Chapter 11
Capacity Development on GHG Inventories in Asia

WGIA Workshop on Greenhouse Gas Inventory in Asia

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Abstract The Greenhouse Gas Inventory Office (GIO) of Japan has organised the "Workshop on Greenhouse Gas Inventories in Asia (WGIA)" since 2003. The workshop is tasked to improve GHG inventory dataset credibility in Asia and help bind countries within the Asian region. Participating countries are Cambodia, China, India, Indonesia, Japan, the Republic of Korea, Lao PDR, Malaysia, Mongolia, Myanmar, the Philippines, Singapore, Thailand and Vietnam (14 countries). Since the 6th WGIA (WGIA6) in 2008, WGIA has been convened as part of the "Kobe Initiative" of the G8 Environment Ministers' Meeting. WGIA participants are government officials, inventory compilers, researchers and staff in international organisations. The workshops have been held in other Asian countries to help attract more attendees. Participants from many countries can conduct face-to-face discussions at WGIA. Many achievements were realised through the workshops, in particular:

- Establishment of the WGIA network platform to exchange information on climate change and mitigation of GHG emissions as well as GHG inventory
- Sharing of information and experiences that can be beneficial for other countries
- Identifying common problems and possible solutions
- Updating of the status of national inventory development

This collaborative approach may be applicable for other regions.

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Key Message to Policymakers

- GIO has conducted a Workshop on Greenhouse Gas Inventories in Asia (WGIA) annually for 12 years.
- Workshop continuity helps develop networks.
- WGIA operates to exchange information among inventory experts.
- Face-to-face workshops are necessary for developing relationships of mutual trust.

11.1 Introduction to WGIA

11.1.1 GHG Inventory in International Negotiations

The 5th Assessment Report published by the Intergovernmental Panel on Climate Change (IPCC) in 2013 stated that "the atmospheric concentrations of the greenhouse gases carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) have all increased since 1750 due to human activity".

In accordance with Articles 4 and 12 of the United Nations Framework Convention on Climate Change (UNFCCC), all Parties to the Convention are required to submit greenhouse gas inventories to the Conference of the Parties (COP) under the convention as part of their national communications (NCs) at a frequency determined by the COP.

GHG inventories are important for ensuring the transparency and accuracy of each country's mitigation actions by quantifying anthropogenic GHG emissions. In this respect, national GHG inventories, which provide information on the GHG emissions and their trends over time, play a critical role as a basis for decisionmakers to design and implement strategies for mitigation actions and GHG emission reductions within their country.

Inventories form the basis of national policy development because they can be used to:

- Identify the major sectors where abatement will have a real impact.
- Predict and compare impacts of mitigation measures.
- Choose cost-effective options.

Inventories are essential to monitoring of impacts of mitigation policies and measures because:

- Policymakers need to know if policies are working.
- They need to reflect impacts of mitigation actions and thus require careful choice as regards method.

11.1.2 Responsibility of Developing Countries

Only developed countries, which are the main emitters of greenhouse gas, have climate change responsibilities and are mandated to create and submit GHG inventories periodically. However, recently, developing countries have achieved rapid growth, and the emissions of greenhouse gas caused thereby have significantly increased, which means developing countries will also have to start submitting GHG inventories. It is thus necessary for each country to urgently asses its national circumstances.

Since the Bali Action Plan, which states that Non-Annex I Parties should also take nationally appropriate mitigation actions in a measurable, reportable and verifiable manner, was agreed on at COP13 in 2007, the importance of greenhouse gas inventories has been recognised as a tool for supporting the developing mitigation measures and to verify their efficacy. From the Cancun Agreements, Non-Annex I Parties shall make the biennial update report every 2 years (see Table 11.1).

Table 11.1 Biennial update report, Decision 1/CP.16—Cancun Agreements (Reference: UNFCCC (2011))

	Frequency	Content
National communications	4 years	National circumstances
		GHG inventory
		Adaptation and mitigation action
		Relevant information
		Necessary support
Biennial update reports	2 years	GHG inventory
		Information on mitigation action
		Needs and support received

11.1.3 The Role of Greenhouse Gas Inventory Office of Japan (GIO)

The Greenhouse Gas Inventory Office of Japan (GIO) was established in July 2002 in the Center for Global Environmental Research (CGER) at the National Institute for Environmental Studies (NIES). Its mission is to compile the annual national greenhouse gas (GHG) inventory of Japan; to implement various GHG inventory-related tasks and activities, such as providing support and assistance for the technical review of the national GHG inventory of Japan for the UNFCCC and the Kyoto Protocol; and to contribute to capacity building of Asian countries in developing and improving their GHG inventories (see Table 11.2).

The "National GHGs Inventory Report of JAPAN (NIR)" and "GHGs Emissions Data of Japan", both of which are published annually, as well as information on and reports from the "Workshop on Greenhouse Gas Inventories in Asia (WGIA)" are available and posted on the GIO website.

Additionally, some members join the process of the technical review of other parties for the UNFCCC and the Kyoto Protocol in some countries such as Germany as a member of the expert review team (ERT).

11.1.4 One Part of the National System

The Ministry of the Environment of Japan (MoEJ), with the cooperation of relevant ministries, agencies and organisations, prepares Japan's national inventory and compiles supplementary information required under Article 7.1, which is annually submitted to the Conference of the Parties through the UNFCCC Secretariat in accordance with the UNFCCC and the Kyoto Protocol.

The MoEJ takes overall responsibility for the national inventory and therefore does its utmost to improve the quality thereof. The MoEJ organised the "Committee for the Greenhouse Gas Emission Estimation Methods" in order to integrate the latest scientific knowledge into the inventory and to ensure it reflects recent

Table 11.2 List of tasks of Greenhouse Gas Inventory Office of Japan (GIO)

Task of Greenhouse Gas Inventory Office of Japan
- Preparing annual national GHG inventory
- Providing support for Japan's national GHG inventory
- Support and assistance of political actions relating to GHG inventory
- Convening the Workshop on GHG Inventories in Asia (WGIA)
- International cooperation for improvement of GHG inventory
- Participation in GHG inventory review as reviewer

international provisions. The estimation of GHG emissions and removals, the key category analysis and the uncertainty assessment are then carried out by taking the decisions of the committee into consideration. Substantial activities, such as the estimation of emissions and removals and the preparation of Common Reporting Formats (CRF) and National Inventory Report (NIR), are performed by the Greenhouse Gas Inventory Office of Japan (GIO), which belongs to the Center for Global Environmental Research of the National Institute for Environmental Studies. The relevant ministries, agencies and organisations provide the GIO with the appropriate data (e.g. activity data, emission factors, GHG emissions and removals) through compiling various statistics and also provide relevant information on supplementary information required under Article 7.1. They then check and verify the inventories (i.e. CRF, NIR), including the spreadsheets that are actually utilised for the estimation, as a part of the quality control (QC) activities.

The checked and verified inventories determined as Japan's official values are then published by the MoEJ and submitted to the UNFCCC Secretariat by the Ministry of Foreign Affairs (Reference: Ministry of the Environment, Japan and Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2014)).

Figure 11.1 shows the overall institutional arrangement for Japan's inventory preparation.

11.1.5 The Objective of WGIA

Thus far, on the basis of Articles 4 and 12 of the UNFCCC, Annex I countries have compiled a GHG inventory annually, but Non-Annex I Parties have only done so once or twice and with the national communications (NCs).

However, at COP16 in 2010 and COP17 in 2011, it was agreed that, in addition to the NCs, all Parties to the Convention, including Non-Annex I Parties, shall submit information on GHG inventories as a biennial update report (BUR). It was also agreed at COP17 that developing country Parties should submit their first BUR by December 2014 and subsequent reports every 2 years. For this reason, more accurate inventories, which support the development of mitigation measures and the verification of the effectiveness of these measures, need to be reported at a higher frequency than ever before. The importance of periodical GHG inventories

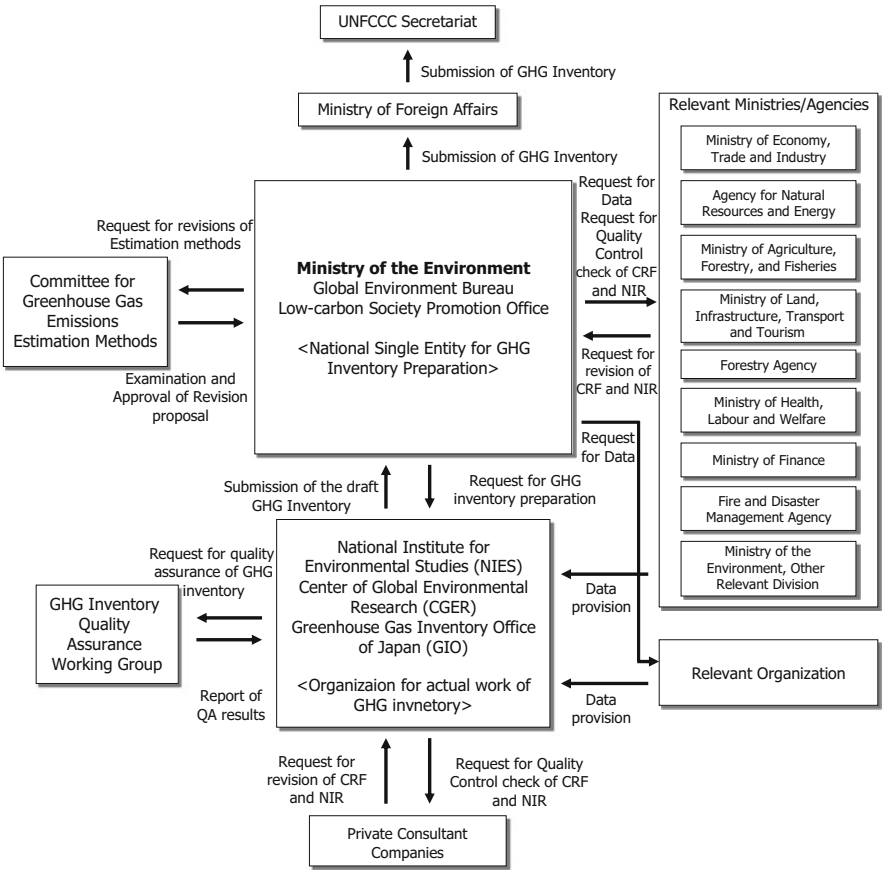

Fig. 11.1 Japan's institutional arrangement for national inventory preparation (Reference: Ministry of the Environment, Japan and Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2014))

is increasing on an international basis, which means Non-Annex I Parties unfamiliar with compiling the GHG inventory periodically will require capacity building.

With this aim in mind, GIO convened the Workshop on Greenhouse Gas (GHG) Inventories in Asia (WGIA) in 2003. In order to improve the quality of GHG inventories, it is important for the related countries to exchange information on them, as this will aid inventory compilers and administrators managing the compilation. Since 2003, government officials, inventory compilers and researchers directly involved with inventory preparation in the participating countries have met to exchange information at the workshop (Reference: Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2012)).

The objectives of the workshop are:

– To enhance sector-specific capacity for inventory compilation (mutual learning)
– To facilitate periodical national GHG inventory preparation for national communications (NCs) and biennial update reports (BURs)

- To discuss the possibility of inventories as a supporting tool for mitigation measures/NAMAs
- To explore issues on measurability, reportability and verifiability (MRV) at various levels
- To provide an opportunity for countries in the Asian region to cooperate and share information and experiences related to their own national GHG inventories
- To support countries in Asia in improving the quality of inventories via regional information exchange (Reference: Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2015))

Participating countries are Cambodia, China, India, Indonesia, Japan, the Republic of Korea, Lao PDR, Malaysia, Mongolia, Myanmar, the Philippines, Singapore, Thailand and Vietnam (14 countries).

WGIAs consist of the following sessions:

- Plenary sessions
- Sectoral working group sessions
- Mutual learning sessions
- Hands-on training sessions

Basically, each WGIA consists of three of the above four sessions.

11.1.6 History of WGIA

Japan is the only Annex I Party in Asia with experience in completing the periodical GHG inventory in Asia. Since Asian cultures and climates vary greatly from those of Europe and the USA, so do the methods of estimating emissions and removals and institutional arrangements. As Japan has constructed an appropriate methodology and institutional arrangement based on Asian culture and climate, it can share its GHG inventory information through WGIA with other countries in Asia, due to their cultural and climatic similarities.

The WGIA and capacity building for measurability, reportability and verifiability were both initiated in 2003 with the aim of building capacity within Asia to develop a GHG inventory. Since its sixth meeting in 2008 (WGIA6), WGIA has been convened as a part of the "Kobe Initiative" of the G8 Environment Ministers' Meeting (Reference: Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2009a)).

WGIA has grown since its first meeting in 2003, from 27 participants to over 100 at WGIA7 in 2009 (Reference: Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2009b)) then to 130 at WGIA10 in 2012. The 2014 WGIA (WGIA12) was attended by 123 persons from 14 WGIA member countries and international organisations and is now one of the biggest climate change events in Asia. It has also received requests from countries such as Pakistan and East Timor, which are not currently members of WGIA, to attend future WGIA meetings. There is the possibility of expanding the scale of the workshop.

Table 11.3 List of host countries

Month, year	Host country	Theme
November 2003	WGIA1: Thailand	Identified problems and needs of support
February 2005	WGIA2: China	Shared information and experiences gained through inventory development
February 2006	WGIA3: Philippines	Discussed technical matters on each sector inventory
February 2007	WGIA4: Indonesia	Organised working groups and discussed sector-specific issues
September 2007	WGIA5: Malaysia	Identified needs for further inventory improvement
July 2008	WGIA6: Japan	Reaffirmed the importance of inventory development
July 2009	WGIA7: Republic of Korea	Shared information and experiences/discussed sector-specific and crosscutting issues
July 2010	WGIA8: Lao PDR	Shared information and experiences/discussed sector-specific and crosscutting issues
July 2011	WGIA9: Cambodia	Initiated "mutual learning"
July 2012	WGIA10: Vietnam	Shared information and experiences/conducted mutual learning
July 2013	WGIA11: Japan	Shared information and experiences/conducted mutual learning
August 2014	WGIA12: Thailand	Shared information and experiences/conducted mutual learning

The participating countries that acted as host countries for WGIA from 2003 to 2014 are shown in Table 11.3.

11.1.7 Contents of WGIA

1. Topics Discussed in Plenary Sessions

   The topics of discussion covered various categories on WGIA as shown below. WGIAs consist of the following sessions:

- Plenary sessions
- Sectoral working group sessions
- Mutual learning sessions
- Hands-on training sessions

Basically, as mentioned above, each WGIA consists of three of the above sessions. All participants join the plenary sessions and then choose sectoral working-group sessions as well as hands-on training sessions. Mutual learning sessions are closed sessions and are limited in participant number.

Plenary sessions deal with overall and cross-cutting issues on national GHG inventory preparation, such as data provision, institutional arrangements and introduction to countermeasures for climate change of Japan and host countries, as well as mitigation action such as NAMAs. Through discussions in the plenary sessions, participants in WGIAs share information from various data sources, which is useful for improving their inventory preparation systems.

The topics in plenary sessions were:

- Progress report on Non-Annex I Parties' national communications (NCs) shared by the UNFCCC Secretariat
- Progress of NCs and BURs in each participating country
- National systems for periodical national GHG inventory preparation
- Relationships between inventory and mitigation measures/NAMAs
- Enhancement of network for supporting measurability, reportability and verifiability (MRV)
- Quality assurance/quality control (QA/QC)
- Uncertainty assessment
- Time-series consistent estimates, etc.

In plenary sessions, UNFCCC provides information on the international framework and COP decisions. Participants welcome this presentation as cross-cutting issue such as QA/QC; UA and time-series consistency important for quality improvement of the GHG inventory are discussed.

2. Sectoral Working Group Sessions

Regarding the GHG inventory, there are many sectors and categories, such as energy, industrial process, agriculture, LULUCF (land use, land-use change and forestry) and waste. WGIAs provide the sectoral working group sessions in order to discuss particular sector-specific issues and find solutions to them. There are various issues for inventory preparation in each sector, and the sectoral working group sessions deal with sector- or category-specific issues.

Table 11.4 shows main topics containing sectoral working group sessions. The WGIA participants are government officials and inventory compilers or researchers directly involved with inventory preparation. Inventory compilers and researchers attended the breakout sessions for each expert sector or category; and government officials attended the breakout group of cross-cutting issues such as regional and/or city-level GHG inventories. Discussion of such sector-specific issues among sectoral experts is recommended in order to cover the issues thoroughly.

Table 11.4 Topics of sectoral working group sessions

	Crosscutting	Energy	Agriculture	LULUCF	Waste
WGIA6	Awareness raising of GHG inventories		Strategies to improve reliability of data	Use of remote-sensing data	Strategies to improve reliability of data
WGIA7		Statistics for energy sector	Emission factors utilized for NCs	Activity data from remote-sensing and GIS	Improvement of data collection scheme
WGIA8	Institutional arrangements for inventory preparation		Estimation methods and development of parameters	Follow up of WGIA7 (remote sensing and GIS data)	Information exchange on the current status of sectoral inventory preparation
WGIA9	Non-CO_2 gas estimation QA/QC systems	Estimation of CO_2 emissions from transport sector			Development of waste statistics
WGIA12	GHG inventory at various levels		Relationship between national GHG inventories and mitigation measures, specifically NAMAs		

3. Mutual Learning Sessions

The mutual learning (ML) session is an activity to improve the inventories of individual countries through the following processes: (1) exchanging inventories between two countries, (2) learning from a partner's inventory and (3) exchanging comments on each other's inventories. The primary purpose of ML is to improve GHG inventories by providing details of methods and data for GHG emission/removal estimation between two countries and exchanging comments on the methods and data. Studying a partner country's inventory and discussing it with its compilers provide useful information for inventory preparation and compilation. ML is also expected to foster and strengthen cooperation among GHG inventory experts in Asia. Since the aim of ML is not criticism or auditing, participants can freely communicate on a one-to-one basis as equals, rather than in one-way communication as is found with the examiner–examinee relationship (Reference: Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2015)).

ML was introduced to other participating countries in WGIA8 in 2010 and participants requesting mutual learning sessions between WGIA countries in the sessions of WGIA. Therefore, ML has been conducted since WGIA9 (Reference: Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2010)).

The ML sessions are closed sessions in order to ensure confidentiality of discussions in the sessions; only participants, chairpersons, facilitators and

rapporteurs for each ML session and the WGIA Secretariat are allowed to enter conference rooms for the sessions in principle (Reference: Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2015)).

Through the discussions, participants studied their partner country's methodologies for GHG emission estimations, which usually differ from their own, to receive hints on improving their own inventory. They also shared any technical issues (e.g. data collection, adoption of emission factors, national system) in order to better overcome them.

Several participants in past MLs stated that they had improved their inventory through the ML experience and in particular were able to refine their inventories before official submission to the UNFCCC such as NCs and BURs. The participants in WGIA11 acknowledged the efficacy of ML in improving their inventories and agreed that implementation of MLs should continue in future WGIAs.

In the case of WGIA12, the WGIA Secretariat notified the participants of WGIA of the ML and received applications from 29 teams from eight parties on December 2013. Considering the requirements of the applicants and an appropriate balance among sectors and feasibility of implementation, the WGIA Secretariat (GIO) organised them into pairs (Indonesia and Myanmar on energy sector, China and Mongolia on agriculture sector and Vietnam on LULUCF sector) on April 2014 (Reference: Proceedings of WGIA12 2014).

Thus, the ML sessions were conducted for the energy sector, agriculture sector and LULUCF sector, as shown in Table 11.5. Participating countries studied worksheets for emission estimates and methodology reports to estimate the emissions of partners and exchanged comments and answer sheets before the WGIA discussion. Many findings and hints to improve the GHG inventories were exchanged across the table in the session of WGIA12 in Bangkok (Reference: Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2015)).

Prior to WGIA12, only ten countries had attended the ML sessions. As mentioned above, ML is useful for improving one's own inventory and is considered a form of external quality assurance activity by some participants. It is hoped that more participants will join the ML sessions in future WGIA.

Table 11.5 List of countries participating in mutual learning

	Energy	Industrial processes	Agriculture	LULUCF	Waste
WGIA9	Indonesia–Mongolia			Lao PDR–Japan	Cambodia, Indonesia, RoK
WGIA10	Cambodia–Thailand	Indonesia–Japan	Indonesia–Vietnam		China–RoK
WGIA11	Lao PDR–Thailand		China–Myanmar		Malaysia–Vietnam
WGIA12	Indonesia–Myanmar		China–Mongolia	Vietnam	

Reference: Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2015)

Table 11.6 List of hands-on training sessions

	Topic
WGIA6	How to implement a key category analysis
WGIA7	How to fill data gaps
WGIA8	How to implement mutual learning for national GHG inventories
WGIA10	How to use the new IPCC Inventory Software (energy, industrial processes, waste)

4. Hands-On Training Sessions

Most WGIA participating countries have insufficient experience in GHG inventory preparation, especially in terms of technical issues such as key category analysis and IPCC Inventory Software. Technical issues on how to implement inventory preparation obviously need addressing with training, which is why WGIA is useful as it provides hands-on training sessions. In the sessions participants can attempt to actually implement some of the technical processes of inventory preparation.

Table 11.6 shows the topics of hands-on training sessions.

11.1.8 Latest Workshop on GHG Inventories in Asia (WGIA12), 2014

The Ministry of the Environment of Japan (MoEJ) and the National Institute for Environmental Studies (NIES) convened the WGIA as a capacity building workshop for measurability, reportability and verifiability (MRV) as a part of Japan's assistance for developing countries. Ever since 2003, the workshops have aimed at supporting Non-Annex I (NAI) Parties in Asia to develop and improve their GHG inventories.

In August 2014, the 12th workshop was held and attended by over 120 experts from 14 WGIA member countries (Cambodia, China, India, Indonesia, Japan, the Republic of Korea, Lao PDR, Malaysia, Mongolia, Myanmar, the Philippines, Thailand, Singapore and Vietnam), as well as representatives from the Secretariat of the UNFCCC, Technical Support Unit from the IPCC Task Force on National Greenhouse Gas Inventories (IPCC TFI TSU), the Regional Capacity Building Project for Sustainable National Greenhouse Gas Inventory Management Systems in Southeast Asia (SEA GHG Project), the United Nations Environment Programme (UNEP), the Food and Agriculture Organization of the United Nations (FAO), the Global Forest Observations Initiative (GFOI), the Asia-Pacific Network for Global Change Research (APN), the US Agency for International Development (USAID), the US Environmental Protection Agency (USEPA) and relevant Japanese institutes in Bangkok, Thailand.

The GIO (Secretariat of the WGIA12) both organises the programmes of WGIA, according to the needs and requests of the participants, and conducts the WGIA.

In WGIA12, the biennial update report (BUR) to be submitted by Non-Annex I countries by year end and the international consultation and analysis (ICA, part of BUR) were key topics on the discussion agenda. Also discussed were the importance of accurate GHG inventories and QA/QC activities; the importance of MRV at various levels, such as region and city levels, for verification of implementation and planning for NAMA; the necessity of consolidating stable systems of GHG inventory for applying high cost–benefit technology in the AFOLU sector; and the need to maintain ongoing correspondence with inventory compilers and researchers providing new technology.

Through WGIA12, the capacity development of participating countries for MRV and the network for BUR were enhanced, with the aim of creating BUR, conducting ICA and implementing the intended nationally determined contributions (INDCs).

WGIA 13 will be held in Indonesia, where BURs submitted by Non-Annex I Parties this year will be presented by the participants. Further, mutual learning and discussions concerning ICA will be conducted. (Reference: Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2015)).

11.2 Achievements of WGIA

11.2.1 Enhanced Relationships

The Workshop on Greenhouse Gas Inventories in Asia (WGIA) has been run since 2003 to provide an opportunity for countries in the Asian region to cooperate and share information and experiences related to the development of the national GHG inventory. In 2014, the WGIA12 was held in Bangkok, Thailand.

As described above, Japan, the only Annex I Party in Asia, has been sharing its experiences concerning compiling the periodical GHG inventory with WGIA participants, and the participants have been sharing information related to methodology, such as country-specific emission factors for Asian countries. Since the IPCC default emission factor was not appropriate for the climate of SE Asia, particularly for agriculture, LULUCF and waste, sharing specific regional emission factors is beneficial, and in this respect, Japanese researchers provided much data to assist in the development of regional- and country-specific emission factors. Governmental officials also shared information concerning institutional arrangements based on Asian culture, and this sharing of information ensures that the methodology and institutional arrangements of Asian countries are appropriate. Building a tighter network of Japanese researchers and Asian government officers and researchers is important for the GHG inventory, as well as for countermeasures against climate change.

As mentioned above, the first WGIA in 2003 had 27 participants, which rose to 130 in 2012. The latest WGIA (WGIA12) in 2014 had a participation of 123, from 14 WGIA member countries and international organisations in 2014. WGIA has become one of the biggest events on climate change in Asia. Requests have even been received from non-member countries, such as Pakistan and East Timor, to join future workshops. As regards the size of the event, in theory it could be scaled but could suffer due to insufficient budget or capacity of GIO, the WGIA Secretariat.

In the beginning, the main participants were researchers, and topics concerned the national system and technical issues of each expert. Recently though, the proportion of government officials attending has been increasing. At the latest WGIA, not only GHG inventory technical issues but also mitigation issues and regional- or city-level inventories were discussed. Many government officials and policymakers also evaluated measurements concerning climate change.

Further, advanced research and development on emission factors and climate change issues in Japan have also been introduced, the research of which has been helpful in creating the GHG inventory for Asian countries. The introduction of climate change research in SE Asia has enabled collaboration between Japanese researchers and local researchers in other Asian countries. Japanese researchers became aware of the needs of WGIA countries through discussions at WGIA. Furthermore, WGIA also enables government officials to access the latest information on climate change research, which illustrates the importance of the government–research relationship.

Relationships between researchers and government officials are bolstered at the GIO-held WGIA every year. Further, activities unrelated to WGIA have also been held, such as the initiation of mutual learning between Japan and Korea. Mutual learning is an opportunity to understand all the different GHG inventories and how they contribute to improving GHG inventories. Korea also mentioned that mutual learning is implemented as a form of external quality assurance in the WGIA sessions. As already described in Sect. 11.1.7, mutual learning has also been conducted between other countries in WGIA sessions every year. Lao PDR, which attended the mutual learning sessions in WGIA9 and WGIA11, also introduced a mutual learning programme that emphasises peer reviews of the LULUCF with GIO. Lao PDR commented that this enhanced both accuracy and completion of the inventory of the LULUCF sector of the Lao PDR.

WGIA is financed from a budget of the Ministry of the Environment, Japan. GIO, part of the National Institute for Environmental Studies, convened the WGIA and invites researchers to discuss the technical issues of GHG inventories free of international opinion or negotiations, an environment deliberately fostered so that researches can speak freely without being hindered by governmental or international bias. This forum for free discussion was built on a relationship of mutual trust, and as it moves from country to country every year and is not solely based in Japan, this enables host countries to participate more easily. As a result WGIA can be attended by many participants, enabling face-to-face contact crucial to carrying issues forward.

11.2.2 Sharing Information Such as Sector-Specific Issues and General Issues of GHG Inventory

1. International Negotiation

TSU and UNFCCC have attended WGIA since its inception, where they continue to disseminate information on the status of international negotiations and UNFCCC mandates based on the latest information on COP. WGIA also gave government officials a chance to catch up on progress in international negotiations, and the Q&A session provides a chance to better understand institutional arrangements and policy measures.

In the actual workshop, Japan and the host countries introduce countermeasures individually taken for climate change and participating countries share their NCs. Through such presentations, progress in countermeasures for climate change of WGIA countries—which share similar climatic, international position and economic circumstances—can be shared, thus clarifying the status of each country. WGIA is thus an effective means by which to evaluate the results of policy.

2. Sharing of Information and Experience

In WGIA, current internationally relevant information and estimation methodology are discussed, which benefits other countries. Further, common problems and possible solutions are identified.

11.2.2.1 Estimation of Time-Series GHG Emissions/Removals

Mongolia estimated its annual time-series GHG emissions and removals from 1990 to 2006, as can be found at http://www-gio.nies.go.jp/wgia/wg7/pdf/4.2.5.%20Dorjpurev%20Jargal.pdf

Thailand estimated its quadrennial time-series GHG emissions and removals from 1990 to 2003, as well as annual time-series GHG emissions excluding LULUCF from 2000 to 2005, which can be found at http://www-gio.nies.go.jp/wgia/wg7/pdf/4.2.6.%20Sirintronthep%20Towprayoon.pdf http://www-gio.nies.go.jp/wgia/wg6/pdf/3-3%20Sirintornthep%20Towprayoon.pdf

Indonesia estimated its annual time-series GHG emissions and removals from 2000 to 2005, as follows: http://www-gio.nies.go.jp/wgia/wg7/pdf/4.2.7.%20Rizaldi%20Boer.pdf

11.2.2.2 Development of Country-Specific Emission Factors

China developed country-specific emission factors for CH_4 emissions from paddy fields and N_2O emissions from cropland, which can be found at:

http://www-gio.nies.go.jp/wgia/wg10/pdf/2-2_5_AFOLU_China.pdf

India developed country-specific emission factors for CH_4 emissions from enteric fermentation by ruminant animals and N_2O emissions from agricultural soils:

http://www-gio.nies.go.jp/wgia/wg8/pdf/3-wg2-3_sultan_singh.pdf
http://www-gio.nies.go.jp/wgia/wg8/pdf/3-wg2-5_chhemendra_sharma.pdf

Indonesia developed country-specific emission factors for CH_4 emissions from rice cultivation:

http://www-gio.nies.go.jp/wgia/wg7/pdf/4.2.7.%20Rizaldi%20Boer.pdf

11.2.2.3 Establishment of National Systems for National GHG Inventory Preparation

Mongolia appointed the National Agency for Meteorology, Hydrology and Environment Monitoring as its designated professional authority for national GHG inventory preparation and structured its national system, in which the agency plays the central function, information on which can be found at:

http://www-gio.nies.go.jp/wgia/wg8/pdf/3-wg1-2_batimaa_punsalmaa.pdf

Korea established the GHG Inventory & Research Center of Korea (GIR) and improved existing national system by entrusting the GIR to act as central coordinator, as explained at:

http://www-gio.nies.go.jp/wgia/wg7/pdf/4.1.5.%20Jang-won%20Lee.pdf
http://www-gio.nies.go.jp/wgia/wg9/pdf/3-wg4-4_mihyeon_lee.pdf

Indonesia enacted Presidential Regulation 71/2011 as the foundation for Indonesian GHG inventory preparation and established a national GHG inventory system; see the following for more details:

http://www-gio.nies.go.jp/wgia/wg10/pdf/3_1.pdf

11.2.2.4 Development of Quality Assurance/Quality Control (QA/QC) System

Mongolia established a QA/QC plan for energy and industrial process sector, as explained at:

http://www-gio.nies.go.jp/wgia/wg9/pdf/3-wg4-3_dorjpurev_jargal.pdf

Korea developed a QA/QC system for the waste sector and applied bilateral peer reviews its GHG inventory with Japan as one of its QA activities, as explained at:

http://www-gio.nies.go.jp/wgia/wg9/pdf/3-wg4-4_mihyeon_lee.pdf

11.2.3 Related Activities and International Cooperation

1. SEA Project

The Regional Capacity Building for Sustainable National Greenhouse Gas Inventory

Management System in Southeast Asia (SEA GHG Project) was held back to back with WGIA every year. The project is ran with the UNFCCC as the lead agency and in collaboration with US Environmental Protection Agency (US EPA), US Agency for International Development (USAID), Colorado State University (CSU), Workshop on GHG Inventories in Asia (WGIA (GIO/NIES)) and USAID Low Emissions Asian Development (LEAD) programme. The participants of the SEA GHG Project and WGIA have the same aim, and holding similar activities at the same time has a synergistic effect for the relevant parties.

The aim of the SEA GHG Project meeting is to provide updates and feedback with SEA participating countries of their current status, gaps, challenges, barriers and capacity building needs (or technical assistance) in developing national GHG inventories for the third national communication (NC3) and first biennial update report (BUR1). There was also much feedback to WGIA.

2. Participation from USAID, USEPA and AusAID

The participants of WGIA are not only WGIA members—the US Environmental Protection Agency (USEPA), US Agency for International Development (USAID) and the Australian Agency for International Development (AusAID) have also attended. WGIA enables sharing of information on many donors' progress and the needs of the WGIA countries, which assists in coordination. The USA has conducted some projects, such as the SEA project, USAID Low Emissions Asian Development programme (LEAD programme) in Southeast Asia. Australia conducted a study tour for GHG improvement with Indonesia's government, which involved visiting facilities related to application of countermeasures for climate change through the WGIA network.

3. Mutual Learning Between Japan and Korea

The mutual learning between Japan and Korea is the first activity not involving WGIA and was held on the waste sector between GIO and Korea Environment Corporation (KECO) in the annual workshop in Korea in 2008. Korea's GHG inventory compiler invited Japan's counterpart to review its waste sector in terms of GHG inventory. Such mutual learning is a two-way process and does not involve one-way communication such as is found in the examiner–examinee relationship. As such, Japan checked Korean GHG inventories, but also Korea checked Japanese GHG inventories and gave Japan some comments. The comments from Korea contributed to improve the transparency of Japanese GHG inventories. The second mutual learning was held on the waste sector between Japan and Korea in Japan in 2009, and the third mutual learning was held on all sectors between Japan and Korea in Korea in 2010. Many findings resulted, which were not subjected to the

UNFCCC review, and thus also contributed to improved transparency of each other's GHG inventories.

The Secretariat of WGIA introduced this activity in WGIA8 in 2010. With the agreement of the participants, ML has been held in the WGIAs that followed as one of the sessions. For Non-Annex I Parties not mandated to be reviewed by UNFCCC, no particular attention needs to be paid to GHG inventories after submission. Previously, Non-Annex I Parties had never studied another's GHG inventories, which is where mutual learning provides an opportunity to study and learn from others' GHG inventories, which contributes to overall improvement of a country's own GHG inventories. Emission factors which other countries have developed and implemented to improve their GHG inventories, as well as issues concerning institutional arrangements which other countries face, and so on can be shared via ML. After ML, Non-Annex I Parties recognised the need both for the information in order to compile their own GHG inventories and the information on other countries, for comparison. Transparency and comparability are thus improved, and such findings lead to overall improvements in the GHG inventory.

4. Mutual Learning Plays a Role as External Quality Assurance (Korea and Lao PDR)

Korea, which is not included in Annex I Parties, does not have a responsibility to be reviewed by UNFCCC. And, as mutual learning does not employ any procedures such as UNFCCC reviews and only uses intercountry evaluations, it improves GHG inventories across the board. Korea implemented mutual learning as a form of external quality assurance in the WGIA sessions. Lao PDR, which attended the mutual learning sessions WGIA9 and WGIA11, also introduced mutual learning as a programme that emphasises peer reviews of the LULUCF with GIO. Lao PDR commented that this enhanced the accuracy and completion of the inventory of the LULUCF sector of Lao PDR.

5. Similarity Between Mutual Learning and International Consultation and Analysis (ICA) Procedure

Mutual learning involves "reading" a partner's GHG inventories in detail and studying other GHG inventories of other countries. As described above, mutual learning plays a role in the form of external quality assurance. In other respects, the ICA process of BUR is similar to quality assurance in that it is conducted by a third party, although it may not be regarded as quality assurance. ICA provides Non-Annex I Parties which lack sufficient human resources of quality assurance new opportunities to improve the quality of their GHG inventories

Mutual learning, just like ICA, contributes to improved transparency and comparability to evaluate the country-specific emission factors developed.

6. Cooperation with JICA Projects

GIO has collaborated with the Japan International Cooperation Agency (JICA) to build the capacity required to conduct periodical GHG inventories of developing countries. Projects have been implemented in Vietnam, Indonesia and Thailand to

date. GIO provides leaning of technical issues of GHG inventories and has formed a relationship between JICA officers, GHG inventory compilers and expert WGIA participants. An author of this paper worked in a project in JICA Indonesia named Project of Capacity Development for Climate Change Strategies in Indonesia and lived in Indonesia for 2 years. The Ministry of Environment of Indonesia was well acquainted with GIO and respected GIO's experience and capacity. Making GHG inventories requires a great deal of networking and good connections, such as with ministries and researchers, as such can enable work to proceed smoothly.

In 2014, the Workshop on Capacity Development on Greenhouse Gas Inventory in the Southeast Asia Region entitled "How can CITC break through GHG inventory barriers?" was held as a back-to-back session of WGIA12, and GIO supported Climate Change International Technical and Training Center (CITC) and Thailand Greenhouse Gas Management Organization (a public organisation). This event represented the launch pad for CITC, and many participants of WGIA12 remained afterwards to attend this event. CITC is a training centre for other developing countries and was established by TGO as part of south–south cooperation.

11.2.4 Networks

1. South–South Cooperation: Thai–Myanmar Co-learning

A study visit of Myanmar's inventory compilers to Thailand for sharing information on measurement methodologies on the agriculture sector was held via the WGIA network. In the visit Myanmar learnt about measurement of GHG emissions from crop residue burning and rice straw burning from a Thai academic. Therefore, intercountry cooperation between neighbouring Non-Annex I Parties with similar socioeconomic or climatic conditions enhances regional cooperation and improves both parties' national GHG inventories.

2. Mutual Learning Between Australia and Indonesia

In 2012, Australia conducted a study tour for GHG improvement, which involved inviting Indonesia's government to observe a facility applying climate change countermeasures. In return, Indonesia's government invited Australia to check its GHG inventory in Indonesia. This is called mutual learning. The idea and importance of mutual learning to improve the quality of the GHG inventory originated at WGIA. Australia and Indonesia have communicated through the WGIA network.

3. Cooperation with Asia-Pacific Integrated Model (AIM)

GIO is part of the National Institute for Environmental Studies (NIES). A further Asian-related research team exists within NIES—the Asia-Pacific Integrated Model (AIM) team. The AIM team is involved with predictions of GHG emissions. The GHG inventory itself provides the key data needed for policy development to

identify the major sectors, and the data in the inventory is also needed for prediction of GHG emissions and removals. The function of GHG emission predictions is one of the key benefits of the GHG inventory; thus, the AIM team is invited to the WGIA every year.

Many government officials who perform policy development attend WGIA as they need information on GHG emission predictions. Further, in developing countries, many GHG inventory compilers and experts are also in charge of policymaking and prediction of GHG emissions; thus, the one-workshop discussion covering GHG inventory and prediction is very useful for them.

Furthermore, participants from Myanmar requested GIO to introduce AIM team to them in order to learn more about prediction of GHG emissions. WGIA is thus the hub of Asia's climate change network.

11.2.5 Achievements

WGIA has produced several publications, as below:

- Promoted WGIA activities at a side event of SB24, COP15, COP19 and COP20
- Published a WGIA activity report "Greenhouse Gas Inventory Development in Asia – Experiences from Workshops on Greenhouse Gas Inventories in Asia"
  - (a summary report of 1st–4th WGIA)
- Proceedings of every WGIA

11.3 Other activities of WGIA

11.3.1 Website and Mailing List

In order to share and archive the information, GIO developed a website which is updated by workshops. PDF files of presentations given at the workshop and proceedings of WGIA can be downloaded for each year. These documents contain valuable and unique information and are thus downloaded all over the world, especially the information on least-developed countries. Documents for downloading can be found at the link below:

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

A mailing list of persons related to GHG inventory in Asian countries is prepared and managed by GIO. This mailing list is used to announce COP events and other international meetings. If participants wish to distribute information, such as conferences and events in COP, this can be done so via WGIA-Mailing List. Information exchanged through WGIA-Mailing List may be posted on the WGIA

website for public access if so requested or considered useful. Also, the WGIA network platform can be used in parallel with other existing network platforms to complement them and should not be regarded as a replacement or competitor.

11.3.1.1 Brief Background Information on WGIA-Mailing List

The Greenhouse Gas Inventory Office of Japan (GIO) at the National Institute for Environmental Studies (NIES) developed the WGIA-Mailing List to serve as a primary support channel and to provide an opportunity for the WGIA community to share experience, knowledge and resources, voice concerns, seek advice and discuss topics of interest related to greenhouse gas inventories.

This is an initiative established for the WGIA community as an online regional network platform that all may take full advantage of through participation, according to the conclusions reached at Session III "Networking Experts in Region" at WGIA5. Currently, all participants in each WGIA subscribe to this mailing list.

11.3.2 WGIA-EFDB (Emission Factors Database)

In WGIA, participants share their experience with a focus on the estimation methods used in the GHG inventories, key category analysis and ways to address the problems faced in GHG inventory preparation and development to date.

In WGIA5, 2007, participants noted the utility of continuous and improved networking with stakeholders. Malaysia, Cambodia and Indonesia stated that a continuous database of emission factors for GHG inventory was needed. At that time no system for collecting GHG inventory data, such as activity data and emission factors, existed in developing countries. In Asia, some countries used emission factors of neighbouring countries with similar climate conditions, but there was no system or means by which to share such information. There was, therefore, a broad-based opinion concerning the need to develop a database for emission factors in order to share country-specific emission factors developed by WGIA participants.

Since WGIA7, GIO has collected a number of papers presenting country-specific emission factors developed for the various sectors. These values should be integrated in the Emission Factors Database (EFDB) being developed for the region.

One of the activities for the sectoral working group workshop during WGIA6 was to analyse data entered into the EFDB by closely scrutinising what environmental conditions, management practices or specific circumstances were developed for the EF. This meant that experts could discuss if an EF developed for another country may be "applicable" or "appropriate" for use in their own inventory. In this regard, experts could include, via adding remarks at the time of data entry in the EFDB, details as to what countries are "appropriate" for use of the EF factors, which would help other GHG inventory staff in the various countries in the region.

11.4 Conclusions

11.4.1 Importance of Ongoing, Face-to-Face Discussions

The Workshop on Greenhouse Gas Inventories in Asia (WGIA) has taken place annually since 2003 to provide an opportunity for countries in the Asian region to cooperate and share information and experience related to the development of national GHG inventories. WGIA is organised by GIO, a sustainable organisation. The 12th WGIA was held in Bangkok, Thailand, in 2014. Workshops were held in various host countries, as this leads to more attendees participating from Asian countries and enables more face-to-face discussion. The number of WGIA participants increased from 27 in 2003 to 130 in 2012. The latest WGIA (WGIA12) had an attendance of 123 from 14 WGIA member countries and international organisations in 2014. WGIA has become one of the biggest events for climate change in Asia. Through this ongoing face-to-face workshop, mutual trust among participants has been built.

11.4.2 Sharing of Information and Experience

In WGIA, the latest information and estimation methodologies are discussed, providing an opportunity for other countries to learn. Common problems and possible solutions are identified. This information helps participants compile transparent, accurate, time-series continuous, comparable and continuous GHG inventories. Many countries have overcome common problems and some countries have already developed country-specific emission factors, time-series GHG emission estimations and national systems as a result.

11.4.3 Network Utilisation

The WGIA network platform was established to exchange information on climate change and mitigation of GHG emissions as well as GHG inventory. WGIA's key function is to connect other activities among participants and Japan and also facilitate international cooperation; many collaborative activities, such as the SEA GHG Project, USAID, USEPA, AusAID as well as instances of mutual learning, have taken place as a result.

11.4.4 Continuity of WGIA

One of the reasons why WGIA can continue is its sustainability as an organisation (GIO/NIES). In addition, although the first workshop was just a small meeting, it has since grown, step by step, into something much larger. This environment of free discussion has built relationships of mutual trust among the participants. Holding WGIA every year has been enabled by the mutual trust built among and by the participating countries

References

Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2009a) Proceedings of the 6th Workshop on Greenhouse Gas Inventories in Asia (WGIA6) –"capacity building support for developing countries on GHG inventories and data collection (measurability, reportability and verifiability)" as a part of the "Kobe Initiative" of the G8 Environment Ministers Meeting, 16–18 July 2018, Tsukuba, Japan

Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2009b) Proceedings of the 7th Workshop on Greenhouse Gas Inventories in Asia (WGIA7) capacity building for measurability, reportability and verifiability under the Kobe Initiative, 7–10 July 2009, Seoul, Republic of Korea

Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2010) Proceedings of the 8th Workshop on Greenhouse Gas Inventories in Asia (WGIA8) – capacity building for measurability, reportability and verifiability- 13–16 July 2010, Vientiane, Lao People's Democratic Republic

Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2012) Proceedings of the 10th Workshop on Greenhouse Gas Inventories in Asia (WGIA10) – capacity building for measurability, reportability and verifiability-, 10–12 July 2012, Hanoi, Vietnam

Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2015) Proceedings of the 12th Workshop on Greenhouse Gas Inventories in Asia (WGIA12) – capacity building for measurability, reportability and verifiability-, 4–6 August 2014, Bangkok, Thailand

Ministry of the Environment, Japan and Greenhouse Gas Inventory Office of Japan (GIO), CGER, NIES (2014), National Inventory report of Japan, April 2014

UNFCCC, Decision 1/CP.16, The Cancun Agreements (2011)