

## 1.1. Data Issue

Since launching this project, data collection has been the central issue as the model structure and type of scenarios which can be analysed largely depends on the availability of data. IGES requested each modelers to make a list of required data and IGES distributed it to local collaborators to collect the required data for each sub-sector module. The following list is the summary of data requirements for comparative studies.

- Macro socio-economic data
  - GRP by major sector
  - Demographic data
  - Labors by sector
  
- Energy balance data
  - Sector (Primary energy supply, transformation, final consumption)
  - Energy type (Coal and coal products, Oil and oil products, LNG, Town gas (City gas), Electricity, Heat)
  
- Sectoral data/ transportation, residential, commercial and waste management
  - Classification of registered vehicle
  - Travel demand by type of vehicle
  - Floor space by type of building
  - Appliances by energy service
  - Energy efficiencies by appliance
  - Waste generation and composition
  - Waste management facilities profiles
  
- Emission factor
  - CO<sub>2</sub>
  - Air pollutants (CO, HC, NO<sub>x</sub>, PM) from transportation sector

### Definition of the City

Cities can be defined in a number of ways such as central business district (CBD), densely inhabited district (DID), ward area, etc. Although the data for ward area or DID may be more appropriate indicator for socio-economic analysis of the city, due to the data constraints on technical variables, the data used this time refers to the city as defined by administrative boundary. Collecting the above listed data however, has been faced with several difficulties. Those are:

#### (1) Development of comparable dataset for the four cities.

Each country has different statistical system and different definition even though the same terminology is used, which created the difficulty in interpreting the data. This problem has mostly been solved with the help of local collaborators through consultation at workshops, field survey, as well as e-mail exchange.

#### (2) Effective collaboration in interdisciplinary and international joint research

Another difficulty lies in the fact that this project is interdisciplinary in nature. Experts of specific sector are not necessarily familiarized with the data of other sectors even for their own country, about which we were too much optimistic at project formulation stage. Since local collaborators are experts in a specific field and we asked them to collect local data for not only their specialized field, but also the other sectors, data collection cannot be done smoothly. Interpretation of the technical term especially in

waste management sector, with foreign language was also difficult. These difficulties, nonetheless, have been gradually cleared through a series of workshops and discussion among collaborators, which contributed to capacity building of the researchers involved.

The detailed account of the collected data is given below.

#### Energy Balance Data

In order to link macro socio-economic framework of the cities and their energy consumption and GHG emission profile, data on energy balance, especially energy balance table, is essential. Availability of such data differs from city to city, and situation of each city is summarized in the **Table 4-1-1**.

**Table 4-1-1: Energy Balance Data**

	Type	Source	Year	Sector	Energy type
Tokyo	Final energy consumption data	Internal report of TMG	70, 80, 90-98	31 final cons. sectors in total: Agriculture; manufacturing (22); residential; commercial; Transportation (4)/no Construction, energy for air craft is not included	17 energy types: Coal and coal products (3); Oil and oil products (11); Natural Gas; Town Gas; Electricity
Seoul	Energy balance	Internal database of KEEI	90-98	8 sectors in total; Production(1) Transformation(3) Final cons. (4)/ResCom aggregated	28 energy types: Coal and coal products (5); Oil and oil products (19); Natural Gas; Town Gas; Electricity; Heat
Beijing/ Shanghai	Energy balance	Commercial publication	85, 90, 95-99	17 sectors in total; Supply (4); Transportation(6); Final cons. (7). Partially available: mining (7); manufacturing (17)	18 energy types: Coal and coal products (7); Oil and oil products (8); Natural Gas; Electricity; Heat No Town gas

While energy balance table of Beijing and Shanghai are published, the ones of Seoul and Tokyo are not. In the case of Seoul, energy balance table is obtained with the help of Prof. Jo at Andong National University, Korea. In the case of Tokyo, the data is obtained from internal report of Tokyo Metropolitan Government (TMG). The data for Tokyo however, is not a balance table, but final energy consumption data estimated by using basic unit data of consumption of various fuels by sector. Estimation method is clarified in the report of TMG..

Looking at the data, while data of Tokyo is rich in the type of sectors, Seoul data is most detailed in terms of energy types though sector is aggregated compared to Tokyo. The detail of Chinese data is in between Tokyo and Seoul.

In order to enable the comparative study of energy consumption by sector, those energy balance data from each city are modified to the common format as shown below.

**Table 4-1-2: Common Format of Energy Balance Data**

UNIT:	Industry TOE	Residential TOE	Commercial TOE	Transportation TOE	Others TOE	Total TOE
Coal						
Crude Oil						
Diesel						
Gasoline						
Kerosene						
Heavy Oil (Fuel Oil, Bunkner)						
Other Petroleum Products						
LPG						
Natural Gas						
Town Gas						
Electricity						
Heat						
Others						
Total						

#### Sectoral Data

In addition to the basic macro socio-economic data which is relatively easy to collect, sectoral data for transportation, residential & commercial (Res/Com) and municipal solid waste (MSW) management have also collected with continuous effort. Those sectoral data are in most cases, technical and even though the terminology is same among the cities, the estimation method, concept, definition, etc. are different. Necessary modification is made where applicable, and the data which is not available but vital, are estimated using existing data. Collected and estimated data are summarized in the **Table 4-1-3**. This is the best we could get by now. With more time and resource, more detailed data may be obtained in the future.

#### Emission Factor

Having estimated the energy consumption by sector in each city, the next step was to estimate the GHG emission by fuel type by sector. IGES collected the basic emission factor by sector for each city and provided those data to the experts. Experts in transportation, Res/com and MSW management utilized those data and developed their own methodology to calculate the emission from respective sectors. Again, those data are normally not published and collected from reports of commissioned survey by local government of each city. Such survey was targeted to specific issues at each locality and thus the definition, sector classification of the data used to calculate emission factor is not common among each report. Such differences of the data among each city is summarized in the **Table 4-1-4**.

**Table 4-1-3: Sectoral Data**

	Transportation		Residential/Commercial		Waste management	
	Vehicle fleet	Travel demand	Floor space	Appliances	Waste volume	Facilities
Tokyo	Bus, Truck, Passenger vehicle, light car (<660cc) Truck (4), Bus (2), Sedan (2), Light motor (2), Special use (2), Heavy special kinds of vehicle →6 types, 3 types	Passenger-km, Ton-km vehicle-km (survey report)	Commercial (office, school, hospital, entertainment, etc), Residential (wooden and non-wooden (5))	No. of energy service devices (heating, cooling, lighting refrigerator, TVs, etc) Energy efficiency by type	Waste collected volume by treatment method and by type (10) Calorific value of waste by type	No. of facilities (incinerator, landfill site, composting) Capacity of facilities
Seoul	Bus, Truck, Passenger car, Special vehicle NA for further detail data → 3 types	Vehicle number, Driving distance (national average) vehicle-km (pass. car, taxi, bus)	Total residential only No commercial	No	Waste collected volume by treatment method and by type (10) Calorific value of waste by type	No. of facilities (incinerator, landfill site, composting) Capacity of facilities
Beijing/ Shanghai	Passenger vehicle (including bus), Truck Car, Small bus, Large bus, Small truck, Large truck →6 types, 3 types	Working hour of passenger vehicle, speed, Ton-km, average freight capacity vehicle-km (survey report)	Total residential only No commercial	No. of major energy service devices for urban and rural No efficiency data	Waste collected volume by type Paper, plastic and textile are integrated No calorific value	No

**Table 4-1-4: Emission Factor**

	CO2	CO	NOx	HC	PM-10
Tokyo	National emission factor (MoE, Japan) TEPCO	g/km by type of vehicle	Note1: Classification of vehicle type (Passenger vehicle, bus, light truck and ordinary truck) is based on transportation census which is not consistent with Tokyo statistical yearbook and vehicle registration data. Note2: Emission factors for each type of vehicle in use are estimated based on the existing vehicle fleet composition by vintage and their emission standards.		
Seoul	IPCC guideline (1996) Energy balance	g/km by type of vehicle	Note1: Private passenger car, tax, small bus (gas., diesel, LPG), medium bus (diesel), large bus (LNG), small truck (gas., LPG, diesel) medium truck, large truck Note2: Past emission factors are estimated based on the existing vehicle fleet composition by vintage and their emission standard. No information for future		
Beijing/ Shanghai	IPCC guideline (1996) Energy balance	g/km by type of vehicle	Note1: Light duty gasoline vehicle, Light duty diesel vehicle, Light duty gasoline truck 1 and 2, Light duty diesel truck, Heavy duty diesel truck, Heavy duty gasoline vehicle, Heavy duty diesel vehicle. Note2: Past emission factors are estimated based on the existing vehicle fleet composition by vintage and their emission standard.		