Carbon Emissions and Mitigations: Lessons from Cross-City Analyses in Asia

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Urbanization in Asia

- Asia hosts 1.6 billion in 2005 – almost 50% of the world urban population
- About 1.1 billion additional urban population in Asia during 2005-2030 (worldwide urban population addition: 1.8 billion)
- Asia has:

  11 out of 20 mega-cities (over 10 million people),

  17 out of 30 cities of 5-10 million,

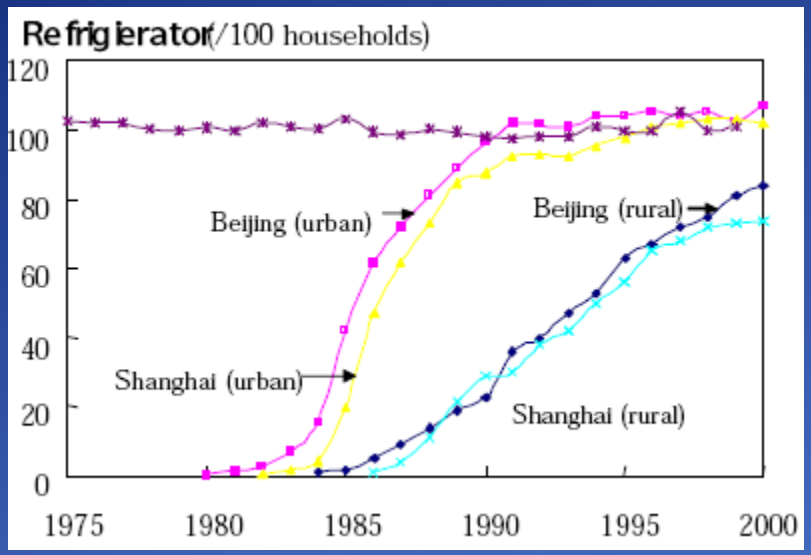
  184 out of 364 cities of 1-5 million,

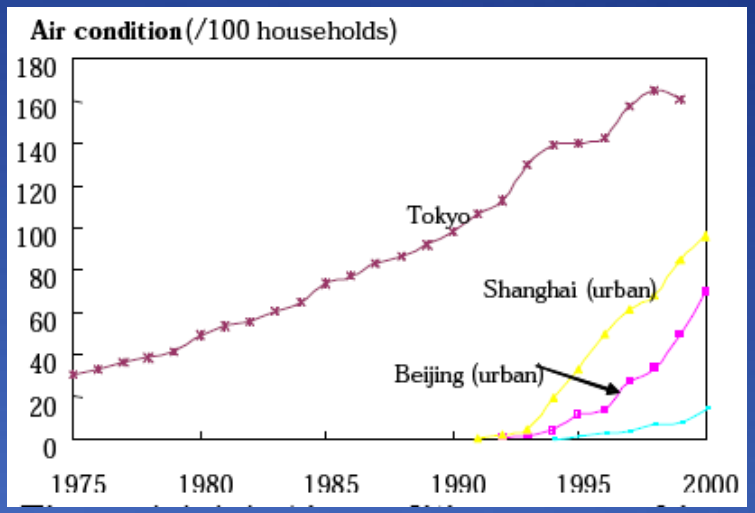
  225 out of 455 cities of 0.5-1 million

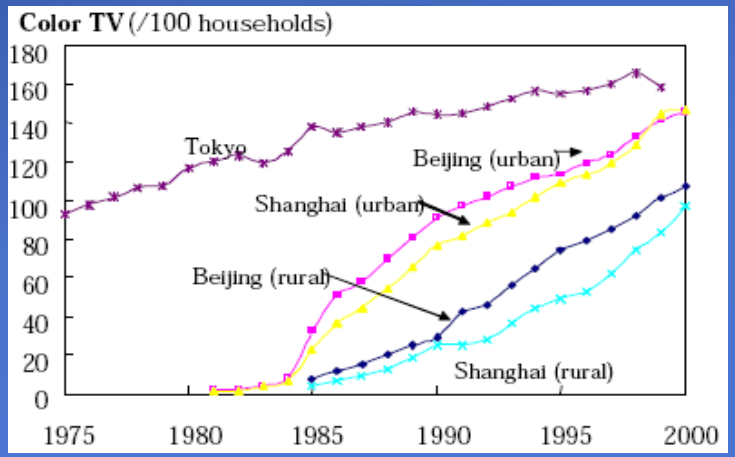
Slide courtesy: Arnulf Grubler, Yale/IIASA; Mostly from T. Chandlers and UN data

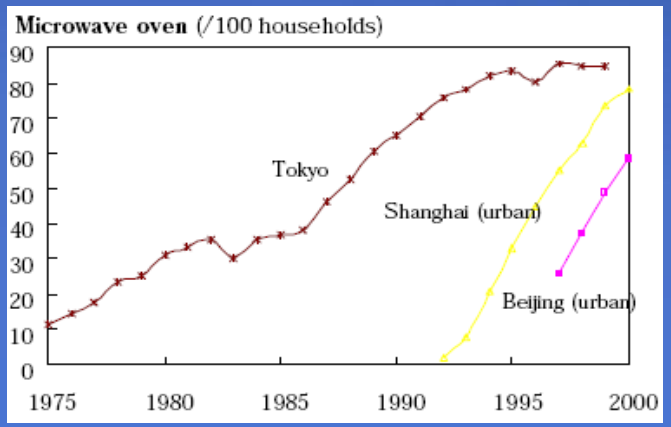
Source: United Nations, Department of Economic and Social Affairs, Population Division (2006). World Urbanization Prospects: The 2005 Revision. Working Paper No. ESA/P/WP/200.

Ownership of energy intensive appliances









Source: Mastumoto 2003

Growing motorization in cities

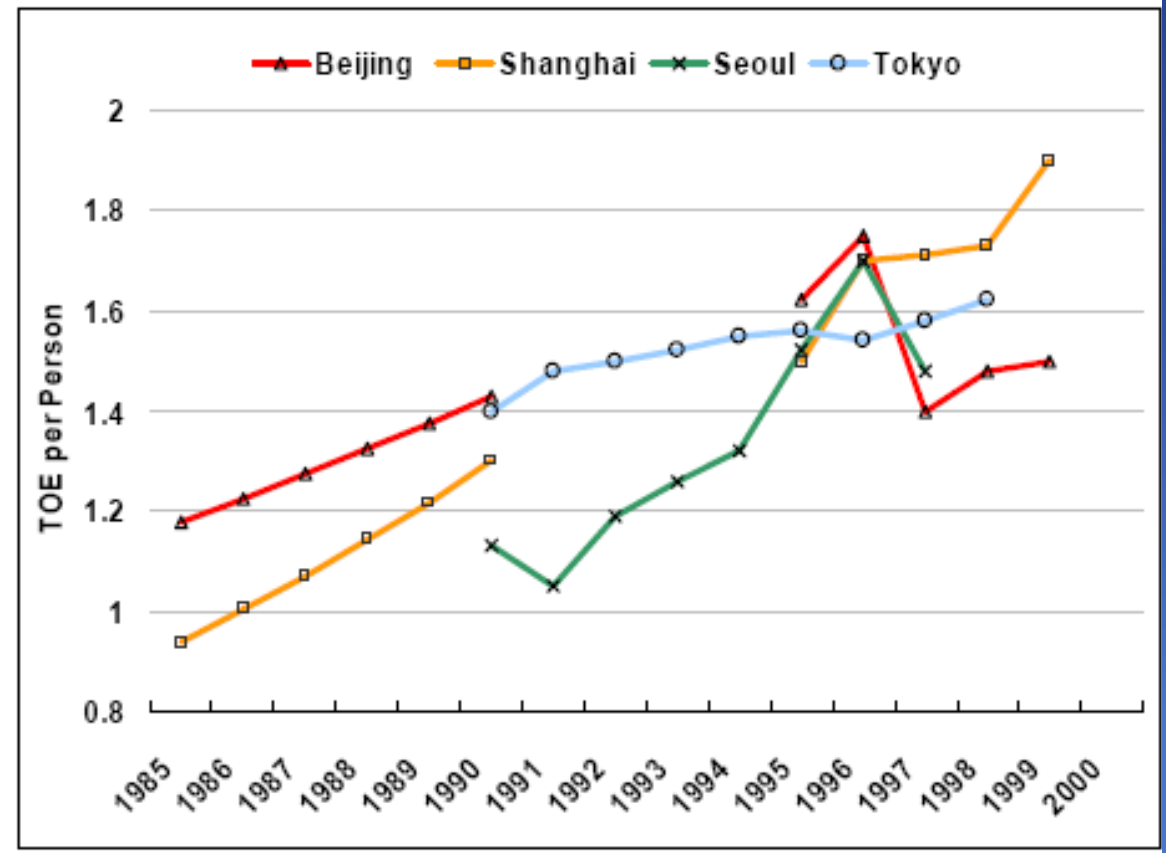
- Passenger vehicle ownership per capita in urban areas is higher than the national per capita vehicle ownership in most countries.

Passenger Vehicle Ownership per 1,000 Population

Economy	1980	2002	2020	1980-2002 (%)	2002-2020 (%)
China	2	19	65	10.8	7.1
Beijing	9	80	177	10.4	4.5
Shanghai	5	47	100	10.7	4.3
HKC	41	59	70	1.7	1.0
Indonesia	5	16	26	5.4	2.7
Jakarta	34	143	161	6.7	0.7
Japan	203	428	522	3.4	1.1
Tokyo	159	266	271	2.4	0.1
Korea	7	204	284	16.6	1.9
Seoul	15	205	288	12.6	1.9
Thailand	-	100	158	-	2.6
Bangkok	-	324	389		1.0

Source : APREC Analysis 2006

Growing Per capita urban Energy Consumption in four cities, 1985-1999



Source: Dhakal (2004).

Adopted from APERC : 2006

CO2 emissions

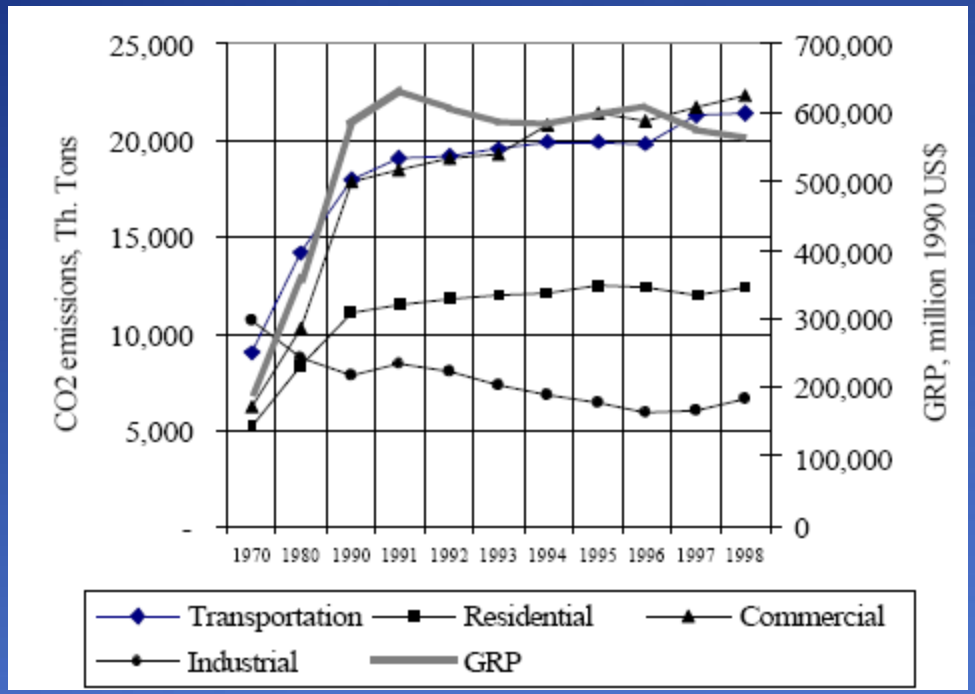
Growth of CO2 emission

City	Period	AAGR, %
Tokyo	1990-98	1.70
Seoul	1990-98	1.63
Beijing	1990-98	2.00
Shanghai	1990-98	5.00

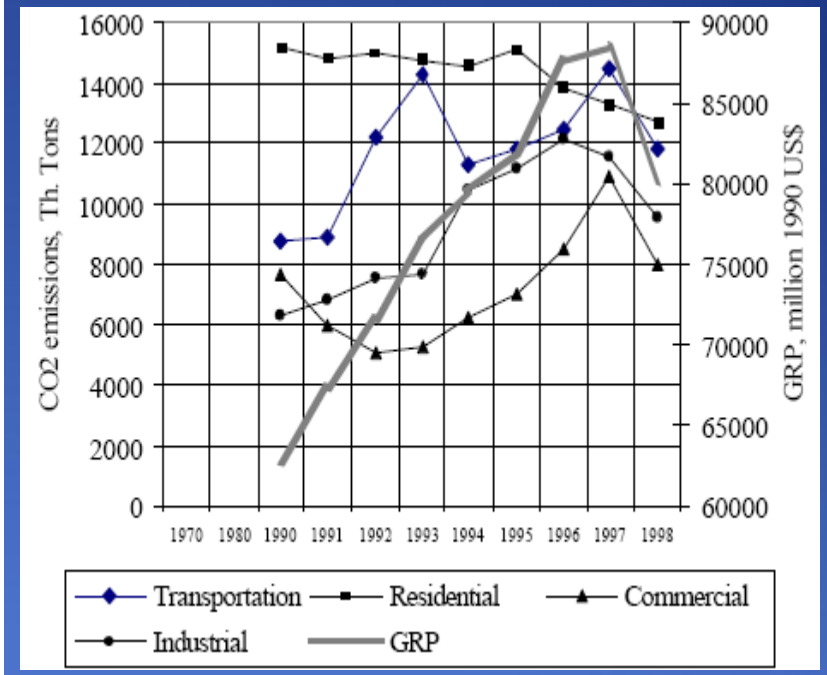
Source: Dhakal, 2003

Sectoral CO2 emissions in Tokyo and Seoul

Tokyo



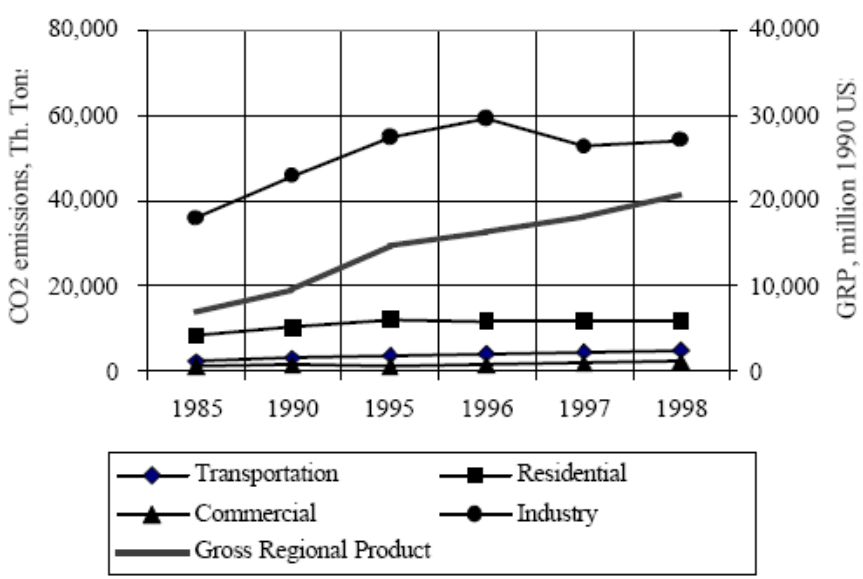
Seoul



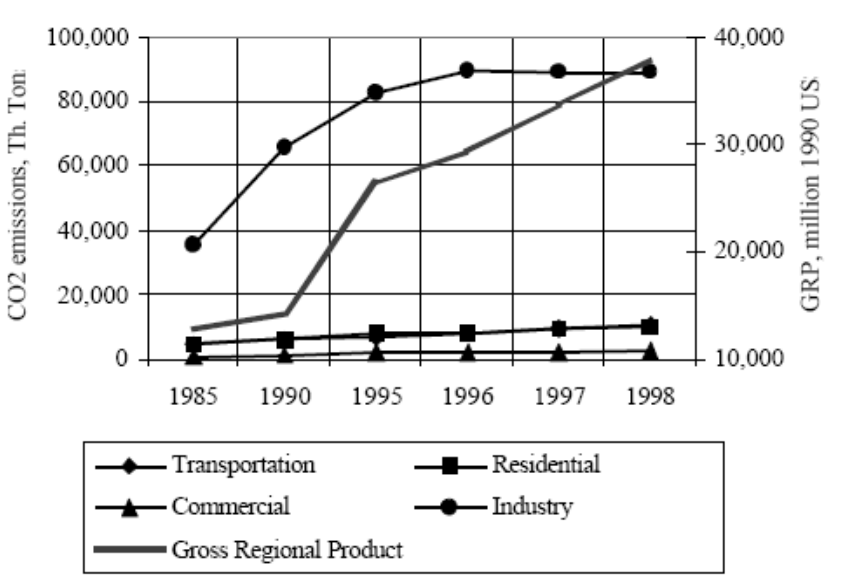
Source: Dhakal 2003

Sectoral CO2 emissions in Beijing and Shanghai

Beijing

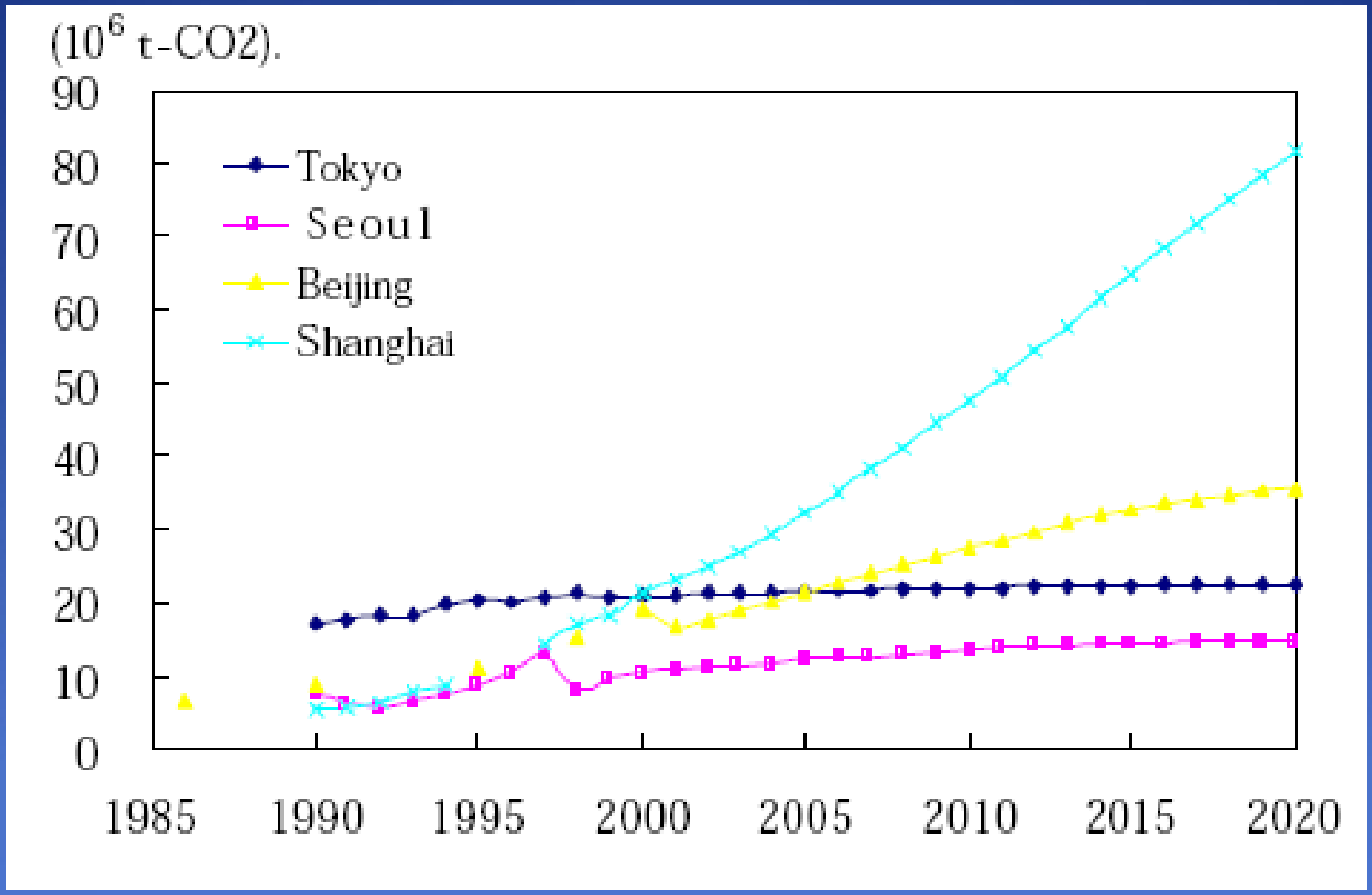


Shanghai



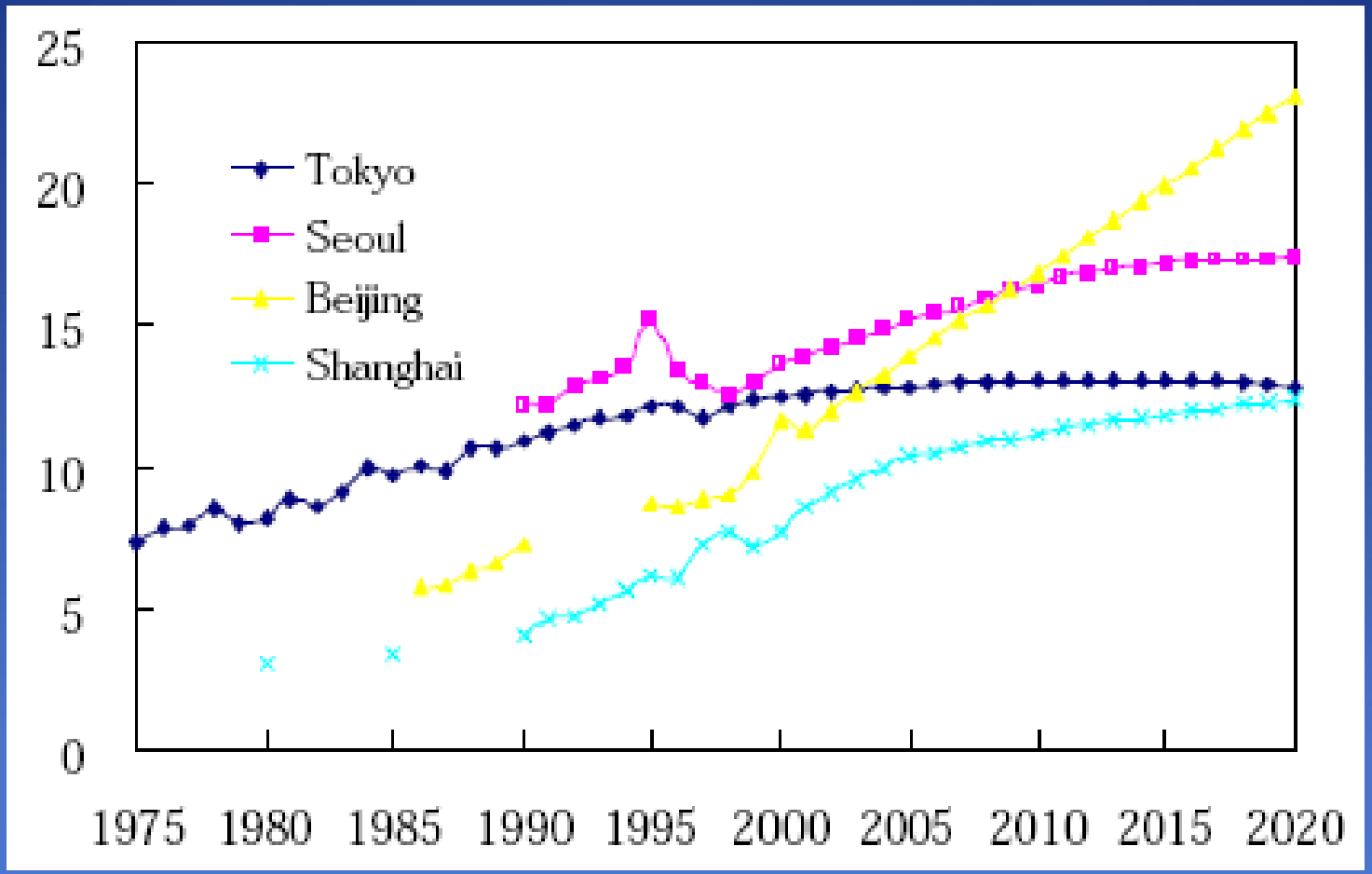
Source: Dhakal, 2003

Projection of total CO2 emission from the commercial sector



Source: Mastumoto 2003

Projection of total CO2 emission from the residential sector



Source: Mastumoto 2003

Some GHG friendly policies/measures in Asian Cities

- Mass transit system, Tokyo, Singapore
- Transport demand management policies, Singapore
- Biofuels, Thailand
- Electric vehicles, Solar water heaters and cleaner brick kilns, Kathmandu
- Differential vehicle tax rates, Bangkok

Effect of carbon tax when modal shift to MRT and Railway option is considered

- Effect of carbon tax with shifting of passenger travel demand served by low occupancy vehicles (cars, vans and pickups) to MRTS and railway services (by 10% in 2015 and to 30% in 2050) could reduce CO_2 emission by
  - 10.1% under C10+ (5.5% without MRT option),
  - 16.5% under C75 (11.5% without MRT option) and
  - 19.2% under C100 (16.4% without MRT option)

Carbon tax's effectiveness is significantly increased if the MRT and railway option considered.

Bio-fuel and hybrid vehicles

- At CO2 reduction target of 10%, bio-diesel buses would be found cost effective to replace the LPG buses in Beijing, Delhi, Mumbai, HCMC, Jakarta; Bio-diesel cars would be cost effective in Jakarta and Mumbai

- In addition, at the 10% CO_2 reduction target, hybrid cars would be attractive to replace gasoline and/or LPG cars in Beijing, HCMC and Jakarta. .

Source : AIT 2007

Energy efficiency improvement (EEI) in buildings - a major option

- Growing urbanization & large potential to reduce GHGs from the building sector
- Building energy efficiency is mostly a neglected area in most countries and lacks building energy code; weak enforcement where it exists
- Demand side management in buildings
- Local know-how on design and construction of energy efficient buildings lacking in most countries
- ESCOs need to be developed to promote EEI.
- Lack of energy efficient building materials

Building sector energy consumption increasing

- By 2030 residential floor area demand is likely to be more than 168% of that in 2005.
- Floor area of the service and other sectors also to grow with GDP.
- Energy efficiency in buildings - - a neglected area in most cities
- Lack of energy standard/regulations and incentives for energy efficiency improvements in buildings

Decentralized Renewable Energy production by urban households/enterprises

- Policies and financing mechanism to promote the use of RETs lacking:
  - Policies requiring the electric utility to purchase excess of the self generated electricity based on RE
  - Use of feed-in-tariff and net metering for self generators
  - Building code/regulation requiring the use of RETs
  - Promotion of green certificates (tradable)
  - Green pricing

Converting Urban Waste into Energy

- Large volumes of municipal solid wastes (MSW) are generated in Asian cities.
- Use of MSW to produce energy can have multiple dividends: reducing GHG emission and avoiding fossil fuel use in electricity generation.

  MSW projects can also have relatively high CDM benefits.
- Potential yet to be exploited in most DC cities => capacity building needed.

Uncertainties in urban CO2 Emission estimation

- The role of modal shift to Mass transit system and transport demand management
- Floor area/per capita and Energy intensity of new buildings
- The role of biofuels and cleaner vehicles
- Building energy management and DSM
- Waste management
- Land use and transport planning
- Policies on renewable energy

Thank you