

SP 6 : Energy Scenarios for Asia and their Air Quality and Greenhouse Gas Impacts
Shobhakar Dhakal
Urban energy use and carbon emissions in China and its cities


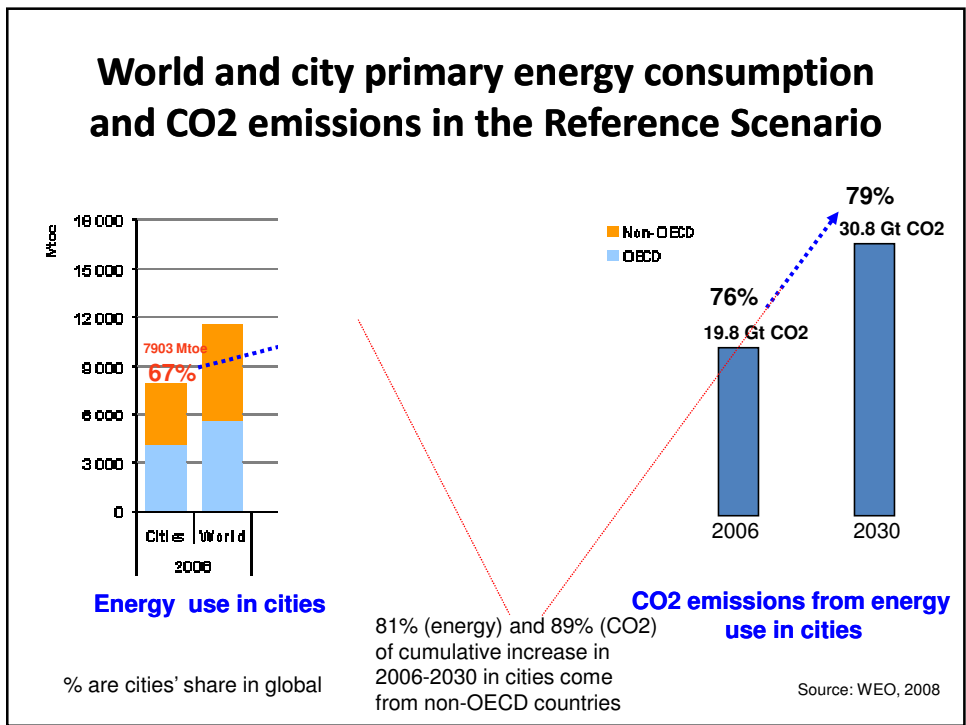
Better Air Quality Conference 2008- Sub Plenary
 13 November 2008, Bangkok, Thailand

Urban energy use and carbon emissions in China and its cities

Shobhakar Dhakal, Ph.D.
 Executive Director, Global Carbon Project (GCP)

GCP Tsukuba International Project Office
 c/o National Institute for Environmental Studies (NIES)
 Onogawa 16-2, Tsukuba, Japan 305 8506
 E-mail: shobhakar.dhakal@nies.go.jp

Fellow, National Institute for Environmental Studies
 Visiting Associate Professor, Graduate School of Environmental Studies, Nagoya University

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City energy use and urbanisation rate, 2006

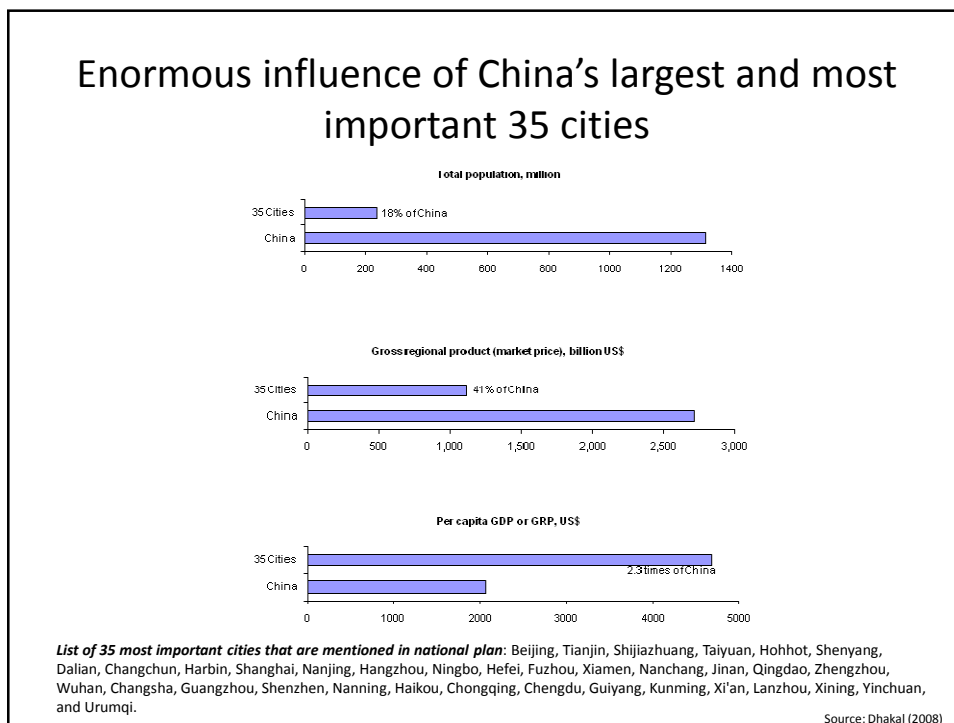
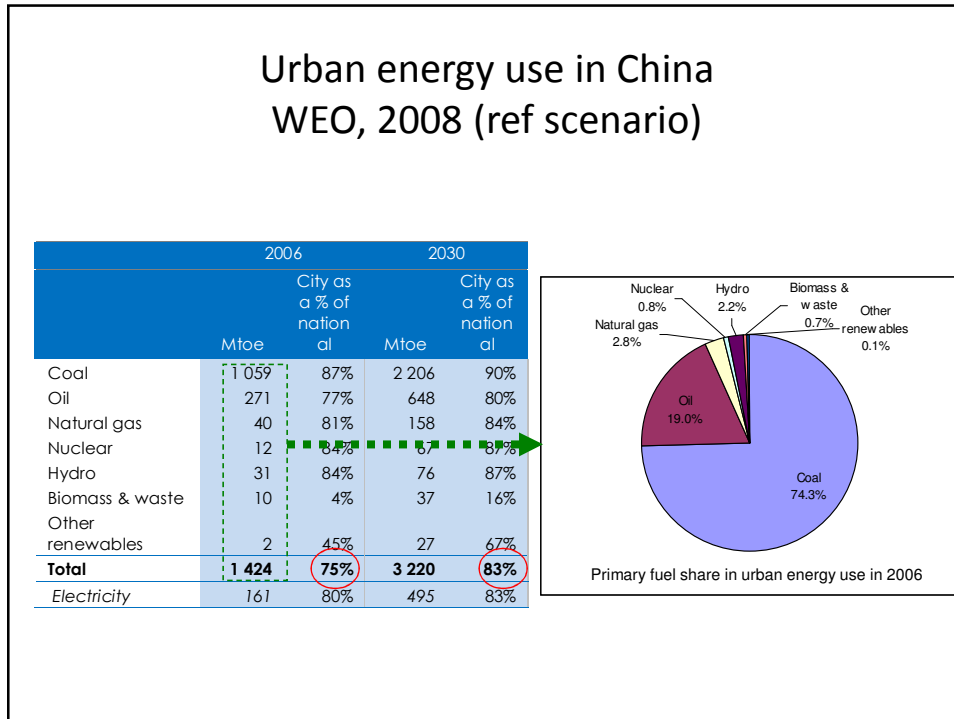
Region	Share of city primary energy demand in regional total	Ratio of city per-capita primary energy demand to regional average	Urbanisation rate
US	80%	0.99	81%
European Union	69%	0.94	73%
Australia and New Zealand	78%	0.88	88%
China	75%	1.82	41%

• Cities' energy use percapita is lower than natl average in US, Europe, Australia and New Zealand and almost double in China
 • In China such gap will be narrower by 2030 but rising urbanization increase energy use and carbon emissions

Source: WEO, 2008

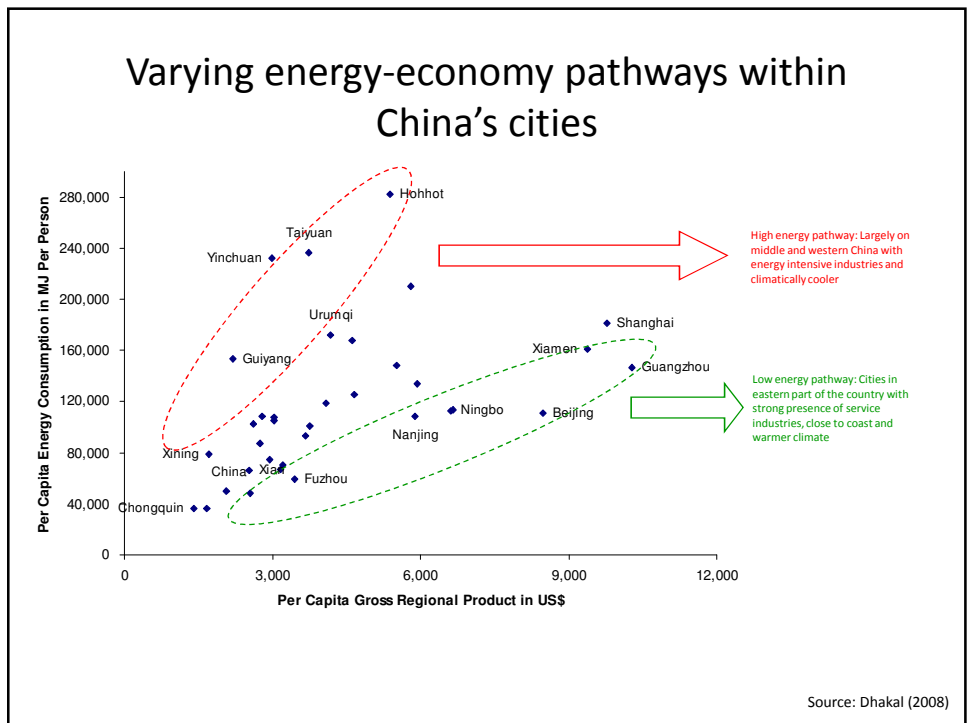
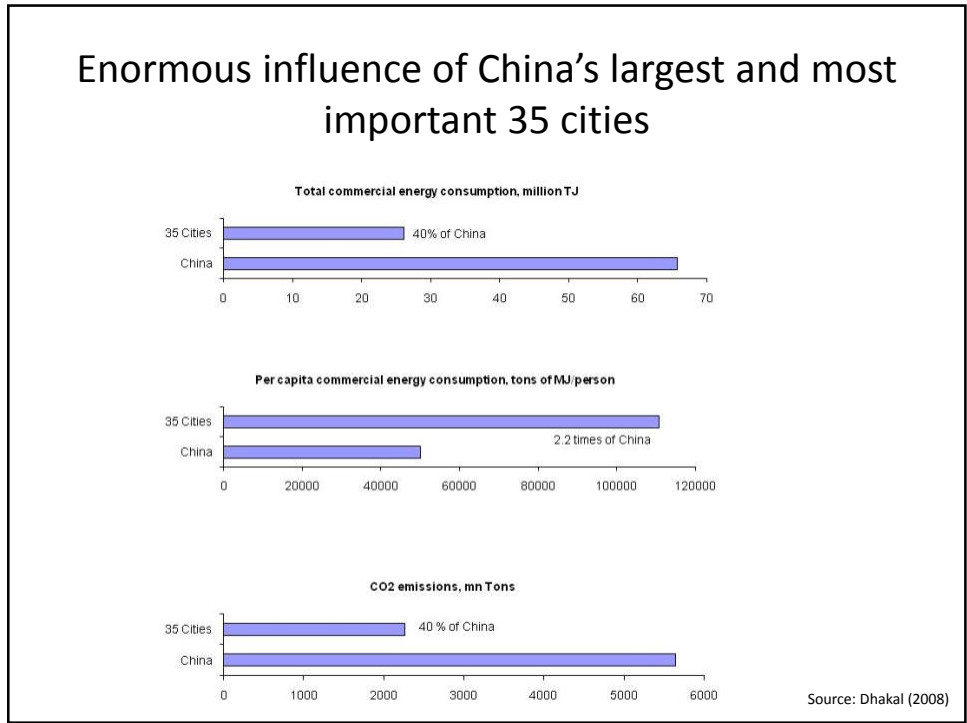
- ### The China case
- China contributes significantly
 - 16.8 % of global urban population (UN 2007)
 - 15% of global primary energy demand, and
 - 19% of global energy-related CO2 (WEO 2007)
 - China's primary energy demand will increase further
 - By 2.2 times in 2005-2030 to 3,819 Mtoe
 - Urbanization in China will increase further
 - 60% (880 million) by 2030 from 41 % (545 million) in 2005. MGI (2008) projects is to one billion for 2030
 - Urban energy use will increase further
 - Per capita energy in cities are 1.8 times higher than national averages in 2006
 - Such gap will narrow in the future but rapid urbanization will ultimately lead to increasing urban energy use
 - 90% of GDP by 2025 from urban economy (MGI, 2008)

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Four cities

Basic indicators of Beijing, Shanghai, Tianjin and Chongqing, 2006

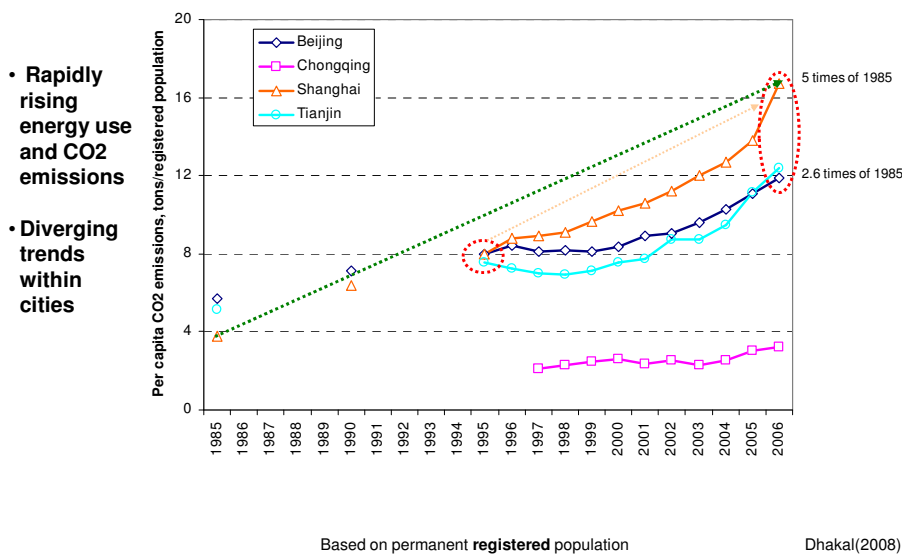
City	Beijing	Shanghai	Tianjin	Chongqing
Area, Sq Km	16,410	6,340	11,920	82,400
Resident population, million	15.81	18.15	10.75	2,808
Registered population, million	11.98	13.68	9.49	3,199
Urban share in resident population (%)	84%	89%	76%	47%
Gross regional product, billion US\$	98.7	130.0	54.7	43.8
Total energy use, thousand TJ ^a	1,332	2,480	1,271	1,160
Total energy related CO ₂ emissions, million tons ^a	142.10	228.74	117.61	103.97

Note the difference between resident and registered population

^a Total energy means sum of TFC, distribution/transmission losses and conversion losses

Source: Dhakal (2008)

Per capita CO₂ emissions

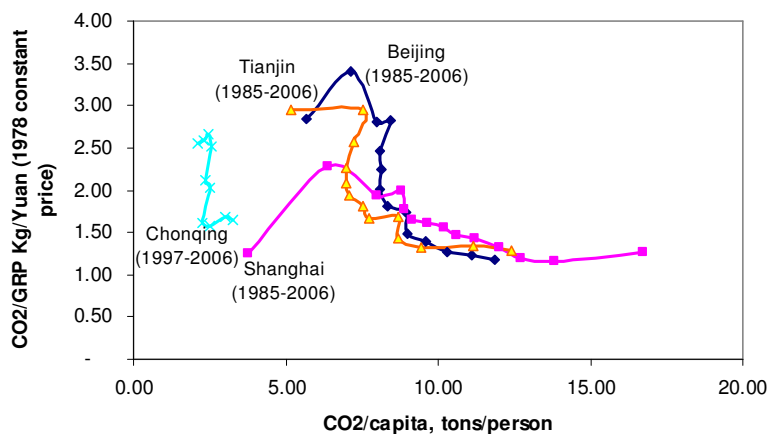


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Common trends in CO2 contribution

- Sectoral CO2 transition
 - Decreasing share of industry sector (except Tianjin)
 - Rising share of commercial and transports sectors
 - Largely unchanged share of residential sector
- Fuel's CO2 transition
 - Declining share of direct coal burning
 - Rising share of electricity and oil
 - Smaller role of natural gas than expected in Shanghai and Tianjin

Carbon intensity of economy and per capita trends



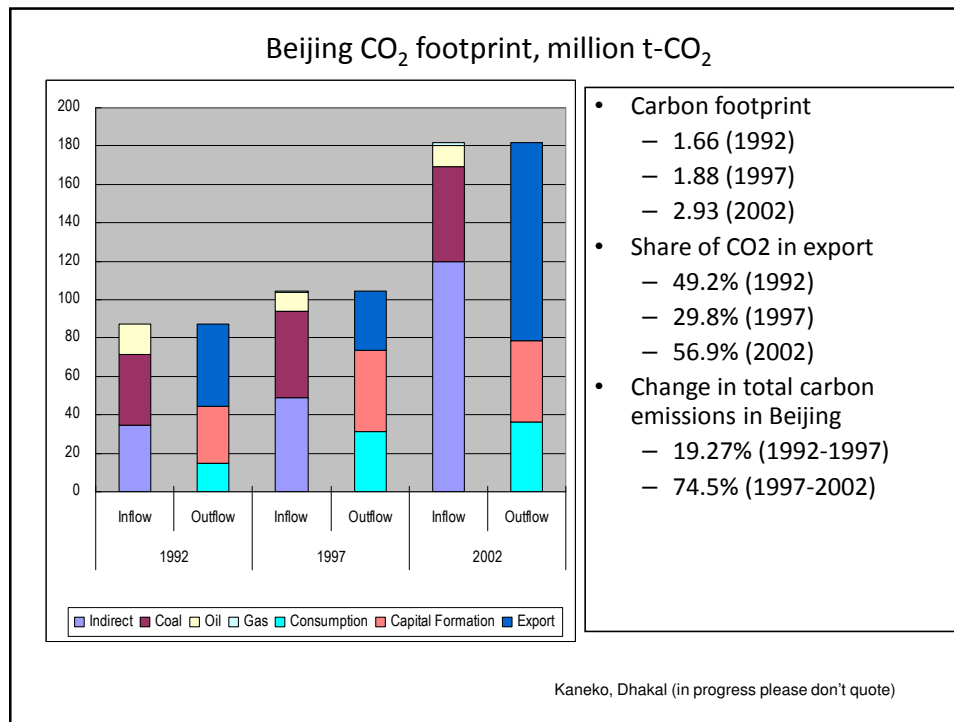
- Failed to perform well, in general (ideally should move towards origin over time)
- Large gain in carbon intensity of economy but this has slowed or even worsened in recent years
- No way to reduce control per capita emission for now – but clearly needs to be dampened at least

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Conclusion

- 67% of global energy is used in urban areas and they are responsible for 76% of energy related CO₂ (IEA new analyses)
- Asia, and in particular China is and will play bigger role in determining global urban energy and emissions in the future
- China
 - Already about 75% of total energy are used in urban areas and such share will further increase to 83% by 2030 when urban population reaches 880 million despite narrowing urban to national per capita energy gaps
 - China's 35 largest cities have and will have enormous and disproportionate influence in shaping nation's energy and carbon future
 - As evidenced from Beijing, Shanghai, Tianjin, and Chongqing analyses, a rapid energy transition taking place in cities- a low carbon path is evidently needed to find despite obvious difficulties

Conclusion

- The fact that city's footprints are high needs new considerations for allocating responsibility - the ultimate goal should be to lessen footprint of cities
- In Chinese cities policy interventions in energy system has synergies with the CO2 reduction but that is not enough if current fuel structure persists
 - Areas of interventions
 - Clean energy, especially greater penetration of natural gas and limiting use of coal for household and commercial sectors
 - Economic structure change from primary to secondary industries and more thrust to lift up the tertiary sector
 - Energy efficiency through numerous methods to different sectors, and
 - Strengthening of public and mass transportation system in the face of fierce pressure from private cars

- Thank you
- Shobhakar.dhakal@nies.go.jp
- Shobhakar.dhakal@gmail.com

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World primary energy demand in cities by fuel in the Reference Scenario

	2006		2015		2030		2006-2030*
	Mtoe	City as a % of world	Mtoe	City as a % of world	Mtoe	City as a % of world	
Coal	2 330	76%	3 145	78%	3 964	81%	2.2%
Oil	2 519	63%	2 873	63%	3 394	66%	1.2%
Gas	1 984	82%	2 418	83%	3 176	87%	2.0%
Nuclear	551	76%	630	77%	726	81%	1.2%
Hydro	195	75%	245	76%	330	79%	2.2%
Biomass & Waste	280	24%	358	26%	520	31%	2.6%
Other Renewables	48	72%	115	73%	264	75%	7.4%
Total	7 908	67%	9 785	69%	12 374	73%	1.9%
Electricity	1 019	76%	1 367	77%	1 912	79%	2.7%

* Average annual growth rate.

Source: WEO, 2008

China: 1999 Regulation of Statistics Classification on Urban and Rural Population

- Population coverage: both agriculture and non-agriculture population
- Mobility coverage: both resident hukou population and resident non-hukou population staying over six months
- Spatial coverage: Selected areas of “designated cities and towns” that include:
 - High density districts (over 1500 persons/km²) of cities at prefecture, quasi-provincial and provincial level
 - Town proper and city proper of (i) counties under prefectures (ii) county level cities, and (iii) low density districts of cities at prefecture, quasi provincial and provincial level
 - Selected villagers’ committees, residents’ committees and special areas with population over 3000 persons of rural towns

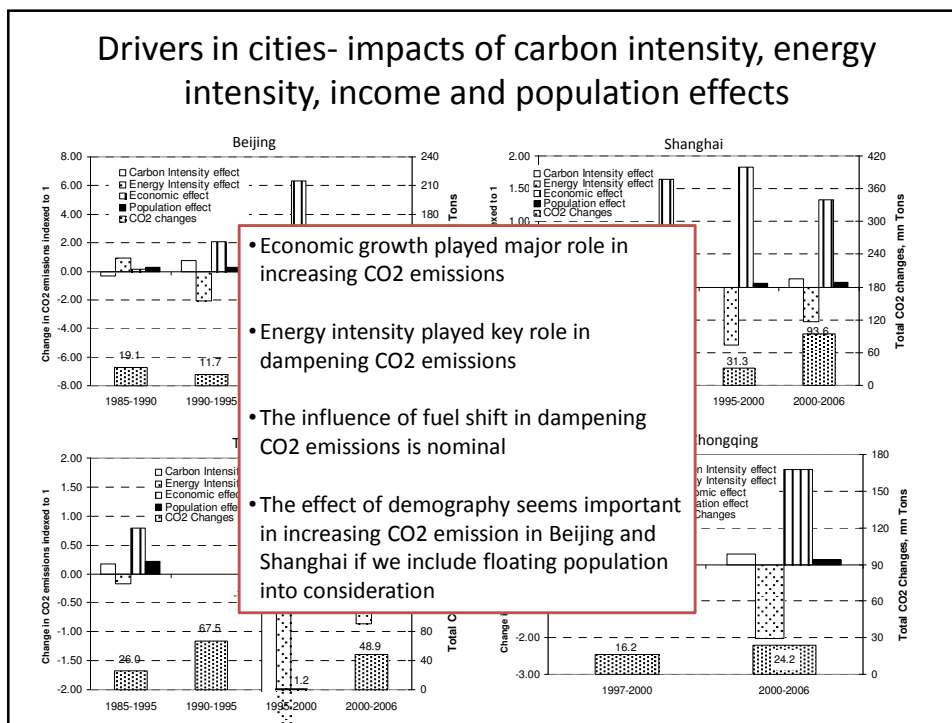
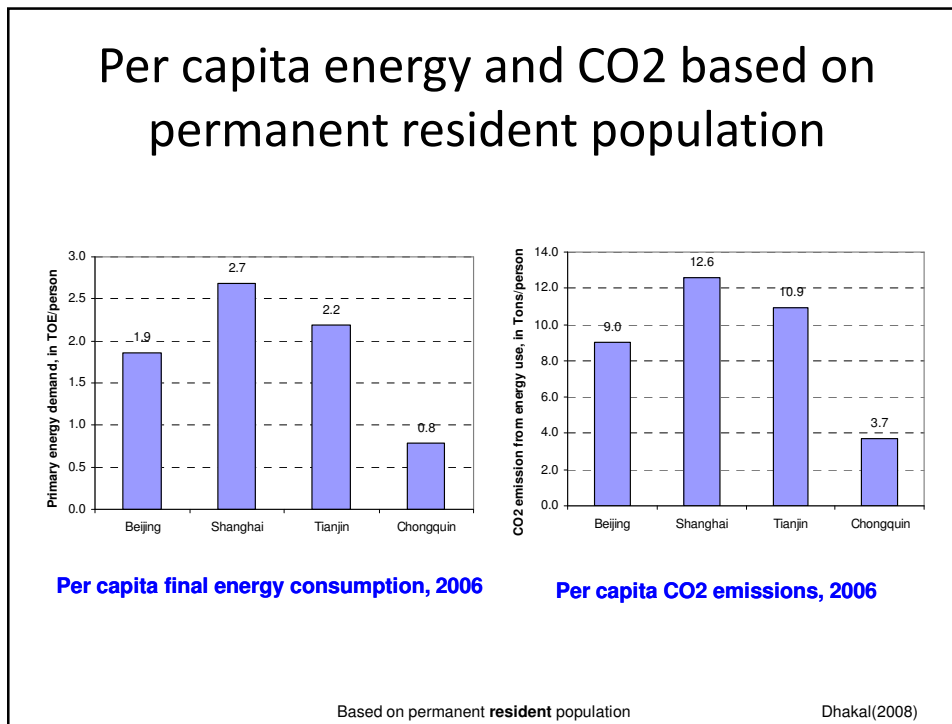
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