - data management and collection;
  - strategies for data generation and improvement;
  - systems for data archiving and record keeping;
  - mechanisms for synchronization and cross-feeding between emission inventories, national energy balances and relevant sector surveys;
  - guidance for technical peer reviews, procedures for QA/QC and uncertainty management.

- Design for dissemination of information through web-based management system.

Methane Emission from Thai Paddy Fields by using the Sensor Technique

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King Mongkut's University of Technology Thonburi
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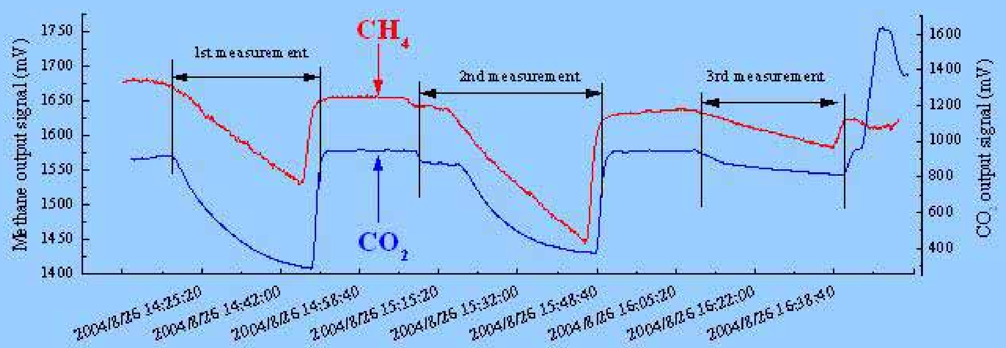
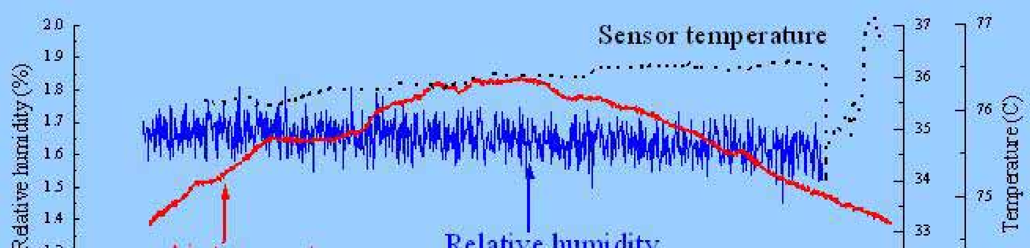
Backgrounds

- APN CAPaBLE GHG Inventory Project; NIES (Japan) and JGSEE (Thailand), 2004-2006
- 2004: Training in Japan
  - Reported in 2nd Workshop on GHG Inventories in Asia Region (WGIA) in Shanghai
- 2005: Measurements in Thailand paddy fields

Portable methane sensor



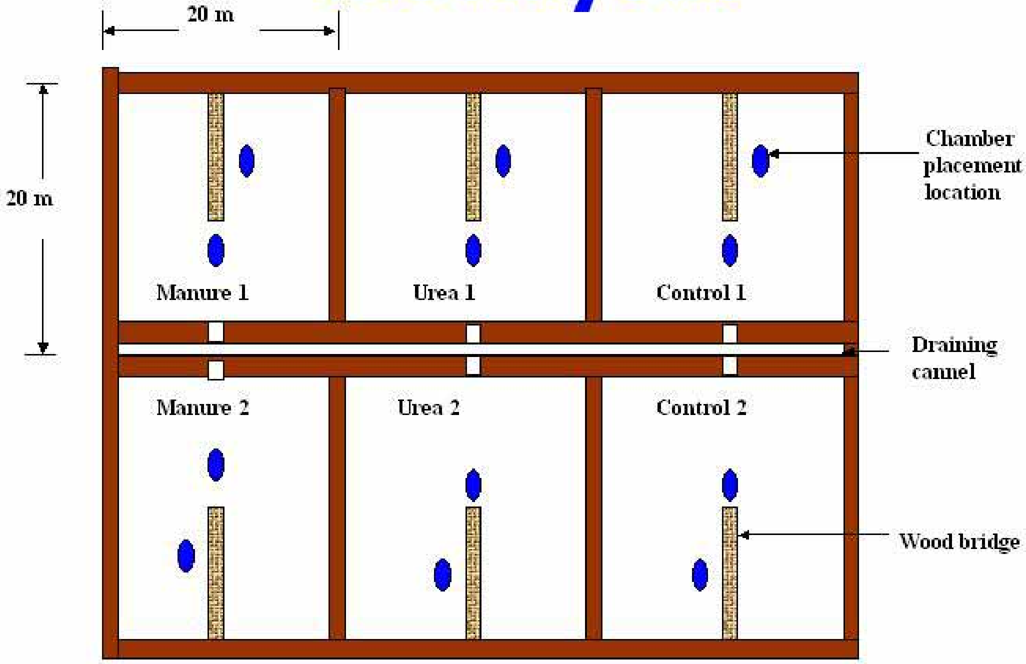


Measurements in Thailand

Experiment Designs

- **Irrigated fields**
- **Continuous flooding**
- **Treatments:**
  - **No fertilizer**
  - **Chemical fertilizer only**
  - **Manure fertilizer only**

Plot layout



- Field preparation for rice cultivation was begun in the end of April 2005.
- Seeds of rice (Rachinee cultivar) were sown by hands on 22 April 2005.
- Chemical fertilizer (urea) was applied on 14 days after seed sowing (DAS) at the rate of 12.5 kg per plot and again on 26 DAS at the same application rate.

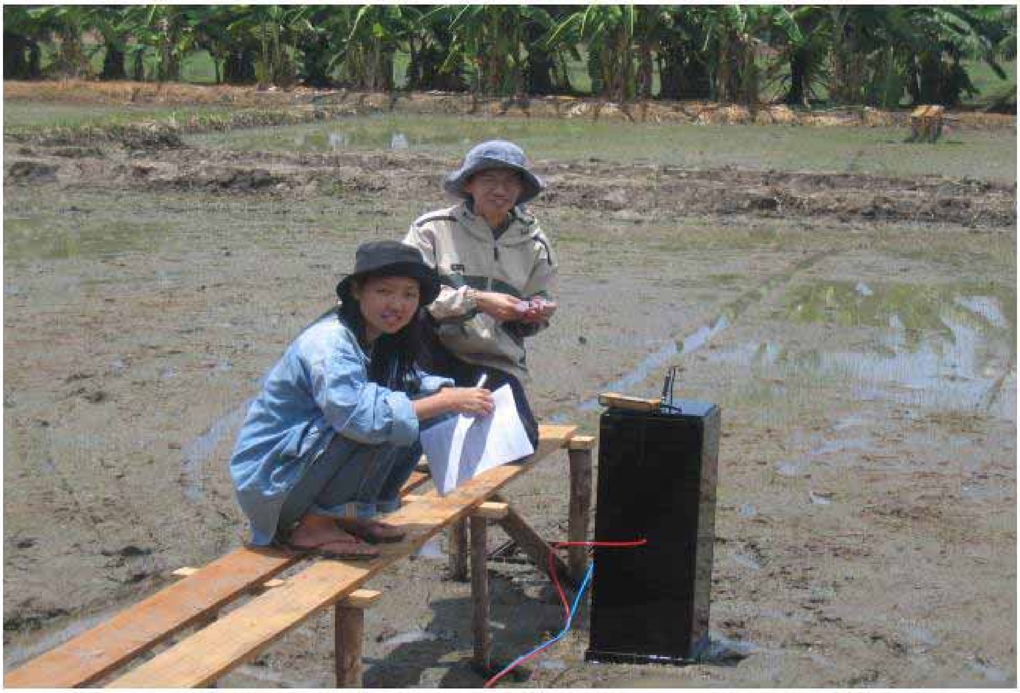
- **Farmyard manure was applied only once at the beginning of rice cultivation at the rate of 45 kg per plot.**
- **Drained water from all fields at the end of growing season on 79 DAS to facilitate harvest by farm machinery**
- **Rice in all treatments was harvested on 30 July 2005 or 99 DAS.**


Six separate plots

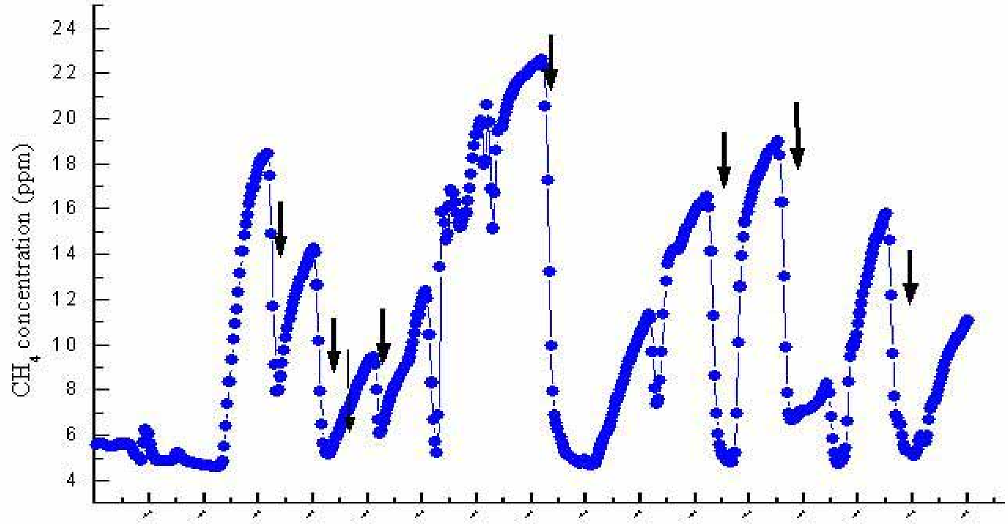

Prepareing the wood bridg


Measurement of CH_4 and CO_2 flux

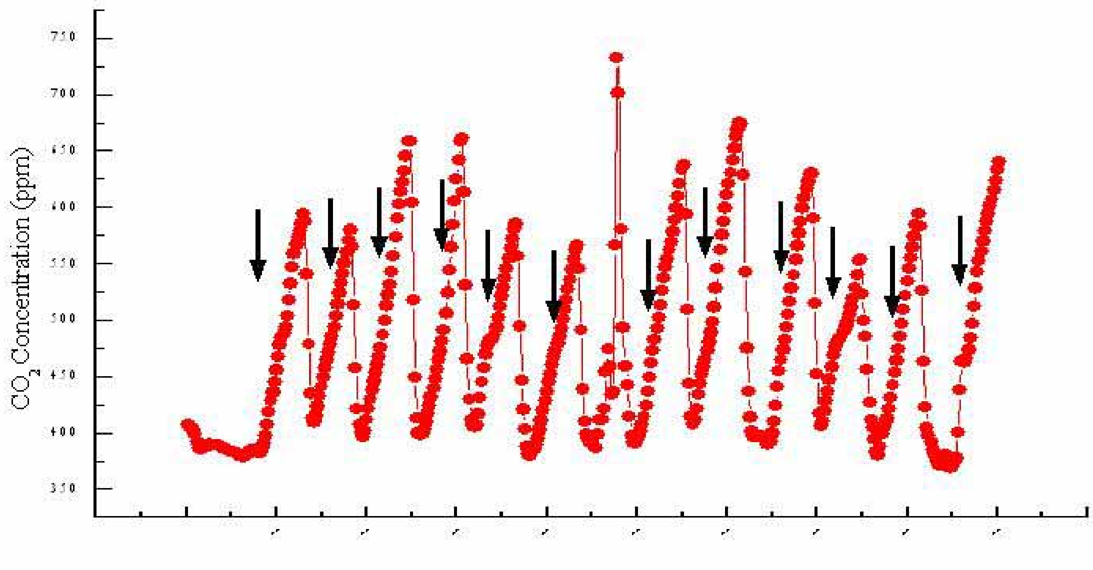

Chamber placement

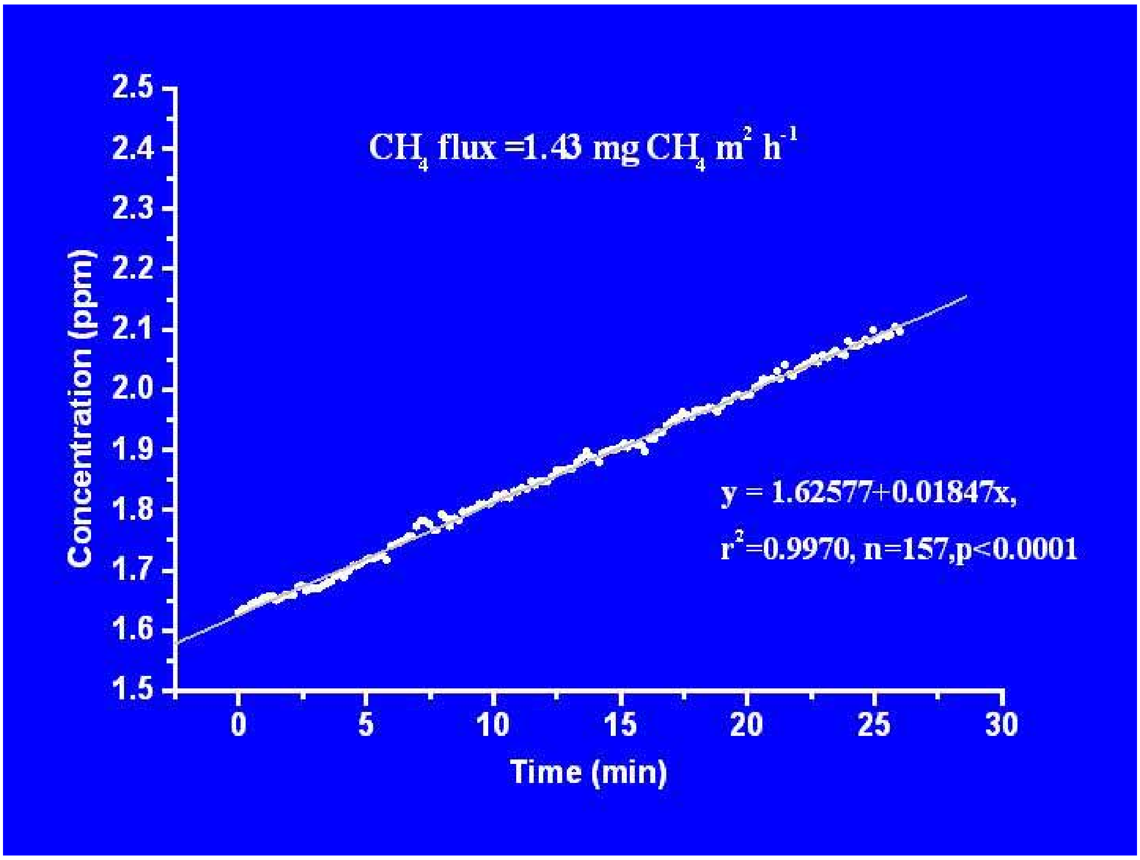


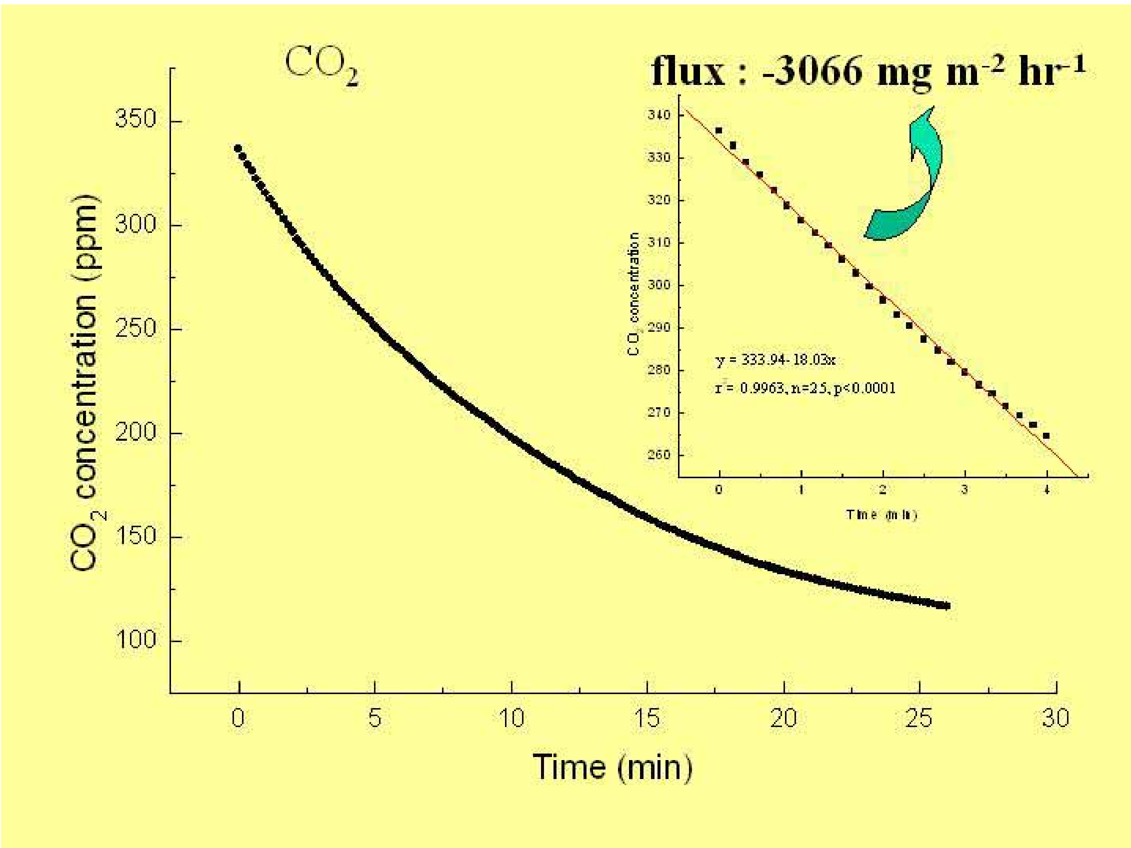
CH_4 measurements

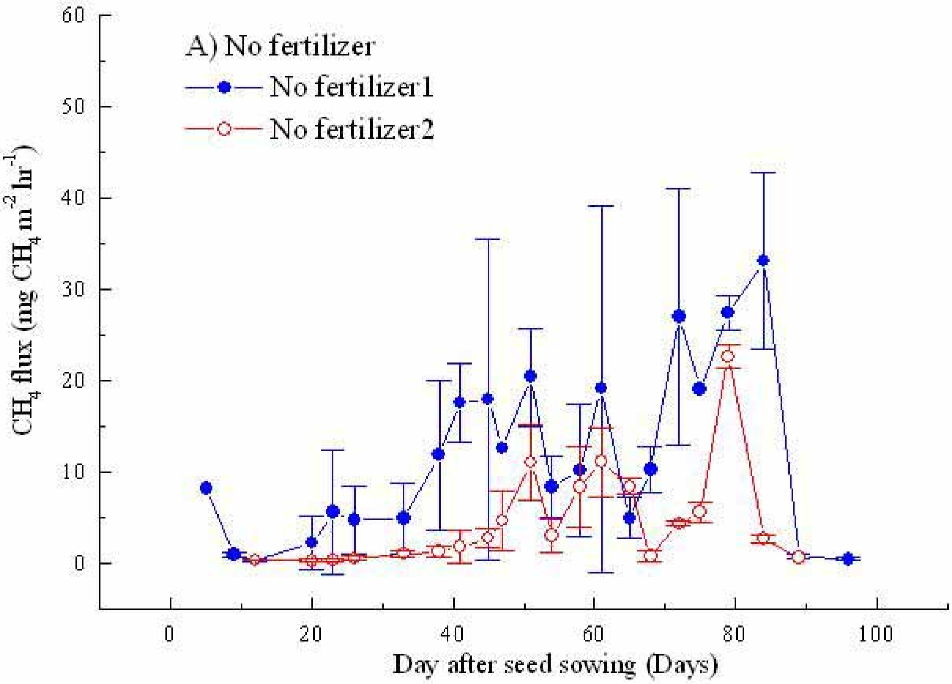


Measurement of CO_2

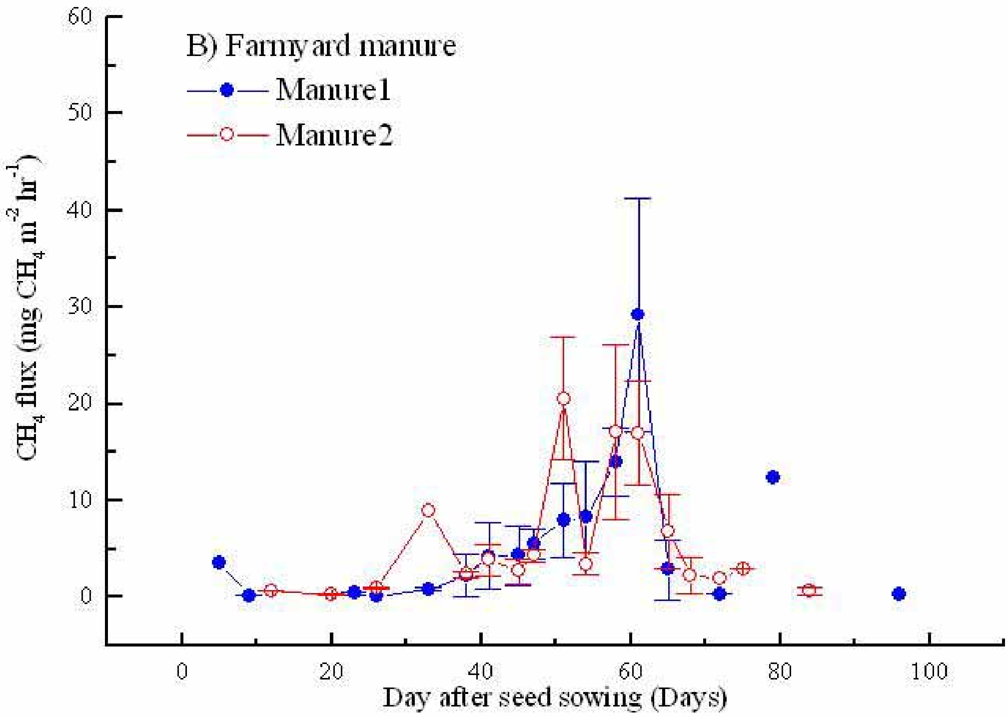



CH4 flux =1.43 mg CH4 m2 h-1
y = 1.62577+0.01847x,
r2=0.9970, n=157,p<0.0001
Concentration (ppm)
Time (min)

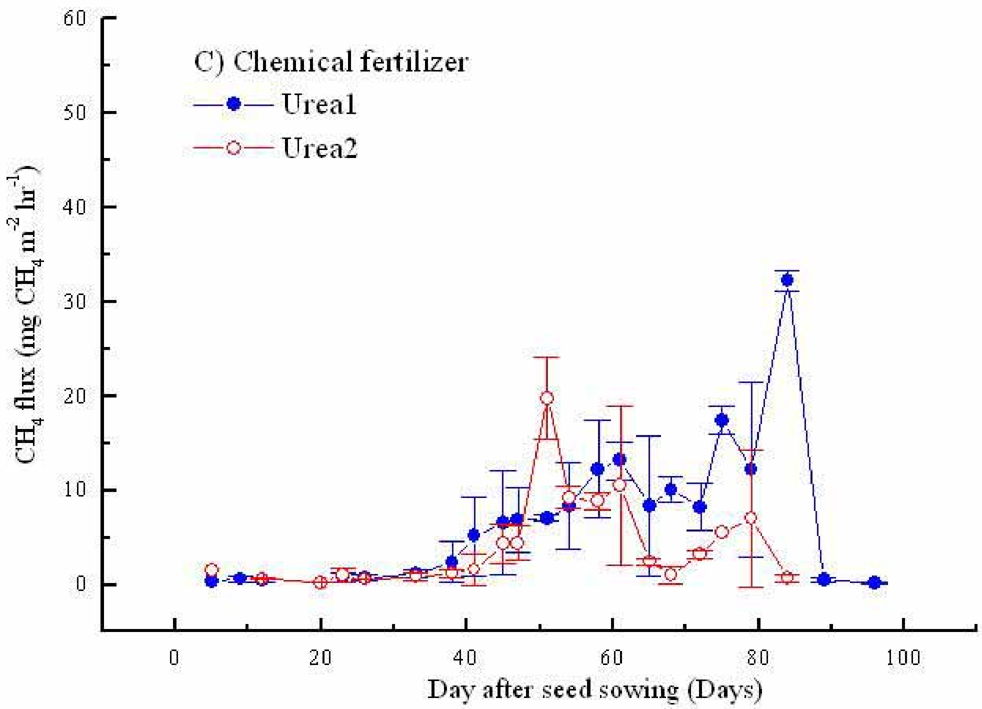

CO2
flux : -3066 mg m-2 hr-1
y = 333.94-18.03x
r2= 0.9963, n=25, p<0.0001
CO2 concentration (ppm)
Time (min)

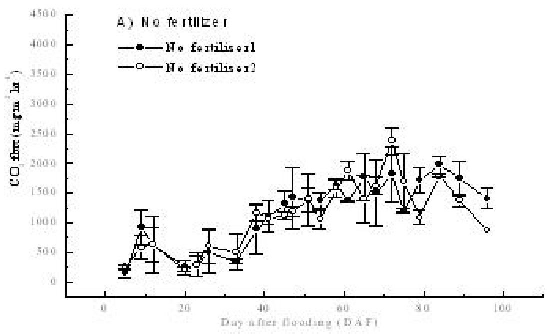


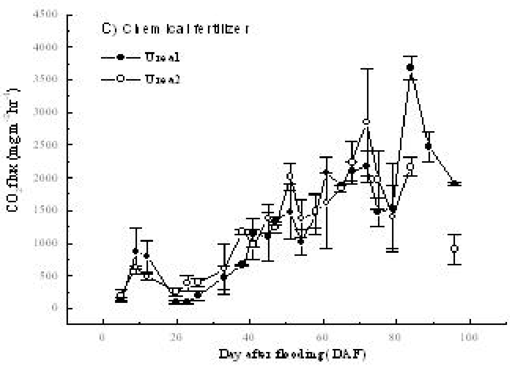
A) No fertilizer
No fertilizer1
No fertilizer2
CH4 flux (mg CH4 m-2 hr-1)
Day after seed sowing (Days)

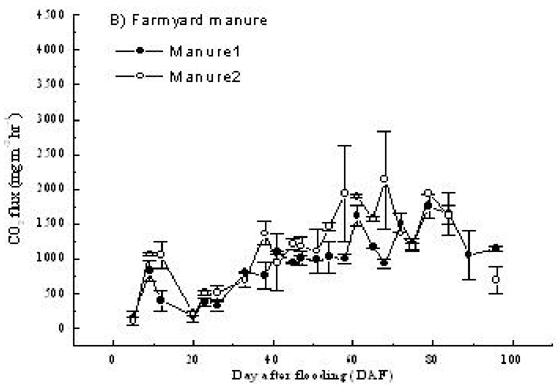


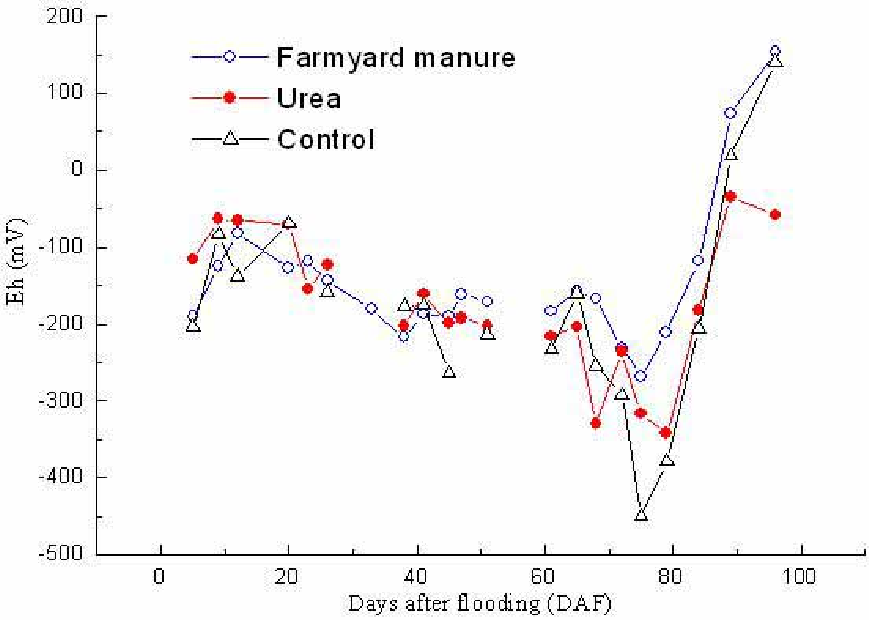
B) Farmyard manure
Manure1
Manure2
CH4 flux (mg CH4 m-2 hr-1)
Day after seed sowing (Days)

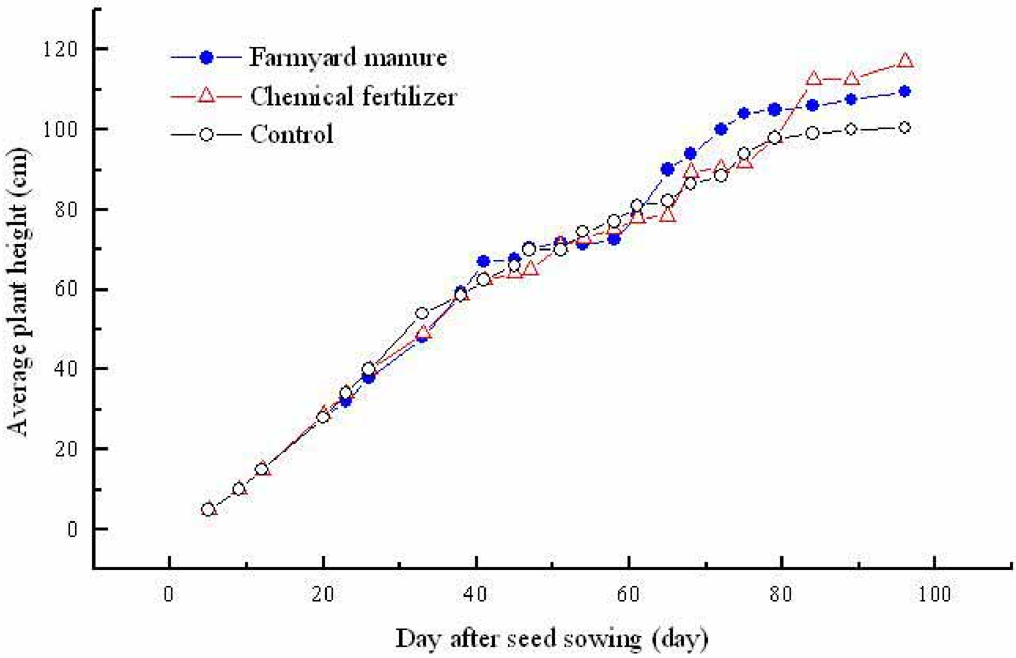

C) Chemical fertilizer
Urea1
Urea2
CH4 flux (mg CH4 m-2 hr-1)
Day after seed sowing (Days)


A) No fertilizer
No fertiliser1
No fertiliser2
Day after flooding (DAF)


C) Chemical fertilizer
Urea1
Urea2
Day after flooding (DAF)


B) Farmyard manure
Manure1
Manure2
Day after flooding (DAF)


Farmyard manure
Urea
Control
Eh (mV)
Days after flooding (DAF)


Farmyard manure
Chemical fertilizer
Control
Average plant height (cm)
Day after seed sowing (day)

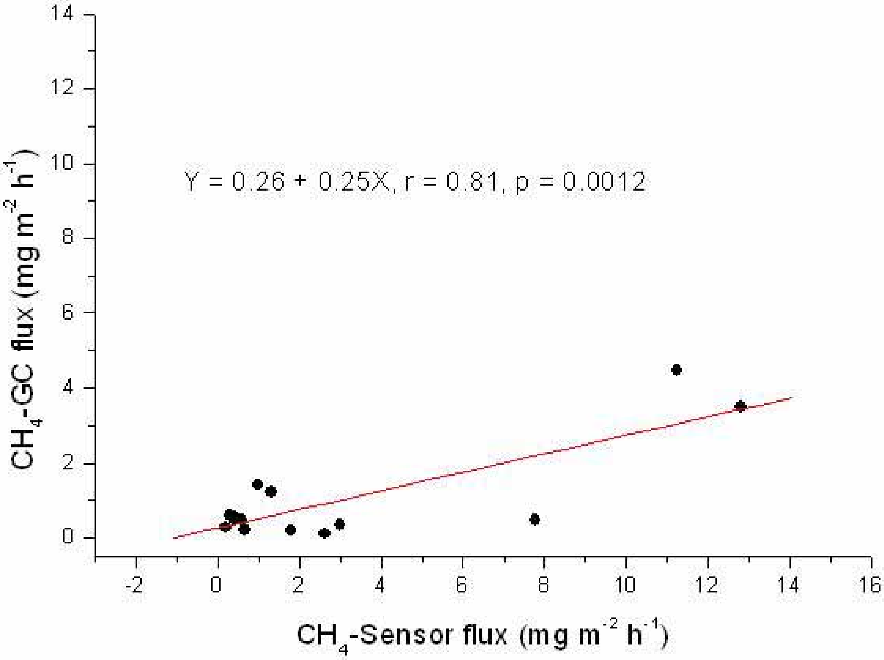
Flux Summary: first crop 2005

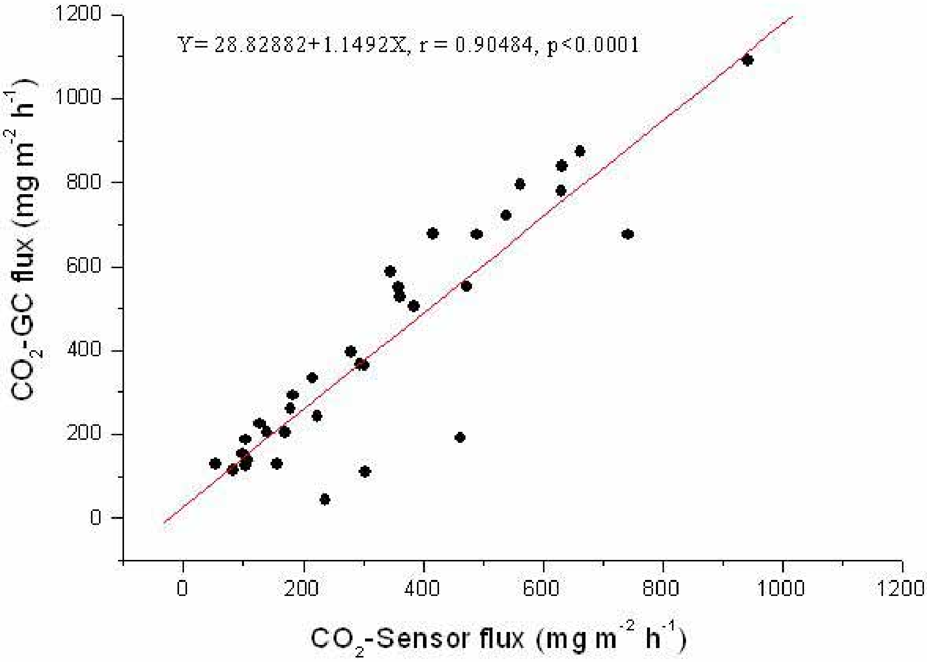
Treatment	CH_4 flux	CO_2 flux
	g/m²/crop	
Control	8.5	2420.9
Chem.	11.0±3.6	2700.2
Manure	13.8±2.9	2308.6

Grain Yield

Treatment	Grain (ton/ha)
Control	4.3
Chem.	5.2
Manure	4.7

GC-Sensor Results-Comparison





Issues needed further investigation

- Effects of fertilization—2nd and 3rd crops.
- Discrepancies in methane flux between GC and Sensor technique—need more measurement data, cross calibration

Nitrous Oxide and Methane emissions and Nitrogen Dynamics in Hedgerow Systems in the Uplands of Southern Philippines

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[1]University of the Philippines Los Baños, [2]Mindanao State University,
[3]Cotabato Foundation College of Science and Technology,
[4]UPLB Foundation Inc., College, Laguna

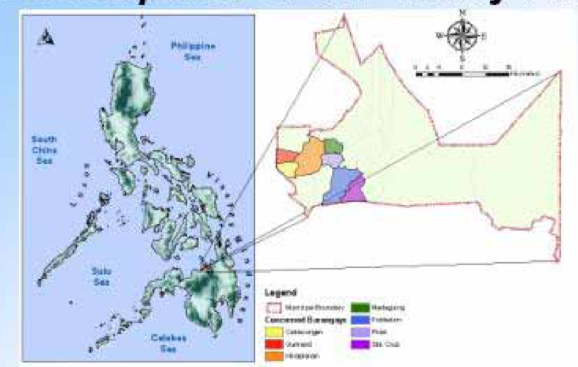
Overview

- Agricultural soils are the most important anthropogenic source of nitrogen oxide emissions (N_2O and NO) .
- Agroforestry is a dynamic, ecologically-based, natural resource management system.
- In hedgerow systems tree litter, crop residues and animal manure are used as green manure to restore or maintain soil fertility.
- Such systems may serve as source of N_2O and methane (CH_4).
- *Eucalyptus deglupta* and *Gmelina arborea* are the two top ranking trees planted in the agroforestry farms in Claveria, Misamis Oriental, Philippines.

Objective

This study aims to estimate the methane emissions from livestock holdings and nitrous oxide emissions through fertilization, tree litterfall and decomposition, maize residue incorporation and livestock manure in *G. arborea* and *E. deglupta* hedgerow systems. It also aims to present the nitrogen dynamics and other possible source of N_2O emissions in hedgerow agroforestry systems.

Description of the Study Area



The SAFODS Philippines Research Site

Claveria is a land-locked agricultural municipality in the province of Misamis Oriental in Northern Mindanao.

It is composed of 24 barangays.

Its topography is generally rugged, characterized by gently rolling hills and mountains with cliffs and escarpments.

The climate of Claveria is classified as having a C2 rainfall distribution, with 5 or 6 wet months (>200 mm/mo) and 2 or 3 dry months (<100 mm/mo).

Methodology

Experimental treatments

The experimental treatments (tree species, tree age, spacing) and number of replicates employed in the study.

Experiment No. 1 (7 year-old trees, 2 replicates per treatment)	**Experiment No. 2 (1 year-old trees, 3 replicates per treatment)**
Control for *G. arborea*, pure maize (*Z. mays*) 1 x 3 m (*G. arborea* + *Z. mays*) 1 x 9 m (*G. arborea* + *Z. mays*) Control for *E. deplupta*, pure maize (*Z. mays*) 1 x 3 m (*E. deglupta* + *Z. mays*) 1 x 9 m (*E. deglupta* + *Z. mays*)	Control, pure maize (*Z. mays*) 1 x 3 m (*G. arborea* + *Z. mays*) 1 x 9 m (*G. arborea* + *Z. mays*) 1 x 3 m (*E. deglupta* + *Z. mays*) 1 x 9 m (*E. deglupta* + *Z. mays*)

Management practices

- Planting: 1 seed per hill (Pioneer Hybrid 3014) at 60cm between furrows and 25-30cm between rows

- Fertilizer application:

Type of fertilizer	Application rate (kg ha^{-1})	Time of application
1. Solophos (0-18-0)	166.67	Before seed sowing
2. Urea (46-0-0)	195.65	30 DAE

- Other practices:
  - Inter-row cultivation at 30 and 60 DAE
  - Hand weeding

Litterfall

- Set-up: Four (4) litter traps were randomly positioned under the trees per plot.
- Litterfall collection: monthly

Soil erosion and runoff

- A micro-plot with a dimension of 4 x 6 m was constructed in each plot. A locally made galvanized iron with dimension of 7 ft in length, 1 ft in width and a depth of 0.5 ft were installed in each plot. A water meter was also attached to the collector for water runoff recording. Connected to the water meter is a 64 L capacity plastic for sediment load collection.

Collection and recording

Soil erosion: after an erosive rainfall event

Surface runoff: every after rainfall event

Stemflow

- Open plastic hose fitted around the trunk of 4 randomly selected hedgerow trees
- Collection and recording: after every rainfall event

Throughfall

- 16 plastic container were randomly placed within the plot
- Collection and recording: after every rainfall event

Harvesting and biomass determination of maize

- Harvesting: 105-110 days after planting
- Plant Biomass: destructive sampling of 16 sample plants per plot. Root, stalk, leaf and cob were segregated.
- Dry weight: One hundred fifty grams (150g) fresh weight of the sub-sample for each component was taken for oven drying at 70° C for 48 hours.

Leaf litter decomposition

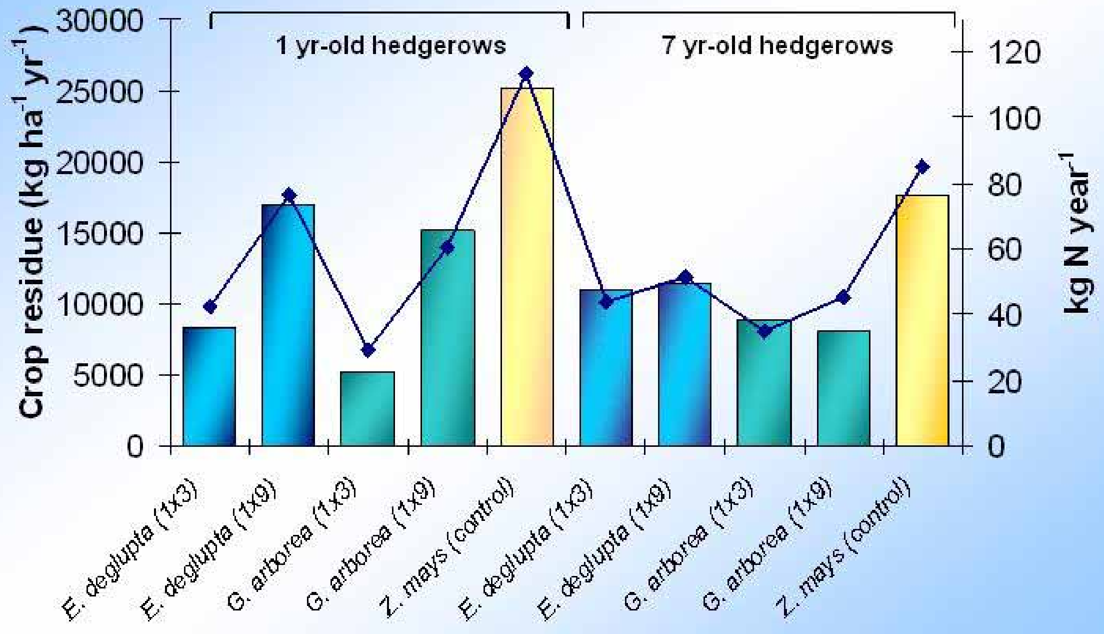
- Set-up: A total of eight (8) net bags (12 x 12 in) containing 50g leaf samples were randomly placed inside each plot.
- Collection: Two bags per plot were collected every 21 days. Collected samples were weighed for fresh weight and oven-dried.
- Decomposition rate: percent loss in weight

Livestock survey in Claveria

- Sampling technique: stratified random sampling
- Respondents: 300 farmers were randomly selected for the household interview
- Basis: elevation and agroforestry system classes
- Survey instrument: composed of set of questions related to livestock holdings and feed requirements

Results

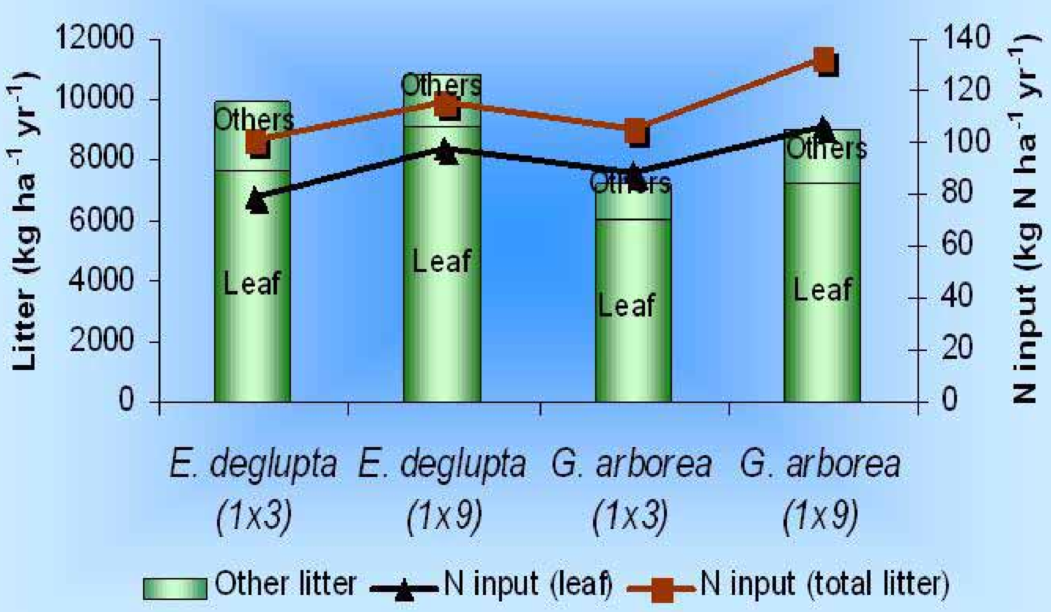
Crop residue and N input



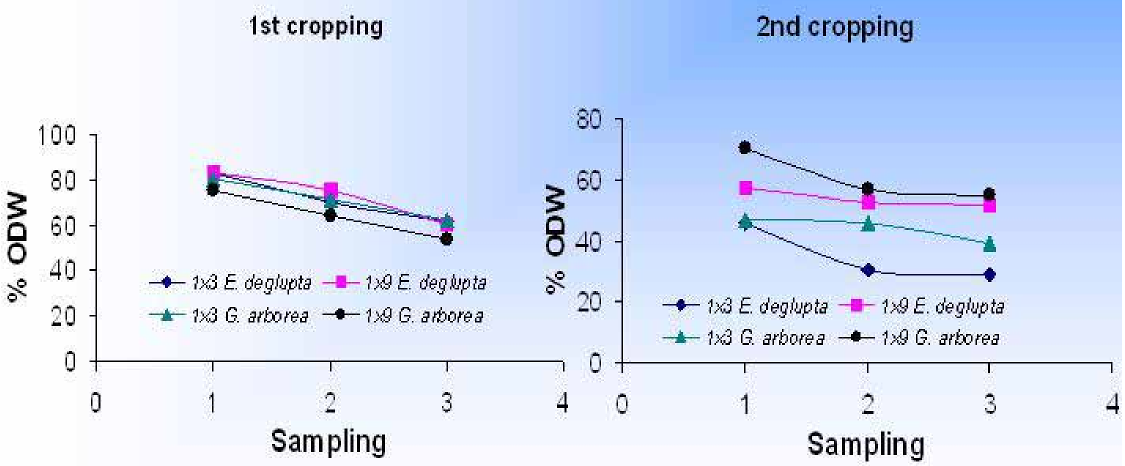
Fertilizer nitrogen applied in the different plots

Tree Species	Tree Age (yrs)	Tree spacing (m x m)	Plot size (ha)	N applied (kg N ha^{-1} yr^{-1})	1-$Frac_{GASF}$	F_{SN} (kg N ha^{-1} yr^{-1})
E. deglupta	1	1 x 3	0.018	221	0.9	199
E. deglupta	1	1 x 9	0.018	188	0.9	169
G. arborea	1	1 x 3	0.018	221	0.9	199
G. arborea	1	1 x 9	0.018	188	0.9	169
Z. mays			0.018	201	0.9	181
E. deglupta	7	1 x 9	0.032	346	0.9	311
E. deglupta	7	1 x 3	0.032	221	0.9	199
G. arborea	7	1 x 9	0.032	346	0.9	311
G. arborea	7	1 x 3	0.032	221	0.9	199
Z. mays			0.032	201	0.9	181

Leaf and total (leaf, twigs, branches) litter from 7-year old E. deglupta and G. arborea



Decomposition of 7 year-old E. deglupta and G. arborea leaf litter



Livestock Survey

Local values for nitrogen input from animal wastes based on average live weight

Animal	Average animal live weight (kg)	Daily manure production (% of LW)	Daily manure production (FW, kg)	Dry matter (%)	Daily manure production (ODW, kg)	Nitrogen content (%)	Total N animal^{-1} yr^{-1} (kg N yr^{-1})
Cattle	300	5	15.0	15	2.25	1.5	12.3
Carabao	350	5	17.5	15	2.60	1.5	14.2
Goat	15	3	0.45	25	0.11	1.5	0.6
Pig	80	5	4.00	20	0.80	2.0	5.84
Chicken	1.2	3	0.04	20	0.01	3.0	0.11

Sources of nitrogen inputs, N_2O and CH_4 emissions in hedgerow systems

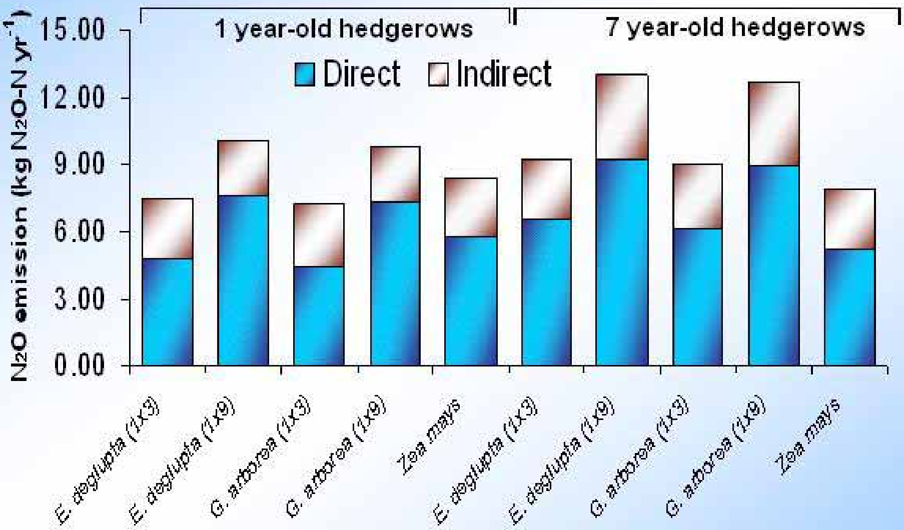
Nitrous oxide emissions from grazing animals (N_{EXPR}) using local values for N excretion per animal type

Livestock Type	Number of animals	N excretion per animal type (kg $head^{-1}$ yr^{-1})	Total annual N excretion (kg N)	Fraction pasture range and paddock	N_{EXPR} (kg N yr^{-1})	EF3 (kg N_2O-N/kg N)	$N_2O_{GRAZING}$ (kg N_2O yr^{-1})
Non-dairy cattle	258	12.3	3,173.4	1	3,173.4	0.02	99.74
Carabao	62	14.2	880.4	1	880.4	0.02	27.67
Goat	46	0.6	27.6	1	27.6	0.02	0.87
Swine	398	5.8	2,308.4	1	2,308.4	0.02	72.55
Poultry	1,252	0.1	125.2	1	125.2	0.02	3.94
Total			6515	1		0.02	204.77

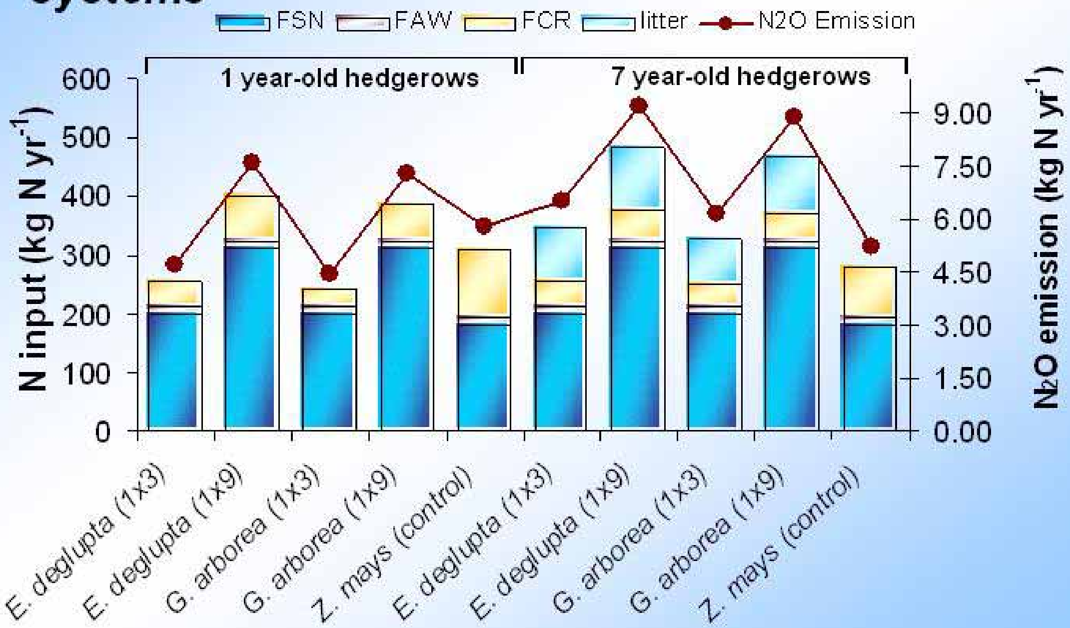
Nitrous oxide emissions from grazing animals (N_{EXPR}) using IPCC (1997) default values for N excretion per animal type

Livestock Type	Number of animals	N excretion per animal type (kg $head^{-1}$ yr^{-1})	Total annual N excretion (kg N)	Fraction pasture range and paddock	N_{EXPR} (kg N yr^{-1})	EF3 (kg N_2O-N/kg N)	$N_2O_{GRAZING}$ (kg N_2O yr^{-1})
Non-dairy cattle	258	40	10,320	1	10,320	0.02	324.34
Carabao	62	40	2,480	1	2,480	0.02	77.94
Goat	46	12	552	1	552	0.02	17.35
Swine	398	16	6,368	1	6,368	0.02	200.14
Poultry	1,252	0.6	751.2	1	751.2	0.02	23.61
Total			20,471.2	1		0.02	643.38

Direct and indirect N_2O emissions in E. deglupta and G. arborea hedgerow systems



Nitrogen inputs and total N_2O emission in E. deglupta and G. arborea hedgerow systems



Total methane (CH_4) emissions from enteric fermentation and manure management per animal type

Animal Type	Enteric fermentation (kg CH_4 yr^{-1})	Manure management (kg CH_4 yr^{-1})	Total methane emissions (kg CH_4 yr^{-1})
Non-dairy cattle	11,352	516	11,868
Carabao	3,410	186	3,596
Goat	230	10.1	240.1
Swine	597	2,786	3,383
Poultry	-	28.8	28.8
Total			19,115.3

Issues regarding GHG inventory

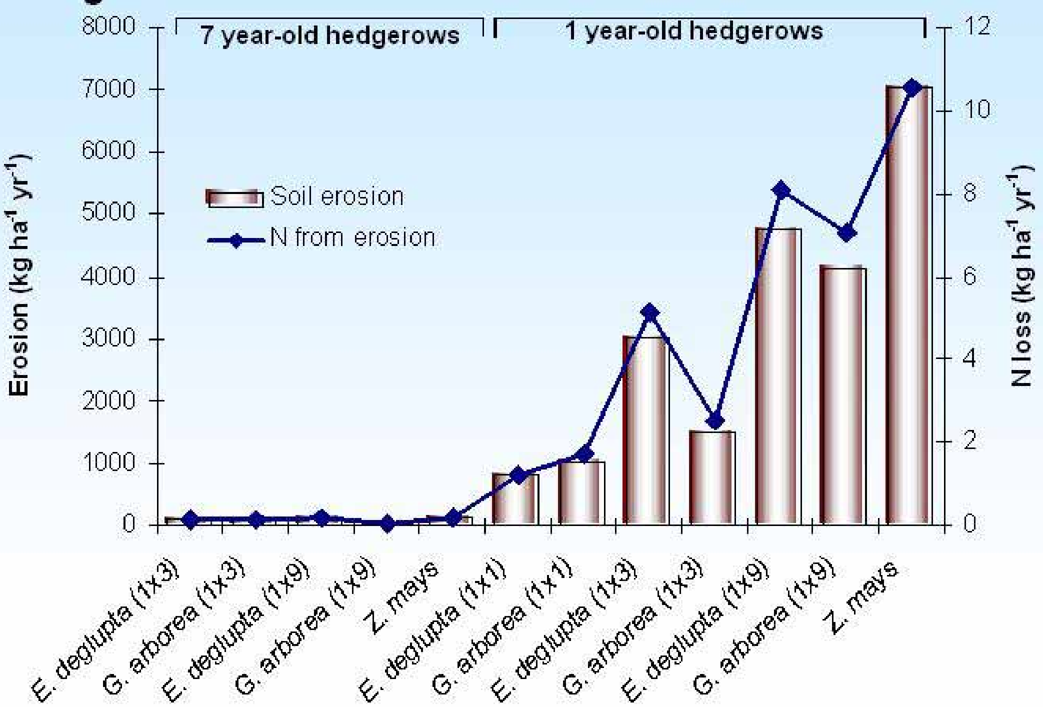
Ratios of crop residue:grain and residue: grain+cob

Tree species	Tree age	Spacing	Maize residue (g plant^{-1})	Grain yield (g plant^{-1})	Grain + cob (g plant^{-1})	Ratio (residue: grain)	Ratio (residue: grain+cob)
E. deglupta	1	1x3	220.75	81.74	101.72	2.70	2.17
E. deglupta	1	1x9	287.12	111.07	135.78	2.59	2.11
G. arborea	1	1x3	176.07	60.71	74.99	2.90	2.35
G. arborea	1	1x9	203.13	74.45	90.88	2.73	2.24
Z. mays			308.26	115.23	138.14	2.68	2.23
E. deglupta	7	1x3	195.11	58.83	72.41	3.32	2.69
E. deglupta	7	1x9	307.23	86.27	103.88	3.56	2.96
G. arborea	7	1x3	122.11	29.96	40.30	4.08	3.03
G. arborea	7	1x9	272.59	75.31	89.95	3.62	3.03
Z. mays			439.93	110.37	138.42	3.99	3.18

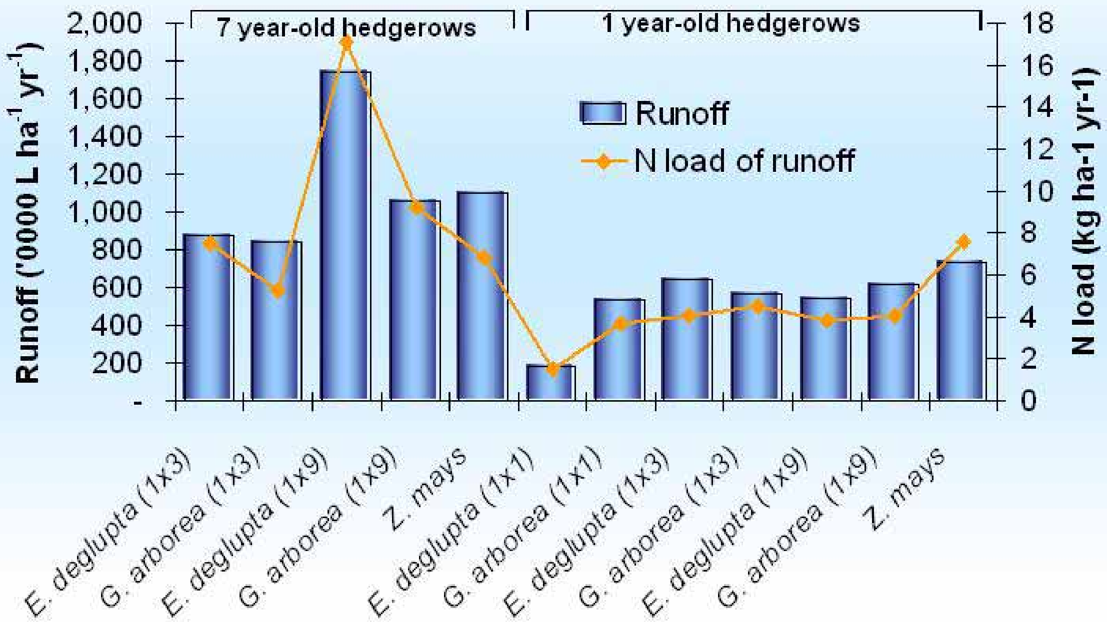
Local and IPCC default values for the N excretion values for the different animal types

Livestock type	N excretion per animal type (IPCC, kg head^{-1} yr^{-1})	N excretion per animal type (local, kg head^{-1} yr^{-1})
Non-dairy cattle	40	12.3
Carabao	40	14.2
Goat	12	0.6
Swine	16	5.8
Poultry	0.6	0.1

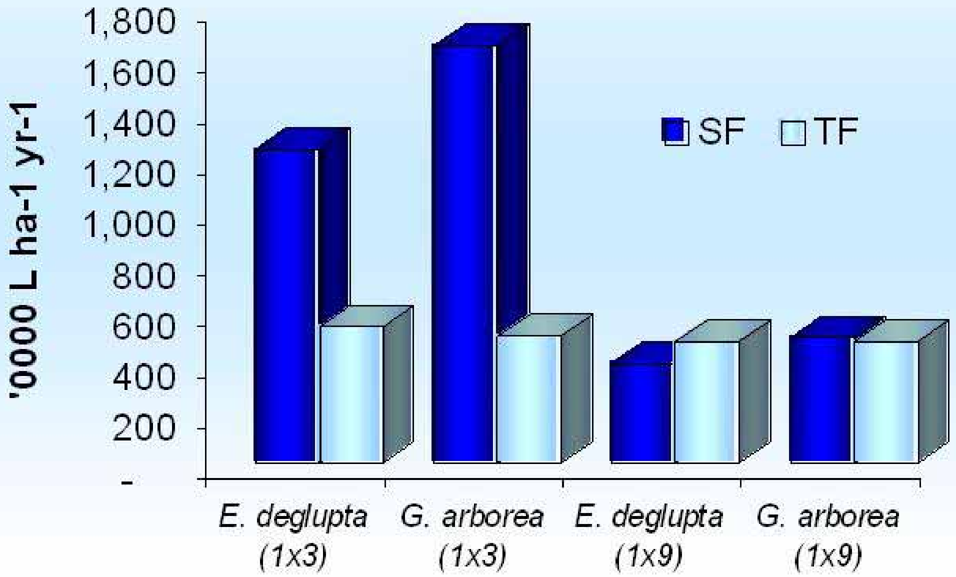
Soil erosion and N loss under 7 and 1 year old hedgerows



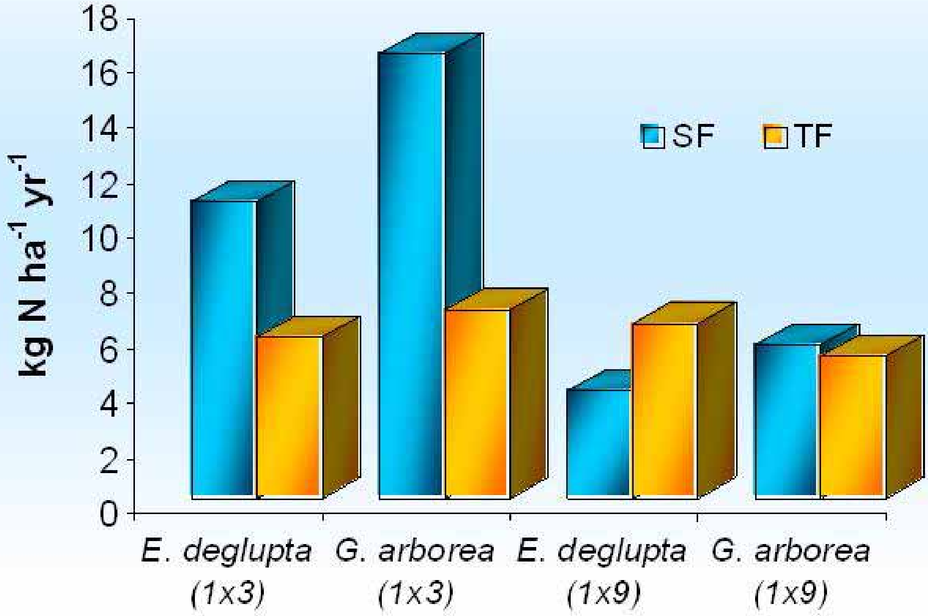
Runoff and N loss under 7 and 1 year old hedgerows



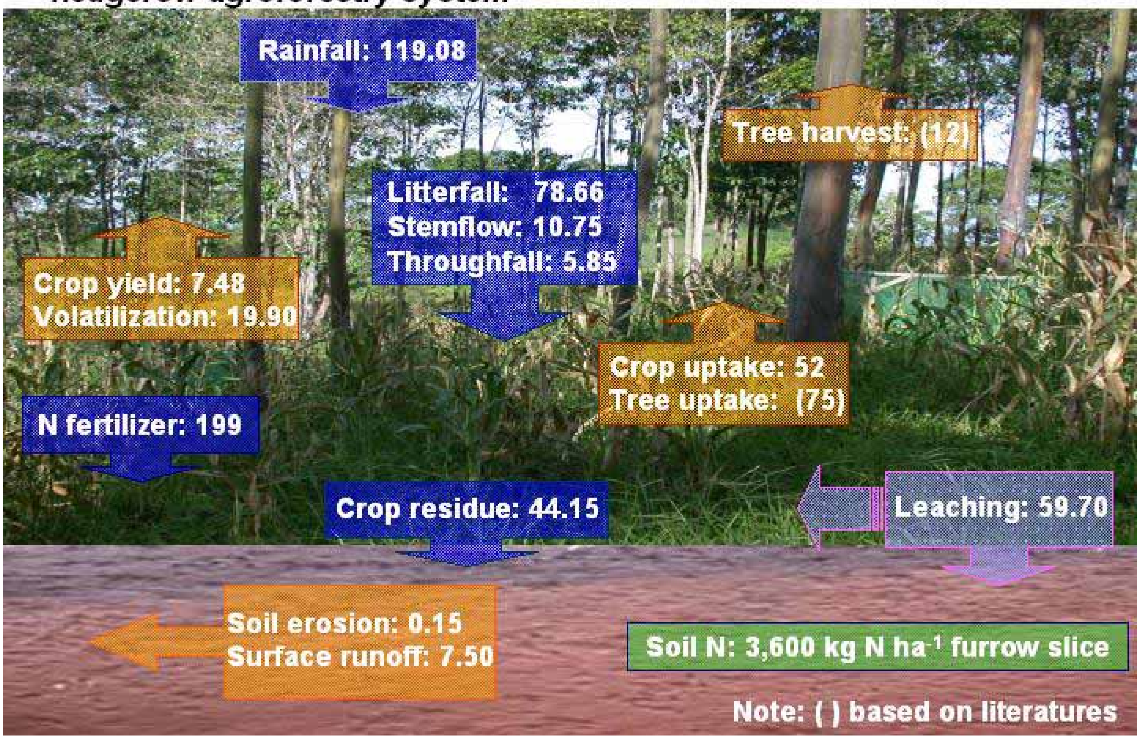
Stemflow (SF) and Throughfall (TF) under 7 year old hedgerows



Nitrogen load of Stemflow (SF) and Throughfall (TF) under 7 year old hedgerows



Nitrogen flow (kg ha^{-1} yr^{-1}) in a 7 year old 1x3 Eucalyptus deglupta hedgerow agroforestry system



Conclusions

- In tree-based hedgerow systems, crop residue incorporation and fertilizer application are the major sources of nitrogen inputs. Animal manure, litterfall, stemflow and throughfall are other sources of nitrogen inputs into the soil.
- Nitrogen losses from hedgerow systems include soil erosion, surface runoff, crop harvest (grain yield) and volatilization and leaching of N fertilizer.
- Indirect sources of N_2O emissions in hedgerow systems are atmospheric deposition of NH_3 and NO_x and N leaching.

Conclusions

- The major source of N_2O emissions from the agroforestry systems studied is the direct N_2O emissions from soil.
- Maize monocropping system had higher N_2O emissions than hedgerow systems.
- Enteric fermentation is the major source of methane emissions from domestic livestock in Claveria.
- Soil erosion is significantly reduced in a established 7-year old hedgerows.

Conclusions

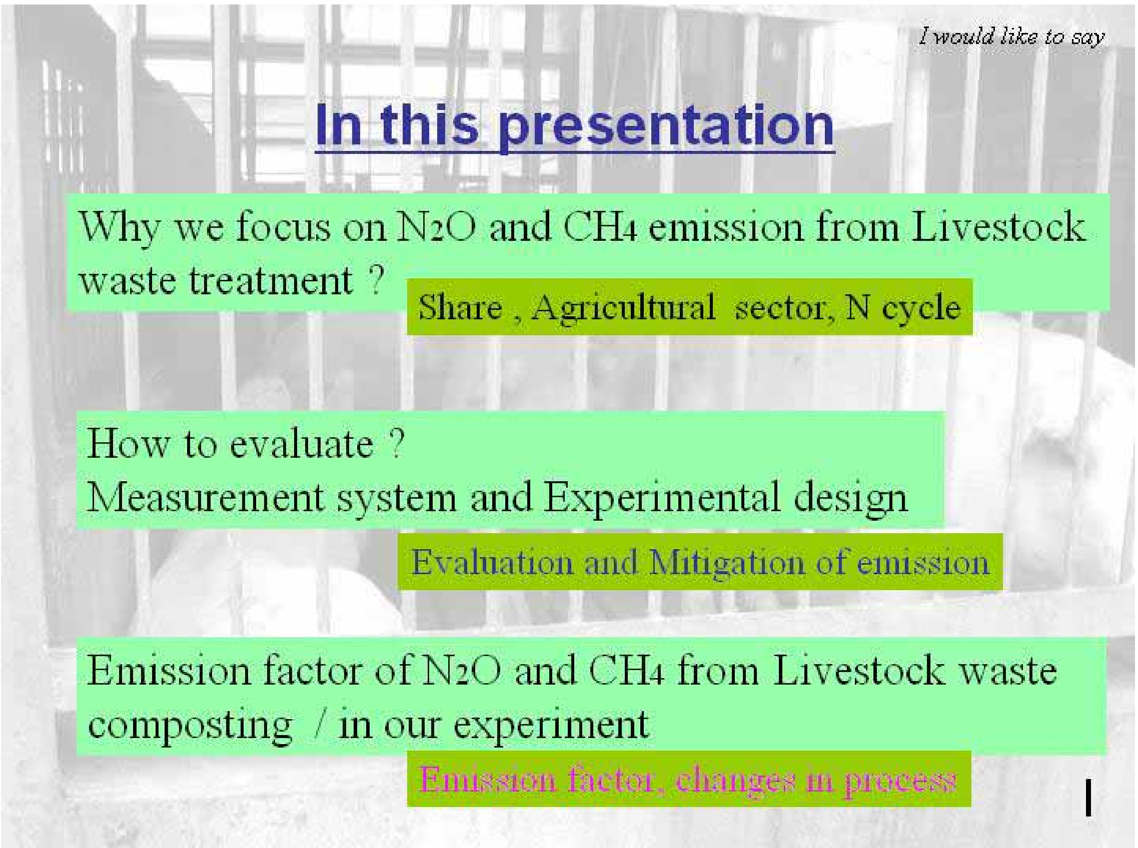
- Considerable amounts of N are contained in stemflow, throughfall, runoff and erosion which could be possible source of N emission in hedgerow AF systems.
- Use of local values for N excretion factors will reduce uncertainties in the estimates of N excretion from animal manure.
- A number of factors identified in this study that needs further research to improve estimates of N_2O emissions were the N excretion factor per animal type, residue to grain (residue to crop) ratio, fraction leaching and fraction volatilization.

Acknowledgement

This study is part of the Smallholder Agroforestry Options for Degraded Soils (SAFODS) Project funded by the European Union. We would like to thank the farmer respondents who shared their time, experience and knowledge with the research team. SALAMAT.


END OF PRESENTATION


Better evaluation system for N_2O and CH_4 emission from composting (and wastewater purification) of Livestock waste
Takashi OSADA
National Agricultural Research Organization, JAPAN,


I would like to say
In this presentation
Why we focus on N_2O and CH_4 emission from Livestock waste treatment ?
Share , Agricultural sector, N cycle
How to evaluate ?
Measurement system and Experimental design
Evaluation and Mitigation of emission
Emission factor of N_2O and CH_4 from Livestock waste composting / in our experiment
Emission factor, changes in process
I

Why N2O CH4 ?

Why we focus on N2O and CH4 emission from Livestock waste treatment ?

-About 94 million tons of livestock waste

-contains 737 Gg of Nitrogen.

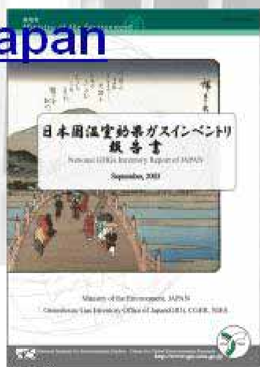
-around 10,999 Gg CO_2 eq of N_2O and 933 Gg CO_2 eq of CH_4 might be emitted from composting and other livestock waste treatment processes (Ministry of the Environment, Japan 2002).

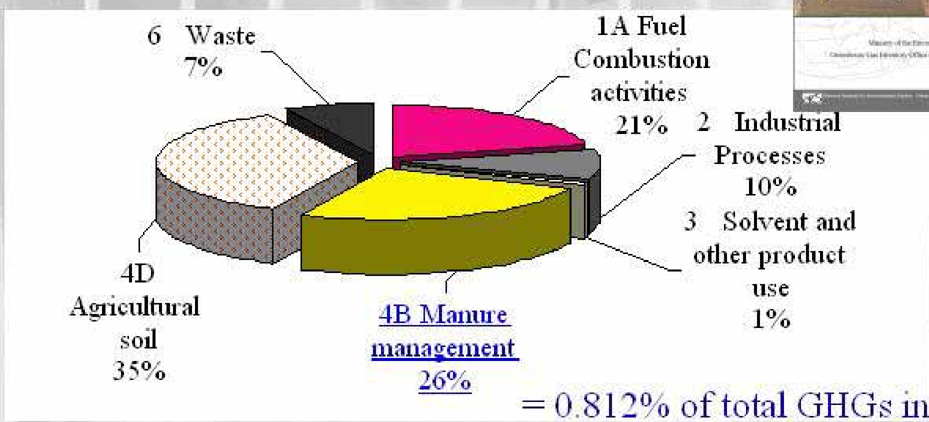
II

Why N2O CH4 ?-1

Estimated source of N2O in Japan

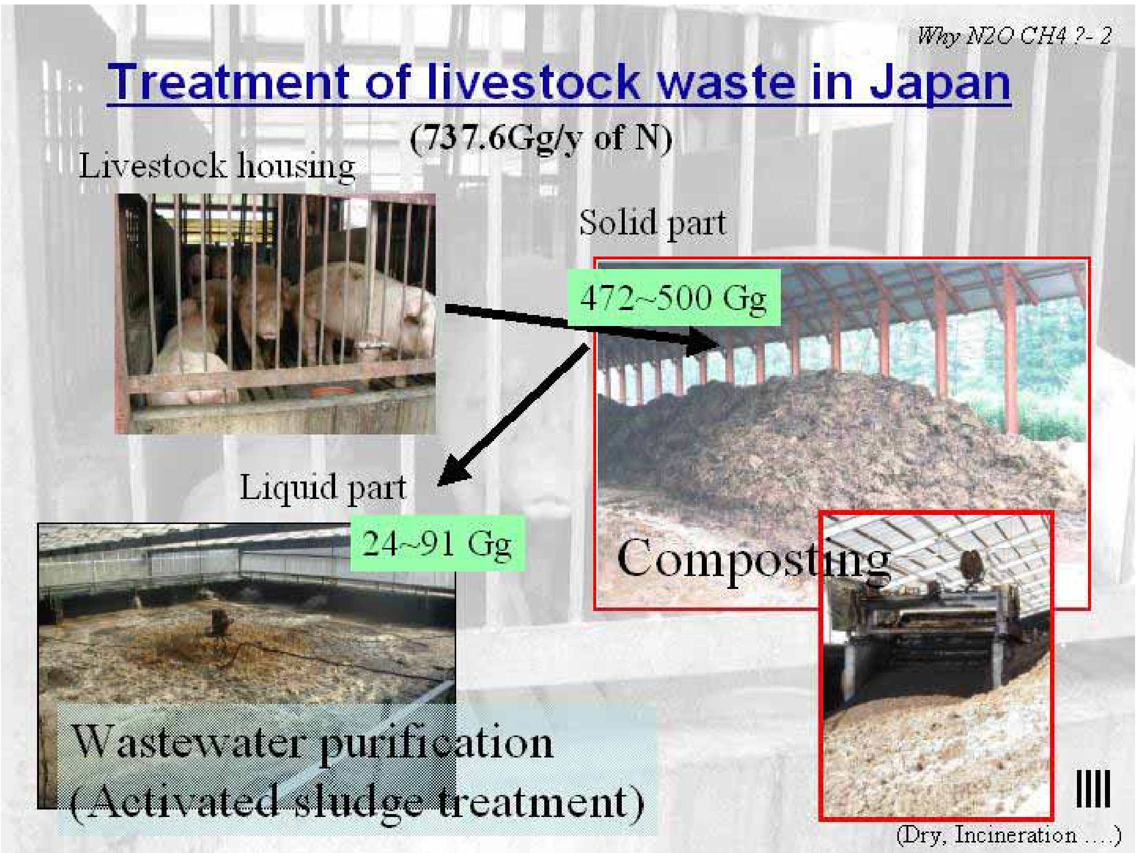
(anthropogenic generation , 2002)

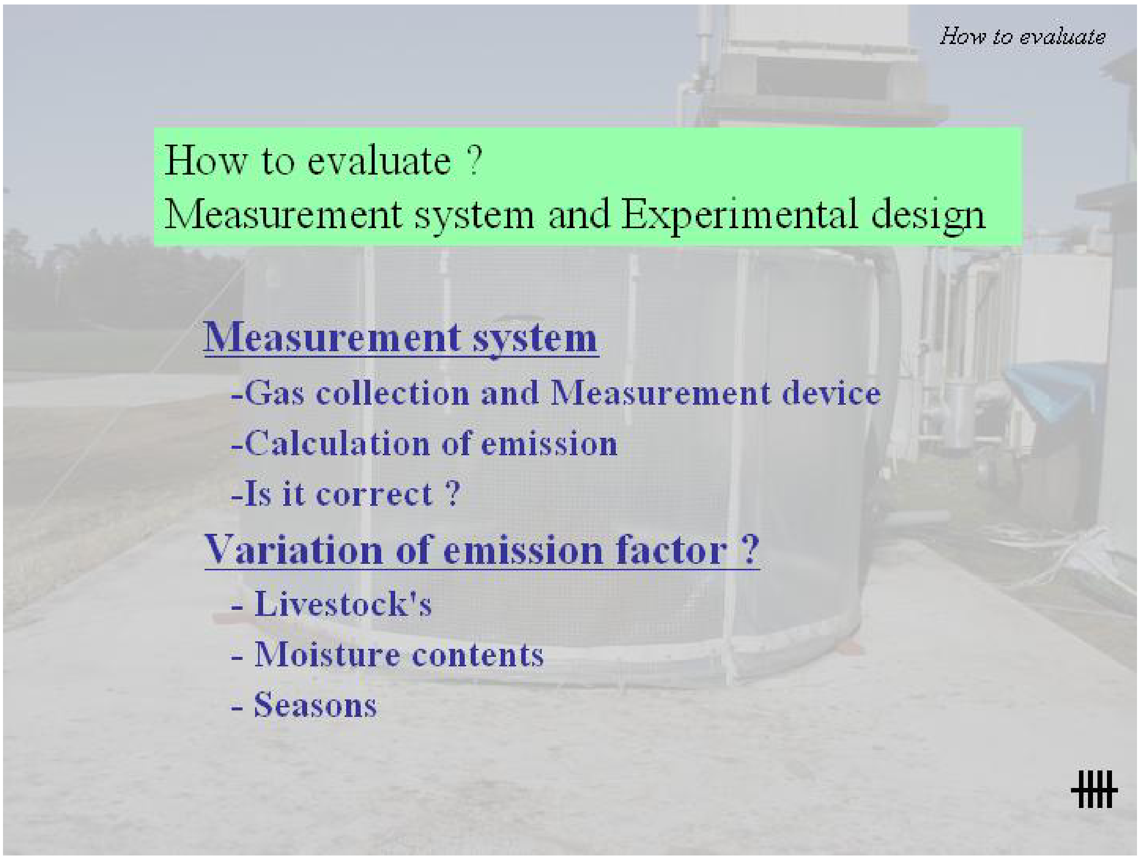


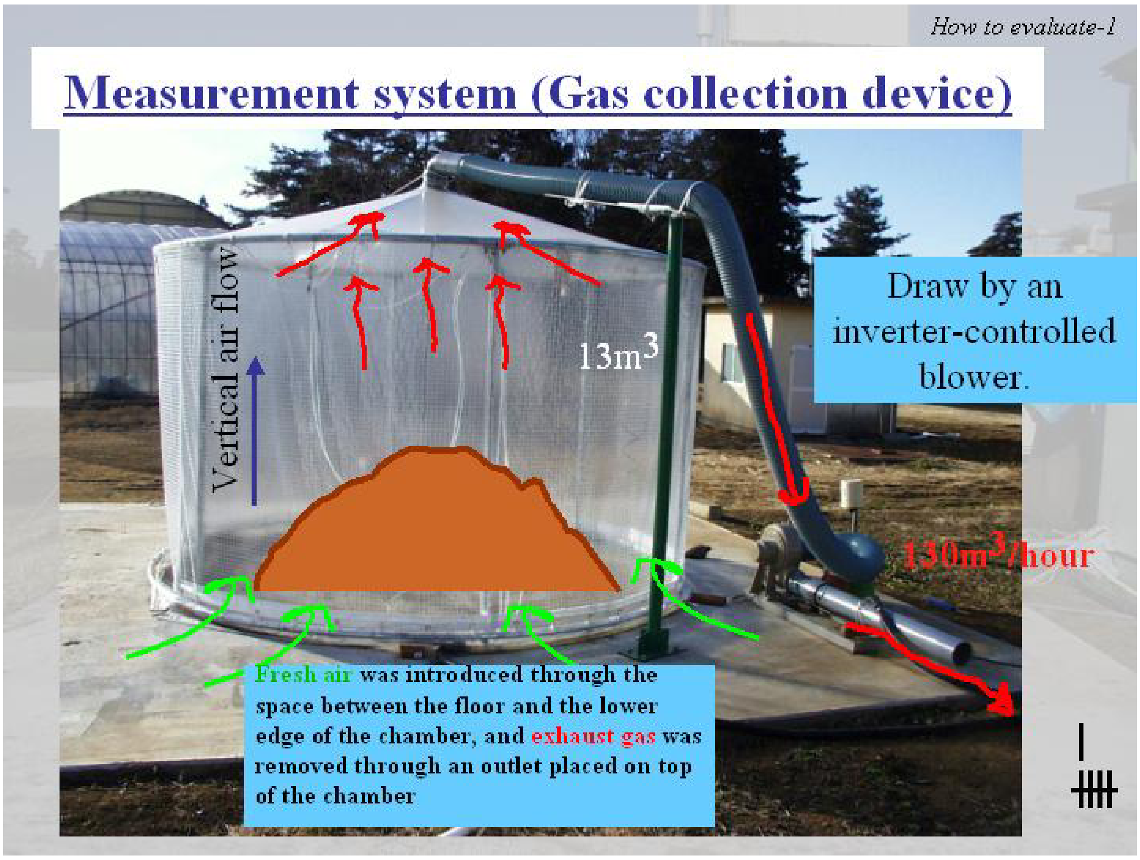


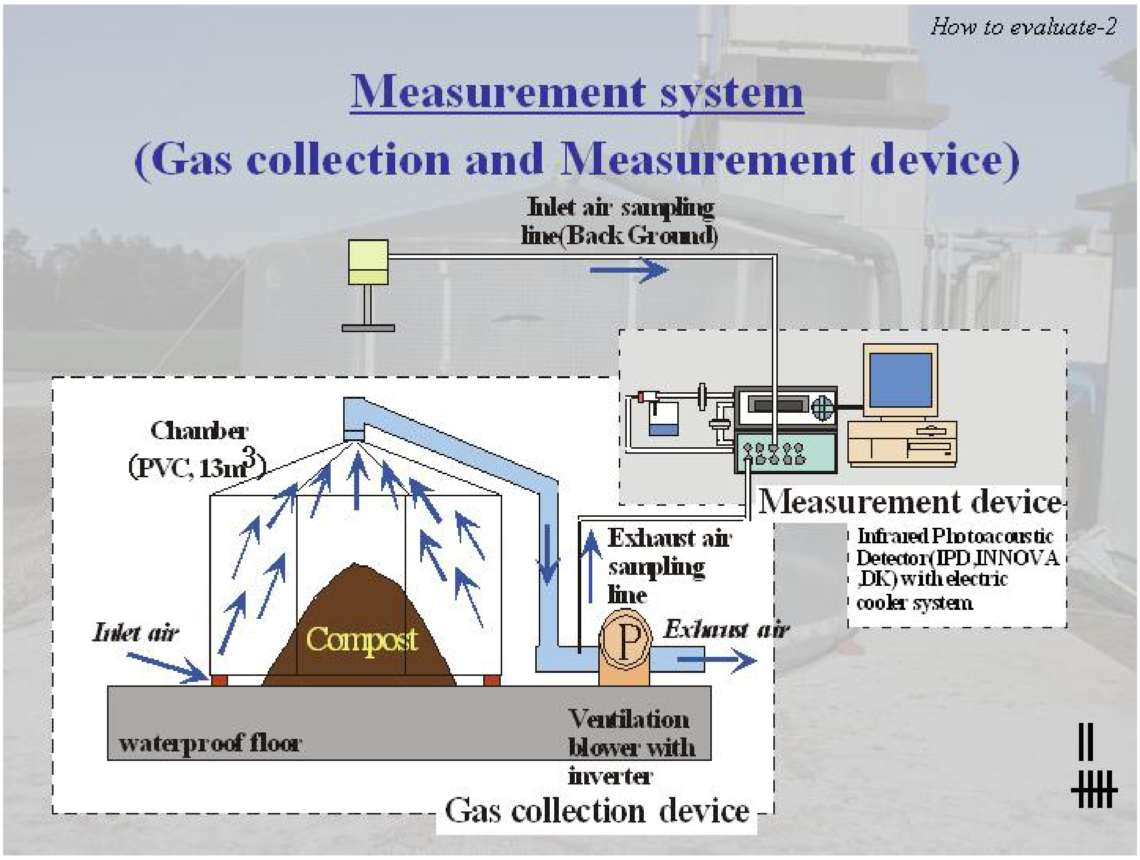
= 0.812% of total GHGs in Japan
(one of key source category)

III


Why N2O CH4 ?- 2
Treatment of livestock waste in Japan
(737.6Gg/y of N)
Livestock housing
Solid part
472~500 Gg
Liquid part
24~91 Gg
Composting
Wastewater purification
(Activated sludge treatment)
(Dry, Incineration ….)


How to evaluate
How to evaluate ?
Measurement system and Experimental design
Measurement system
-Gas collection and Measurement device
-Calculation of emission
-Is it correct ?
Variation of emission factor ?
- Livestock's
- Moisture contents
- Seasons

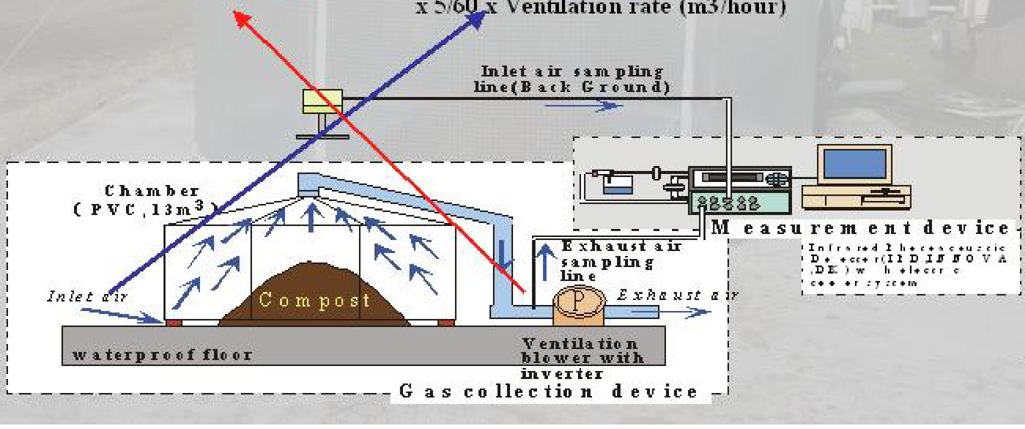

How to evaluate-1
Measurement system (Gas collection device)
Vertical air flow
13m3
Draw by an inverter-controlled blower.
130m3/hour
Fresh air was introduced through the space between the floor and the lower edge of the chamber, and exhaust gas was removed through an outlet placed on top of the chamber


How to evaluate-2
Measurement system
(Gas collection and Measurement device)
Inlet air sampling line(Back Ground)
Chamber (PVC, 13m3)
Measurement device
Infrared Photoacoustic Detector(IPD,INNOVA ,DK) with electric cooler system
Exhaust air sampling line
Inlet air
Compost
Exhaust air
waterproof floor
Ventilation blower with inverter
Gas collection device

Measurement system
(Gas collection and Measurement device)

The rate of emission (E) of each substance (NH_3, CH_4 and N_2O) was computed from the amount of ventilation and the concentration differences of each substance between the inlet and outlet air samples.

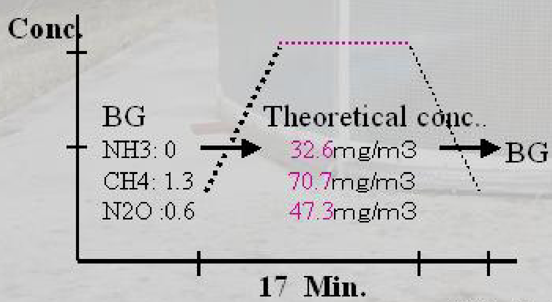
E (mg/5min.) =
(Conc. of outlet air (mg/m3) – Conc. of inlet air (mg/m3))
x 5/60 x Ventilation rate (m3/hour)



Methods for evaluation of this system

1st step
Recovery test with pure substances

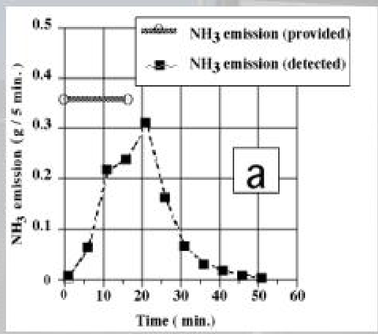
In order to evaluate recovery efficiencies, a fixed quantity of each substance (gas) was generated within the center of the chamber 15 cm high, and the total amount of emissions by this chamber system was calculated.



*Stabilized ventilation late and fixed late of gas generation

How to evaluate-5

1st step
Result of Recovery test with pure substances



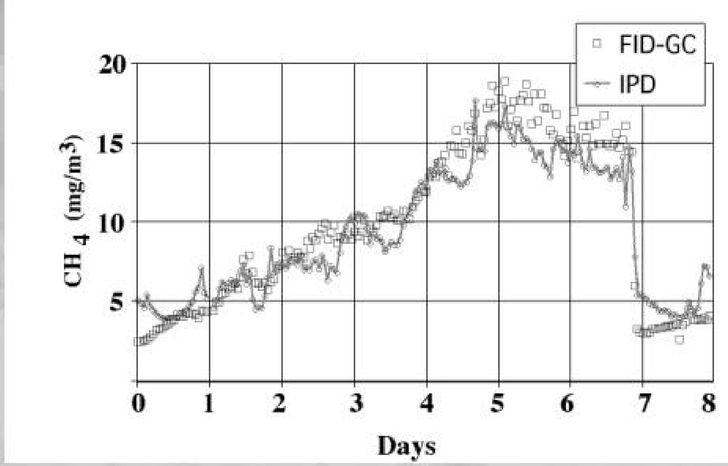
No great difference was found in movement of three sorts of substances. In the 130 m3/h exchange volume condition for 17-minutes the concentration of each substance became elevated during 40 - 50 minutes.

The average recovery of each substance was good based on the results of a field examination. NH3, CH4 and N2O recoveries were 98.5% (S.D. 6.25), 96.6% (S.D. 4.03) and 99.5% (S.D. 2.68), respectively

How to evaluate-6

Step 2
Comparison with values from conventional methods at composting examination (CH4)

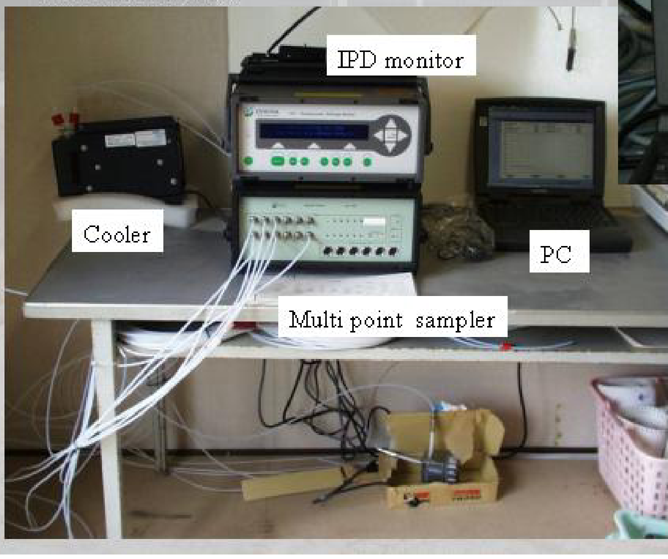
The results of both method were compared, and the changes of CH4 concentration were considered to be very similar.



The total amount of methane generated over 8 days following the start of the composting was 227g by the IPD method and 239g by the FID-GC method, and the difference was small at around 5%.

Measurement system (Measurement device)

-Infrared Photoacoustic Detector (IPD, multi gas monitor type 1312, INNOVA, Copenhagen DK) at 5-min. intervals(continuous measurement).
-Gas dried by electric cooler was used for measurement of methane and nitrous oxide for improved accuracy.



Sampling gas were introduced IPD passed through 4mm diameter Teflon tubes at 15min. Interval.

Experimental design

Mixture of Feces & Sawdust (400kg ap.)

Piled & Turned weekly →

Runs	Livestock	Products of the compostig		Turning interval of the pile	Days of composting
		Total weight	Moisture content		
		kg	%		
Dairy 1	Dairy cattle manure	602.0	83.5	15 days	119
Dairy 2		455.0	85.6	15 days	119
Beef 1	Beef cattle manure	149.4	45.7	7 days	63
Beef 2		198.0	56.1	7 days	49
Pig 1	Fattening pig manure	110.0	35.4	7 days	56
Pig 2		147.8	48.4	7 days	106
Pourtry 1	Poultry manure	112.0	11.9	7 days	64
Pourtry 2		99.2	25.9	7 days	57

Result

N_2O and CH_4 emission from Livestock waste composting

Gas emission factor

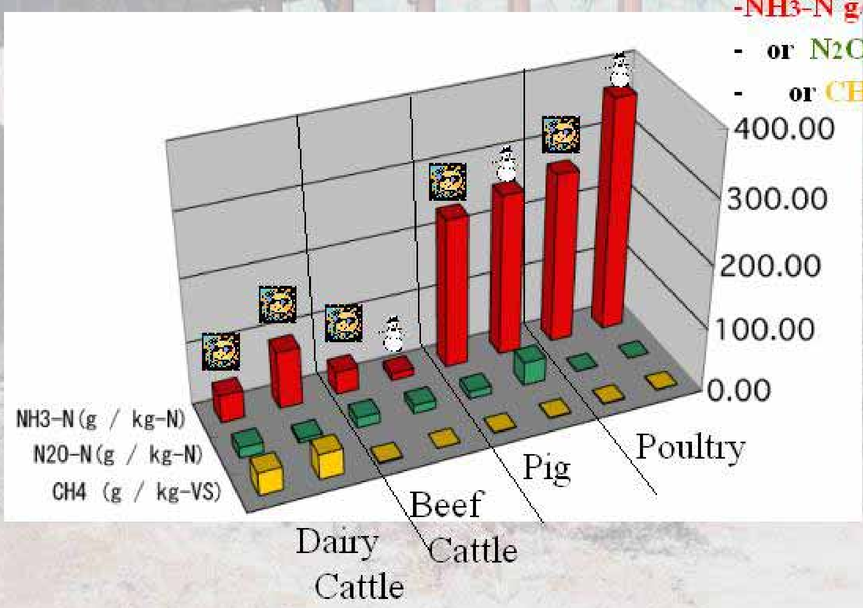
- N_2O-N g/kg N or CH_4 g/kg OM (units)
- Moisture content / Season
  / Dry (Am.Temp.)

Emission pattern

- Difference between Forced or Passive
- Ammonia and Nitrous Oxide

NH_3, N_2O and CH_4 emission during composting of each livestock manure

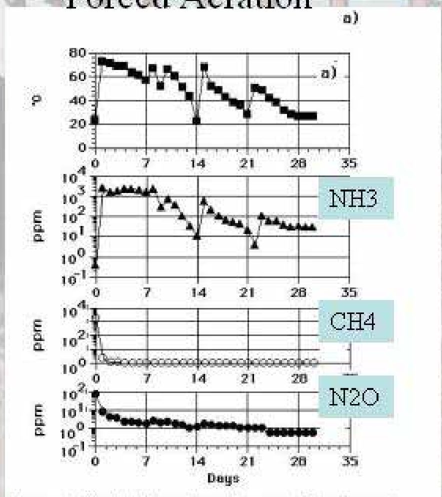
-NH_3-N g/kg N
- or N_2O-N g/kg N
- or CH_4 g/kg VS
(units)



Result-2

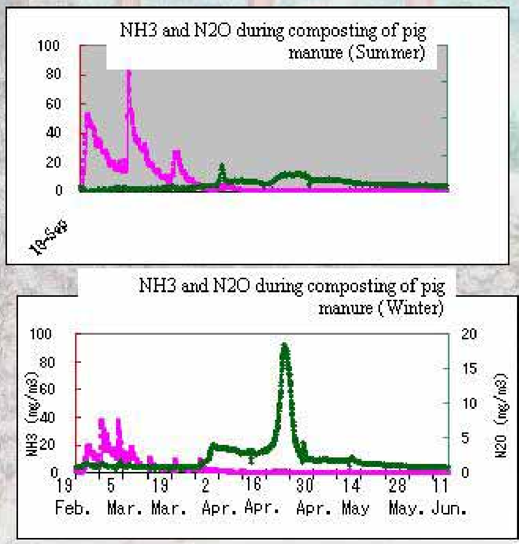
Changes of N_2O and NH_3 emission during composting

Gas emission from Forced Aeration



Changes of **a)** material temperature, **b)** ammonia, **c)** methane and **d)** nitrous oxide concentration of exhaust gas under 38.5 L m^{-3} min^{-1} aeration with matured compost additional condition.

Gas emission from Piled compost



Conclusion (1/2)

We developed a system for the quantitative measurement of emissions from composting using a large dynamic chamber in an experiment.

According to the results of this experiment, the composting-manure emission factors of CH_4 and N_2O varied significantly between livestock types, moisture contents of the pile materials and ambient temperature . Those factors should also depend on manure treatment type.

This can be important information not only for inventory data but for the development of greenhouse gas regulations and technologies.

Conclusion (2/2)

In Asian countries, the compost process is widely used for the treatment of livestock waste. Although the exact amount of greenhouse gases generated from actual composting is not known.

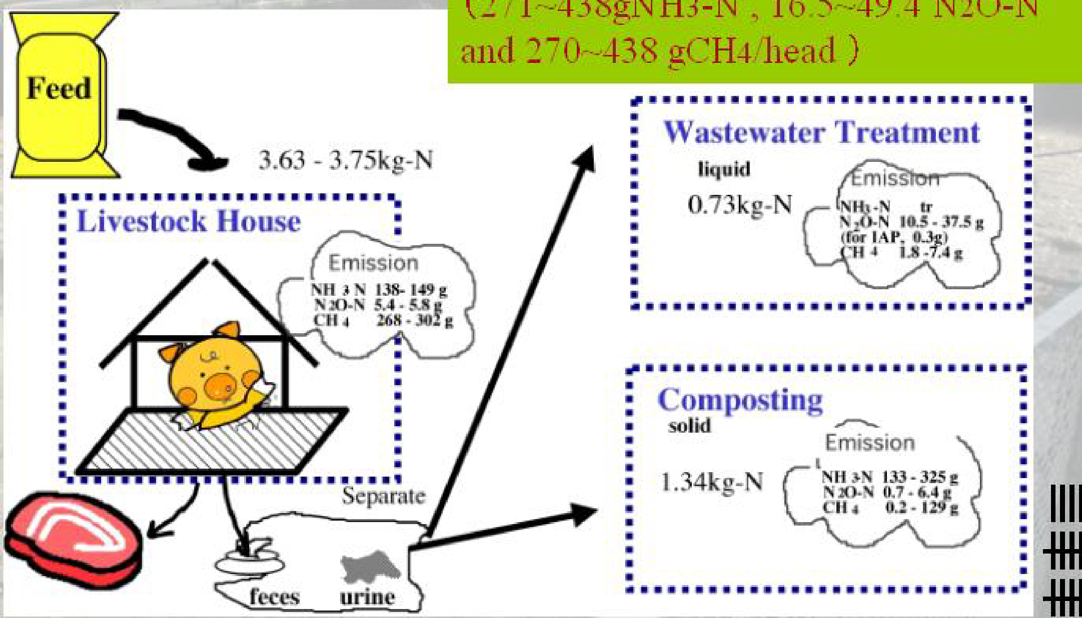
Not only the compost, but the emission factor of each treatment system should be evaluated under each countries procedure and general conditions, because those factors might be widely varied.

It is important that each country has the measurement technique of GHG emission, not only for inventory data but for the development of greenhouse gas regulations and technologies.

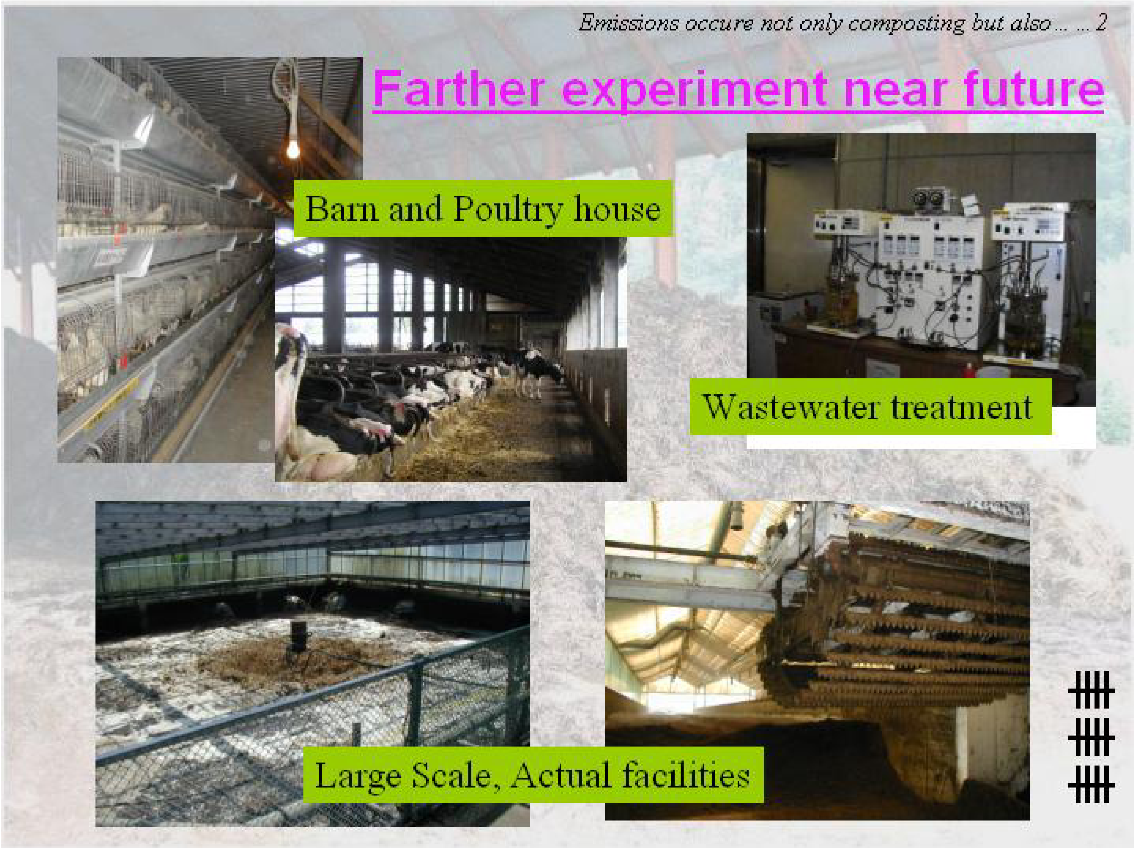
Emissions occure not only composting but also … … 1

The NH_3-N, N_2O-N and CH_4 emissions from the swine keeping unit and its manure contributes

(271~438gNH_3-N , 16.5~49.4 N_2O-N and 270~438 gCH_4/head)



(a full fattening period of 8 weeks)


Emissions occure not only composting but also 2
Farther experiment near future
Barn and Poultry house
Wastewater treatment
Large Scale, Actual facilities


Thank you for
your Attention !!
動物産業起源的
温室効果説定
没有推測的那様大・・・
我那様希望着
The greenhouse effect of Animal Industry origin
might not be so big as you suppose, I hope.

3[rd] Workshop on GHG Inventories in Asia Region
23 -24 February, 2006, Manila, The Philippines.

Development Inventory of the Country-specific Activity Data and Estimation Methods for Forests Ecosystems and Land-use Change in Malaysia

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

MS ISO 9001 : 2000

1

Forest Resources Malaysia

- Classification of forest types in different regions
- Verification of reported figures/ statistics
- Definition & interpretation
- Reporting source
- Policy & Jurisdiction
- Satellite imageries vs. aerial photograph techniques
- Uncertainties & unsuitability of assumptions

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2

Malaysia: Forested Area By Region, 2000 (Million Hectares)

Region	2000	2005
Peninsular Malaysia	5.94	
Sabah	4.42	
Sarawak	9.84	
Total	20.20	

Source: FDPM, FD-Sabah & Sarawak

MS ISO 9001 : 2000

3

Malaysia: Permanent Reserve Forest by Region, 2000 (Million Hectares)

Region	Protective	Productive	Total
Peninsular Malaysia	1.90	2.90	4.80
Sabah	1.03	4.97	6.00
Sarawak	0.91	2.69	3.60
Total	2.91	10.56	14.40

Source: FDPM, FD-Sabah & Sarawak

MS ISO 9001 : 2000

4

Malaysia: Distribution and Extent of Major Forest Type, 2000 (Million Hectares)

Region	Inland	Swamp	Mangrove	Others	Total Forested Land
Peninsular Malaysia	5.500	0.200	0.100	0.100	5.900
Sabah	3.810	0.120	0.340	0.340	4.420
Sarawak	8.640	1.040	0.130	0.130	9.840
Total	17.950	1.360	0.670	0.284	20.160

Source: FDPM, FD-Sabah & Sarawak

The Extent of Forest Resources

- Rich biodiversity of flora & fauna
- Sustainable Forest Management (SFM)
  - Achieve balance between development and conservation
- National & State forest policies
  - National Forestry Policy (NFP) 1978
  - Sarawak Forest Ordinance (1958)
  - Sabah Forest Policy (1948)

The Extent of Forest Resources (cont.)

- Permanent Forest Estate (PFE)
  - Permanently maintained fpr economic, protection, recreational and/or other purposes.
  - Production Forest
    - Supply of resources
  - Protection Forest
    - Conserving resources and biodiversity
- Stateland Forest (SLF)
  - Land reserve for development

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7

Malaysia: National Communication

- National Initial National Communication 1994
- Second National Communication 2000 – on-going

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8

Initial Communication Possible Uncertainties

- Definition of classifications/ categories
- Extend of forest resources inventory
- Default values
- Extensiveness of calculations
- Collaborators & Working Group
- Incomparable practices and data

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9

Essential Data Comparison

	Initial Inventory	Current Inventory
Area	Acreage of forest and agriculture plantation	Acreage of PRF category and sub-categories, stateland, wildlife reserves, plantations, and non-forest trees.
Annual growth rate	Acacia mangium = 15.0 tdm/ha Others = 11.0 tdm/ha (average of Eucalyptus, Tectona, Pinus spp.) Source: IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2, 1995.	• Acacia Mangium • Tectona grandis • Pine • Azadirachta excelsa • Rubber • Oil palm • Others = 12.5[2] tdm/ha (mixed fast-growing hardwoods)
Commercial harvest	Plantation logs = 10,232,348 m3 Rubberwood = 1,156,667 m3	Total HHW/ MHW/ LHW = 5,049,284 m3 Rubberwood – Not available

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10

	Initial Inventory	Current Inventory
Fuelwood	Not accounted.	Figures from FD- Sabah & Sarawak only.
Non-forest trees	Not accounted	Statistics and key assumptions of FDPM, FD – Sabah & Sarawak..
Area converted annually	1 kha	FDPM, FD – Sabah & Sarawak statistics on area harvested (mean average less than 10 years)
Fraction biomass on-site and off-site	Burned on-site = 0.07 (tropical forest) Carbon fraction burned on/off - site = 0.45 Burned off-site = 0.68	Integrated working group assumptions.

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11

Second National Communication

- FRIM appointed leading LULUCF sector
- Working closely with several relevant departments
  - Forest Department: Peninsular Malaysia, Sabah & Sarawak.
  - Department of Agriculture (DOA)
  - Universiti Putra Malaysia (UPM)
  - Malaysian Palm Oil Board (MPOB)
  - Malaysian Rubber Board

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12

Second National Communication Approach

Software – Upcoming new tools adoption

↓

Review Initial National Inventory

↓

Define Tier Approach

↓

Defining Classifications/ Key Categories & Forest Types

↓

Consultations & Workshops

↓

Adopt Good Practice Inventory by Region

↓

Continuous Updating & Network

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13

Comparison of Sectoral Report for Land-Use Change & Forestry (Gg)

	Total Land-Use Change & Forestry (CO_2 removals)	Changes in forest and other woody biomass stocks (CO_2 removals)	Forest & grassland conversion (CO_2 emissions)	Abandonment of managed lands (CO_2 removals)
Initial Inventory		-68,717		N/A
Current Inventory (Peninsular Malaysia & Sarawak)	-290,309	-236,778	10,550	-64,082 (Sarawak only)

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14

Progress Update

- Completed Peninsular Malaysia
- Completed Sarawak
- Review & Update
- Sabah to be completed March
- Inclusion of soil activity data
- Reporting
- Initiate new tools

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15

Issues & Challenges

- Close cooperation
  - Awareness
- Forest Inventory Data
  - Forestry Department
  - Forest Research
  - Ministries
- Sins of reporting
  - Forest conversion
  - Shifting cultivation
  - Totally Protected Area (TPA)
- Assumptions & Uncertainties
  - Agreement to conclusion

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Knowledge Gaps

- Inclusion of Totally Protected Area/ National Parks/ Wildlife Reserves
- Abandonment of managed lands
  - Logging purposes
  - Shifting cultivation
- Plantation
  - Oil palm
  - Rubber
- Soil activity data
  - Soil types
  - Land use
  - Mapping

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Knowledge Gaps (cont.)

- New software tool adaptation
- Long-term monitoring & measurement activity/ research
  - Incorporation of other studies
  - Experimental plots
- Ground survey of forest/ plantation establishment
  - Age
  - Growth rate

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18


Knowledge Gaps (cont.)
• Estimation & Assumptions of burning
• Forest fire
• EFDB
• GPG-LULUCF 2003
• Training & Workshop Update
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19
FRIM


Conclusion
• Working group to integrate existing reporting and classification of resources
• Update on software tools and discussion groups
• Responsible experts involvement
• Continuous reporting
• Experience of various countries
MS ISO 9001 : 2000
20
FRIM


Acknowledgement
• Dr. Elizabeth Philip
• Dr. Abdul Rahim Nik
• LULUCF Working Group
• National Institute for Environmental Studies (NIES)
• Department of Environment and Natural Resources of the Philippines
• The University of Philippines Los Banos
• Ministry of Environment Japan
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21
FRIM
INSTITUT PENYELIDIKAN PERHUTANAN MALAYSIA


Thank You!
MS ISO 9001 : 2000
22
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INSTITUT PENYELIDIKAN PERHUTANAN MALAYSIA

The 3rd Workshop on GHG Inventories in Asia Region

February 23-24, 2006

Manila, Philippines

Development of the LULUCF's GHG Inventories of Cambodia

Prepared by
Heng Chan Thoeun, CCCO
Ministry of Environment, Cambodia

1

Outline of Presentation

1. Introduction
2. Direct Measurement of Biomass of the Major Forest Type
3. Conversion of measured biomass values into values in carbon pools under the GPG-LULUCF
4. Development of activity data for 2000 including assumptions made to estimate land areas which went through land use conversion

2

1. Introduction

- Cambodia ratified the UNFCCC on 18 December 1995;
- Acceded to the Kyoto Protocol on 4 July 2002;
- Ministry of Environment (MoE) is the National Focal Point for the UNFCCC and the Kyoto Protocol;
- Cambodian National GHG Inventory was prepared for the first time in 1994 as the base year by the Climate Change Enabling Activity Project (CCEAP) *phase1 and phase2:* Improvement of Activity Data and Emission Factors for Forestry Sector. The methodologies based on the Revised 1996 IPCC Guidelines;
- Cambodia is a project partners, which conduct a field surveys for the improvement of GHG inventories of the LULUCF sector, funded by Asia Pacific Network (APN) and executed by the National Institute for Environmental Studies (NIES) of Japan;

3

1. Introduction (cont.)

- For 2004-2006, the CAPaBLE project in Cambodia focused on activities:
  - Determination of the overall work plans
  - Planning and preparation for the training in Dec. 2004
  - Organizing a three-days field training (Koh Kong province)
  - Planning and preparation for the measurement in CAPaBLE plots
  - Implementation of the first time measurement (Mar. 2005)
  - APN CAPaBLE-NIES: Meeting with MoE-Cambodia (October 4-7, 2005): Prepare the Excel table format for the application of collected and analyzed data to an inventory by using the IPCC's GPG-LULUCF; Compare the estimation methodologies used between the previous and new inventories; Evaluate the overall methodology used; Discuss the items to be included in the final activity report
  - The second time measurement (Jan-Feb. 2006)
  - Data analysis, evaluation of the measurement, and report

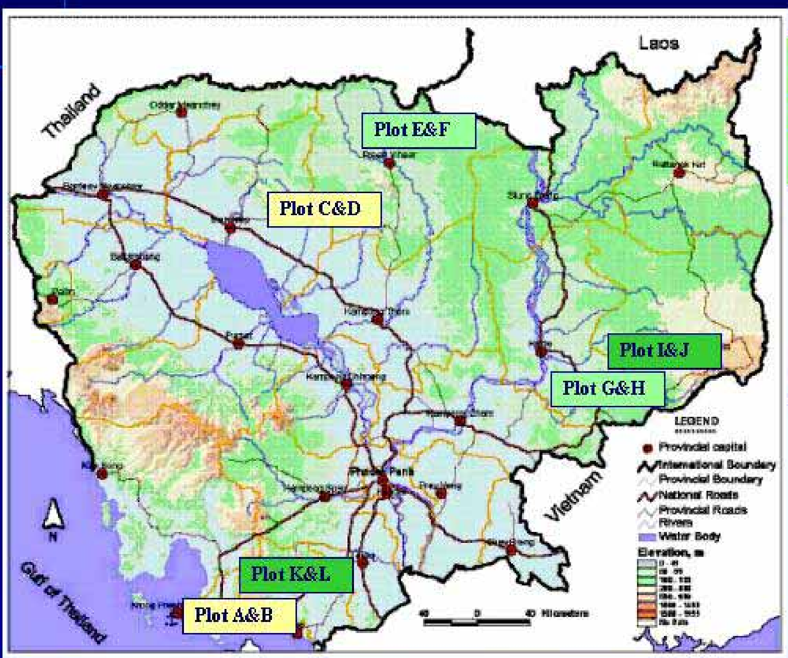
4

2. Direct Measurement of Biomass of the Major Forest Type

- The field survey focused on the main forest types which play an important role as the key source/sink categories:
  - Evergreen forest;
  - Deciduous forest; and
  - Secondary forest;
- Two different locations of field measurements were conducted for each forest type;
- The objectives of field surveys are to: (i) identify type, species and number of trees in three selected forest types; (ii) estimate the aboveground biomass of tress in these selected forest types; and (iii) estimate the annual biomass increment of the selected forest types.

5

2. Direct Measurement of Biomass of the Major Forest Type (cont.)



Note:
- Secondary: A,B,C,D
- Deciduous: E,F,G,H
- Evergreen: I,G,K,L

Map of Cambodia

6

2. Direct Measurement of Biomass of the Major Forest Type (cont.)

Locations and schedule of survey

Plot	Forest type	Location	Measurement Time 1	Measurement Time 2
A	Secondary forest	Sihanoukville (Ream NP)	28 Feb-3 March 05	January 06
B				
C		Siem Reap (Kulen Prumtep NP)	6 -9 March 05	February 06
D				
E	Deciduous	Preah Vihear (Wildlife sanctuary)	19-23 March 05	February 06
F				
G		Kratie -Snoul (Wildlife sanctuary)	27-31 March 05	January 06
H				
I	Evergreen	Kratie -Snoul (Wildlife sanctuary)	2-5 April 05	January 06
J				
K		Kampot (Bokor NP)	6-9 April 05	January 06
L				

7

2. Direct Measurement of Biomass of the Major Forest Type (cont.)

- The methodology for field survey followed by *Hairiah K. et al. (2001): Methods for sampling carbon stocks above and below ground* and the final report of the Cambodia Climate Change Enabling Activity Project's Phase 2 (2003).
- The measurement consists of two parts:

  (i) non-destructive sampling for the trees, including diameter and height of living tress and necromass;

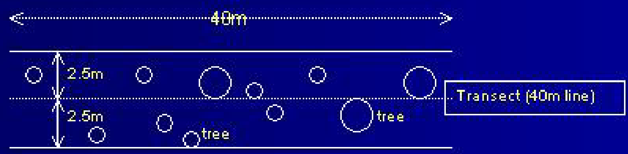
  (ii) destructive sampling for the understorey, necromass, and living tree biomass.

8

2. Direct Measurement of Biomass of the Major Forest Type (cont.)

- Sampling protocol for living tree biomass and tree necromass (Diameter >30 cm): Sample area: 20m x 100 m = 2000 m^2;

- Sampling protocol for living tree biomass and tree necromass (Diameter from 5-30 cm): Sample area: 5m x 40 m = 200 m^2 within in the sample size Diameter >30cm



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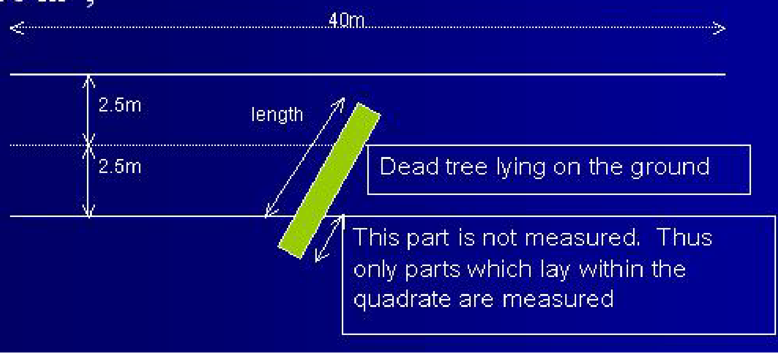
2. Direct Measurement of Biomass of the Major Forest Type (cont.)

- For each tree specie is recorded and the diameter at 1.3m above the soil surface is measured using a diameter tape (diameter at breast height: DBH) for the First and Second time;
- Height of trees, selected within a plot, is also measured and recorded for the First and Second time;
- Sampling protocol for tree necromass: Sample area: 5m x 40 m = 200 m^2;



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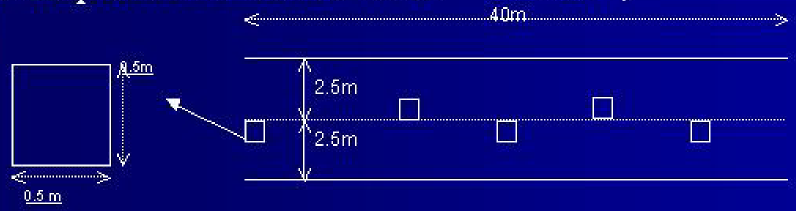
2. Direct Measurement of Biomass of the Major Forest Type (cont.)

- Sampling protocol for destructive sampling in 1.25 m²:

Sample area: 5m x 40 m = 200 m² ;



- *Living tree biomass:* set up randomly a sampling frame of 0.5m x 0.5m in each quadrate with trees less than 5 cm DBH, i.e. seedling or saplings, are harvested within the 1m x 1m quadrate;
- *Coarse litter:* crop residues, all unburned leaves and branches;
- *Fine litter:* dark litter, including all woody roots which partly decomposed;
- *Sun dry:* living tree biomass, coarse litter and fine litter are dried using sun-light.

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3. Conversion of measured biomass values into values in carbon pools under the GPG-LULUCF

Translation of carbon pools from CAPaBLE to GPG-LULUCF

CAPaBLE				IPCC Pool
Carbon pools	**Symbol**	**Definition**	**Sampling method**	**Carbon pools**
Live trees	BT	with a stem diameter of 30 cm in standard sample plot (20*100 m)	Non-destructive	Aboveground biomass
	LT	with a stem diameter of 5<…<30 cm in large area (5*40 m)		
Understorey	L+S	includes trees less <5cm in diameter	Destructive	Aboveground biomass
Litter	CLit	Coarse/standing litter: tree necromass <5cm in diameter and/or <50 cm length	Destructive	Litter
	FLit	Fine litter: dark litter, including all woody roots which partly decomposed		Litter
		Surface roots		
Dead felled trees	DFT	Dead trees on the ground with a diameter >5cm and >50cm length	Non-destructive	Dead wood
Stump (trunk) remains in forest	DST	Dead standing trees with a diameter >5cm and >50cm length	Non-destructive	Dead wood

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3. Conversion of measured biomass values into values in carbon pools under the GPG-LULUCF (cont.)

Summary of key points of CAPaBLE survey in IPCC definition

IPCC pools	CAPaBLE Carbon pools	Forest types: Secondary, Deciduous, and Evergreen Forests (t dm/ha)			
		T=1	T=2	Difference	Average
Living Biomass: - Aboveground and - Belowground biomass	- Live trees - Understorey				
Dead Organic Matter: - Dead wood, - Litter	- Dead wood - Coarse litter - Fine litter				
Soils: Soil organic matter	N/A				

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4. Development of activity data for 2000 including assumptions made to estimate land areas which went through land use conversion

- Base on IPCC GPG-LULUCF, to estimate the land areas which go through the conversion of land uses in 2000, a number of assumptions were proposed to be taken;
- The difference areas of specific land use categories between the initial and final point in time experienced land conversion;
- For example, in Cambodia, it was estimated that the land area of Forest Land was decreased by around 55,000 hectares in 2000. In this case, we assumed the area of Forest Land went through land use conversion and the rest of Forest Land area remained as Forest Land;

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4. Development of activity data for 2000 including assumptions made to estimate land areas which went through land use conversion (cont.)

- The difference areas of land use categories between the beginning and end of year 2000, the increased and decreased areas of land use categories through conversion in 2000 were obtained;
- The increased land area of a land use category means that the area was increased because some lands were converted from different land use categories into the land use category;
- The total of increased area is equivalent to that of the decreased area. Then estimated the areas of land use conversion of each land use category by making assumption considered the most realistic;

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4. Development of activity data for 2000 including assumptions made to estimate land areas which went through land use conversion (cont.)

Assumptions made to estimate the areas of land use conversion

Assumption No.	Land conversion concerned (Area in Ha)		Description of assumption
	Before	After	
1	Grassland (2,529.5)	Forestland (2,529.5)	It is difficult to predict forest planting was conducted after destroying existing forests. Considering ecological reasons, it is also difficult to plant trees in wetlands. Hence, it is assumed that all plantations were established in grasslands.
2	Forestland (3,336.3)	Grassland (3,336.3)	It is the most realistic to assume grassland was established by converting forestland.
3	Grassland (247.5)	Settlements (247.5)	It is the most realistic to assume settlements was established by converting grassland.
4	Forestland (54,565.3)	Cropland (83,785.3)	The remaining area of forestland that went through conversion was reported here.
5	Grassland (29,220)		It is assumed that the rest of area of cropland converted from different land uses was area converted from grassland.
6	Grassland (4,196.5)	Other land (6505.5)	The remaining area of grassland that went through conversion was reported here.
7	Wetlands (2309.0)		It is assumed that the rest of area of other land converted from different land uses was area converted from wetlands.

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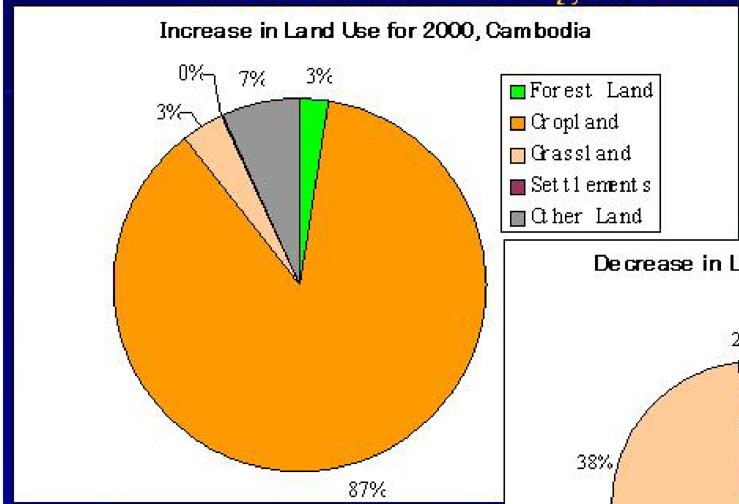
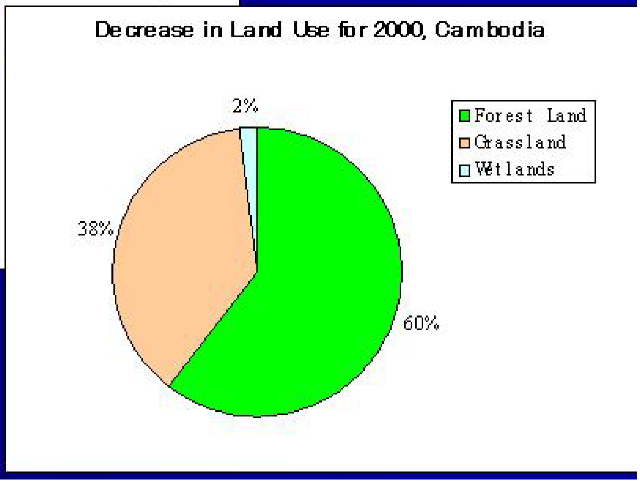
4. Development of activity data for 2000 including assumptions made to estimate land areas which went through land use conversion (cont.)

Land area went through conversion in 2000





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18

Experience learned by using the IPCC's Good Practice Guidance on Land Use, Land-Use Change and Forestry in developing Japan's GHG inventories

SATO Atsushi
Greenhouse Gas Inventory Office of JAPAN
(Mitsubishi UFJ Research & Consulting)

1

Outline

1. Overview of Japan's GHG Inventory
2. Overview of LULUCF Sector
3. Comparison between LULUCF Inventory and LUCF Inventory
4. LULUCF Inventory Preparation

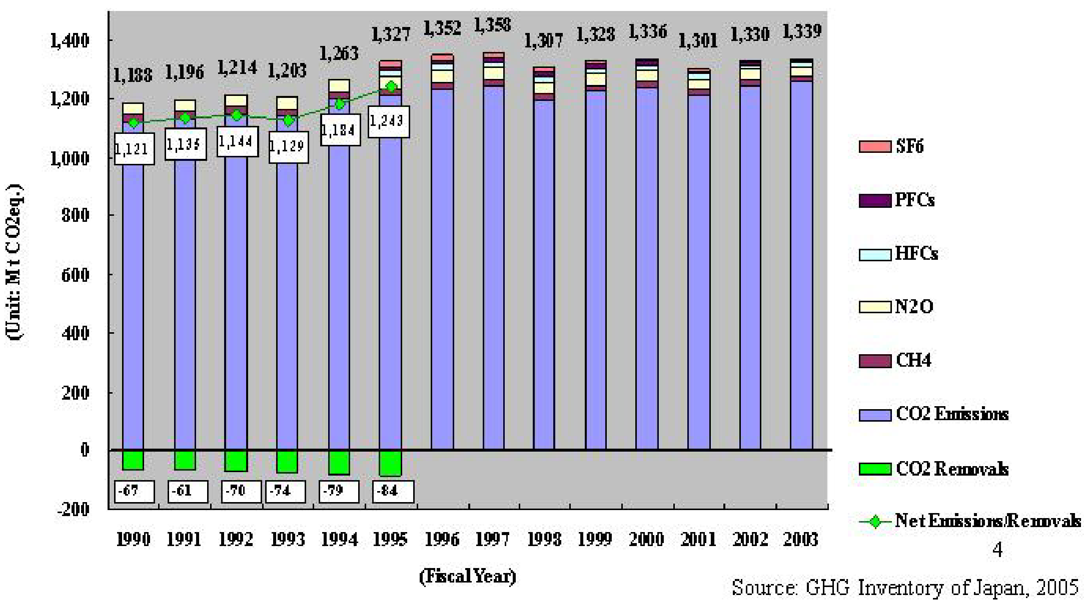
2

1. Overview of Japan's GHG Inventory

3

GHG emissions and removals in Japan

- GHG emissions from source : 1,327 Mt CO_2eq. in 1995
- CO_2 removals into sink : 84 Mt CO_2 in 1995



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Source: GHG Inventory of Japan, 2005

Japan's GHG inventory

- Developed and submitted to UNFCCC every year since 1996
- Using CRF (Common Reporting Format) and Excel based calculation files
- Have been preparing NIR since 2003
- Will use CRF reporter for submitting to UNFCCC from 2006

Japan has been developing national inventory system to satisfy the UNFCCC and Kyoto Protocol requirements 5

Japan's inventory preparation system

- The Ministry of Environment (MOE) is the national entity responsible for national inventory.
- GIO and some private-sector consulting firms work together with MOE for inventory preparation.
- Other Ministries are involved in the inventory preparation system by providing data, confirming data from technical view point and so on.
- External experts review calculation methods, EF, activity data, and an entire inventory and provide advice.

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2. Overview of LULUCF Sector

7

GHG emissions and removals of LULUCF sector in Japan

Table1: Emissions & Removals of LULUCF sector in 1995

$GgCO_2eq$

Land Use Categories		CO_2	CH_4	N_2O
5A. Forest Land	**-93,149**			
1. Forest Land remaining Forest Land		-91,637	22.45	2.28
2. Land converted to Forest Land		-1,537	IE	IE
5B. Cropland	**2,298**			
1. Cropland remaining Cropland		0	0.00	0.00
2. Land converted to Cropland		2,085	6.17	207.26
5C. Grassland	**1,636**			
1. Grassland remaining Grassland		0	NE	NE
2. Land converted to Grassland		1,635	0.93	0.09
5D. Wetlands	**231**			
1. Wetlands remaining Wetlands		NO,NE	NE	NE
2. Land converted to Wetlands		225	5.52	0.56
5E. Settlements	**4,548**			
1. Settlements remaining Settlements		-332	NE	NE
2. Land converted to Settlements		4,759	109.29	11.09
5F. Other Land	**1,127**			
1. Other Land remaining Other Land			NE	NE
2. Land converted to Other Land		1,114	11.82	1.20
Total Land-Use Categories	**-83,309**	**-83,688**	**156**	**222**

(+) emission, (-) removal

Source: LULUCF CRF of Japan, 2005

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Feature of land use in Japan

- Area of forest cover is large
  - two-third of national land
  - this ratio has not been changed for the last 100 years.
- Most of agricultural land use is arable and tillage.
  - grassland is not significant in Japan
- The ratio of settlements have been increasing.
  - urban greening also have been performed

Table: Area of Land Use in Japan

Land Use Category		1990	1995	2003
Forest	[10^4ha]	2,524	2,514	2,509
Agricultural land use	[10^4ha]	534	513	482
Wilderness	[10^4ha]	27	26	26
Water surface and river	[10^4ha]	132	132	134
Road and Residential land	[10^4ha]	275	291	313
Other land use	[10^4ha]	285	303	316
Total	[10^4ha]	3,777	3,779	3,780

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Source: Land White Book, MLIT Japan, 2005

Japan's LULUCF (LUCF) Inventory

- Developed LUCF Inventory based on 1996GL and used it until 2004 submission.
- Revised based on LULUCF-GPG in 2005 (LULUCF Inventory).
- Development and revision of LULUCF Inventory is ongoing.
- Inventory for Kyoto Protocol article 3.3 and 3.4 is under development as well.

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LULUCF inventory preparation system

- MOE is the responsible agency and coordinator.
- Forest Agency (FA), Ministry of Agriculture Forestry and Fisheries (MAFF) and Ministry of Land Infrastructure and Transport (MLIT) also play important role for LULUCF inventory preparation from technical viewpoints.
- Expert review is conducted as appropriate for improving LULUCF inventory quality.

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3. Comparison between LULUCF Inventory and LUCF Inventory of Japan

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Main Changes on LULUCF-GPG from IPCC1996GL-LUCF

- Reclassification of calculation categories
  - Land based categorization
  - All national land and the entire land use change between categories are covered
  - Land use information in the past (ex.20years) is required
- Clarification of five carbon pools for calculation
  - Above-ground Biomass, Below-ground Biomass, Dead wood, Litter, Soil Organic Matter
  - Reporting will be conducted under three categories (Living Biomass, Dead Organic Matter, Soil)
- Annex (necessary information) and Appendix (extra information)

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LUCF Inventory of Japan until 2004

The Categories Japan reported under LUCF-CRF based on 1996GL

LUCF Category		Status	LULUCF Inventory
5A	2.Temperate Forests	○	→5A1
	5.Other (Park and Green space conservation zone)	○	→5E1
5B	2.Temperate Forests conversion	○	→5B2, 5C2, 5D2, 5E2, 5F2
	4.Grassland conversion	NE	Newly estimated
5C	2.Abandonment of managed temperate forests	NE	-
	4.Abandonment of managed grassland	NE	-
5D	CO_2 emissions and removals from Soil	NE	Newly estimated

※ Other Categories are reported as NO

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Source: GHG Inventory of Japan, 2005

LULUCF Inventory of Japan in 2005

Status of reporting in Japan's LULUCF-CRF based on LULUCF-GPG

From \ To	Forest	Cropland	Grassland	Wetlands	Settlements	Other land
Forest	○	○	○	○	○	○
Cropland	○	○	○	○	○	○
Grassland	○	○	○	○	○	○
Wetlands	○	○	○	○	○	IE
Settlements	○	○	○	○	○	IE
Other land	○	○	○	IE	IE	○

5(I)	5(II)	5(III)	5(IV)	5(V)
IE	NO (Organic Soil) NE (Mineral Soil)	○ (Organic Soil) NO (Mineral Soil)	NE	○(controlled fire) NE (wild fire)

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Source: Revised GHG Inventory of Japan, 2005

Status of 2005 Japan's LULUCF inventory compared to the previous LUCF inventory

Carbon pool	Status of LULUCF inventory compared to LUCF inventory
Living Biomass	• Some methodologies are used for forest removals and emissions. • Carbon loss from forest disturbance and forest fire are newly estimated. • Emissions from land use change concerning non forest lands are newly estimated.
Dead Organic Matter	• Dead Organic Matters are reported as NE.
Soil	• Emissions and removals from carbon stock changes caused by land use changes are newly estimated under "conversion" categories. • Using Tier.1 (no change) for "remaining" categories.
Non CO_2 Gas	•Non CO2 gas emissions from "disturbance associated with land-use conversion to cropland " and "biomass burning" are newly estimated.

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General information on transformation from LUCF to LULUCF inventory

- Estimation
  - New estimations will be required generally.
- Data
  - More data are necessary to complete LULUCF Inventory.
- Complexity
  - Category classification becomes complex.
- Consistency
  - Much more attention is necessary for land classification consistency and time series consistency

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4. LULUCF Inventory preparation

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Profile of Japan's LULUCF Inventory

- **Statistics-based land classification system**
  - Area of lands and land use changes is derived from several statistics.
- **Excel-based calculation system**
  - Special skills are not really required for inventory compiler.
- **Many parameters are country specific**
  - Improvement for parameter usage and data collection is ongoing.

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Difficulties we faced in 2005

- Consistent Land use category setting and appropriate estimation methods of land use change
- "Remaining" and "Conversion" classification.
  - How do we know the information on land use and land use change in the last 20 years?

→The method and improvement planning is under discussion.

- Lack of country specific parameters

→Relevant research has been performed

- Appropriate estimation and interpolation methods.

→Inspection and improvement has been conducted

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Potential advantages and disadvantages of two land classification methodologies

	Statistical Base (Approach1,2)	GIS Base (Approach3)
Advantage	• Existing forest inventory, land statistics or agricultural census can be used. • Consistent to agriculture sector. • Periodic updating is relatively easy. • Categorization is easy if single statistic is used for preparation.	• Existing GIS data can be used if available • Consistent land categorization can be performed
disadvantage	• Consistent land categorization may be hard work if several data are used together.	• Georeference is essential • Periodic updating might involve high cost and work.

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What should be considered for LULUCF Inventory Preparation

- Analysis of data acquisition and applicability are necessary.
- The objective and precision level should be clarified.
- Cooperative framework between inventory compiler and the data providers, experts and so on may be important.

22

The Estimate Model of MSW Generation in China

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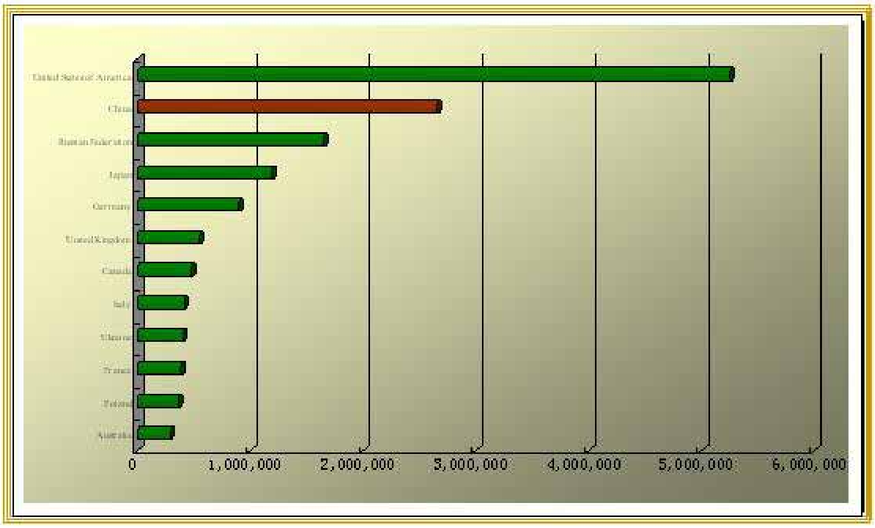
Center for Climate Impact Research, SEPA

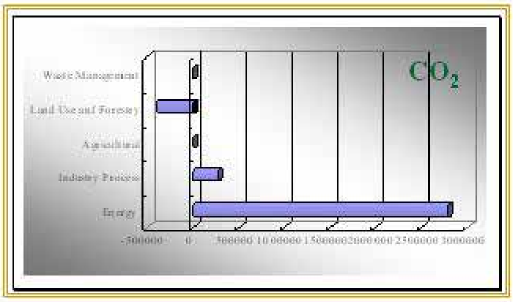
Contents

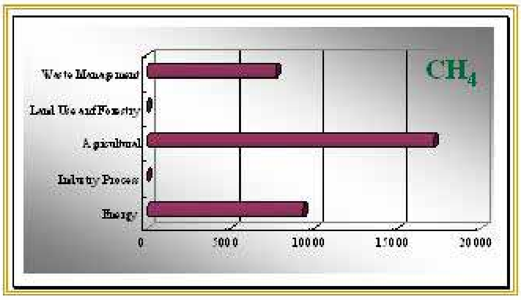
- Solid waste generation in China
  - Municipal solid waste generation of China
  - Industrial solid waste in China
- The driving force analysis of MSW in China
  - Urban non-agricultural population
  - Gross Domestic Product (GDP)
  - The area of city
  - Urban population
  - The number of city
  - GDP per capita
- The forecast model of MSW and scenario analysis
- Conclusions

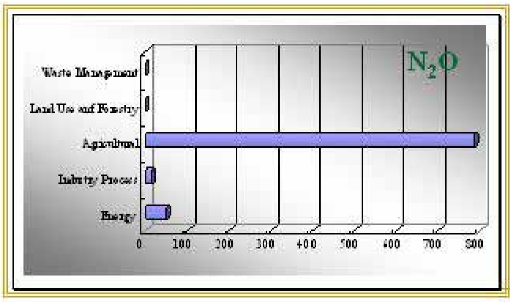


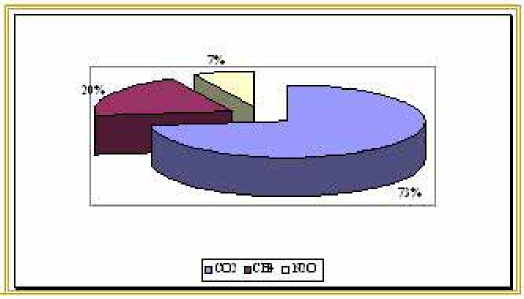
GHGs Emission in 1994

The Greenhouse Gas Emission in different sector of China (1994)









Solid waste generation in China

- **Municipal solid waste generation of China**
  - Municipal solid waste include: garbage of resident, sweeping waste in a city, community waste, waste from markets and restaurants etc. Clinic waste and poisonous waste are not include in MSW, and they are treated separately in special areas.

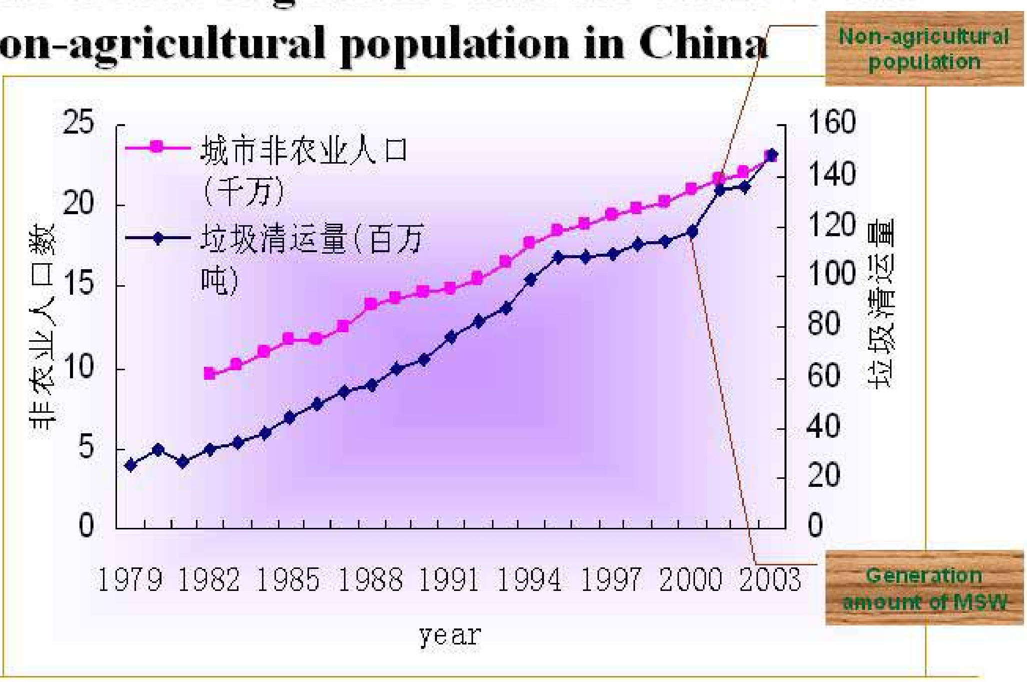
Weigh(metage)

Visual

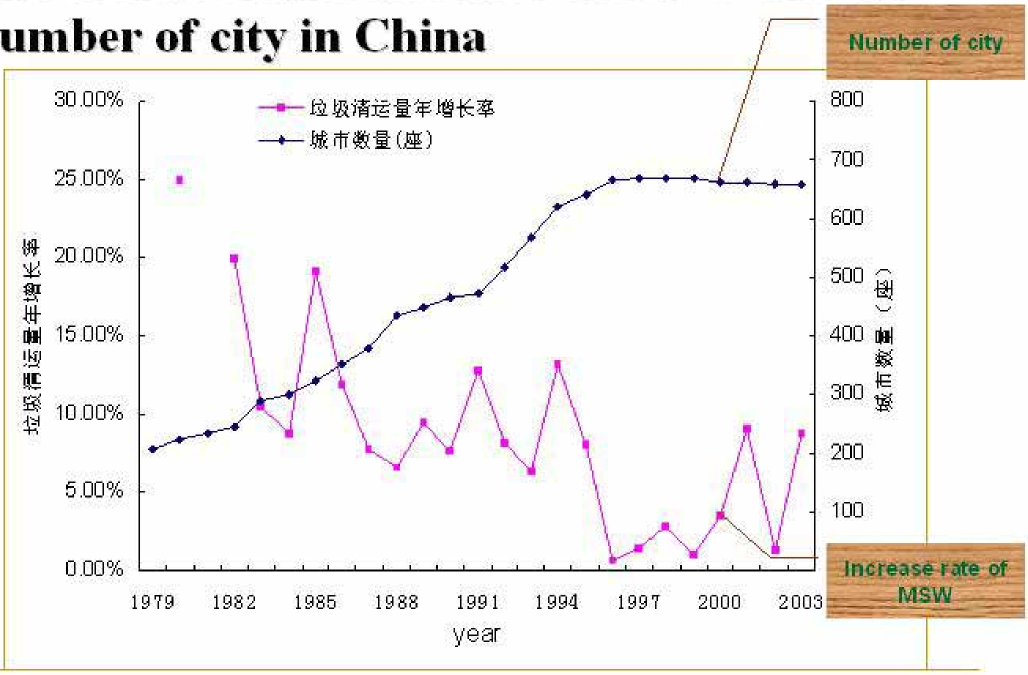
Carrying / generate Amount

- **Industrial solid waste in China**

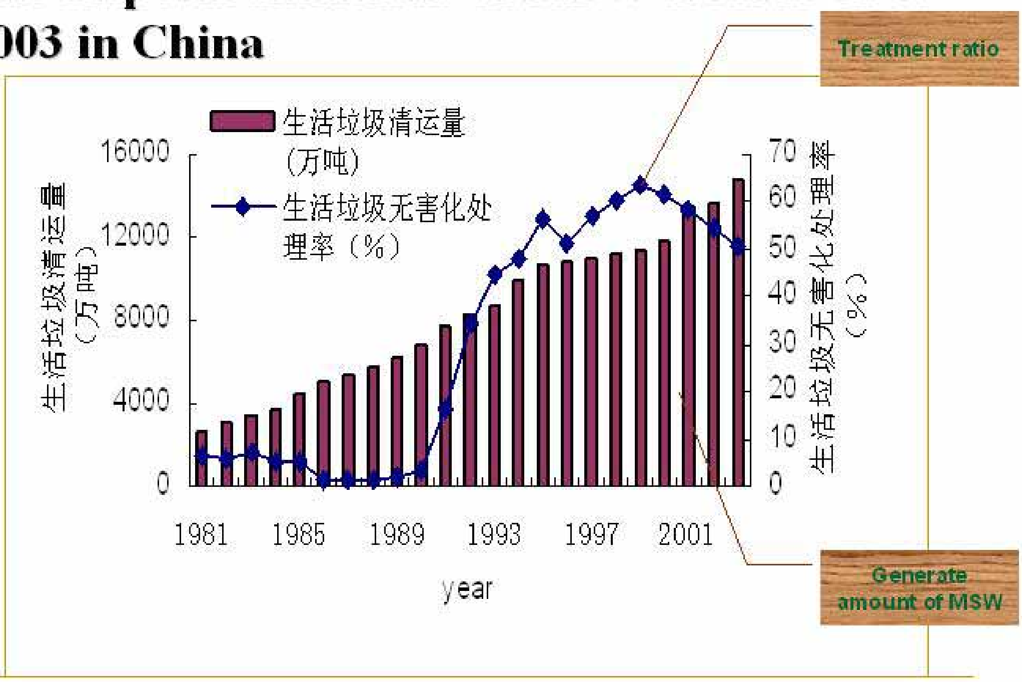
The trends of generate amount of MSW and non-agricultural population in China



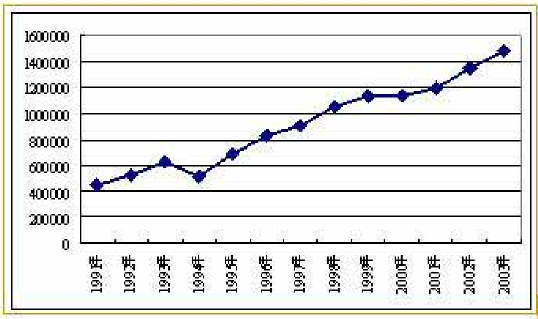
The trends of increase rate of MSW and the number of city in China

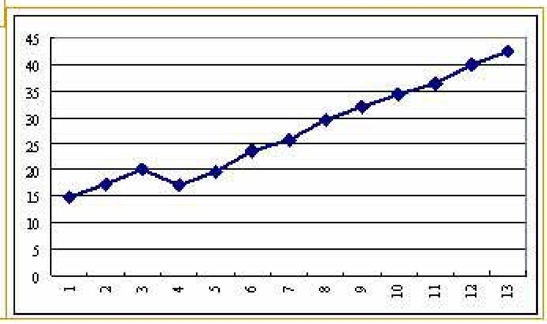


The disposal situations of MSW from 1981 to 2003 in China

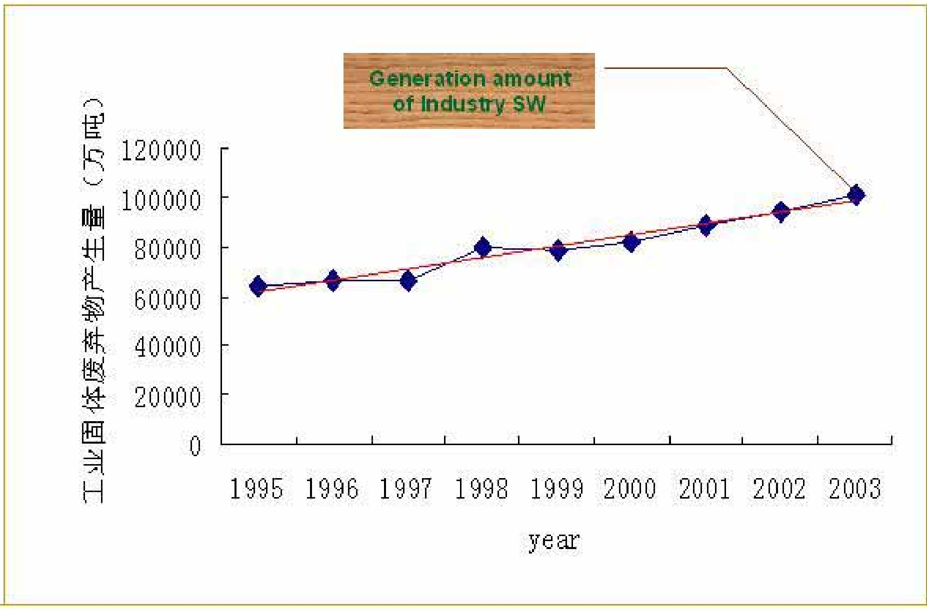


The disposal situations and treat ratio of Waste Water from 1991 to 2003 in China



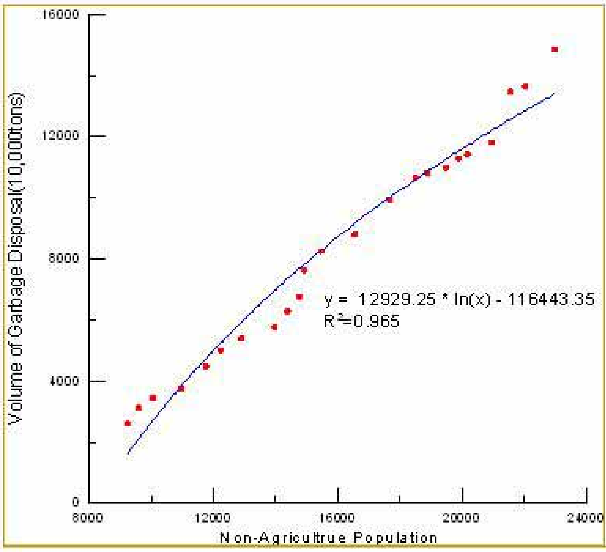


The trend of generate amount of industry solid waste in China



The driving force analysis of MSW(1)

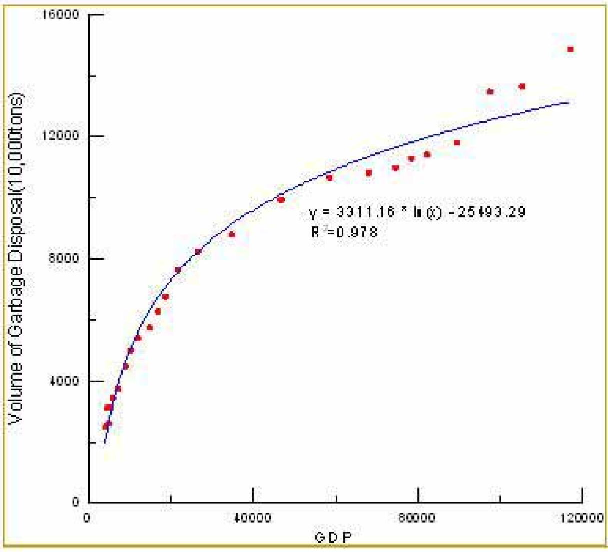
Urban non-agricultural population



The relation of non-agriculture population and the generate amount of MSW

The driving force analysis of MSW(2)

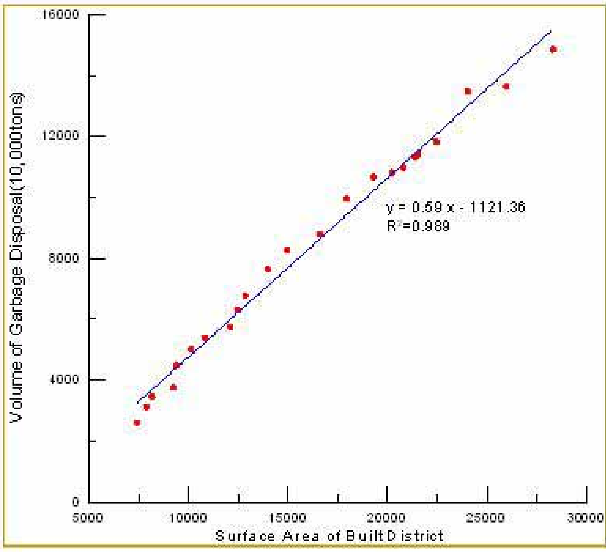
Gross Domestic Product (GDP)



The relation of GDP and the generate amount of MSW

The driving force analysis of MSW(3)

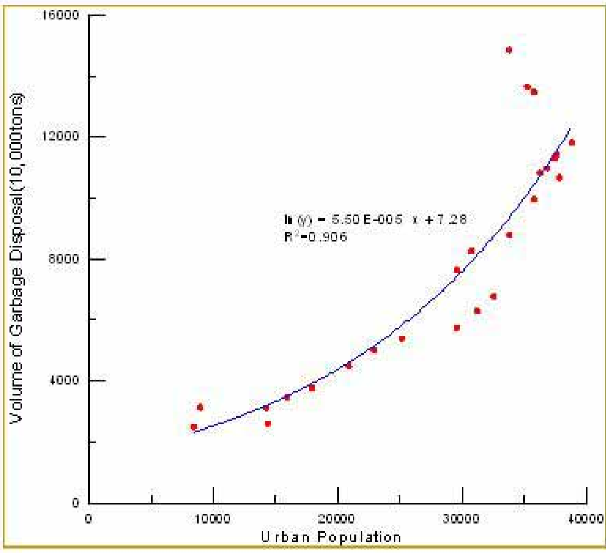
The area of city



The relation of area of city and the generate amount of MSW

The driving force analysis of MSW(4)

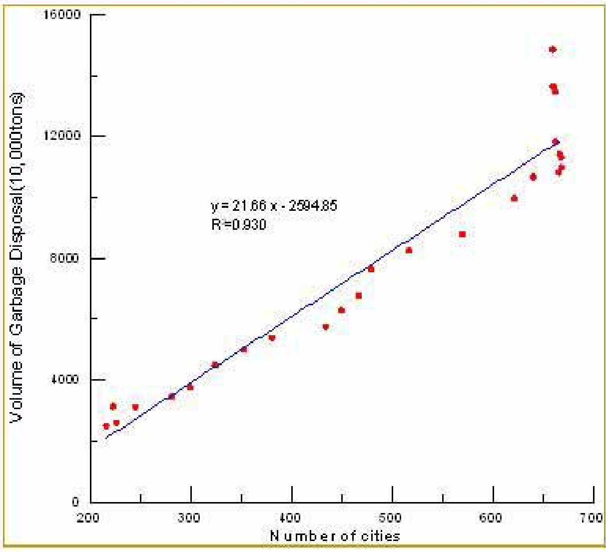
Urban population



The relation of urban population and the generate amount of MSW

The driving force analysis of MSW(5)

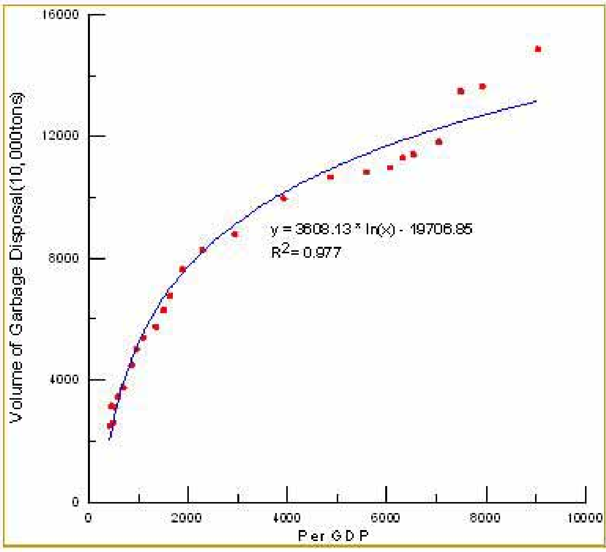
The number of city



The relation of city numbers and the generate amount of MSW

The driving force analysis of MSW(6)

GDP per capita



The relation of per GDP and the generate amount of MSW

The forecast model of MSW

1. **Forecast model based on GDP**

$$W_g = f_{(GDP)} = 3311.16\ln(GDP) - 25493.29$$

The correlative coefficient $R^2 = 0.978$

2. **Forecast model based on GDP per capita**

$$W_g = f_{(GDP/perCapita)} = 3608.13\ln(GDP/perCapita) - 19706.85$$

The correlative coefficient $R^2 = 0.977$

3. **Forecast model based on Non-Agriculture Population**

$$W_g = f_{(Non-AP)} = 12929.25\ln(Non-AP) - 116443.35$$

The correlative coefficient $R^2 = 0.965$

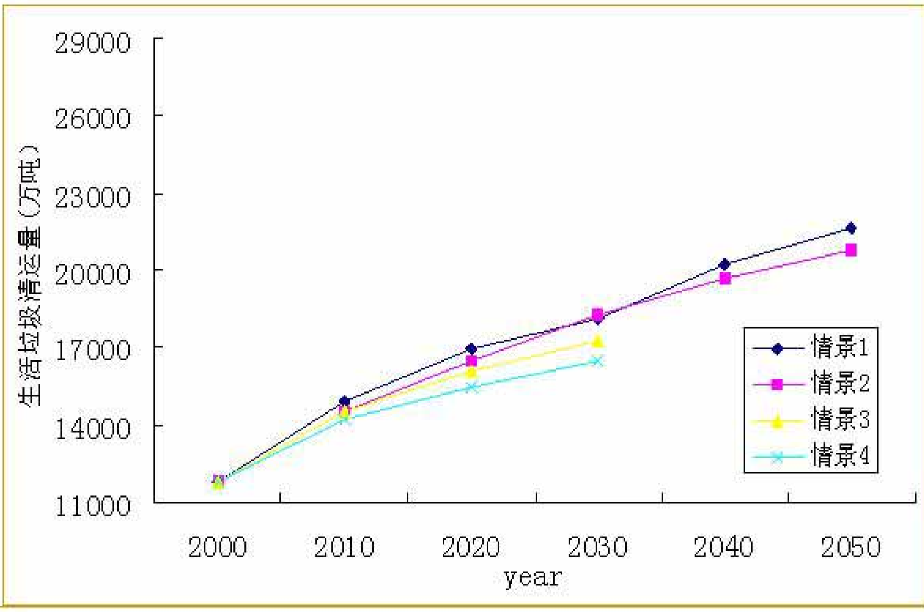
scenario design and results analysis (1)

Scenario I : Based on the GDP

Year	2010	2020	2030	2040	2050
S1	197694	367007	522370	1005209	1530721
S2	178936	321962	544767	846006	1181895
S3	175997	286681	404392		
S4	160224	237171	318738		

S1: http://macrochina.com.cn/report/free/detail/xs/008/00001493.shtml
S2: http://www.drcnet.com.cn/new_product/drcexpert/showdoc.asp?doc_id=144563
S3 & S4: 王高尚、韩梅《中国重要矿产资源的需求预测》。

scenario design and results analysis (2)



scenario design and results analysis (3)

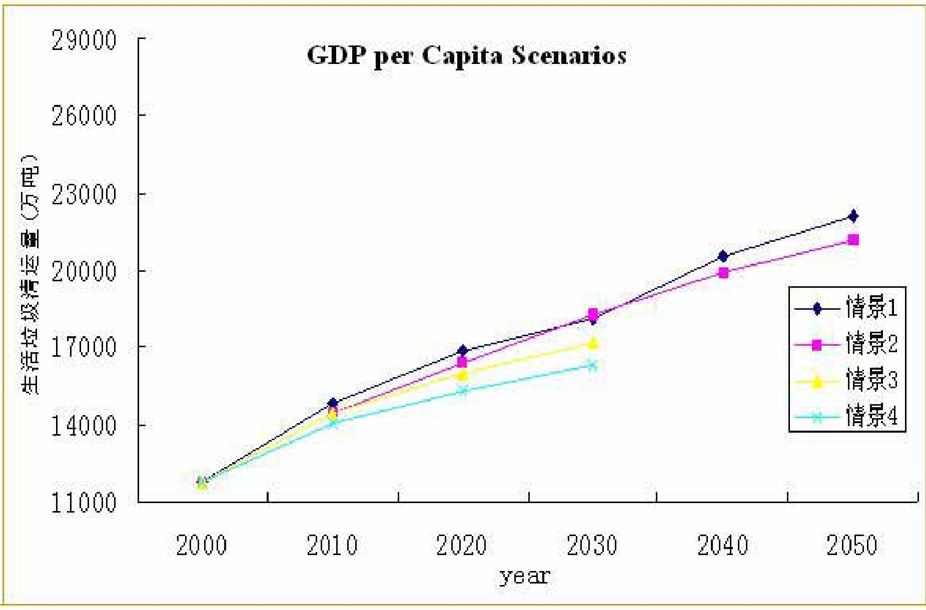
China's population predicted by FAO Unit : 10^8 persons

Year	2010	2020	2030	2040	2050
Population	13.72903	14.38192	14.59865	14.48698	14.05191

The four future per GDP scenes in China Unit : yuan

Year	2010	2020	2030	2040	2050
S1	14399.70	25518.64	35782.09	69387.06	108933.31
S2	13033.40	22386.58	37316.26	58397.68	84109.21
S3	12819.33	19933.43	27700.64		
S4	11670.45	16490.91	21833.39		

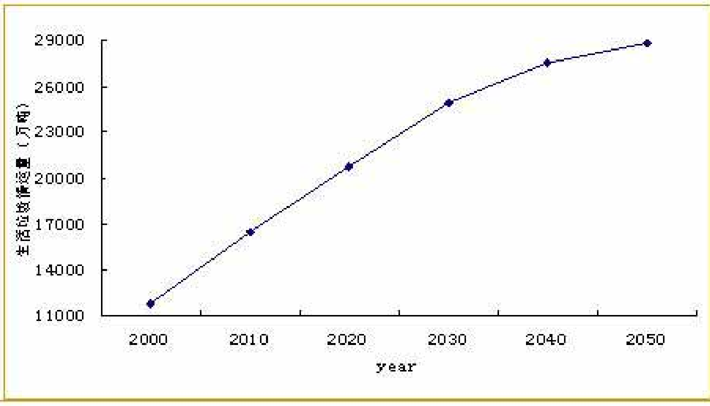
scenario design and results analysis (4)



scenario design and results analysis (5)

Non-Agriculture Population Scenarios

Year	2000	2010	2020	2030	2040	2050
Non-A Population	20952.5	29101.4	40419.6	56139.6	68433.9	75593.6



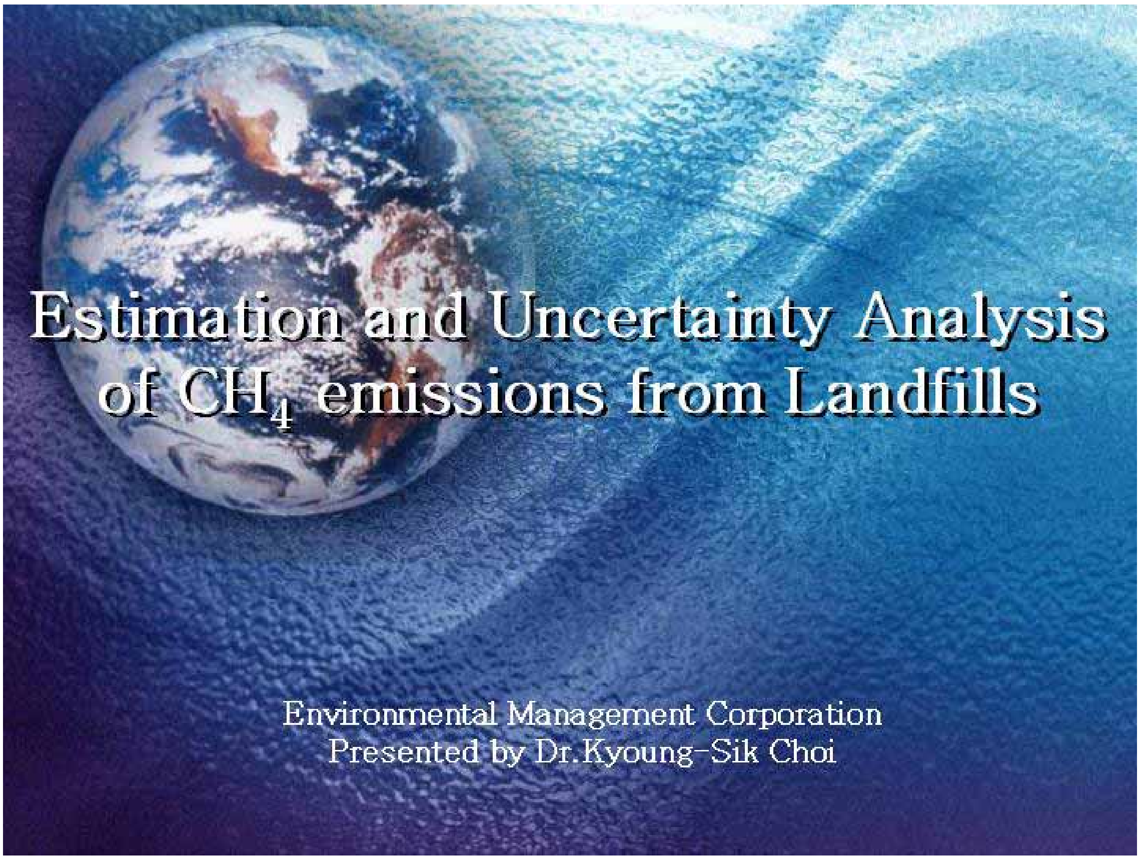
Scenario analysis and conclusions

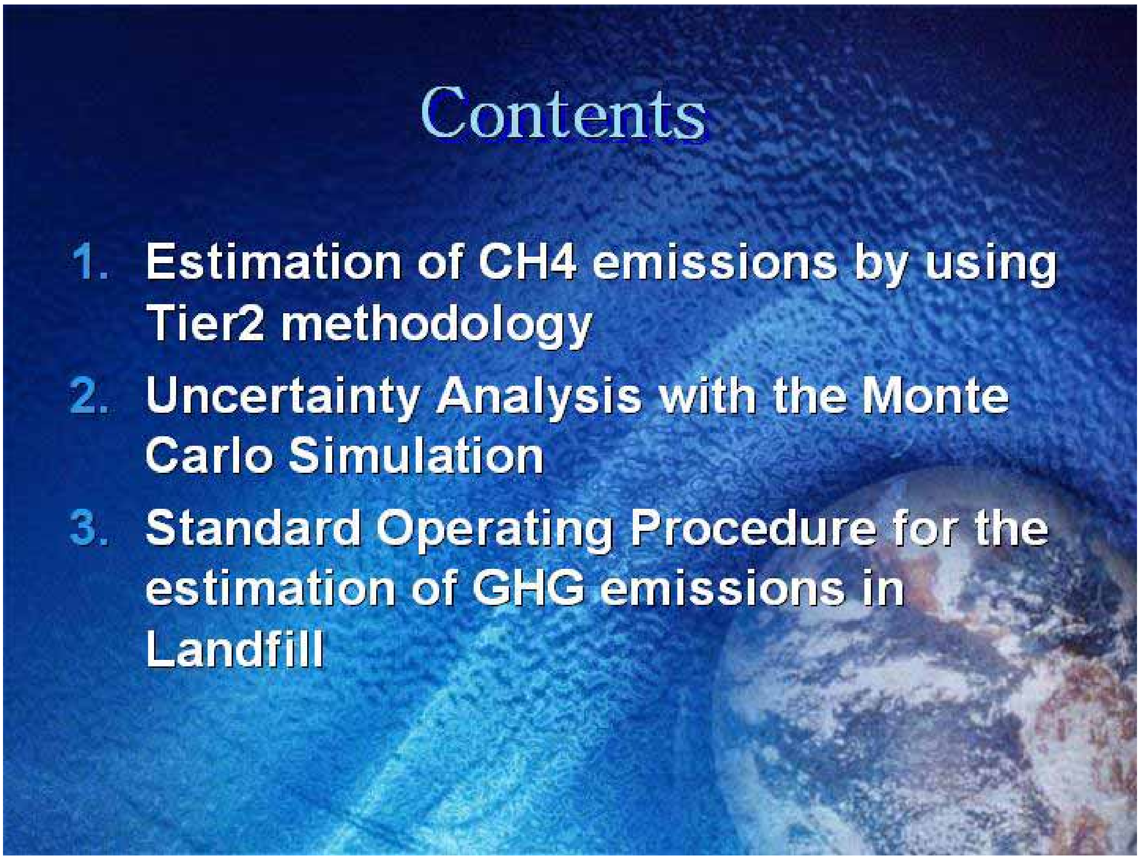
The results from these model are similar although the driving forces are different. Especially the results from GDP model and GDP per capita model. The results shows that the MSW generate amount will increase with time.

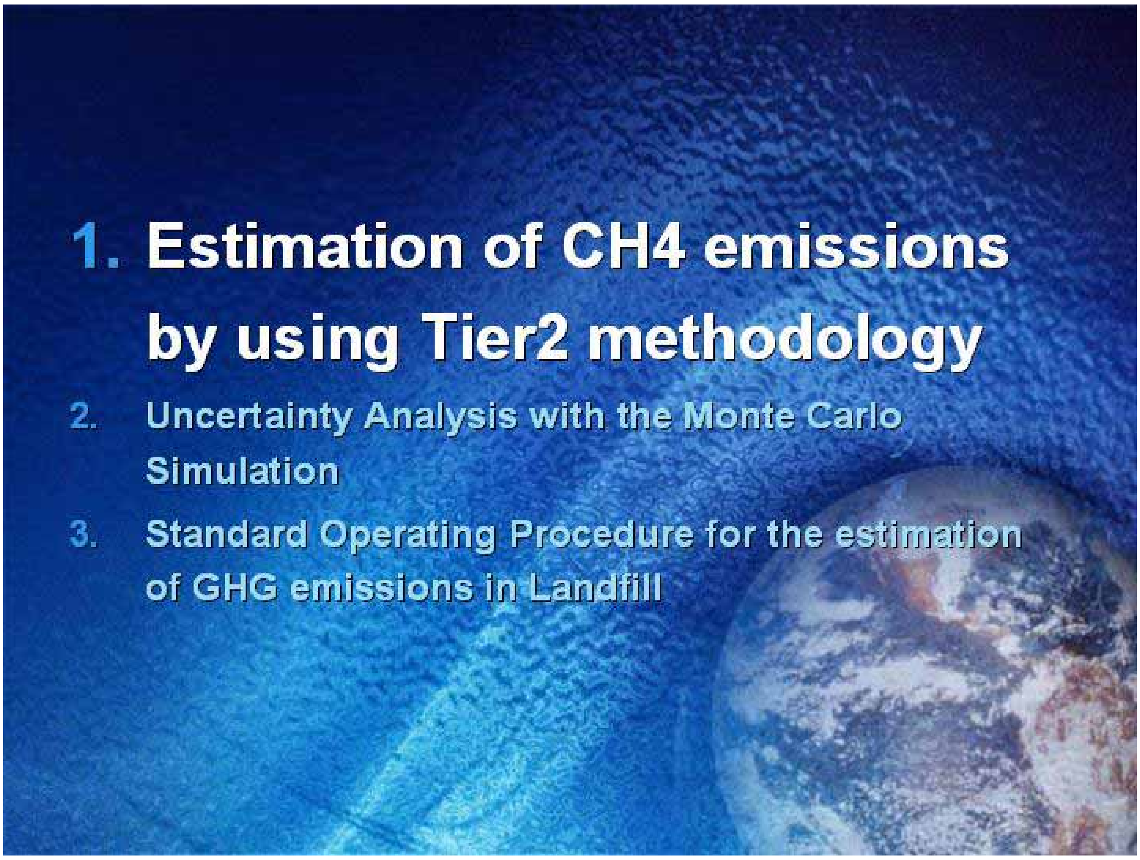
This result does not consider the CDM program and the methane collection and recycling technology. Compare with Non-agriculture population model, the results of GDP model and GDP per capita model are little lower than Non-agriculture model, the main reason is that the GDP and GDP per capita models include whole country, it is the country average, while the no-agriculture population model is much close to real situation of China.

The GDP model result indicates that the MSW of China in 2030 will range from 1647 to 1828 million tones with different scenarios, the GDP per capita model gives a range from 1634 to 1828 million tones, while the Non-agriculture population model gives more reasonable result, it is 2495 to 2879 million tone.

Thanks for your attention!


Estimation and Uncertainty Analysis of CH_4 emissions from Landfills
Environmental Management Corporation
Presented by Dr.Kyoung-Sik Choi


Contents
1. Estimation of CH4 emissions by using Tier2 methodology
2. Uncertainty Analysis with the Monte Carlo Simulation
3. Standard Operating Procedure for the estimation of GHG emissions in Landfill


1. Estimation of CH4 emissions by using Tier2 methodology
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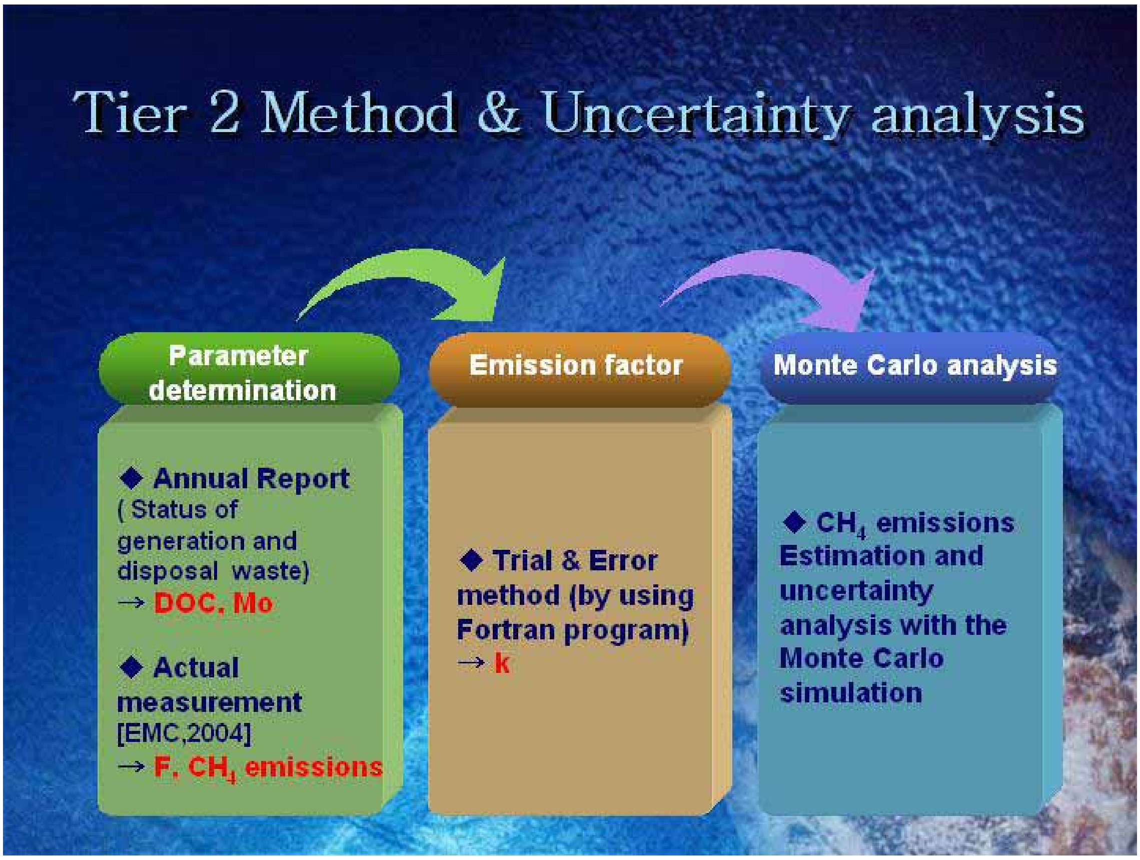

Tier 2 Method & Uncertainty analysis
Parameter determination
◆ Annual Report (Status of generation and disposal waste) → DOC, Mo
◆ Actual measurement [EMC,2004] → F, CH_4 emissions
Emission factor
◆ Trial & Error method (by using Fortran program) → k
Monte Carlo analysis
◆ CH_4 emissions Estimation and uncertainty analysis with the Monte Carlo simulation

Case Study : Y landfill

☐ **Status of Y landfill ('02)**

Province	Total Area (m2)	Total volume (m3)	Waste (m3)	Starting Year	Closing Year
Kyonggi	83,043	1,435,000	538,000	'96	'08

☐ **CH4 emissions**

(Unit : ton/yr)

	Extraction well	Surface	Total
Y landfill	836	2232~8507	2,385~9,343

Parameter Determination

Tier 2 Eq.

$$Q_{CH_4}(t) = \sum_{i=1}^{N} M_0(i) L_0(i)[\exp\{-k(t-i)\} - \exp\{-k(t-i+1)\}]$$

$M_0(i)$ = Total amount of solid waste landfilled (from MoE)
$L_0(i)$ = MCF x DOC x DOC_F x F x 16/12
MCF(1), DOC_F(0.55) : Default value
DOC, F : Calculated from annual data

DOC

$$DOC\,(\%) = CCF \times FW_f + CCP \times PA_f + CCW \times WO_f + CCR \times RU_f$$

F

Extraction well : Volume ratio (CH_4 : CO_2)
Surface : The ratio of slope of regression line (CH_4 and CO_2)

▪ Key parameters for k-value estimation

DOC

Year	1996	1997	1998	1999	2000	2001	2002
DOC	0.12	0.17	0.12	0.14	0.13	0.14	0.14

F

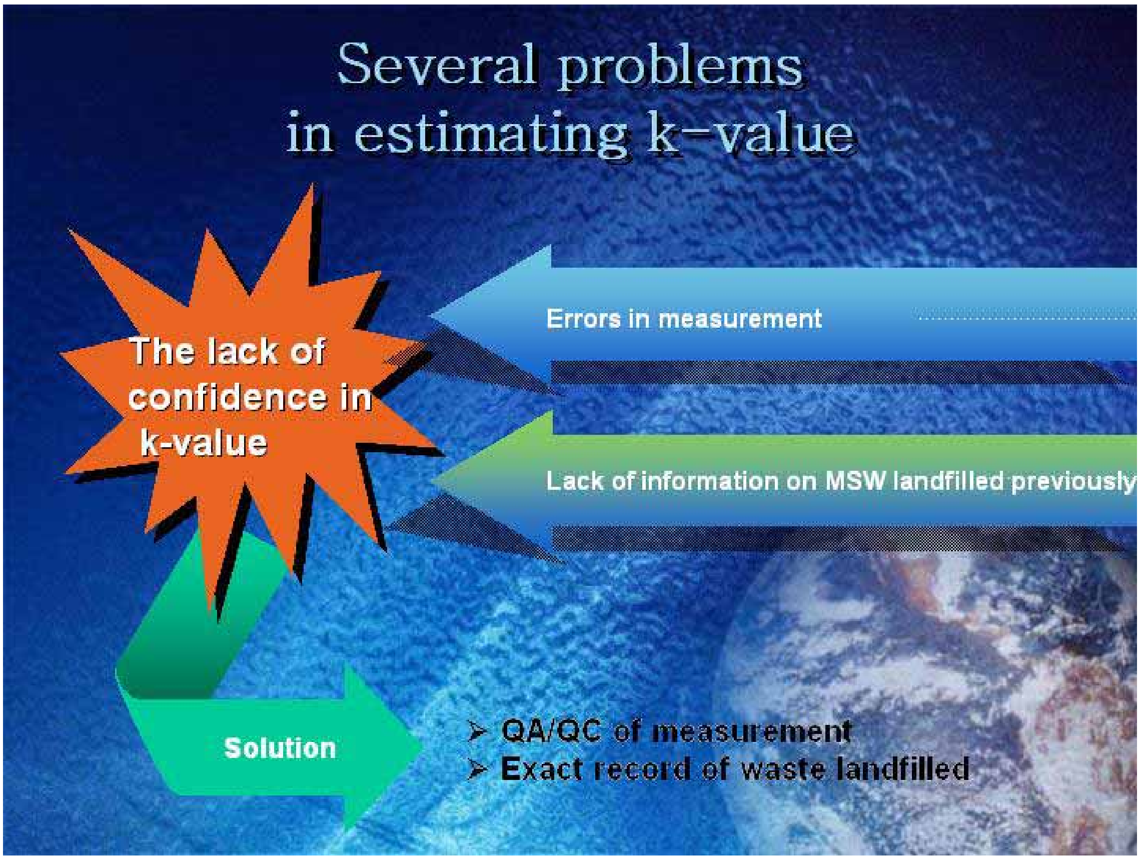
	F-value
Extraction well	0.59
	0.60
Surface	0.57
	0.47
	1.00
	0.76

CH4 emissions (Unit:ton/yr)

Point	Surface	well	Total	Remarks
1	2231.86	835.6	3067.46	2wells measured and sumed up
2	3489.17		4324.77	
3	8507.44		9343.04	
4	1549.42		2385.02	

K-value (Y landfill)

F	Actual CH4 emissions (A)	k	Simulation results of CH4 emissions (B)	(A) - (B)
0.47	3067.46	0.51837	2085.59	981.871
	4324.77	0.51837	2085.59	2239.181
	9343.04	0.51837	2085.59	7257.451
	2385.02	0.51837	2085.59	299.431
0.57	3067.46	0.51837	2562.62	504.835
	4324.77	0.51837	2562.62	1762.145
	9343.04	0.51837	2562.62	6780.415
	2385.02	0.26844	2385.03	0.008
0.59	3067.46	0.51855	2624.35	443.106
	4324.77	0.51855	2624.35	1700.416
	2385.02	0.24548	2385.02	0.004
0.60	3067.46	0.51845	2689.81	377.654
	4324.77	0.51845	2689.81	1634.964
	9343.04	0.51845	2689.81	6653.234
	2385.02	0.22647	2385.01	0.007
0.76	3067.46	0.31933	3067.46	0.002
	4324.77	0.51839	3180.14	1144.626
	2385.02	0.15121	2385.02	0.004



◆ Re-derivation of k

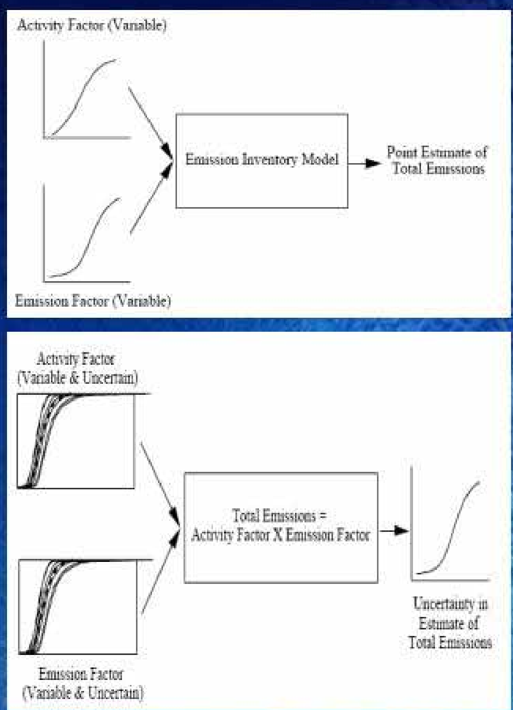
F	Actual CH4 emissions (A)	k	Simulation results of CH4 emissions (B)	(A) – (B)
0.47	3067.46	0.190	3067.49	0.033
	4324.77	0.370	4324.75	0.015
	9343.04	1.000	6669.14	2673.897
	2385.02	0.127	2385.00	0.018
0.57	3067.46	0.139	3067.44	0.015
	4324.77	0.250	4324.81	0.043
	9343.04	1.000	8088.11	1254.930
	2385.02	0.097	2385.07	0.049
0.59	3067.46	0.132	3067.47	0.008
	4324.77	0.234	4324.76	0.013
	9343.04	1.000	8371.90	971.138
	2385.02	0.092	2385.01	0.010
0.6	3067.46	0.129	3067.47	0.009
	4324.77	0.227	4324.74	0.030
	9343.04	1.000	8513.80	829.239
	2385.02	0.090	2385.00	0.022
0.76	3067.46	0.092	3067.52	0.058
	4324.77	0.152	4324.75	0.017
	2385.02	0.067	2384.88	0.142
	9343.04	0.709	9343.05	0.015

1. Estimation of CH4 emissions by using Tier2 methodology

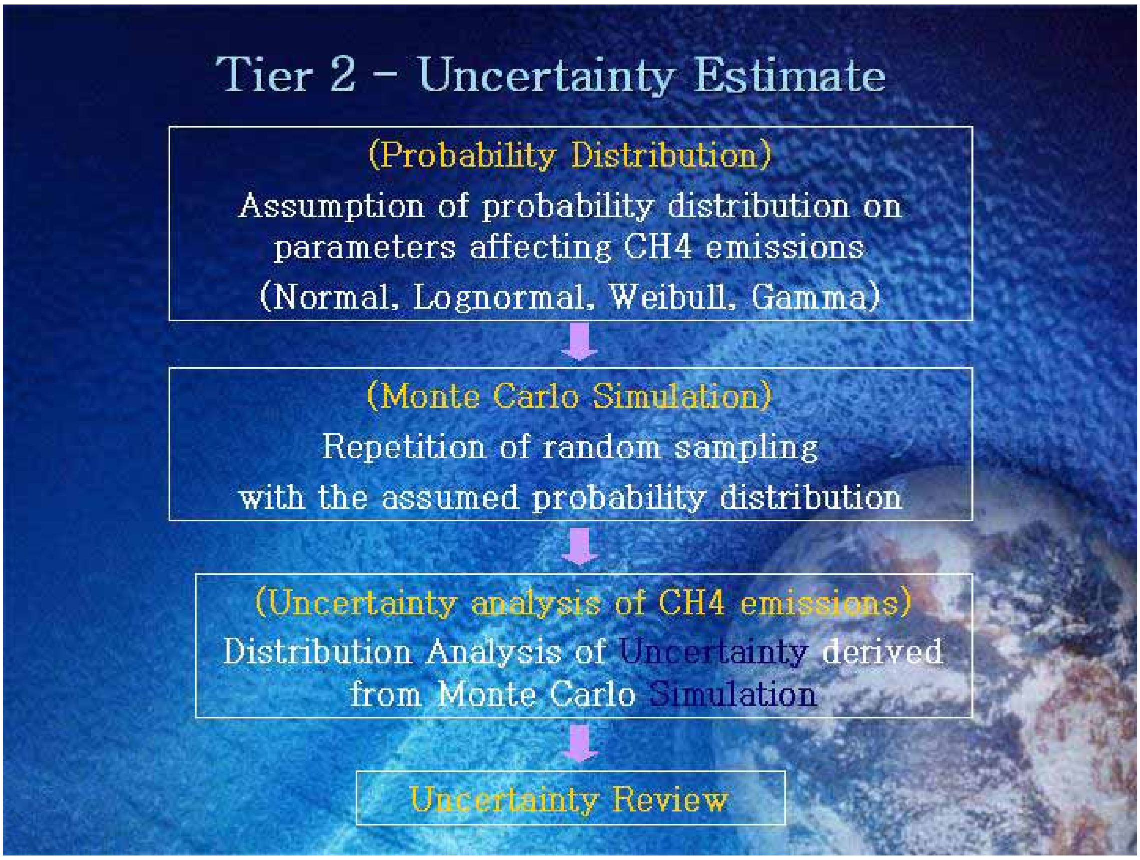
2. Uncertainty Analysis with the Monte Carlo Simulation

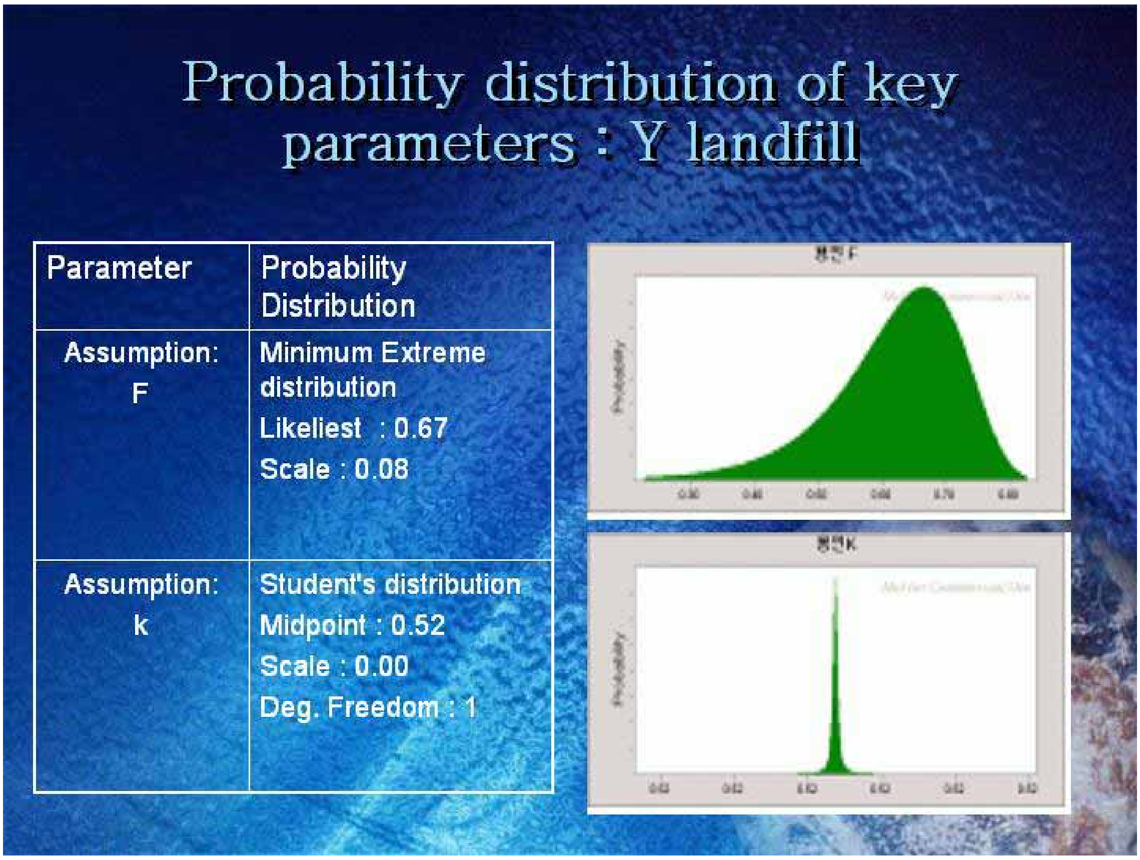
3. Standard Operating Procedure for the estimation of GHG emissions in Landfill

Tier 2 – Probabilistic Approach – Monte Carlo



- Probabilistic Assessment
- Probability of all available data
- Generation : matching all the data with probability
- Distribution of generation : variability, uncertainty


Tier 2 – Uncertainty Estimate
(Probability Distribution)
Assumption of probability distribution on parameters affecting CH4 emissions
(Normal, Lognormal, Weibull, Gamma)
(Monte Carlo Simulation)
Repetition of random sampling with the assumed probability distribution
(Uncertainty analysis of CH4 emissions)
Distribution Analysis of Uncertainty derived from Monte Carlo Simulation
Uncertainty Review

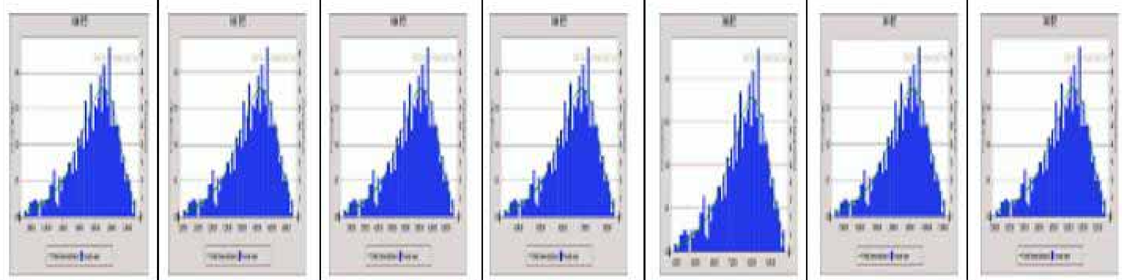

Probability distribution of key parameters : Y landfill
Parameter
Probability Distribution
Assumption: F
Minimum Extreme distribution
Likeliest : 0.67
Scale : 0.08
Assumption: k
Student's distribution
Midpoint : 0.52
Scale : 0.00
Deg. Freedom : 1

Estimation results of CH_4 emissions

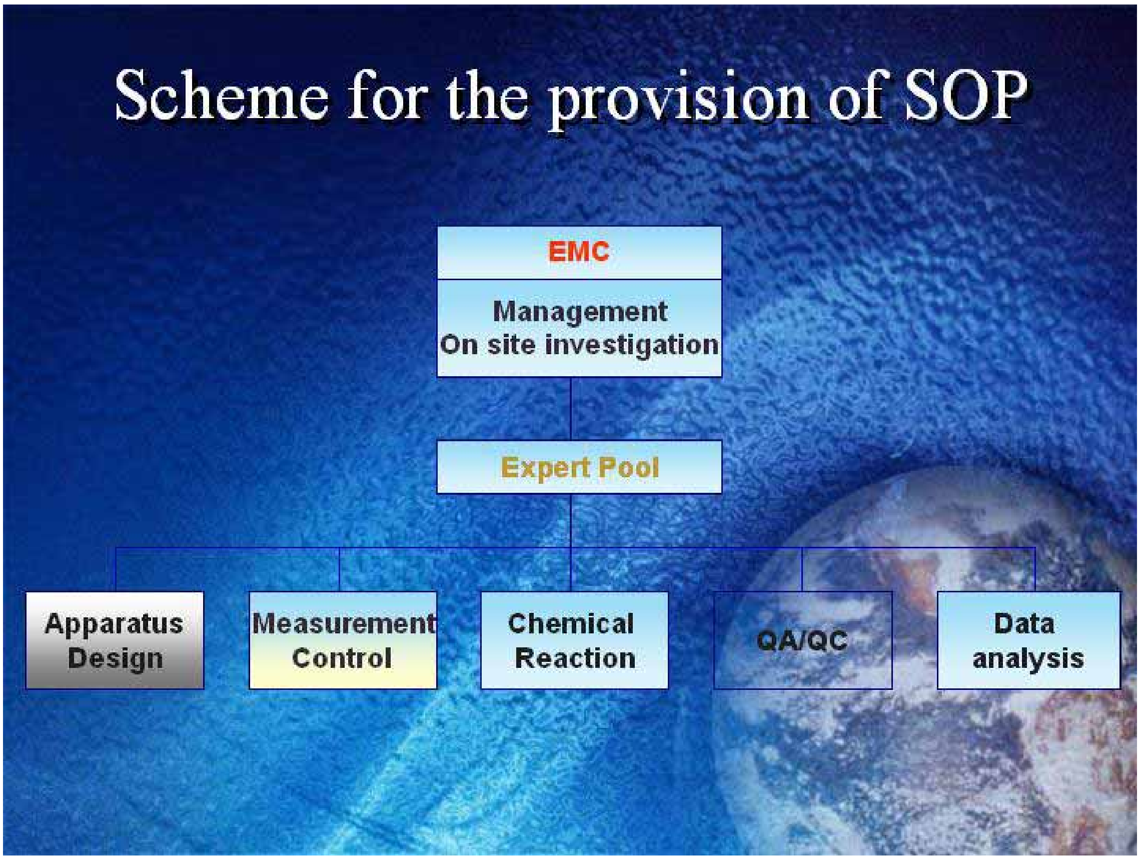
Statistics	1996	1997	1998	1999	2000	2001	2002
Trials	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Mean	1,759	3,816	5,190	6,378	7,440	8,508	9,607
Median	1,818	3,942	5,362	6,589	7,686	8,791	9,925
S.D	302	654	889	1,093	1,275	1,458	1,646
Min.	316	686	933	1,146	1,337	1,529	1,727
Max.	2,301	4,989	6,786	8,339	9,728	11,126	12,562

Estimation results of CH4 emissions : Y landfill

1996	1997	1998	1999	2000	2001	2002




1. Estimation of CH4 emissions by using Tier2 methodology
2. Uncertainty Analysis with the Monte Carlo Simulation
3. Standard Operating Procedure for the estimation of GHG emissions in Landfill


Scheme for the provision of SOP
EMC
Management
On site investigation
Expert Pool
Apparatus Design
Measurement Control
Chemical Reaction
QA/QC
Data analysis


Development Plan of SOP
SOP
Apparatus design
+ on site investigation
Based on SOP Draft
SOP Draft
Final SOP
EMC
Expert Pool
SOP modification through Discussion
Findings from on the spot study
On site
Investigation
Apparatus design
+ on site investigation
Based on SOP Draft


Development Plan of SOP
Placement of SOP in Korean Standard Method
Improvement of reliability on
emissions measurement and estimation

Conclusion

- Monte Carlo analysis makes possible to estimate GHG emissions considering uncertainty despite the limitation of data
- Tier2 method requires historic waste quantities and composition, disposal practices until the time measured
- QA/QC and SOP can improve reliability in emission estimation

Thank you

- *UNFCCC GHG Inventory workshop in Seoul to be on the September*
- *email promote@emc.or.kr for more information*

ｉ） Presentations

SessionⅢ

Energy WG Report

Session 3, 3rd WGIA

Feb 24, 2006

Manila

Overview

- Good Practices
- Challenges & possible solutions including within WGIA network
- Other things discussed
- Summary/Conclusion

Good Practices

- India
  - Establishment of a National Inventory Management Systems
  - Data Collection from important 3 sectors; Power Plant, Transport, Iron & Steel
  - Adoption of Tier2 methodology
  - Plant Specific Emission Factors

Good Practices

- Malaysia
  - Establishment of a NC2 Group
  - Data collecting Methodology; e.g. approach to stakeholders in many ways
  - Institutionalize the GHG program
  - Passion to improve inventory

Good Practices

- Japan
  - Collaboration between Energy Agency and Ministry of the Environment (Inventory Agency)
  - Balance Approach (Mass Balance, Energy Balance, Carbon Balance)
  - Institutionalizing the country's Inventory Programm

Challenges & possible solutions

- **Activity Data**
  Sharing Experiences on Collecting Data Focused on Specific Area below
  1. Transportation (traveling distance),
  2. Power Plant
  3. Heavy Industry

  We will prepare document or table by 4th WGIA

- **Emission Factor**
  Making Table: Values with Basic Assumptions for Country-Specific EF

  if possible, until Completion of Activity Report of our WGIA

Challenges & possible solutions

- **QA/QC**
  1. Making Different Data Base to Compare
  2. Describe Routine Process and Assignment to implementing agency

- **Uncertainty Assessment**
  Follow up and update data/information
  Original purpose of U.A. for improving inventory (e.g. Improve the national statistics)

Summary/Conclusion

- Sharing Experiences on Collecting Activity Data Focused on Specific Area

  We, Energy group, will prepare document or table by 4th WGIA

Agriculture WG Report

Session 2, 3rd WGIA
Feb 24, 2006
Manila, Philippines

Agriculture WG members

1. Dr. Batimaa Punsalmaa (Chair; Mongolia)
2. Mr. Syamphone Sengchandala (Reporter; Laos)
3. Mr. Chan Thou Chea (Cambodia)
4. Dr. Shuzo Nishioka (Japan)
5. Dr. Takashi Osada (Japan)
6. Dr. Damasa Magcale Macandog (Philippines)
7. Dr. Amnat Chidthaisong (Thailand)

Overview

- Good Practices
- Challenges & possible solutions including within WGIA network
- Other things discussed
- Summary/Conclusion

Good Practices

- Detailed data collection from the experiments (Agroforestry, rice paddy and animal manure treatment).
- Very comprehensive measurements.
- Well designed experiment and simple, portable equipments for measurements of CH_4, N_2O, NH_3 emissions.
- Applying water management and fertilization strategy could reduce CH_4 and N_2O emissions from agricultural system in Asian countries.
- Composting of livestock manure reduces N_2O and CH_4 emission

Challenges & possible solutions

- Challenges
  - Development of regional-specific Emission Factors for Asian region.
  - Establishing network of monitoring station for GHG emissions
  - To get funding for research and capacity building in the region.
- Solutions
  - Develop and implement regional research project
  - Collaboration among experts
  - Sharing the database and expertise

Other things

- Improve emission factor and data collection for CH_4 from enteric fermentation from livestock (only if it is a key source)
- Burning of crop residues (CH_4 & N_2O)—avoid burning and convert it into compost

Summary/Conclusion

- Agriculture sector is one of the main contributors to GHG sources (CH_4&N_2O) in Asia.
- To improve GHG inventory in this sector, we need to collect data, expand experiments, establish monitoring network, and develop region-specific emission factors.
- Collaborations among regional experts

LULUCF WG Report

Session 3, 3rd WGIA
Feb 24, 2006
Manila

Overview

- Good Practices (GPs)
- Challenges & possible solutions
- Other things discussed
- Summary/Conclusion

Good Practices

1. Malaysia: various aspects of improvements made and to be made between INC and SNC
2. Cambodia: direct measurement of RF for major forest categories
3. Japan: experience from preparing inventories with GPG-LULUCF compared to previous inventories

Good Practices (GPs)

AD	✓ Use statistical base approach to define land-use category under GPG-LULUCF, rather than e.g. GIS ✓ Estimate shifting cultivation area from the shifting cultivators' data and a length of shifting cultivation cycles ✓ Create new standard format which can integrate the GHG activity data development with regular forest inventory
E/RF	✓ Develop factors for major forest categories
QA/QC	✓ Implement data verification through personal consultation and round-table discussion with relevant persons and agencies ✓ Conduct trend analysis to detect inappropriate use of emission factors or activity data

Note: AD = Activity Data; E/RF= Emission/Reduction Factor.

Good Practices (continued)

Institutional	✓ Establish appropriate institutional arrangements through distribution of responsibility among relevant sectors, establishment of cooperation with statistical officers or relevant sectors, establishment of working group consisting members of various sectors, etc.

Challenges & possible solutions

AD	■ Different level of details of forest categories and forest strata between states/provinces	□ Encourage local research agencies/universities to engage in this research area and seek endorsement from local/relevant authority for the work
E/RF	■ Difficulty in defining appropriate number of destructive sampling which is cost-effective	□ Get additional data from other sources (national inventories of other countries in the region, related studies, students' theses)

Challenges & possible solutions (continued)

Uncertainty	■ Difficulty in developing good activity data and emission factors for the key categories which might not be cost-effective	☐ Apply the 2000 IPCC GPG in a number of regions/provinces that contribute to the GHG emissions of those categories
Institutional	■ Frequent change of personnel working on inventories	☐ Institutionalize GHG inventory at least national focal point ☐ Develop reference manual in local language

Other things discussed

- Duplication of efforts of country to country collaboration identified

Summary/Conclusion

- In the WG, experience and ideas were shared actively and some could be actually applied.
- Data availability could be improved by enhancing:
  - National-local & sector-sector coordination
  - Official support is essential
  - Sharing data among countries in the region
- Sustainable institutionalization is key.
- Continuing information sharing at the regional level will be helpful. Technical information exchange/stock (e.g. RF) could be initiated in the region but we don't know yet how to...

Report of Waste Working Group

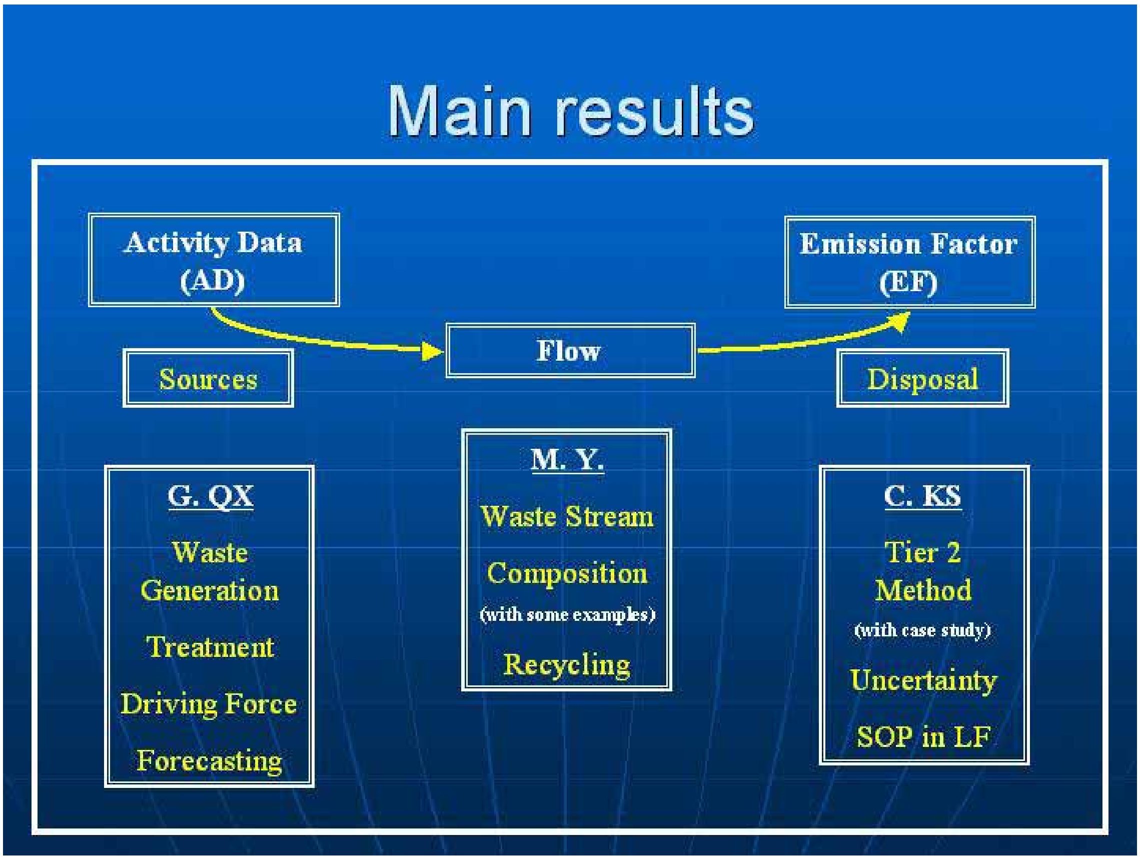
3rd WGIA

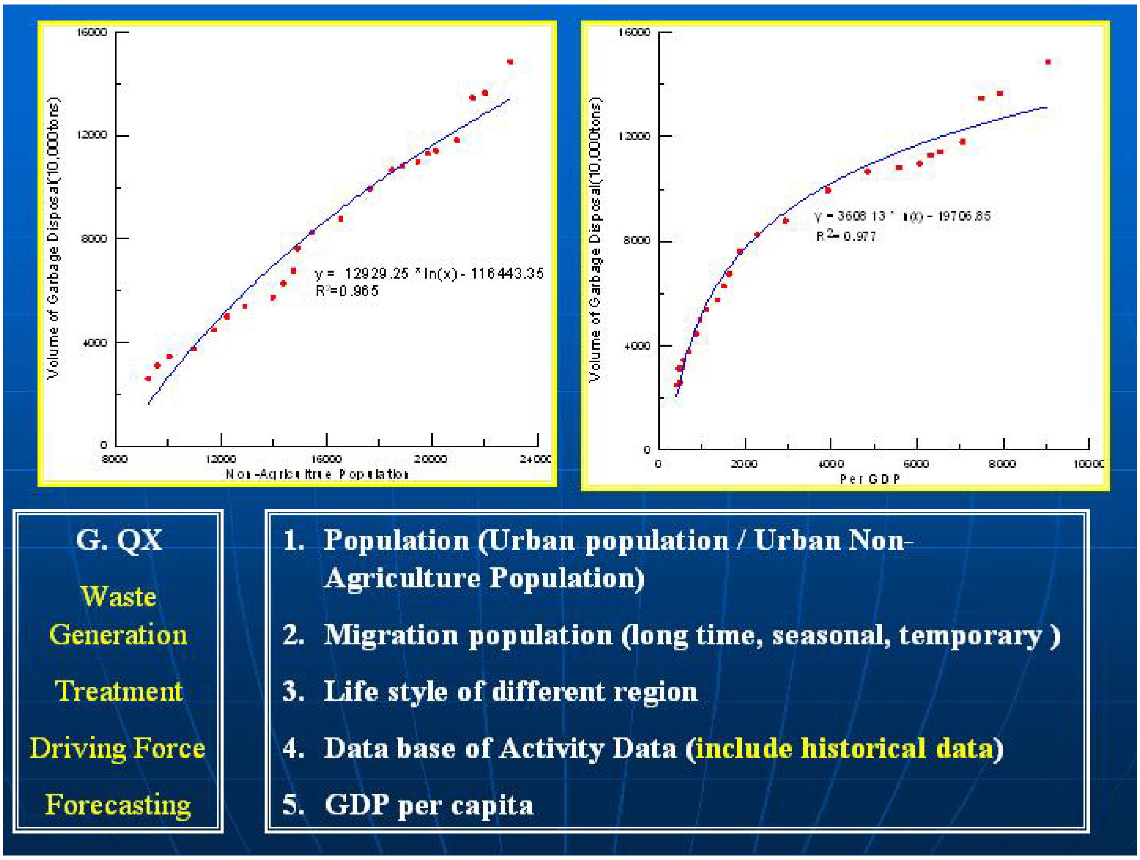
23 February, 2006

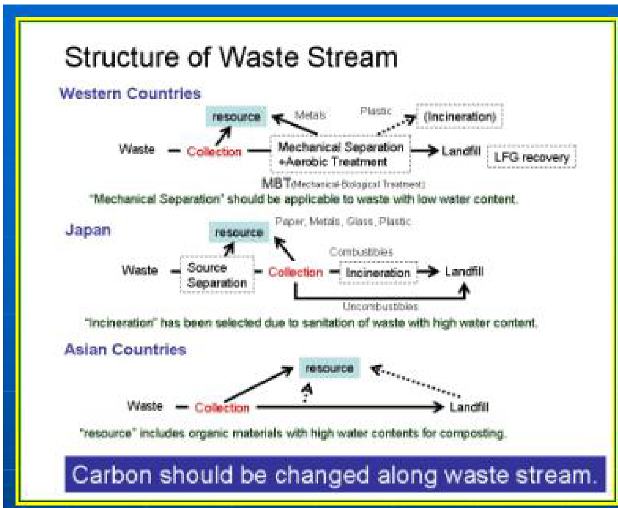
Manila, Philippines

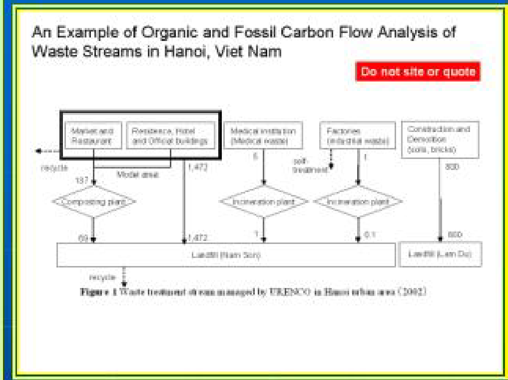
Group members

- Dr. Sirintornthep Towprayoon
- Dr. Gao Qingxian
- Mr. Yasuhiro Baba
- Dr. Masato yamada
- Dr. Kyoung sik Chio
- Ms. Eunhwa Chio
- Ms. Raquel Ferraz Villanueva
- Ma. Gerarda Asuncion D. Merilo
- Ms. Bujidmaa Borkhuu


Main results
Activity Data
(AD)
Emission Factor
(EF)
Sources
Flow
Disposal
G. QX
Waste
Generation
Treatment
Driving Force
Forecasting
M. Y.
Waste Stream
Composition
(with some examples)
Recycling
C. KS
Tier 2
Method
(with case study)
Uncertainty
SOP in LF


Volume of Garbage Disposal(10,000tons)
y = 12929.25 * ln(x) - 116443.35
R²=0.965
Non-Agriculture Population
Volume of Garbage Disposal(10,000tons)
R² = 0.977
Per GDP
G. QX
Waste
Generation
Treatment
Driving Force
Forecasting
1. Population (Urban population / Urban Non-Agriculture Population)
2. Migration population (long time, seasonal, temporary)
3. Life style of different region
4. Data base of Activity Data (include historical data)
5. GDP per capita





M. Y.

Waste Stream

Composition

(with some examples)

Recycling

1. **Waste Streams analysis / Composition analysis**
2. **Recycling ----decision maker**
3. **National regulation or law**
4. **2006 guidelines default data**
5. **Direct measurement --- k value**

C. KS

Tier 2 Method

(with case study)

Uncertainty

SOP in LF

1. **Tier 2 method and its Uncertainty analysis**
2. **Case Study --- Huge range form surface**
3. **k value estimation and several problems**
4. **Uncertainty analysis with the Monte Carlo simulation**
5. **Standard Operating Procedure (SOP) and QA/QC**

Land Fill……

Composing……

Incineration……

Others……

Waste to Energy…….

Recycling and reuse……

Suggestion and conclusions

- Set up a net work for ……
  - AD, EF, site measurements, treatment technology etc.
- Waste streams analysis……
  - For each country / region
- Measurement in site……
  - For each country or region
- Standard Operation Procedure……
  - Set up a work group with same guidance
- Clarify the co-benefit (as the strategy)……
  - Cooperate with others (environmental scientist etc.)

Thanks

ⅱ) Other documents

Proposal for the Concept of the WGIA Activity Report

Prepared by the WGIA Secretariat
umemiya.chisa@nies.go.jp

Presented at
The 3rd Workshop on GHG Inventories in Asia Region
Manila, Feb. 23-24, 2006

Outline

- The Origin of the proposal
- What for? Who will be the readers?
- Timeline
- Contributors

Origin of the Proposal…

- The 2nd WGIA recommended to:
  - ✓*compile relevant information on EFs…*
  - ✓*compile reports, publish findings…*

(The 2nd WGIA Proceedings, pg. 12-13)

- The 3rd WGIA generated concrete information, sector by sector

Let's start discussing the creation of the WGIA Activity Report!

What for? Who will read it?

1. Present a list of action items essential for the improvements of GHG inventories in Asia
2. Compile information that has been exchanged and discussed in the WGIAs
3. Record the history of the WGIAs

<Readers in mind>

·Inventory Developers

- in Asia
- outside Asia

·Possible Sponsors

Timeline

- Meeting a significant event, such as *"The 16th Asia-Pacific Seminar on Climate Change", which will be held on Sep. 2006?*

Timeline

- Meeting a significant event? (e.g. AP Seminar)

Activity \ Month	~ May	~ Jun	~ Aug	Sep
Individual writings	→			
Circulation among all		→		
Editing & Printing			→ (By Secretariat)	
Completion				AP Seminar*

* The Asia-Pacific Seminar on Climate Change (http://www.ap-net.org/seminar/h01.html)

Contributors (Authors)

- Participants of the 3rd WGIA
- Secretariat for edition

Any comments, suggestions?

Purposes	●Present a list of action items ●Compile information exchanged ●Record the history of the WGIAs
Readers	●Inventory developers in and outside Asia ●Possible sponsors
Timeline	●Meeting a significant event, such as the 16th AP Seminar in Sep. 2006
Contributors	●The participants of the 3rd WGIA ●Secretariat for edition

Proposal for the Outline of the WGIA Activity Report

Prepared by the WGIA Secretariat

Presented at
The 3rd Workshop on GHG Inventories in Asia Region
Manila, Feb. 23-24, 2006

Structure of the Chapters

1. Executive Summary	
2. Background	●What are GHG inventories?
3. Introduction to WGIA	●Objectives, approach, etc.
4. How are GHG inventories developed in Asia?	●Institutional arrangements, methodology of each country
5. Energy Sector	Outcomes from each WG: ●Good practices ●Challenges & possible solutions ●Other things discussed
6. Agriculture Sector	
7. LULUCF Sector	
8. Waste Sector	
9. Regional characteristics	●Findings across the region
10. Conclusion	
Appendix	●Participants list, agendas

Structure of the Chapters (continued)

1. Executive Summary	Done by Secretariat
2. Background	Done by Secretariat
3. Introduction to WGIA	Done by Secretariat
4. How are GHG inventories developed in Asia?	Outcomes from 1st and 2nd WGIAs
5. Energy Sector	Outcomes from 3rd WGIA
6. Agriculture Sector	
7. LULUCF Sector	
8. Waste Sector	
9. Regional characteristics	Individual presentation
10. Conclusion	Done by Secretariat
Appendix	Done by Secretariat

Breakdown of Chap. 5~8 (Sector)

Items		Details	Page	Authors (proposal)
i.	Introduction of the WG	●WG members ●Outline of programme	0.5	Secretariat
ii.	Good Practices (GP)			
	Summary of GPs	●Summary of discussion made	0.5-1	Chair of the WG
	GP X, Y, Z …	●Abstract, article	4-8 for each	Each speaker
iii.	Challenges & Possible Solutions	●Summary of discussion made	1-2	Chair of the WG
iv.	Other things discussed	●Summary of discussion made	1	Chair of the WG

Structure of the Chapters (continued)

1. Executive Summary	Done by Secretariat
2. Background	Done by Secretariat
3. Introduction to WGIA	~~Done by Secretariat~~
4. How are GHG inventories developed in Asia?	Outcomes from 1st and 2nd WGIAs
5. Energy Sector	Outcomes from 3rd WGIA
6. Agriculture Sector	
7. LULUCF Sector	
8. Waste Sector	
9. Regional characteristics	Individual presentation
10. Conclusion	Done by Secretariat
Appendix	Done by Secretariat

Breakdown of Chap. 4 (each country)

Items	Details	Page	Authors (proposal)
i. Cambodia	●History of GHG inventories ●Institutional arrangement & methodology ●Overview of the latest inventory ●Problems and constrains	3-4	Participant(s) from a country
ii. China	Same as above		
iii. India…	Same as above		

Preferably, by ALL

Structure of the Chapters (continued)

1. Executive Summary	Done by Secretariat
2. Background	Done by Secretariat
3. Introduction to WGIA	Done by Secretariat
4. How are GHG inventories developed in Asia?	Outcomes from 1st and 2nd WGIAs
5. Energy Sector	Outcomes from 3rd WGIA
6. Agriculture Sector	
7. LULUCF Sector	
8. Waste Sector	
9. Regional characteristics	Individual presentation
10.Conclusion	Done by Secretariat
Appendix	Done by Secretariat

Breakdown of Chap. 9 (Regional)

Items		Authors (proposal)
i. Sectoral features of GHG inventories from non-Annex I Parties	Presented in 3rd WGIA	*Mr. Revet from UNFCCC?*
ii. Regionally-significant source/sink categories in Asia	Presented in 2nd WGIA	*Ms. Umemiya*

Please provide your comments…

- Is outline OK?
- Could you contribute to the report as an author?
- Any concerns?
  - Suggested deadline for individual article is until mid-May, 2006

iii) Appendix

Summary Table of Energy WG Discussion Results

Good Practices		
India: (1) Establishment of a national inventory management system; (2) data collection from 3 important sectors (power plants, transport, iron and steel); (3) adoption of the Tier 2 methodology; (4) plant specific emission factors. **Malaysia**: (1) Establishment of an expert group for the second national communication; (2) data collection methodology (e.g., approach stakeholders in many ways); (3) institutionalization of the GHG program; (4) passion to improve inventories. **Japan**: (1) Collaboration between the Energy Agency and the Ministry of the Environment as an inventory agency; (2) balance approach (mass balance, energy balance, carbon balance); (3) institutionalization of the national inventory program.		
#	Challenges	Possible Solutions
1	Collection of Activity Data	Share experiences on collecting data specifically focusing on the following areas: (1) transportation (travel distance); (2) power plants; (3) heavy industry. Prepare a document or a table by the 4th WGIA.
2	Development of Improved Emission Factors	Make tables for the values of country-specific emission factors with basic assumptions adopted. If possible, prepare a table before the completion of the WGIA Activity Report.
3	Implementation of Quality Assurance/Quality Control (QA/QC)	・ Make different database for comparison ・ Describe routine processes and task allocation to implementing agencies
4	Implementation of Uncertainty Assessment	・ Follow-up and update data and information (this is the original purpose of Uncertainty Assessment)

Summary Table of Agriculture WG Discussion Results

<table>
<tr><th colspan="3">Good Practices</th></tr>
<tr><td colspan="3">• Detailed data collection from experiments (agroforestry, rice paddy and animal manure treatment)
• Comprehensive measurement
• Well-designed experiments and simple, portable equipment for measurements of CH_4, N_2O, NH_3 emissions
• Water management and fertilization strategy could reduce CH_4 and N_2O emissions from agricultural systems in Asian countries.
• Composting of livestock manure reduces N_2O and CH_4 emissions.</td></tr>
<tr><th>#</th><th>Challenges</th><th>Possible Solutions</th></tr>
<tr><td>1</td><td>Developing region-specific emission factors for Asian region</td><td rowspan="3">• Develop and implement regional research project
• Collaborate among experts
• Share databases and expertise</td></tr>
<tr><td>2</td><td>Establishing a network of monitoring station for GHG emissions</td></tr>
<tr><td>3</td><td>Funding for research and capacity building in the region</td></tr>
<tr><th colspan="3">Other things discussed</th></tr>
<tr><td colspan="3">• Improve emission factors and data collection for CH_4 from enteric fermentation from livestock (only if it is a key source)
• Burning of crop residues (CH_4 & N_2O): avoid burning and convert it into compost</td></tr>
</table>

Summary Table of LULUCF WG Discussion Results

<table>
<tr><th colspan="3">Good Practices</th></tr>
<tr><td colspan="3"><u>Activity Data</u>: (1) Use statistical approach to define land-use categories under GPG-LULUCF, rather than, for example, GIS-based approach; (2) estimate shifting cultivation area from the shifting cultivators’ data and length of shifting cultivation cycles; (3) create new standard format which can integrate GHG activity data development with regular forest inventory work.
<u>Emission/Removal Factors (E/RF)</u>: (1) Develop factors for <u>major</u> forest categories.
<u>Quality Assurance/Quality Control (QA/QC)</u>: (1) Implement data verification through personal consultation and round-table discussion with relevant persons and agencies; (2) conduct trend analysis to detect inappropriate use of emission factors or activity data.
<u>Institutional Arrangements</u>: (1) Establish appropriate institutional arrangements through distribution of responsibility among relevant sectors, establishment of cooperation with statistical officers or relevant sectors, establishment of working group consisting members of various sectors, etc.</td></tr>
<tr><th>#</th><th>Challenges</th><th>Possible Solutions</th></tr>
<tr><td>1</td><td><u>Activity Data</u>: Different level of details of forest categories and strata between states/provinces</td><td>Encourage local research agencies/universities to engage in this research area and seek endorsement from local/relevant authority for the work.</td></tr>
<tr><td>2</td><td><u>E/RF</u>: Difficulty in defining appropriate number of destructive sampling which is cost-effective</td><td>Get additional data from other sources (national inventories of other countries in the region, related studies, students’ theses).</td></tr>
<tr><td>3</td><td><u>Uncertainty</u>: Difficulty in developing good activity data and emission factors for the key categories which might not be cost-effective</td><td>Apply the 2000 IPCC Good Practice Guidance (GPG) in a number of regions/provinces that contribute to the GHG emissions of those categories.</td></tr>
<tr><td>4</td><td><u>Institutional Arrangements</u>: Frequent change of personnel working on inventories</td><td>・ Institutionalize GHG inventory work, at least at the level of national focal point.
・ Develop reference manuals in local language.</td></tr>
<tr><th colspan="3">Other things discussed</th></tr>
<tr><td colspan="3">・ Duplication of efforts of country-to-country collaboration that might have decreased the efficiency of such collaboration was identified.</td></tr>
</table>

Summary Table of WASTE WG Discussion Results

Good Practices
Activity Data: (1) Use statistical data to analyze waste generation amounts and establish (as appropriate) statistical models for calculating municipal solid waste generation amounts based on different driving forces, for example, urban population, GDP and GDP per capita. (2) Conduct analysis of waste streams and waste composition, based on sampling analysis. (3) Conduct disaggregated estimation in a way that is adapted to the situation in each country. (4) Introduce the TIR 2 method of solid waste treatment and analyze uncertainty based on case studies. (5) Introduce standard operating procedures (SOP). **Emission Factors (EF)**: (1) Develop emission factors of municipal solid waste, for example, waste generation amounts, DOC, k value and waste treatment management level. (2) Analyze the waste stream and its composition. **Quality Assurance/Quality Control (QA/QC)**: (1) Implement data verification through personal consultation and round-table discussions with relevant persons and agencies. (2) Conduct trend analysis to detect inappropriate use of emission factors or activity data. (3) Reduce uncertainty by conducting direct measurements for key parameters. **Institutional Arrangements**: (1) Set up an institutional network to improve activity data (AD), emission factors (EF), site measurements and treatment technology, etc. (2) Establish appropriate institutional arrangements through allocation of responsibility among relevant sectors, establishment of cooperation with statistical officers or relevant sectors, establishment of working groups consisting of members of various sectors, etc.

#	Challenges	Possible Solutions
1	**Activity Data**: Lack of accurate waste generation amounts and DOC; lack of detail and accurate information about waste treatment and management levels.	• Encourage local research agencies/universities to do site measurements in waste areas and to collect detailed information of waste treatment management levels. • Seek support from local/relevant authorities for inventory work. • Set up a database of activity data (including historical data).
2	**EF**: Difficulty in getting appropriate k values and DOC parameters in different countries or regions.	• Get additional data from other sources (national inventories of other countries in the region, related studies, and students' theses).

		• Share information with other countries in the same region.
3	**Uncertainty**: Waste composition depends on the lifestyle in different regions, and the management level depends on the economic situation and public environmental awareness. The migrating human population in urban areas is difficult to determine.	• Apply the 2000 IPCC Good Practice Guidance (GPG) in a number of regions/provinces that contribute to GHG emissions. • Conduct site measurement and sample analysis. • Conduct uncertainty analysis with the Monte Carlo simulation method.
4	**Institutional Arrangements**: Lack of consistency of working groups in waste sector domestically and internationally.	• Institutionalize GHG inventory work, at least at the level of national focal points. • Develop reference manuals in local languages. • Establishing an international network for cooperating in the waste sector.
Other things discussed		
• When developing inventories, it is beneficial strategy to point out to stakeholders the co-benefits of inventory work for climate mitigation. • It is beneficial to cooperate with others scientists and departments, such as environmental scientists and industrial sectors, etc.		

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