



# National greenhouse gas inventory capacity: An assessment of Asian developing countries



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## ABSTRACT

The transparency framework of the Paris Agreement (PA) will be elaborated from the existing arrangements under the UN Framework Convention on Climate Change (UNFCCC). Yet, the capacities of developing countries to regularly report national GHG inventories vary, and their needs for capacity building are closely linked with efforts and achievements of previous inventory preparation. The purpose of this study was to analyze the status and changes in the capacity of 37 developing countries in Asia by using a matrix of capacity-indicators. Indicators were composed for four assessment categories: (1) international engagement of a country in the GHG inventory-related process; (2) institutional capacity to produce a GHG inventory; (3) existing technical capacity available to develop a GHG inventory; and (4) actual technical capacity applied to produce a GHG inventory. The paper also analyzed the scale of international support and variations in meeting with capacity building needs. Eleven countries were identified as having low capacity over time, while 9 improved their capacity. Seventeen countries, including 7 countries with established capacity, continuously had relatively high capacity over time. International support was scarce in the majority of Asian developing countries with the most capacity building needs. Improvements in basic technical capacity available for GHG inventory preparation, such as statistics and the scientific expertise, were found to be a key necessity for countries to respond to the PA's enhanced transparency framework. Based on these findings, the study recommended increasing support for improvements in basic technical capacity, especially in countries where existing capacity is low and support is limited. Such capacity building efforts are also beneficial for countries to form and implement nationally determined contributions (NDCs) and other economic and development policies.

## 1. Introduction

At the 21st session of the Conference of Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC), held in Paris in December 2015, the Paris Agreement (PA) was adopted to strengthen global efforts to mitigate climate change. The core objective of the PA is that all Parties implement their nationally determined contributions (NDCs), which are expected to be progressive each time they are renewed in a five-year cycle. Parties track implementation of their NDCs in accordance with the PA's transparency framework in order to “build mutual trust and confidence and to promote the effective implementation of the PA” (UN, 2015). The PA's transparency framework consists of two information elements: a national inventory report of greenhouse gases (GHGs) and information necessary to track progress in implementing and achieving NDCs by a country. Parties are requested to regularly report on these information elements (UN, 2015).

Almost all Parties to the UNFCCC have reported GHG inventories for nearly 20 years. A national GHG inventory is a compilation of a country's estimated anthropogenic GHG emissions and removals and is prepared following the methods provided in the Intergovernmental Panel on Climate Change (IPCC) guidance and guidelines and the five reporting principles of transparency, accuracy, completeness, comparability and consistency (IPCC, 2006). Under the UNFCCC, developed countries are encouraged to support developing countries to prepare GHG inventories as part of national communications (NCs) and biennial update reports (BURs) (UNFCCC, 2002, 2011).

The PA's transparency framework is yet to be elaborated, but will be built on and enhanced from the existing transparency arrangements (UNFCCC, 2015a,b). Prior to the PA, there are clear distinctions between Annex I (developed) and non-Annex I (developing) countries for the requirements of GHG inventory reporting (UN, 1992). One example of this differentiation is that while Annex I Parties were required to submit GHG inventories annually (UNFCCC, 1999, 2013a), non-Annex I

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**Table 1**  
Overview of assessment categories, criteria, indicators and the data sources used for calculating the capacity value.

Assessment category	Criteria	Indicator (sources)
International engagement	Timely response	Promptness of application for GEF funding by a country for NC1, NC2 and BUR1, if submitted (UNFCCC, 2003, 2012, 2015b, 2015c, 2015d)
Institutional capacity	Coordination capacities	Existence of a single overall coordination body (GHGI <sup>a</sup> )
	National formal/legal arrangements	Existence of national formal/legal arrangements for developing a GHG inventory (GHGI)
	Continuous improvements	Existence of a continuous improvement plan (GHGI)
	Involvement of stakeholders	Existence of arrangements/systems for Involvement of stakeholders (GHGI)
Technical capacity available	Domestic financial resources availability	Existence of domestic financial resources available for sustaining a team of experts (GHGI)
	Understanding of IPCC methods	Number of authors/contributors to IPCC guidelines and guidance (IPCC, 1997, 2000, 2003 for NC1; IPCC, 2006, 2013a, 2013b for NC2 and BUR1)
Technical capacity applied	National scientific capacities	Researchers in R & D <sup>b</sup> (per million people) (WB, 2016a)
	National statistical capacities	Overall Statistical Capacity Indicator <sup>c</sup> (WB, 2016b)
	Transparency	Level of information provided for methodologies in each sector (GHGI)
	Accuracy	Existence of QA/QC plan/arrangements (GHGI) Use of tier 2 or 3 methods in each sector (GHGI) Application of uncertainty assessment (GHGI)
	Completeness	Comprehensiveness of reporting in each sector (GHGI)
	Comparability	Use of appropriate/latest guidelines (GHGI) Application of key category analysis (GHGI)
	Consistency	Timeseries inventories (GHGI) Timeseries consistency (GHGI)

<sup>a</sup> GHG inventory section and annexes of NC1, NC2 and BUR1 submitted by each country.

<sup>b</sup> Representation of years for NC1, NC2 and BUR1 is 2000, 2010 and 2013, respectively.

<sup>c</sup> Representation of years for NC1, NC2 and BUR1 is 2004, 2010 and 2015, respectively.

Parties were required to do so every three to four years as part of NCs and communicate updates on their inventories as part of BURs (UNFCCC, 2002, 2011). Another example is that while Annex I Parties were encouraged to use most recent IPCC guidance and guidelines for inventory compilation, non-Annex I Parties could choose older guidance as references (UNFCCC, 2002, 2013a). In this paper, we refer to Annex I Parties as developed countries and non-Annex I Parties as developing countries.

Differences in reporting requirements between developed and developing countries will likely be smaller under the PA's transparency framework, because it ensures participation by all Parties. However, the existing capacity of developing countries for national reporting is highly variable (Damasa and Elsayed, 2013). Capacity for the purpose of this study refers to the ability of a country to conduct a GHG inventory in response to the international requirements under the UNFCCC. One illustration for varying capacities in developing countries is that, despite agreeing in COP17 that developing countries would submit their first BUR (BUR1) by December 2014, only nine met this deadline (UNFCCC, 2011). To date, only 34 countries have submitted their BUR1 (UNFCCC, 2016a, 2016b, as of September 2016). A challenge for the majority of developing countries is to make reporting on a regular basis, in accordance with the IPCC guidance and guidelines.

Shortage in capacity can be due to a number of factors related to the political, institutional and technical aspects of national systems for preparing GHG inventories (NCSP, 2005; IPCC, 2006; NIES, 2006; Umemiya, 2006; Damasa and Elsayed, 2013; UNFCCC, 2013b; CGE, 2016; US-EPA, 2016). Therefore, capacity building is necessary for countries to prepare and communicate a GHG inventory. Yet, capacity building efforts vary substantially across countries. As we found in this paper, those efforts are closely linked with capacity building efforts and achievements of previous inventory preparation, including support from developed countries. To consider allocation of resources for future capacity building efforts, it is essential to investigate what progress has been made in terms of capacities for making national GHG inventories in developing countries and where and to what extent additional capacity building is needed (Dagnet et al., 2015; Umemiya et al., 2016).

This paper analyzes the change in capacity of developing countries across Asia to develop national GHG inventories by comparing the status of capacity at the time of submitting the first GHG inventory with the status of capacity at the time of submitting subsequent GHG

inventories. We performed this assessment of GHG inventory capacities by using a matrix of capacity-indicators. Further, we analyzed the availability and scale of international support and compared it with capacity building needs we identify in each country.

## 2. Data and methodology

### 2.1. Data

This study focuses on 37 of 55 developing countries in Asia (UN, 2014). These countries were selected, because they have submitted their GHG inventories at least as part of NC1 and NC2 (seven also submitted BUR1) and also because their NCs and BURs were available on-line (UNFCCC, 2016a, 2016b). Data were assembled from publicly available sources and integrated into a single database.

The main data source to assess the GHG inventory development capacities was the GHG inventory section and annexes of individual Parties' NC1, NC2 and BUR1. Another primary source was information collected from the questionnaire survey targeting GHG inventory experts. GHG inventory experts are those who have experience with developing a GHG inventory of a developing country in Asia or supported such a process as an expert. As mentioned below, the survey was conducted to identify the importance of indicators, which we refer to as indicator weighting. Results of the questionnaire provided by ten experts, nine from developing countries and one from a developed country, were used in this study. Additional information on understanding of IPCC methods, national scientific capacities and statistical capacities was taken from a variety of publicly available sources (Table 1).

Data sources for measuring the level of international support related to GHG inventory development were the OECD Rio Marker (OECD, 2016) and the UNFCCC Capacity-building Portal (UNFCCC, 2016c). The OECD Rio Marker is the database focusing on bilateral official development assistance (ODA). The Portal summarizes information provided by United Nations agencies and the Global Environment Facility (GEF) on their respective capacity-building activities, including on GHG inventories.

The submission years of NC1 and NC2 from the countries assessed in this study ranged from 1997 to 2007, and from 2003 to 2016. For BUR1, submissions were between 2014 and 2016. Therefore, for the

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