IGES Discussion Paper-GC-2011-03 March 2012

Sub-national Carbon Governance in Asian Developing Countries: Cases of China, India, Indonesia and the Philippines

Institute for Global Environmental Strategies

Author:
Hidenori Nakamura
Governance and Capacity Group, Institute for Global Environmental Strategies

The Institute for Global Environmental Strategies (IGES) is an international research institute conducting practical and innovative research for realising sustainable development in the Asia-Pacific region.

Abstract

This paper addresses the state of carbon governance, i.e., measurement, reporting and control of greenhouse gas (GHG) emissions, at the sub-national level in China, India, Indonesia and the Philippines, and discusses the possibility of utilising a carbon crediting mechanism to extend low carbon development policies at the sub-national level and needed capacity development towards that end. National governments initiated GHG inventory development at sub-national government level in China and Indonesia, while national governments have not commenced such initiatives yet in India and in the Philippines. A limited number of sub-national governments have developed inventories under the auspices of international organisations in the Philippines, and researchers are mainly estimating emissions at the sub-national level in India. There are currently no carbon reporting and control mechanisms at the sub-national level. However, low carbon development policies and measures in the sectors of transport, commercial buildings, and household and waste have been identified in advanced provincial or city governments selected for study. These policies and measures could be enhanced further by pursuing the possibility of issuing credits based on existing methodologies. Yet, even advanced sub-national governments do not have sufficient personnel and organisational capacity for carbon management. It is therefore desirable and realistic to adopt a policy of capacity development not only for sub-national governments, but also for private sector corporations that already have experience, in order to enhance carbon governance at the sub-national level in Asian developing countries.

1. Objective

This paper aims to i) assess the state of carbon governance at the sub-national level in four selected Asian developing countries: China, India, Indonesia, and the Philippines, ii) present low carbon development policies and measures in selected cities/provinces, iii) show the potential for using carbon credits to extend low carbon policies and measures, and iv) identify necessary capacity development for effective carbon governance at the sub-national level in developing countries in Asia, focusing on utilisation of carbon finance through new market mechanisms.

2. State of carbon governance at the sub-national level in China, India, Indonesia and the Philippines

Table 1 gives an overview of population, economic development and degree of decentralisation for China, India, Indonesia and the Philippines. These are the four target countries in the current study of carbon governance at the sub-national level, and they are classified as lower middle income countries according to the World Bank classification. China is highest and India is lowest in terms of per capita income. Governors or mayors of local governments are appointed by the national government in China while they are directly elected in other countries. Therefore the degree of decentralisation in China is lower than that in other countries. However, resource allocation to local governments is higher in China and lower in the Philippines from the perspective of local governments' own revenue and the number of local governmental officials.

Table 1 Population, economic development and degree of decentralisation in China, India, Indonesia and the Philippines

Country	Population (millions; 2009)	Per capita Gross National Income (US dollars 2009)	Decentralisation (Selection of governor/mayor)	Decentralisation (Local governmental revenue/Total governmental revenue)	Decentralisation (Number of local governmental officials/Number of all officials)
China	1,331	3,650	Appointment	> 40%	> 60%
India	1,155	1,180	Direct election	20 - 40%	30 - 60%
Indonesia	229	2,050	Direct election	20 - 40%	> 60%
Philippines	91	2,050	Direct election	< 20%	< 30%

Sources: Compiled from World Bank (2011), UNITAR (n.d.), Takeuchi (2005), Mori (2008)

Before presenting the state of carbon governance at the sub-national level in the above four countries, the state of carbon governance at national and sub-national level in Japan is presented as a reference. Japan is an Annex-I country of the United Nations Framework Convention on Climate Change (UNFCCC) and has an obligation to reduce greenhouse gas (GHG) emissions according to the Kyoto Protocol. Here carbon governance refers to whether there is a GHG emissions inventory for jurisdictions by emitting sectors, whether there is a mechanism enabling emitters to report their emissions to the government, and whether there is a mechanism that obliges emitters to reduce their emissions or a voluntary agreement to reduce the emissions. Table 2 shows the current state of Japanese carbon governance by different administration levels. All 47 prefectures and 19 designated large cities have developed GHG inventories and around half of the remaining cities—comprising central (*chukaku*) cities with a population greater than 0.3 million and special (*tokurei*) cities with a population greater than 0.2 million—have developed GHG inventories. These actions are associated with the planning of regional climate policy promotion programmes required under the Act on Promotion of Global Warming Countermeasures. Meanwhile, just over half of all prefectures, just under half of all designated cities and three central (*chukaku*) cities[1] have created mechanisms for emissions reporting in the sectors of energy supply, residential and commercial buildings, and industries. These local governments request private companies to report their emissions in addition to preparation and submission of GHG emissions reduction plans. This reporting mechanism is different from the national level GHG emissions calculation, reporting and announcement mechanism, which was introduced during revision of the Act on Promotion of Global Warming Countermeasures in 2005.

[1] Kawagoe city (Saitama prefecture), Kashiwa city (Chiba prefecture) and Kagoshima city (Kagoshima prefecture)

Table 2 Carbon governance in Japan

Sector	Level								
	National government (by law)			Prefectural/desginated city government (by local ordinance or law)			City government (by local ordinance or law)		
	GHG inventory	Emissions reporting (emitters to government)	Emissions control	GHG inventory	Emissions reporting (emitters to government)	Emissions control	GHG inventory	Emissions reporting (emitters to government)	Emissions control
Energy supply	Yes	Yes, for specified large energy users/GHG emitters	Voluntary cooperation with Kyoto target achievement plan, by Nippon Keidanren (Japan Business Federation): Kankyo Jishu Kodo Keikaku (Environment Voluntary Action Programme)	Yes	Yes, for 28 out of 47 prefectures and 7 out of 18 designated cities, as of Apr 2011	Tokyo Metropolitan Government cap and trade, since 2010	Yes, for 20 out of 41 *chukaku cities* (>0.3 mil pop)/18 out of 40 *tokurei cities* (>0.2 mil pop)	Yes, for 3 out of 41 *chukaku cities* (>0.3 mil pop)	No
Transport and infrastructure	Yes	Yes, for specified large energy users/GHG emitters	Voluntary cooperation with Kyoto target achievement plan, by Nippon Keidanren (Japan Business Federation): Kankyo Jishu Kodo Keikaku (Environment Voluntary Action Programme)	Yes	No	No	Yes, for 20 out of 41 *chukaku cities* (>0.3 mil pop)/18 out of 40 *tokurei cities* (>0.2 mil pop)	No	No
Residential and commercial buildings	Yes	Yes, for some commercial users/specified large energy users/GHG emitters	Some commercial users' voluntary cooperation with Kyoto target achievement plan by Nippon Keidanren (Japan Business Federation): Kankyo Jishu Kodo Keikaku (Environment Voluntary Action Programme)	Yes	Yes, for 28 out of 47 prefectures and 7 out of 18 designated cities, as of Apr 2011	Some commercial users: Tokyo Metropolitan Government cap and trade, since 2010	Yes, for 20 out of 41 *chukaku cities* (>0.3 mil pop)/18 out of 40 *tokurei cities* (>0.2 mil pop)	Yes, for some commercial users: 3 out of 41 *chukaku cities* (>0.3 mil pop)	No
Industry (non agricultural)	Yes	Yes, for specified large energy users/GHG emitters	Voluntary cooperation with Kyoto target achievement plan, by Nippon Keidanren (Japan Business Federation): Kankyo Jishu Kodo Keikaku (Environment Voluntary Action Programme)	Yes	Yes, for 28 out of 47 prefectures and 7 out of 18 designated cities, as of Apr 2011	Tokyo Metropolitan Government cap and trade, since 2010	Yes, for 20 out of 41 *chukaku cities* (>0.3 mil pop)/18 out of 40 *tokurei cities* (>0.2 mil pop)	Yes, for 3 out of 41 *chukaku cities* (>0.3 mil pop)	No
Waste management	Yes	Yes, for specified large energy users/GHG emitters	Not applicable	Yes	No	No	Yes, for 20 out of 41 *chukaku cities* (>0.3 mil pop)/18 out of 40 *tokurei cities* (>0.2 mil pop)	No	No

Sources: Compiled from Ministry of the Environment (2008), Baba et al. (2011), http://www.pref.toyama.jp/cms_sec/1705/00009830/00390265.pdf, http://www.climate-lg.jp/policy/gw_prefecture.html, http://www.climate-lg.jp/policy/gw_city.html, and local governments' homepages

Table 3 indicates the state of carbon governance in China. Five provinces and eight cities that are conducting pilot projects on low carbon development guided by the National Development and Reform Commission (NDRC) have started developing GHG inventories ahead of other local governments. Moreover, the NDRC has announced that all provincial governments are obliged to develop GHG inventories. On the other hand, there is neither an emissions reporting mechanism nor an emissions reduction control mechanism at the local level, since China is not obliged to reduce its emissions under the Kyoto Protocol. However NDRC proposes to ask province/city governments to initiate a trial of carbon emissions trading by private companies in the cities of Beijing, Tianjin, Shanghai, Chongqing and Shenzhen, as well as the provinces of

Hubei and Guangdong, by the end of 2013[2]. It is reported that these local governments may use emissions trading mechanisms employed by Australia, the European Union and Japan's Tokyo Metropolitan Government as examples[3].

Table 3 Carbon governance in China

Sector	Level								
	National			Provincial			City		
	GHG inventory	Emissions reporting	Emissions control	GHG inventory	Emissions reporting	Emissions control	GHG inventory	Emissions reporting	Emissions control
Energy supply	Yes	Yes, for specified large energy users/GHG emitters	No	Yes, NDRC selected 7 provinces to pilot the GHG inventory project, including Guangdong, Hubei, Liaoning, Yunnan, Zhejiang, Shaanxi and Tianjin. NDRC mandated all provinces to work on their GHG inventories.	No	No	Yes, but only 8 cities involved in national-level pilot projects for low-carbon provinces and cities need submit their GHG inventories.	No	No
Transport and infrastructure	Yes	Yes, for specified large energy users/GHG emitters	No		No	No		No	No
Residential and commercial buildings	Yes	Yes, for some commercial users/specified large energy users/GHG emitters	No		No	No		No	No
Industry (non agricultural)	Yes	Yes, for specified large energy users/GHG emitters	No		No	No		No	No
Waste management	Yes	Yes, for specified large energy users/GHG emitters	No		No	No		No	No

Source: Compiled from Tsinghua University (2011)

The emissions reporting mechanism at the national level is associated with the reporting mechanism for energy consumption volumes. All provincial governments and large-scale companies have an obligation to directly report energy consumption volumes to the national government. To this end, they submit self assessment reports to the State Council, the NDRC, the National Bureau of Statistics, the Ministry of Supervision, the State-owned Assets Supervision and Administration Commission of the State Council, and the General Administration of Quality Supervision, Inspection and Quarantine. NDRC reviews the reports and compiles an assessment report, which is disclosed to the public after authorisation by the State Council[4]. Even Tianjin, one of the cities participating in a pilot project, only started putting in place a framework for developing a regional GHG inventory in 2011, and it has not finished developing its inventory yet.

The Tianjin Development and Reform Commission organised a kick-off meeting for GHG

[2] Daily Chinese Economy (16 January 2012)
[3] Ibid.
[4] Tsinghua University (2011)

inventory development in May 2011, calling the relevant people. The Tianjin Low Carbon Development Research Centre was established within the Tianjin Environmental Protection Science Institute in July 2011. The Centre aims to develop an inventory, to construct a carbon information database and analysis system, to manage objectives, and to support emissions measurement in industrial sectors. The Centre has made collaborative agreements with Tsinghua University, the Guangzhou Institute of Energy Conversion at the Chinese Academy of Sciences, the World Resources Institute (US), the Swedish Environmental Research Institute (Institutet för Vattenoch Luftvårdsforskning (IVL)), and the International Center for Environmental Technology Transfer, Japan.

Next, the state of carbon governance in India is shown in Table 4. Although there are several inventory estimations prepared by researchers for specific cities or sectors, only a few local governments such as Nagpur and Thane, which are participating in ICLEI South Asia's climate programme, have developed their regional GHG inventories by themselves. Indian state governments were charged with developing and implementing State Action Plans on Climate Change (SAPCC) in accordance with the National Action Plan on Climate Change (NAPCC) established in 2009. However, the planning and implementation of SAPCC by each state government varies, and only Delhi has progressed to the implementation stage. Meanwhile, no state governments have developed a regional GHG emissions inventory.

There are no emissions reporting or control mechanisms specifically targeted for GHG. However, there is a scheme at the national level called Perform Achieve and Trade (PAT). PAT mandates large energy consumers in the sectors of thermal power, fertilizer, cement, pulp and paper, textiles, chlor-alkali, iron and steel and aluminium to cap their energy utilisation, and they are allowed to trade certificates of reduction[5]. Around 500 energy intensive users are identified as designated consumers (DCs) as of 2011. Each DC has a specific target by percent reduction based on the current energy efficiency. The National Mission on Enhanced Energy Efficiency enforces the target specific energy consumption (SEC) for each user for the cycle of three years. DCs shall comply with target SECs and could buy the energy saving certificates (ESCerts) when they do not meet the targets. The DC that reduces the SEC more than the target, the difference can be sold or banked to the subsequent cycle. Non-compliance leads to the payment of penalty. However implementation of PAT is delayed as of 2011.

[5] Torii (2011)

Table 4 Carbon governance in India

Sector	Level								
	National			State			City		
	GHG inventory	Emissions reporting	Emissions control	GHG inventory	Emissions reporting	Emissions control	GHG inventory	Emissions reporting	Emissions control
Energy supply	Yes	No. cf. energy efficiency targets for large energy users	No. cf. energy efficiency targets and trading for large energy users	No	No	No	Yes, but only a few cities including Delhi, Nagpur and Thane	No	No
Transport and infrastructure	Yes	No	No	No	No	No		No	No
Residential and commercial buildings	Yes	No	No	No	No	No		No	No
Industry (non agricultural)	Yes	No. cf. energy efficiency targets for large energy users	No. cf. energy efficiency targets and trading for large energy users	No	No	No		No	No
Waste management	Yes	No	No	No	No	No		No	No

Source: Compiled from TERI (2011)

Table 5 indicates the state of carbon governance in Indonesia. Though there has been a national level inventory since Indonesia started submitting National Communications under the UNFCCC, only Jakarta province has developed an inventory beneath the state government level, and no other sub-national governments have an inventory. In addition, there is no mechanism for emissions reporting from emitters to the government. However, a presidential regulation is currently under discussion as of 2011 so that the Ministry of Environment and other relevant agencies can develop a GHG inventory and emission reporting mechanism. The Indonesian Ministry of Environment is leading the process of designing a GHG inventory system named Sistem Informasi Gas rumah kaca Nasional (SIGN), which is supported by Japan International Cooperation Agency (JICA). Under this system, state and city governments are charged with developing inventories.

Table 5 Carbon governance in Indonesia

Sector	Level								
	National			Provincial			City		
	GHG inventory	Emissions reporting	Emissions control	GHG inventory	Emissions reporting	Emissions control	GHG inventory	Emissions reporting	Emissions control
Energy supply	Yes	No. A draft presidential regulation on GHG inventory is being discussed. The GHG Inventory System (Sistem Informasi Gas rumah kaca Nasional – SIGN) will be handled by the Ministry of Environment, with the support of JICA.	No	Yes, only for Jakarta province	No. SIGN will include the engagement of provincial governments.	No	No	No. SIGN will include the engagement of city governments.	No
Transport and infrastructure	Yes		No			No			No
Residential and commercial buildings	Yes		No			No			No
Industry (non agricultural)	Yes		No			No			No
Waste management	Yes		No			No			No

Source: Compiled from CER Indonesia (2011)

Lastly, the state of carbon governance in the Philippines is presented in Table 6. Beyond national level inventory development for National Communications under the UNFCCC, there is no record of inventory development at provincial government level or in large cities such as the Greater Manila region, Cebu, and Davao. Two cities, namely Puerto Princesa and Naga, which are relatively small and politically committed to environmental protection, have developed GHG inventories with the assistance of international cooperation. There are no emissions reporting mechanisms in the Philippines.

Table 6 Carbon governance in the Philippines

Sector	Level								
	National			Provincial			City		
	GHG inventory	Emissions reporting	Emissions control	GHG inventory	Emissions reporting	Emissions control	GHG inventory	Emissions reporting	Emissions control
Energy supply	Yes	No	No	No	No	No	Yes, only for Puerto Princesa and Naga cities	No	No
Transport and infrastructure	Yes	No	No	No	No	No		No	No
Residential and commercial buildings	Yes	No	No	No	No	No		No	No
Industry (non agricultural)	Yes	No	No	No	No	No		No	No
Waste management	Yes	No	No	No	No	No		No	No

Source: Compiled from Ateneo School of Government (2011)

The state of carbon governance at the sub-national level in four developing countries is summarised as follows. On the one hand, national governments have initiated GHG inventory development at sub-national government level in China and Indonesia. On the other hand, a limited number of local governments have developed inventories under the auspices of international organisations in the Philippines, and it is mainly just researchers who are estimating emissions at the sub-national level in India. In China, meanwhile, reporting and control mechanisms for energy consumption per economic value-added have been developed at the national level in order to promote energy efficiency. Likewise, in India, there is a national level mechanism to manage energy efficiency in the energy supply and industrial sectors, allowing companies to trade excessive or insufficient quotas. These mechanisms do not exist in Indonesia or the Philippines. However, these measures are those of national governments, and not of sub-national governments.

3. Assessment of low carbon development policies and measures at the sub-national level

In this section, low carbon development policies and measures by sectors at the sub-national level in four countries and their typology are briefly presented based on case studies. Case studies for a few selected sub-national governments are used for China and India. A more comprehensive identification of low carbon policies and measures in various sectors would require a large scale study which is not feasible. The number of sub-national governments that have low carbon development policies and measures is currently very limited in Indonesia and the Philippines, and only case studies of these sub-national governments can illustrate the current state.

Policies and measures relating to carbon governance at the local level can be classified into two main categories, 1) those relating to the governments' own offices and public works, as well as 2) the potential for local governments to influence regional stakeholders. Concretely, there are two types of policies and measures involving local governments' own offices and public works: low carbon infrastructure development and low carbon public procurement. Measure to induce behavioural change in other stakeholders to reorient low carbon development can be divided into six categories: regional planning and target setting; cap and trade of emissions limits; subsidies; levies; emissions standards and labelling; and information provision, environmental education and capacity development.

The selection criteria for target cities or local governments included a relatively higher level of economic development in the country, larger population, local government's commitment to low

carbon development, and data availability during the field study. A higher level of economic development and larger population imply the significance of low carbon development for target local governments in the near future. Political commitment for low carbon development may suggest the possible utilisation of carbon market to enhance their low carbon policies and measures in the future. The specific targets selected were: Liaoning province, Tianjin city and Shanghai city in China, Gandhinagar city (Gujarat state) in India, Jakarta province in Indonesia, and Quezon and Makati, two cities comprising part of the Greater Manila region.

In this discussion paper, the results of one sub-national government for each country are presented in detail. For the results of the remaining case studies, i.e., Liaoning province and Shanghai city for China and Makati city of the Philippines, please refer to Tsinghua University (2011) and Ateneo School of Government (2011) respectively.

An example of low carbon development policies and measures at the sub-national level in China

In this sub-section, the case of Tianjin city is presented in detail. Tianjin has determined the following targets for low carbon development in its 12th five-year plan (2011-2015):

- Reduction of energy consumption per 10,000 yuan of GDP by 18%
- Extension of forest coverage up to 23%
- Extension of the ratio of non fossil fuel over total primary energy consumption to 2%

Table 7 shows low carbon development policies and measures designed to achieve the above targets, by sectors and typologies.

Table 7 Low carbon development policies in Tianjin city, China

Sector	Policies and measures	Typology of policies and measures							
		To influence stakeholders' behaviour						To change local governments' activities	
		Regional planning & target setting	Cap & trade	Subsidies	Levies	Standards & labelling	Information provision & education	Infrastructure construction	Public procurement
Transport	Efficient use of bus fuels							√	
	Improved energy efficiency for freight management							√	
	Promoting eco-driving						√		
	Increased utilisation of public transport	√							
	Planning to promote use of public transport	√						√	
Buildings	Development of energy saving guideline for public and commercial buildings						√	√	
	Energy efficiency standards for public and residential buildings					√		√	
	Guidelines for promoting energy saving in existing buildings						√		
	Energy saving standards for construction work					√			
Industry	Renovation of inefficient facilities (cement, steel, etc.)					√			
	Demolishing small scale power plants					√			
	Energy efficiency improvement projects							√	
	Energy audits for large energy users					√			
	Establishing a platform for monitoring energy efficiency					√			
Household	Construction of residential buildings with renewable energy facilities							√	
	Introduction of solar water facilities						√		
	Introduction of biomass facilities			√				√	
	Construction of residential buildings with geothermal heating							√	
	New standards of high energy efficiency for residential buildings					√		√	
	Measurement of heat supply to residential buildings					√	√		
	Distribution of highly efficient lighting appliances						√		
Waste and wastewater	Construction of waste incinerating power plants							√	

Source: Compiled from Tsinghua University (2011)

Taking into account the other two cases of Liaoning province and Shanghai city (See Tsinghua University (2011)), the characteristics of the Chinese situation are as follows: Sub-national governments have set targets comprising sub-divisions of nationally-planned targets for increases in energy efficiency, and for introduction of renewable energy. Moreover, sub-national governments tend to require companies to comply with the standards in various sectors, or to develop facilities by sub-national governments themselves. It is also characteristic that provincial governments are in charge of managing energy supply policy.

An example of low carbon development policies and measures at the sub-national level in India

Gandhinagar city is a capital city of Gujarat state. The city has population of 1.3 million as of 2001 and 43% of them reside in an urbanised region. Main industries of the city include textile, agriculture/food processing, small scale forestry/mining, and tourism. Most of the low carbon development policies in energy sector of Gandhinagar city are implemented under the Solar

City project[6] of Ministry of New and Renewable Energy (MNRE). In the Solar City project, the Gujarat Energy Development Agency, which is a state governmental agency, is a coordinating organisation. Gujarat Power Corporation Limited is an implementing organisation in some cases. The Solar City project was initiated in 2007. The numerical targets are set for solar water heating facility installation and renewable electricity supply towards 2015. It is estimated that the measure of renewable energy introduction in Solar City project will realise GHG emissions reduction of 72,080 ton CO2 equivalent (tCO2e) in 2009, 144,640 tCO2e in 2012 and 237,944 tCO2e in 2015. Likewise, energy efficiency promotion measures in households and commercial buildings, mainly introducing high efficient lighting, are implemented as a part of the Solar City project. In the transport sector, facilities and service development to promote utilisation of compressed natural gas (CNG) for public transport such as bus is conducted. Table 8 presents a brief summary of low carbon development policies in Gandhinagar city.

[6] The project is planned to be implemented in 60 cities. At present 14 cities including Gandhinagar city are receiving financial support from the federal government.

Table 8 Low carbon development policies in Gandhinagar city, India

Sector	Policies and measures	Typology of policies and measures							
		To influence stakeholders' behaviour						To change local governments' activities	
		Regional planning & target setting	Cap & trade	Subsidies	Levies	Standards & labelling	Information provision & education	Infrastructure construction	Public procurement
Energy supply	Target setting for solar water heating systems and renewable-based power generation under Gandhinagar Solar City Project	√							
	Installing solar photovoltaic power plants, as well as solar photovoltaic and wind-solar hybrid power plants							√	
	Reaching out to schools to generate awareness on renewable energy technologies						√		
	Online module and web-based portal for registration and knowledge dissemination						√		
Transport	Solar photovoltaic street lights installation, including those for demonstration project							√	
	Use of solar energy operated vehicles in the state secretariat complex in the city								√
	CNG and biodiesel fuelled vehicles demonstration projects in both public transport (buses, auto rickshaws) and private transport, including deployment of CNG filling stations						√	√	
	CNG buses between Ahmedabad and Gandhinagar							√	√
Buildings	Target setting for energy conservation by residential, commercial and municipal sectors	√							
	Energy efficiency demonstration district						√	√	
	Installing solar water heating systems at civil hospital and other public facility							√	
	Solar photovoltaic rooftop system and solar water heating system on government bungalows							√	
	Energy efficiency demonstration district						√	√	
	Transformer load monitoring							√	
	LED-based village							√	
	Replacement of high wattage lamps with LEDs and CFLs								√
Industry	Replacement of old pumps with energy efficient pumps at water works								√
	Awareness raising campaign for energy audit in the SMEs						√		
Waste and wastewater	Promoting composting for city and kitchen gardens						√		

Source: Compiled from TERI (2011)

An example of low carbon development policies and measures at the sub-national level in Indonesia

Jakarta province is the Indonesian capital, with a population of 9.2 million as of 2009. The GHG emissions from Jakarta province in 2005 were estimated as 43.7 million tons of CO2 equivalent (tCO2e) and its emissions in 2030 in the case of Business as Usual (BaU) are projected as 203.9 million tCO2e. Emissions from the transport sector comprise 44.9% of the total, while the power generation sector accounts for 40.7%. In its regional action plan, Jakarta province has determined a GHG emissions reduction target of 30% by 2030, compared with the case of BaU. This target is equivalent to a reduction of 60 million tCO2e. The plan aims to achieve this reduction through a 57% reduction in the transport sector and a 35% reduction in the power sector. The expected contributions from other sectors include: 3.4% from solid waste

management, 2.4% from industrial process, 1.1% from urban greening, 0.4% from the household sector and 0.2% from wastewater treatment. A brief summary of low carbon development policies and measures in Jakarta province to achieve this target is shown in Table 9.

Table 9 Low carbon development policies in Jakarta province, Indonesia

Sector	Policies and measures	Typology of policies and measures							
		To influence stakeholders' behaviour						To change local governments' activities	
		Regional planning & target setting	Cap & trade	Subsidies	Levies	Standards & labelling	Information provision & education	Infrastructure construction	Public procurement
Energy supply	Renewable energy introduction in island region							√	
Transport	Biofuel utilisation								√
	Bus Rapid Transit introduction							√	
	Use of compressed natural gas for public transport							√	
	Car free day						√		
	Vehicle emissions management					√			
	Vehicle influx regulation zone for peak hours					√			
	Light emitting diode introduction for street lighting							√	
	Mass rapid transit							√	
	Electric road pricing							√	
	Light rail transit							√	
Buildings	Highly efficient lighting and air conditioning at city hall								√
	Conversion from kerosene to liquefied petroleum gas								√
	Green construction pilot project							√	
	Campaign for hourly cutting of lighting						√		
	New energy efficiency standards for buildings					√			
	Energy efficiency improvements for public schools and hospitals							√	
Industry	Change of fuel used						√		
Waste and wastewater	Power generation through waste incineration							√	
	Raising awareness of the need to separate waste from resources						√		
	Local composting projects						√		
	3R programme						√		
	Fertiliser development from wastewater							√	
	Recycling facility development							√	
	Landfill gas power generation							√	
	Wastewater recycling							√	

Source: Compiled from CER Indonesia (2011)

The case of Jakarta province tells us the characteristics of Indonesian policies and measures: most of the measures are transport sector-related, no policies are planned for the household sector, and many measures are related to infrastructure development by the local government itself.

An example of low carbon development policies and measures at the sub-national level in the Philippines

This sub-section studies the low carbon development policies and measures of two cities,

Quezon and Makati, which comprise part of the Greater Manila region, the Philippines' capital. The populations of Quezon and Makati are 2.86 million and 0.6 million, respectively, while the daytime population of Makati becomes 3.7 million. Both cities have received technical assistance from the United States Agency for International Development (USAID) regarding GHG inventory development at the city and community levels. Of these two cities, Table 10 indicates a brief summary of low carbon development policies and measures identified for Quezon city.

Table 10 Low carbon development policies in Quezon city, Philippines

Sector	Policies and measures	Typology of policies and measures							
		To influence stakeholders' behaviour						To change local governments' activities	
		Regional planning & target setting	Cap & trade	Subsidies	Levies	Standards & labelling	Information provision & education	Infrastructure construction	Public procurement
Energy supply	Community-based small scale hydro power development							√	
Transport	Light emitting diodes for street lighting							√	
	Promoting compressed natural gas, liquefied petroleum gas and biofuel						√		
Buildings	Solar energy lighting at schools and city hall							√	
	Green building standards with tax exemption			√		√			
Waste and wastewater	Provision of information of recycling to household						√		
	School education to promote recycling						√		
	Promoting separation of organic waste and recyclables	√					√	√	
	Landfill gas destruction							√	

Source: Compiled from Ateneo School of Government (2011)

In the cases of Quezon and Makati, the main low carbon development policies and measures currently in place are energy efficiency improvements for street lighting and promotion of waste reduction and recycling. There is also potential to develop energy efficiency standards for buildings in the future. However, there are no policies aimed at changing behaviour in the household and industrial sectors.

Commonalities and differences in four countries

Sub-national governments have several low carbon development policies and measures in the sectors of transport, commercial and residential buildings and waste and wastewater management in selected cases of China, India, Indonesia and the Philippines. Sub-national governments in China and India, however, have also low carbon development measure in the sectors of energy supply and industry, due to their mandate in the sectors. It was found that the number of low carbon policies and measures at sub-national level are around twenty in China, India and Indonesia while it is less (around half) in the Philippines.

Most of the low carbon development policies and measures at the sub-national level in four countries are information provision and education to influence local stakeholders or infrastructure construction by sub-national governments. Standards and labelling are also used in particular in China and some in Indonesia and the Philippines. Other measures are not frequently observed in any cases. It was confirmed that some standard setting to influence local stakeholders and local governments' own demonstration projects were already planned in advanced sub-national governments in case study countries.

Low carbon development policies in Kitakyushu city, Japan, and GHG emissions reduction estimates

As a reference for actions to be taken by Asian developing countries in the future, Table 11 lists the low carbon development policies of Kitakyushu city, one of Japan's nationally designated Eco Model Cities. The typologies of each policy, and whether each policy has an estimated GHG emissions reduction due to policy, are also shown. Overall, most of the policies are conducted in collaboration with local companies and residents. In addition, policies involving infrastructure development through local governmental works are conspicuous. Around half of the policies, i.e. 33 out of 61 policies, have an estimated GHG emissions reduction following implementation.

Table 11 Low carbon development policies in Kitakyushu city, Japan

Category	Policy	Typology of policies and measures								With emissions reduction estimate
		To influence stakeholders' behaviour						Local governments' behaviour change		
		Regional planning & target setting	Cap & trade	Subsidies	Levies	Standards & labelling	Information provision & education	Infrastructure construction	Public procurement	
Action planning										
	Action plan	√								√
Transit towards man-made capital-based city										
	Development of 200-year-lifetime model low carbon district	√		√						√
	Low carbon redevelopment of existing urban areas	√				√				√
	Development of extension mechanism					√	√			√
	Energy efficiency increase and extension of lifetime for residential buildings			√			√	√		√
	Application of Comprehensive Assessment System for Built Environment Efficiency - Kitakyushu					√		√		√
	Relocating urban services and residence into central districts and selected locations							√		√
	Increasing public transport services							√		
	Raising citizens' awareness of the need to use public transport						√			
	Promoting advanced technology development							√	√	√
	Promoting a modal shift in transport			√				√		√
	Promoting efficient vehicle traffic							√		√
	Developing energy efficient mechanisms in factories and within the city						√	√		√
	Renewable energy utilisation in urban and public areas							√		√
	Promoting efficient energy utilisation						√	√		√
	Measures to counteract the "heat island" phenomenon			√			√	√		√
	Promoting urban greening	√						√		√
	Forest management and conservation	√		√			√			√
Low carbon industrial cluster development										
	Use of waste heat at factories						√			√
	Hydrogen energy model district development						√			√
	Increasing energy efficiency through production process improvement						√			√
	Promoting energy efficiency in business offices					√	√			√
	Introducing light emitting diodes (LED)							√	√	√
	Supporting introduction of large solar power facilities on factory rooftops						√			√
	Supporting introduction of wind power						√			√
	Recycling of rare metals						√			√
	Promoting recycled construction materials					√				
	Promoting technology development for a low carbon society						√			
	Environmental electronics project						√			
	Vehicle electronics project						√			
	Test demonstration of electric vehicles						√		√	√
	Promoting bio-fuel utilisation						√		√	√
	Promoting green information technology (IT), such as efficient data centres and software as a service (SAAS)						√			√
	Industrial siting strategy focusing on the environment						√			
Learning and behavioural mechanism development										
	Area-wide GHG emissions visualisation project						√			
	Integrated learning system towards low carbon society						√			
	Development of advanced energy park, largest in Japan						√			
	Development of show room in civic centres and elementary schools						√	√		√
	Promoting education by NPOs, reuse of table wares						√			
	Application of Kitakyushu Environmental Capital Certificate						√			
	Characteristic school development project						√			
	Environment project for specific towns and schools					√				
	Environment Capital Kids' Summit						√			
	Project of designated schools for environmental education						√			
	Integrated environmental human capital building in elementary and junior high schools						√			
	Visualisation of GHG emissions through power monitoring system						√	√		√
	Raising the awareness of the Mottainai spirit and Kitakyushu Dream Summit						√			
	Environmental education using funds raised by collecting used cans						√			
	Kitakyushu city eco tour						√			
	Integrated environmental human capital building in higher education						√			
Affluent life through low carbon society development										
	Regional promoting committee for Eco Model City	√					√			
	Promoting renewable energy in households			√						√
	Promoting recycling and reduction of waste with citizens' engagement			√			√			√
	Citizens' activities to enable development of a low carbon society to take root						√			
	Introducing Kitakyushu-type carbon offset						√			√
	Kitakyushu environmental passport project to promote environmentally friendly actions by citizens						√			√
	Extension of the Eco Life Stage environmental event						√			
	Project to identify environmental cause of pride for our town						√			
	Extension of activities for regional centres of education for sustainable development						√			
	Collaborative projects with stakeholders						√			
	Issuing Environmental Capital Report						√			

Source: Compiled from detailed explanation of Kitakyushu city Eco Model City Action Plan (2009)

4. Potential for using credits to promote low carbon development policies and measures at the sub-national level in Asian developing countries

This section examines what policies and measures in each sector could generate carbon credits among the low carbon development policies and measures identified in the sub-national government case studies. A method to quantitatively estimate the GHG emissions reduction due to each policy and measure is required if carbon credits are to be generated from implementation of the policy or measure. The following methodologies are examined to assess the possibility to apply them for this estimation purpose: a) registered methodologies for the clean development mechanism (CDM), b) proposed methodology for new market mechanism, in particular a bilateral offset credit mechanism advocated by the Japanese government[7], c) registered methodologies for Japanese domestic offset mechanism (Japanese-Verified Emissions Reduction (J-VER))[8], and d) methods that are used for GHG emissions reduction estimation by Kitakyushu city of Japan. Table 12 shows three methodologies for estimating GHG emissions reductions: a) CDM, b) J-VER, or c) the new market mechanism methodology proposed for a study commissioned by the Japanese Ministry of the Environment. In addition, Table 13 indicates the methodologies used by Kitakyushu city.

ICLEI Local Governments for Sustainability, Japan—part of the international local governmental network on the environment—has implemented the Regional Carbon Registry project as a part of a global initiative calling for local governments to develop GHG inventories since 2011. ICLEI Japan received reports from 121 Japanese local governments (34 prefectures and 87 cities and special wards) and found that 225 GHG emissions reduction projects were conducted with a budget of 72.5 billion Japanese yen. Of these, 41 involved local governments' own office management and public works, while 184 comprised regional policies and measures. The estimated GHG emissions reduction is reported to be 17.3 MtCO2e[9]. The methods used to estimate emissions reductions are disclosed in the database maintained by ICLEI Japan on the internet[10].

The Low Carbon City Promotion Council in Japan, which is supported and operated by the Japanese Cabinet Office Regional Revitalisation Secretariat, hosted a working group on standards in preliminary calculation methods for GHG emissions in fiscal 2011. However, participating cities reported only a limited number of methods for GHG emissions reduction

7 http://gec.jp/main.nsf/jp/Activities-GHGmitimecha-nmfsrepDB-List1#2010

8 http://www.4cj.org/jver/system_doc/methodology.html

9 http://www.iclei.org/fileadmin/user_upload/documents/Japan/2011/cCCR/20111109press_release_final_.pdf

10 http://registry-japan.org/index.php?id=database

through changes in their own activities or operations: reduction through activities at city hall, reduction through installing solar power equipment subsidised by the city and CO2 emissions reductions originating from waste treatment[11].

Table 12 Methodologies for CDM, New Market Mechanism and J-VER

Sector	CDM	New Market Mechanism	J-VER
Energy supply	Energy efficiency (supply side)		Micro hydro power generation replacing grid power
	Fuel change		Introduction of combined heat and power facilities
	Hydropower generation		Solar power generation replacing grid power
	Utilisation of solar power and solar heating		
	Wind power generation		
Transport and infrastructure	Electrci and hydrogen vehicles	Development of road networks and introduction of Bus Rapid Transit	Use of biodiesel fuel made of waste kitchen oil
	Bus Rapid Transit		Reduction of fuel consumption through efficient transport using information and communication technology
			Eco driving through installing digital tacograph
Buildings	Energy efficiency (commercial)		Reduction of fuel consumption for vehicles by information and communication technology
			Renovation of lighting facilities
			Renovation of air conditioning facilities
			Energy efficiency increase of air conditioning through free cooling and introducing outdoor air
			Introduction of heat pump
Industrial process	Cement		Boiler fuel change from fossil fuel to unused wooden biomass
	Coal mining		Boiler fuel change from fossil fuel to wooden pellets
	Energy efficiency (factory)		Waste heat recycling and utilisation
	Waste gas and heat utilisation		Renewal of boilers and fuel change
			Renewal of ironing facility
			Change of fans and pumps and introduction of invertor controllers
Household			Utilisation of wooden pellet stove
			Use of firewood
Waste and wastewater	Biomass	Semiaerobic landfilling of urban waste	Change of fossil fuel to biomass solid fuel generated from wastewater sludge
	Biogas	Power generation from urban waste combustion	Change of fossil fuel to biogas generated from waste for heat and power supply
	Methane avoidance	Composting organic waste	Use of refuse paper and plastic fuel
	Methane recovery and utilisation	Biomass power generation from organic waste	Use of oil and gas fuel generated by thermal decomposition of waste
		Methane utilisation and power generation from organic wastewater anaerobic treatment	Energy utilisation from waste by thermal recovery at waste treatment facility

Source: Compiled from http://www.iges.or.jp/jp/cdm/report_cdm.html#poa, http://gec.jp/main.nsf/jp/Activities-GHGmitimecha-nmfsrepDB-List1#2010, http://www.4cj.org/jver/system_doc/methodology.html

[11] Paper presented at the 2nd Meeting of the Working Group on Standards in Preliminary Calculation Methods for GHG Emissions, the Low Carbon City Promotion Council in Japan, on 29 July 2011

Table 13 Kitakyushu city's low carbon development policies in Kitakyushu city with GHG emissions reduction methodologies

Sector	Policy	Target of reduction	Implemented by
Energy supply	Improving production process	Emissions from power generation	Private companies
Energy supply	Supporting introduction of wind power generation	Emissions from power generation	Private companies
Building	Promoting energy efficient building	Electricity	Private companies, local government
Building	Promoting energy efficient building	Electricity, fuel	Private companies
Building	Increasing energy efficiency in offices	Electricity	Private companies
Building	Development of energy efficient data centres	Electricity	Private companies
Building	Air conditioning renovation at civic centres and elementary schools	Electricity	Local government
Building	Introduction of power monitoring systems at elementary and junior high schools	Electricity	Local government
Building, energy supply	Renewable energy utilisation in urban and public areas	Emissions from power generation	Local government
Building, energy supply	Promoting low carbon districts	Emissions from power generation, fuel	Private companies
Building, energy supply	Introduction of large solar power facilities on factory rooftops	Emissions from power generation	Private companies
Building, energy supply	Promoting solar power, solar heating and geothermal heat utilisation in households	Emissions from power generation, fuel	Households
Building, transport	Introduction of light emitting diodes	Electricity	Local government
Industry	Use of waste heat in factories	Fuel	Private companies
Industry (cement) and waste-originated CO2	Improving production process	Electricity, fuel	Private companies
Industry (other than cement)	Improving production process	Electricity, fuel	Private companies
Transport	Promoting low carbon districts	Fuel	Households, private companies
Transport	Transition to compact urban structure where people travel on foot	Fuel	Households, private companies
Transport	Promoting efficient vehicle traffic	Fuel	Households, private companies
Transport	Promoting efficient energy utilisation	Fuel	Private companies
Transport	Hydrogen energy model district	Fuel	Private companies
Waste	Promoting recycling and waste reduction in households	Combustion of waste	Households, private companies
Waste	Eco point (reward) projects to promote environmentally friendly actions by citizens	Combustion of waste	Households
Greening	Greeing of rooftop	Decrease of planted area	Private companies, local government
Greening	Promoting planting	Decrease of planted area	Local government

Source: Compiled from detailed explanation of Kitakyushu city Eco Model City Action Plan (2009)

Table 14 indicates low carbon development policies and measures by sub-national governments in four selected Asian developing countries that, if implemented, may be suitable for generating and issuing carbon credits. Suitability is assessed based on registered or proposed methods

identified above for estimating GHG emissions reductions; all measures listed here have corresponding registered methodologies to generate credits.

Table 14 Low carbon development policies with credit issuing potential at the sub-national level in Asian developing countries

Sector	Policies and measures with existing methodology for measurement
Energy supply*	• Increased wind, solar, hydro and biogas power generation
Transportation	• Biofuel utilisation • Bus Rapid Transit
Buildings	• Energy efficiency improvement for large commercial buildings / public hospitals and schools • Renewable energy promotion for buildings • Replacement to light emitting diode for lighting
Industry*	• Conversion of inefficient facilities into highly efficient ones • Improved utilisation of wasted heat
Household	• Solar water heating • Improved energy efficiency in existing residential buildings • Introduction of biomass utilisation facilities
Waste	• Recycling of household organic waste • Waste incineration power plants • Landfill gas collection

Source: Author

Note: * indicates these policies and measures are applicable only for China and India where sub-national governments have the authority to conduct policies and measures in the sectors of energy supply and industry.

Only Chinese and Indian sub-national governments have the authority to implement policies in the energy supply and industrial sectors. In this case, sub-national governments could generate carbon credits by means of existing methodologies through promoting renewable energy, or renovating facilities for higher efficiency and improving utilisation of waste heat in industrial processes.

In the transport sector, the following measures could be promoted while generating carbon credits: introduction of Light Emitting Diodes (LED) for street lighting, promoting bio-fuel utilisation and introduction of Bus Rapid Transit (BRT). To decrease carbon emissions from transport infrastructure itself, Kitakyushu is proposing a method to estimate GHG emissions

reductions due to more efficient automobile traffic, achieved by road planning. However, it would be difficult for Asian developing countries to obtain necessary data such as averaged vehicle speed and utilisation rate to apply the same method in those countries.

Regarding the building sector, sub-national governments themselves can undertake renovations to improve energy efficiency and introduce highly efficient lighting and air conditioners in governmental halls and public schools and hospitals. In addition, measures to introduce energy saving, green building standards, and renewable energy for regional commercial facilities and buildings are also applicable for credit generation. Introduction of energy efficiency standards for buildings are promising to contribute to low carbon development, and are identified as existing or planned low carbon policies in most of the sub-national governments studied in the four Asian developing countries. It would be desirable to promote these policies at the sub-national level (in addition to national level) as a part of internationally supported Nationally Appropriate Mitigation Actions (NAMA) of developing countries. However, reductions based on existing policy are not allowed to be considered “additional” under the CDM. To generate credits, it would require recognition of additionality as well as several treatments such as conservative baseline setting for a scenario without introduction of the standard and relatively short credit issuing period (or credit issuing only once).

In the household sector, the measures that could be enhanced by using carbon crediting include: extension of solar water heating equipment, construction of residences with renewable energy facilities, extension of biomass utilisation facilities, and energy efficiency promotion at existing residences. The Bachat Lamp Yojana program aiming improving energy efficient lighting in residential buildings in India is a good example that has a potential of further extension by carbon financing through credit generation and transaction.

Lastly, low carbon measures that may be able to generate credits in waste and wastewater treatment include: measures involving citizens, such as reduction of residential waste, promotion of recycling, composting and making fertiliser from household organic waste; and waste-based power generation and methane gas destruction at landfill sites.

Activities described above that are still small scale need to be developed into larger programmes to reduce the monitoring costs and to be able to issue credits in order to extend the scheme.

Low carbon development policies and measures by sub-national governments in the sectors of transport, commercial buildings and households have a significant role to play in promoting low

carbon region/city development and consumer behaviours, even in cases where these policies are not suitable to generate credits, and hence additional finance. Therefore it is still important and effective to maintain international technical/financial assistance to extend these policies in developing and emerging countries, without aiming to obtain credits through cooperation.

5. Capacity development for carbon governance at the sub-national level in Asian developing countries

The current state of carbon management for sub-national governments in China, India, Indonesia and the Philippines suggests that even advanced sub-national governments selected for the case studies do not have sufficient personnel and organisational capacity in every country. No sub-national governments in these countries have participated in the National Communication preparation process or NAMA preparation. Lack of participation of even state/provincial governments - higher-level sub-national governments - in the planning stage of the National Communication or NAMA reflects the general national and sub-national governmental relationship in four countries. Sub-national governments cannot develop regional GHG inventories without the assistance of national governments or international experts. Where the mechanism for calculation and reporting of emissions is concerned, there are no mechanisms for reporting by emitters, except for those related to energy consumption in China and energy efficiency in India. The GHG emissions grid coefficients by country have not been determined yet, including those for China[12].

The role of sub-national governments in carbon management at project level is rather indirect if any: either supervision or coordination. A CDM project of gas destruction at a waste landfill site in the Philippines engaged local governments as well as private companies as project participants[13]. In this project, the city government (environmental protection and waste management division) is supervising the project while a Philippines private company is in charge of GHG emissions monitoring after training by in-house and outside experts in biogas. In the case of the Indian Programme of Activities-type CDM (programmatic CDM) in which incandescent lights are replaced with compact fluorescent bulbs, the Ministry of Power's Bureau of Energy Efficiency, which is the coordinating entity, is supervising GHG emissions reduction estimation, while private companies (Indian lighting bulb manufacturers and retailers) that raise funds and participate in the project, conduct monitoring of households before and after

[12] Tsinghua University (2011)
[13] Based on Quezon City Controlled Disposal Facility Biogas Emission Reduction Project. Ateneo School of Government (2011)

the exchange of bulbs[14]. In contrast, in Kerala state, where private companies did not show any interest in participation in the project, the Energy Management Centre, founded by the state government using governmental financial sources, became the implementing organisation and replaced the bulbs in 6.3 million households.

Given the current state of carbon management, it is desirable and realistic to adopt a policy of capacity development for not only sub-national governments but also the private sector. The aim would be to enhance carbon governance at the sub-national level in Asian developing countries best utilising a new market mechanism with Japan. It is desirable that large scale sub-national governments such as provinces/states or large cities have at least minimal knowledge of carbon management in accordance with national climate change mitigation policy. They could then cooperate in the development of a GHG emissions reporting and estimation mechanism, including regional GHG inventories, supported by national and international agencies. Yet this does not imply that sub-national governments receive the emissions reports and develop inventories by themselves. Rather, actual development of inventories would be the responsibility of national or research organisations, as planned in China. The objective of capacity development for sub-national governments is for them to be able to understand the basics of GHG emissions sources by sectors and their estimation methods, and to grasp what the key regional policies for low carbon development are. In order to promote the capacity development suggested here, the Philippines needs to institute the climate change act currently under consideration, in the same way as China, India and Indonesia have already established a national-level climate policy[15]. It is also recommended that capacity development of financial departments and governors/mayors as well as environment and other relevant divisions in local governments is needed so that they can understand the mechanisms of additional fund raising that becomes possible through carbon finance. Once financial departments and governors/mayors understand the possibility of extension of developmental policies by means of carbon credit issuing, low carbon development at the sub-national level will be further promoted.

It would be practical to utilise carbon management experts at private companies that have developed through engagement in CDM project formulation and implementation, in order to promote low carbon development policies through financing by issuing and selling carbon credits. It is desirable to fully utilise private human capital in host countries, in addition to local government officials, for project planning and ex-post emissions monitoring and reporting

[14] TERI (2011)
[15] After the law is enacted, national climate change action plan will be developed. Each local government will develop action plan according to the national action plan. See Ateneo School of Government (2011).

which requires knowledge of carbon management. These are the requirements to develop and operate the urban sector projects generating credits in developing countries. Consecutive capacity building of private-sector carbon management experts is also needed, in addition to the above mentioned capacity building for local governments. Meanwhile, participation of international experts including those from Japan would be necessary to identify and develop low carbon development policies and programmes that are suitable for credit generation in specific countries or regions.

Acknowledgement

This paper is based on the study conducted as a part of the study on Establishing New Market Mechanism through the Development of Methodological and Institutional Framework for MRV in Asian Developing Countries in FY2011, commissioned by the Ministry of the Environment, Japan. The author is indebted to the field study conducted by Tsinghua University, TERI, CER Indonesia, and Ateneo School of Government, in China, India, Indonesia, and the Philippines, respectively. The review and comments of Nanda Kumar Janardhanan, Akira Ogihara and Mark Elder are greatly appreciated.

References

Ateneo School of Government (2011) Carbon governance at sub-national level in the Philippines. Commissioned report to IGES. Available at http://output-db.iges.or.jp/enviroscope/modules/envirolib/view.php?docid=3514

CER Indonesia (2011) Carbon governance at sub-national level in Indonesia. Commissioned report to IGES. Available at http://output-db.iges.or.jp/enviroscope/modules/envirolib/view.php?docid=3513

Ministry of the Environment (2008) Chiho kokyo danta ni okeru chikyu ondanka taisaku no suishin ni kansuru horitsu siho jokyo chosa kekka (Study results on implementation by local governments regarding the Law Concerning Measures for Anti-global Warming.

Baba, K., N. Tagashira, and Z. Jin (2011) Chiho jichitai ni okeru teitanso seisak no jikosei to hakyusei: Chikyu ondanka taisaku jigyosho keikakusho seido wo taishoto shite (A potential effectiveness and diffusion of low carbon policy in local governments: A case of reporting system for business and industry sector). Central Research Institute of Electric Power Industry.

Mori, S. (2008) Indo, nayamashii komuin kyuyo mondai (India, a difficult problem of

governmental officials' salary). Available at http://dankaisedai.iza.ne.jp/blog/entry/523989/

Takeuchi, T. (2005) Chiho bunken: Higashi ajia shokoku no infura seibi ni taisuru inpakuto (Decentralisation: Impacts on infrastructure development in East Asian courtiers). Kaihatsu Kinyu Kenkyujo Ho, 25, pp. 43-68. Available at http://www.jica.go.jp/jica-ri/research/archives/jbic/pdf/25_05.pdf

TERI (2011) Carbon governance at sub-national level in India. Commissioned report to IGES. Available at http://output-db.iges.or.jp/enviroscope/modules/envirolib/view.php?docid=3512

Torii, N. (2011) Market mechanism country fact sheet: India. Available at http://enviroscope.iges.or.jp/modules/envirolib/upload/984/attach/india_final.pdf

Tsinghua University (2011) Carbon governance at sub-national level in China. Commissioned report to IGES. Available at http://output-db.iges.or.jp/enviroscope/modules/envirolib/view.php?docid=3511

UNITAR (n.d.) Process of Decentralisation. Available at http://dcp.unitar.org/IMG/pdf/The_process_of_decentralization_1_.pdf

World Bank (2011) World Development Indicators. Available at http://databank.worldbank.org/ddp/home.do