

China: Towards Green and Low-Carbon Development

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CPI Annual Review of Low-Carbon Development 2010

- China's Low-Carbon Development Overview
- Sector results:
 - Power
 - Industry
 - Building
 - Transportation
 - Agriculture/Forestry
- Key Takeaways
- Next Steps for China
- Implications for the U.S.

(www.ClimatePolicyInitiative.org)

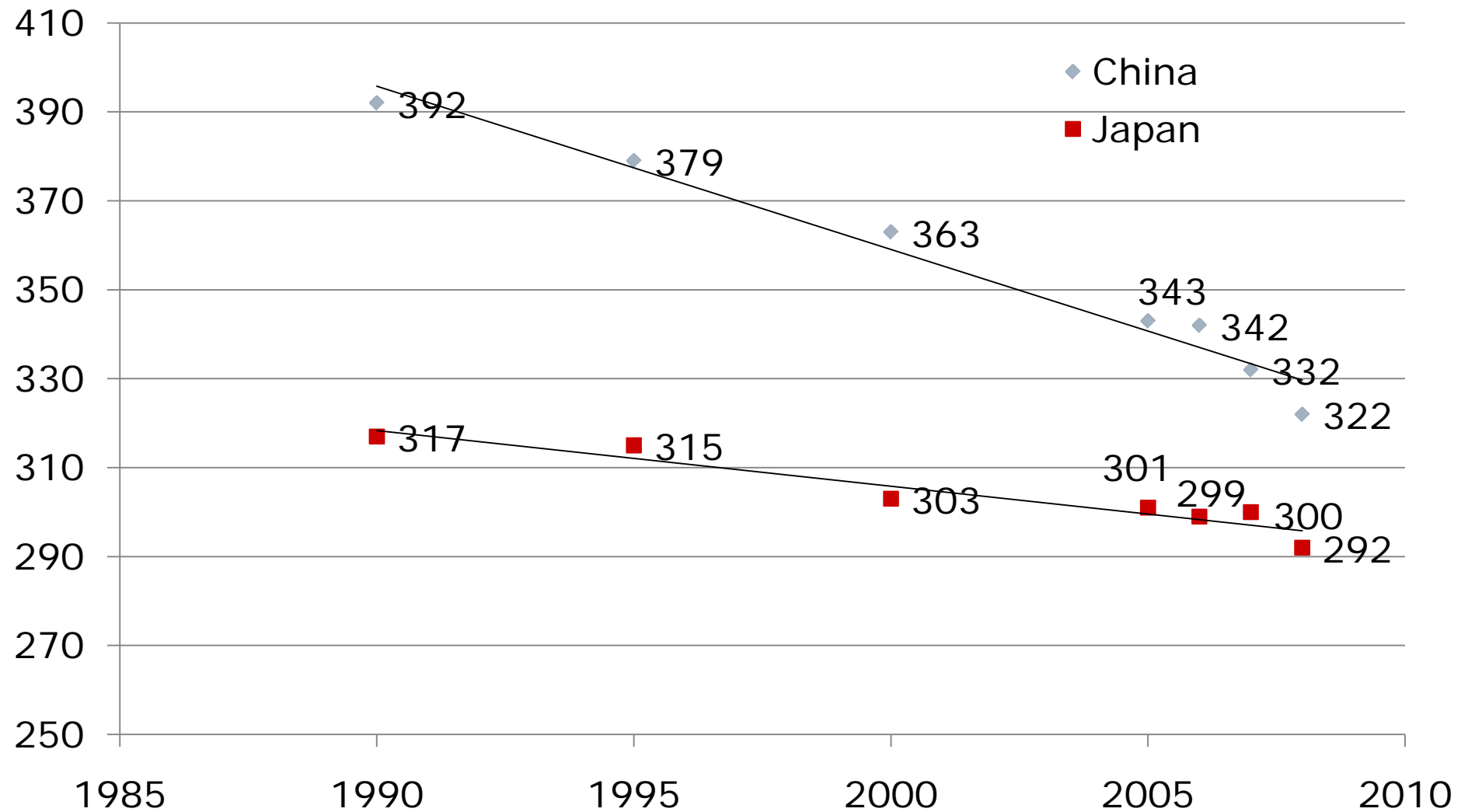


China's energy and carbon efficiency

- ❑ The largest carbon emitter in the world
- ❑ The largest energy consumer in the world
 - ❑ 3.2 5billion tce of energy consumption (2010)
 - ❑ ~7 billion tCO₂ emission from fossil fuel combustion (2010)
- ❑ Energy intensity 5X Japan, 3X U.S.
- ❑ An inefficient economy?

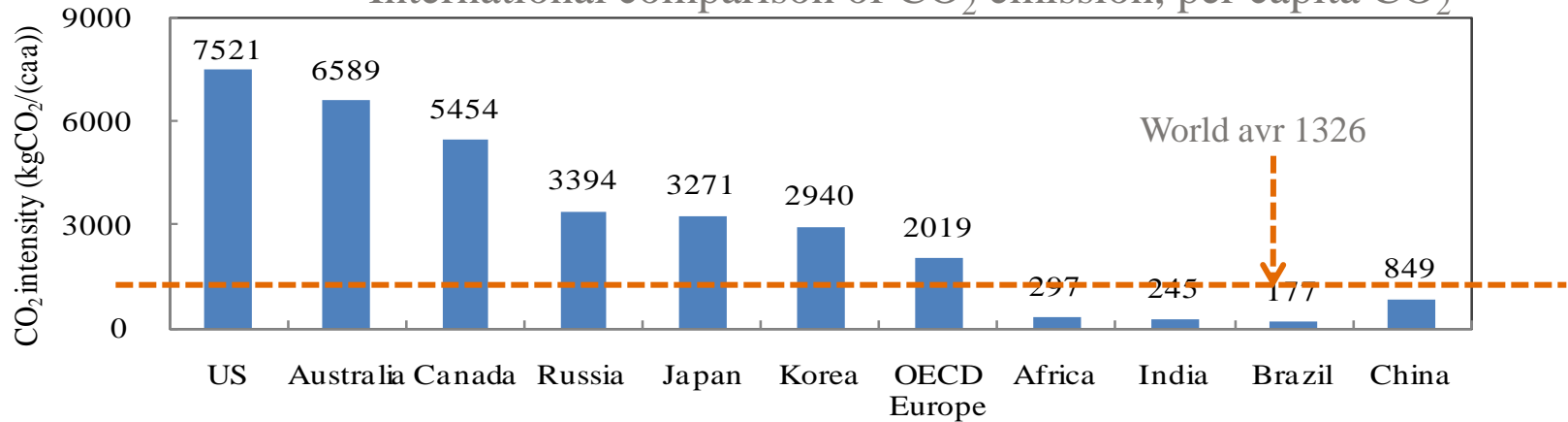


Benchmarking: Power generation

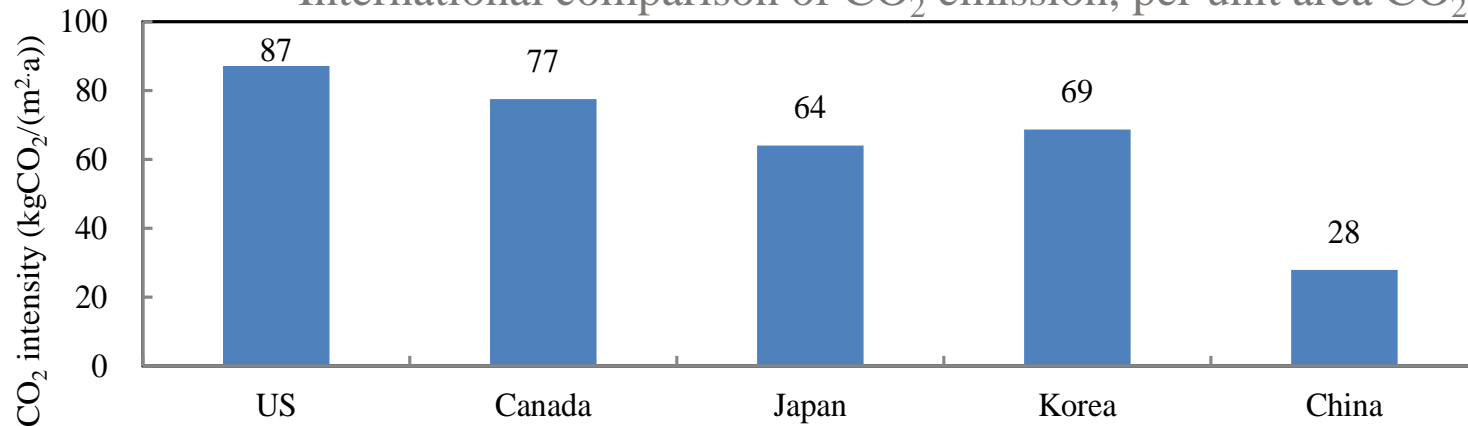


Benchmarking: Building Energy & CO₂ Intensity

International comparison of CO₂ emission, per capita CO₂

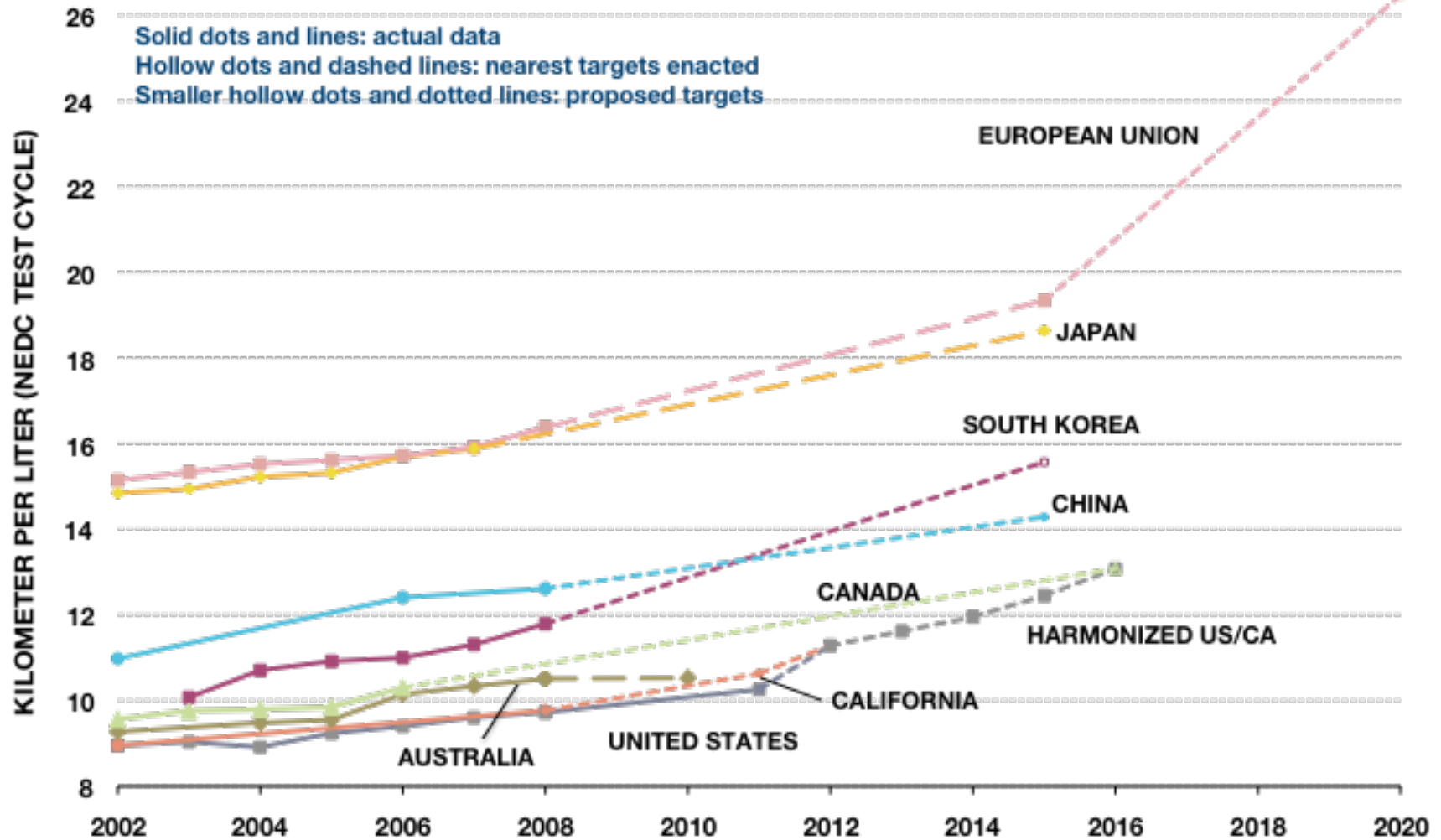


International comparison of CO₂ emission, per unit area CO₂



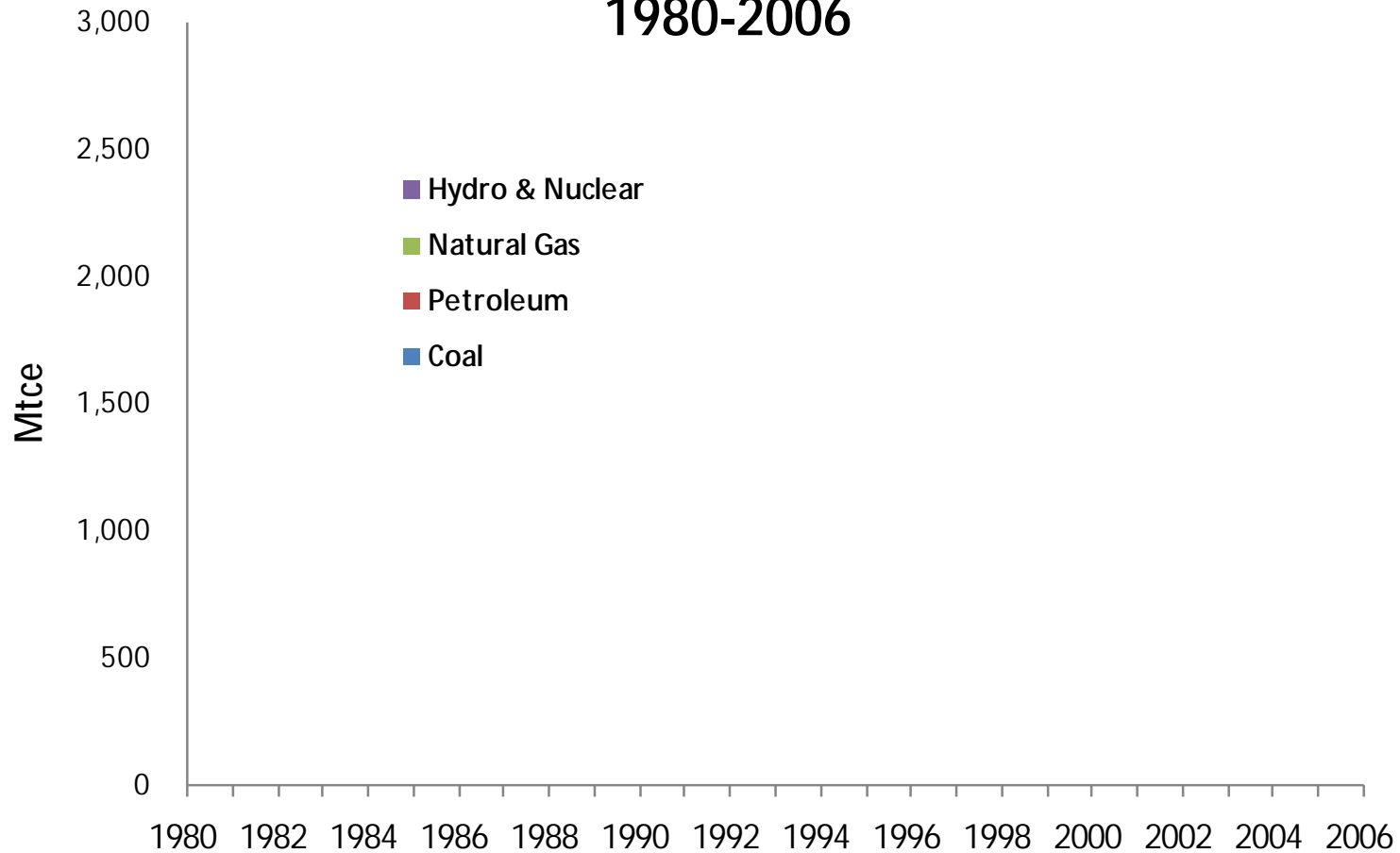
Benchmarking: Fuel Economy Standards

ACTUAL FLEET AVERAGE FUEL ECONOMY DATA THROUGH 2008 AND NEAREST TARGETS ENACTED OR PROPOSED THEREAFTER BY REGION

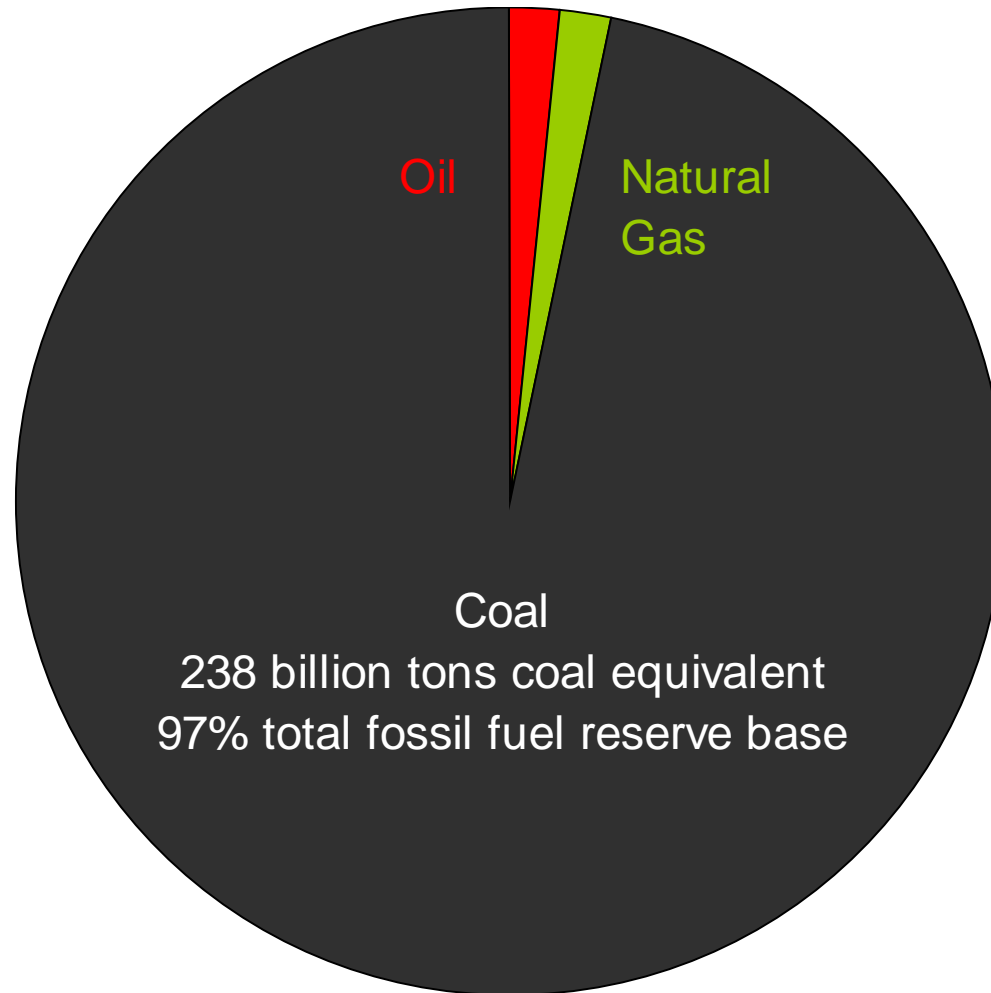


A Coal-based Energy System

China's Primary Energy Consumption 1980-2006

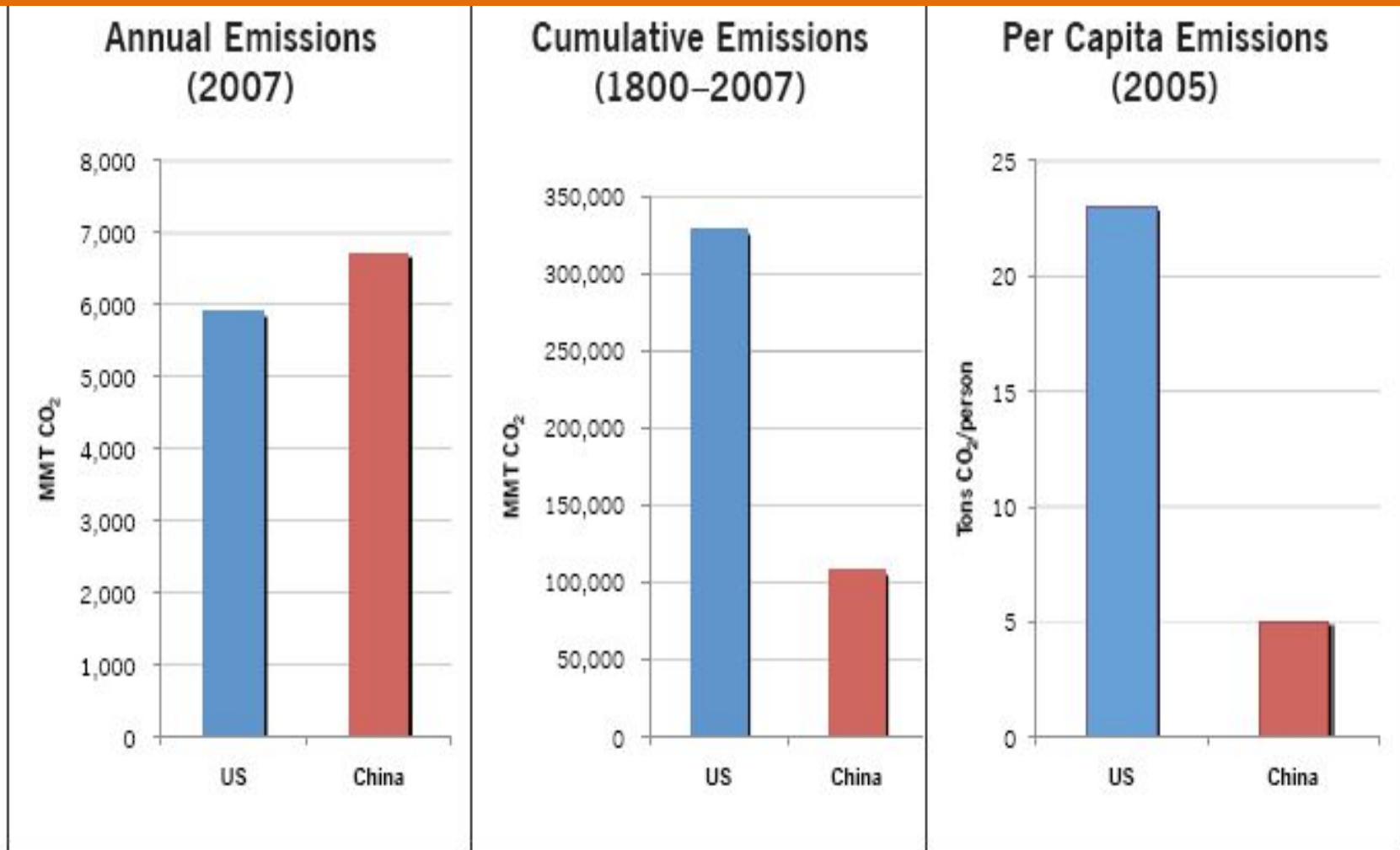


Resource endowment



Source: NBS, 2007.

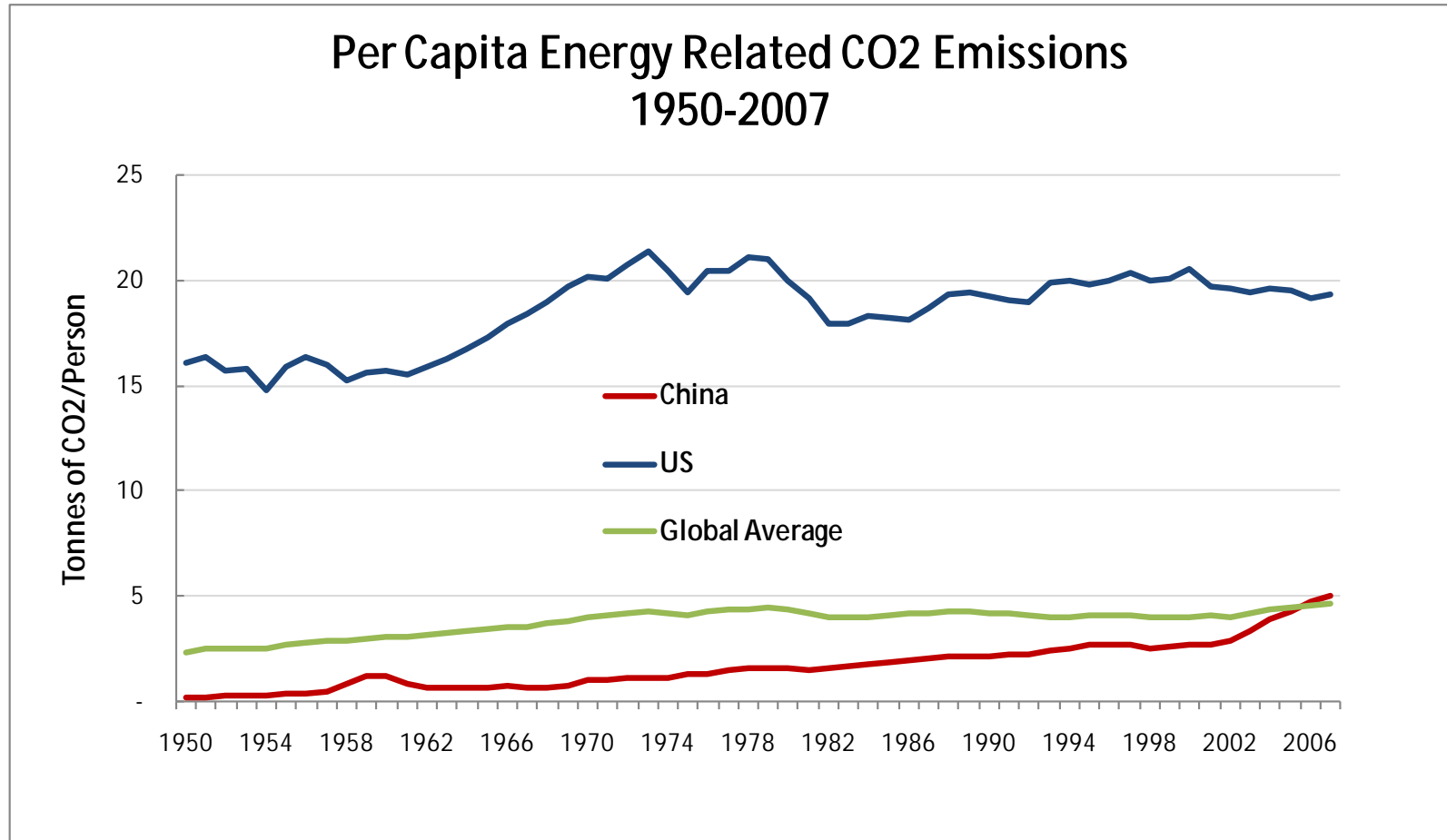
Emissions



Source: Asia Society, 2008. *Common Challenge, Collaborative Response: A Roadmap for U.S.-China Cooperation on Energy and Climate Change*. http://www.asiasociety.org/taskforces/climateroadmap/US_China_Roadmap_on_Climate_Change.pdf

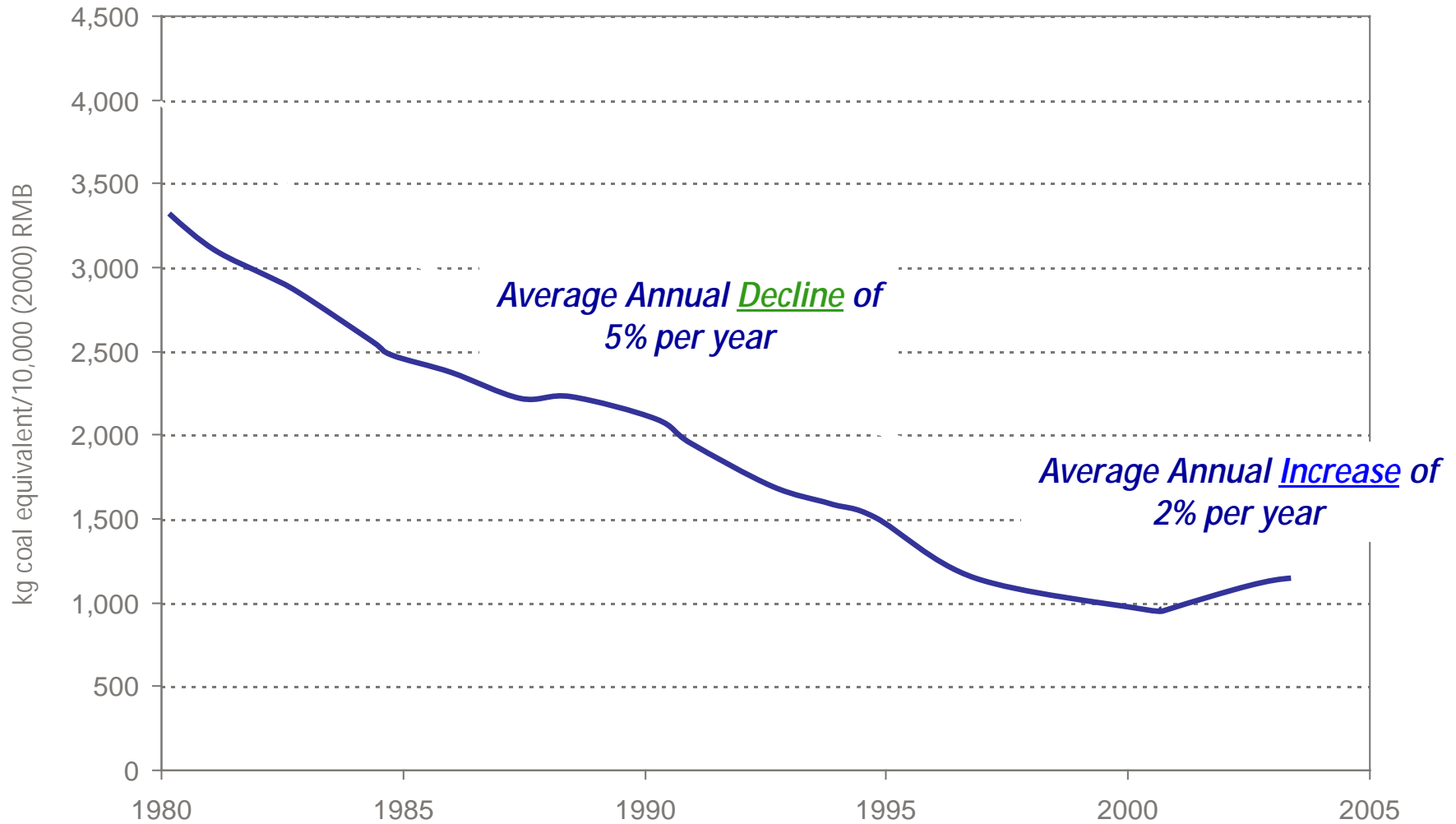
²⁵ Data sources: "CO₂ Emissions From Fossil Fuels," Oak Ridge National Laboratory, Carbon Dioxide Information Analysis Center (CDIAC), 2007; The Netherlands Environmental Assessment Agency (MNP), 2007; Statistical Review of World Energy, BP; IEA, 2007; World Bank database (population data), 2007; CDIAC-ORNL, MNP, BP, USGS (cement), IEA, World Bank.

Per Capita CO2 Emissions



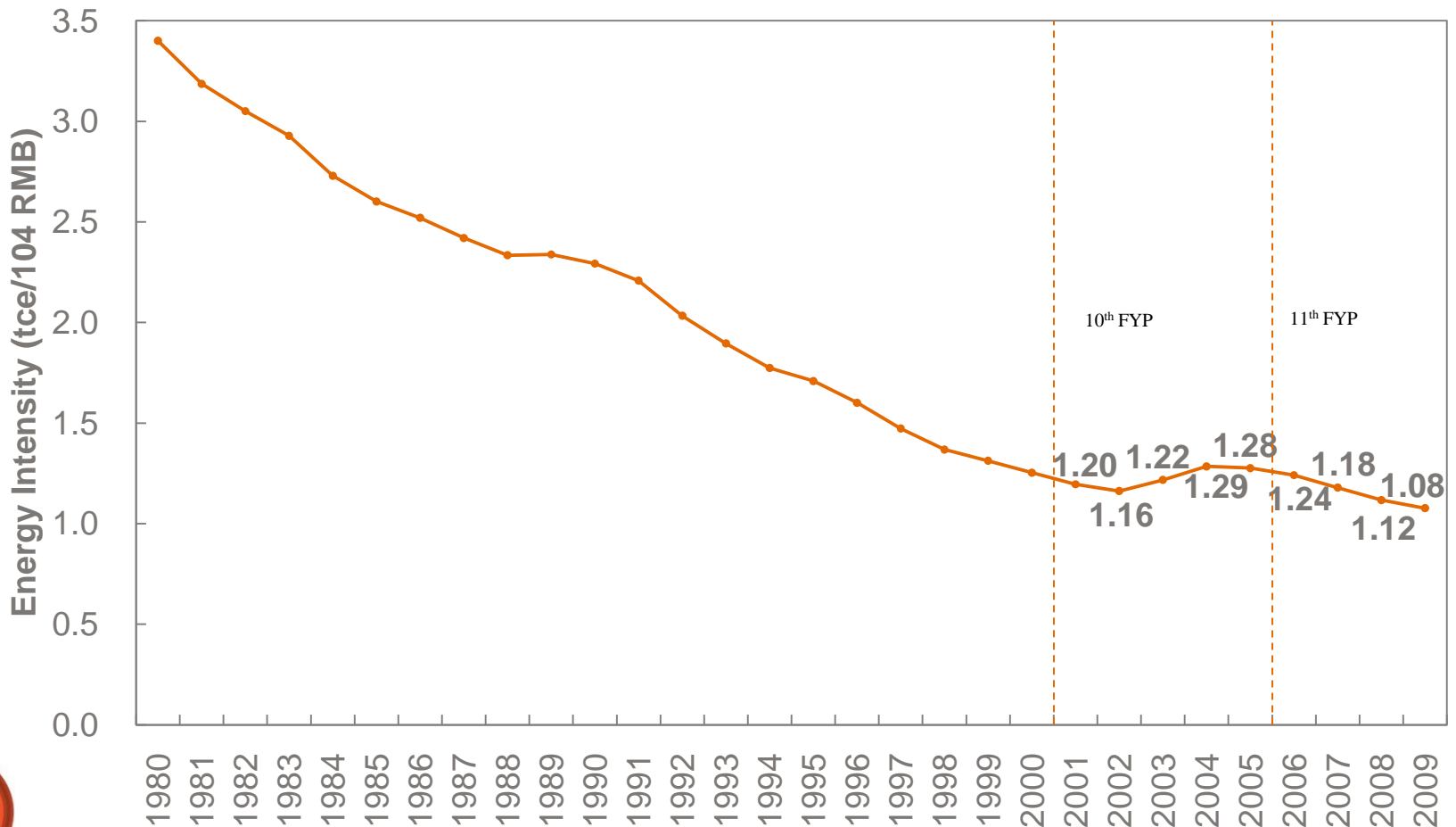
Source: Historical 1950-2005 US, China and global emissions data from Oak Ridge National Laboratory, Carbon Dioxide Information Analysis Center; 2006-2007 US, China and global emissions data are preliminary estimates from Carbon Dioxide Information Analysis Center; 2006-2007 population data of China from China Statistical Bureau; 2006-2007 US and global population data from US Census.

Effort to Reduce Energy Intensity

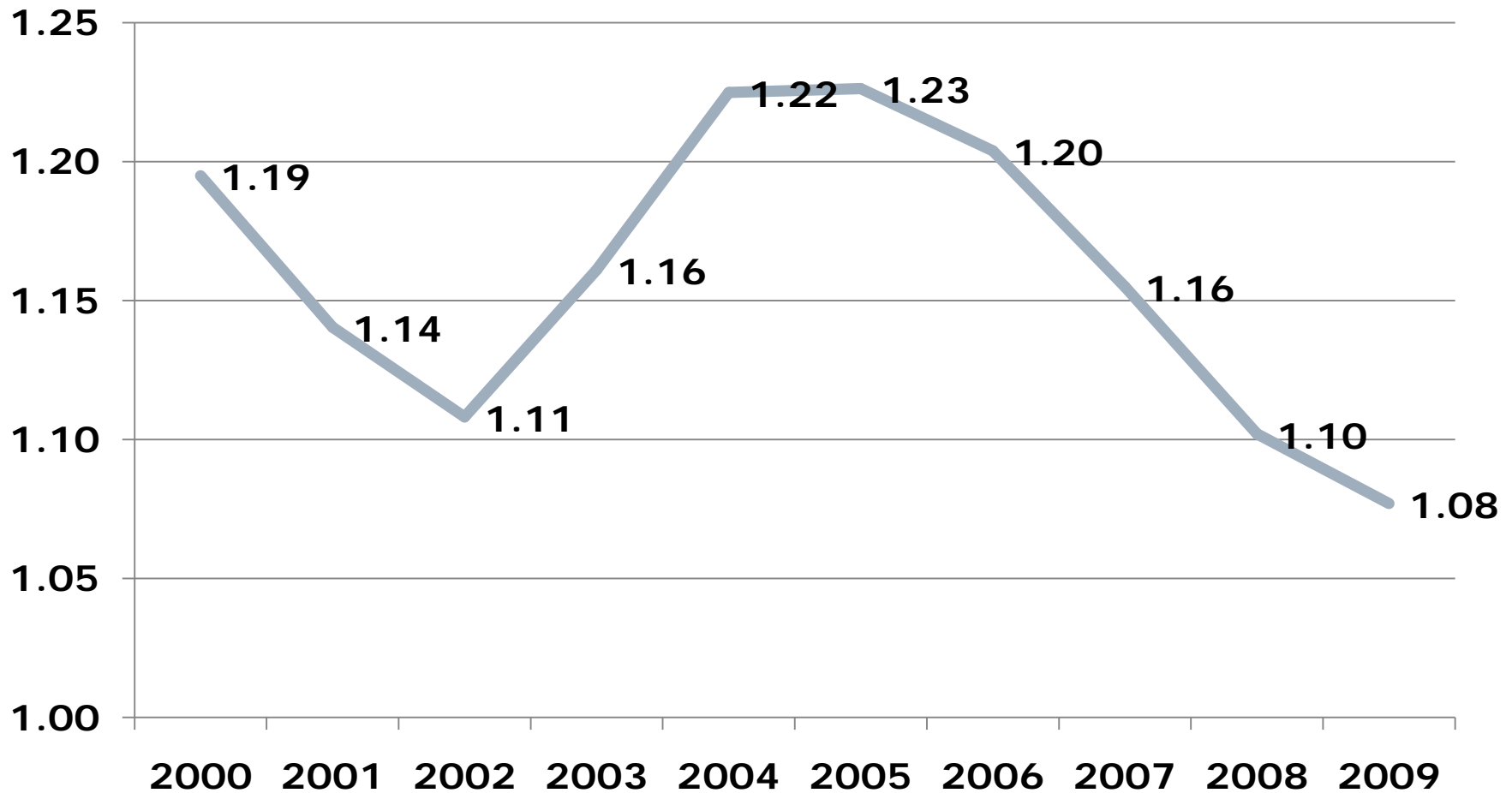


On track to target

During the 11th FYP, China was on track to meet energy intensity target, reversed an upward trend of energy intensity between 2002 and 2005.



Reversal of the trend



Note: energy intensity values are calculated using deflated year 2000 GDP values; expressed in kilograms coal equivalent primary energy consumption per renminbi GDP.

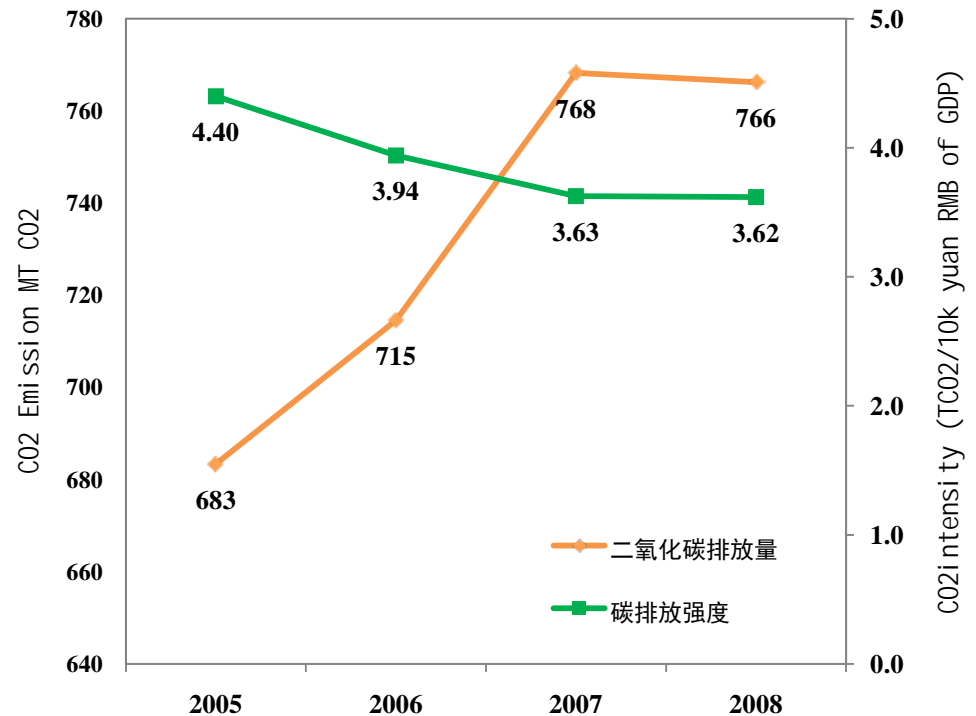
The Power Sector

Power Sector

Energy consumption and CO₂ emission increased rapidly, but energy efficiency and carbon productivity also improved.

Key policies:

- Renewable Energy Law
- large plants/new tech
- Plant Closure Program



Decarbonizing the power industry: 2005 - 2008

	2005	2006	2007	2008
Power industry total capacity (GW)	517	621	713	791
Thermal power capacity (GW)	391	484	554	601
Hydro power capacity (GW)	117	129	145	172
Wind power capacity (GW)	1.1	1.9	4.0	8.9
Nuclear power capacity (GW)	6.9	6.9	8.9	9.1
Power industry total generation (TWh)	2500	2866	3282	3467
Thermal power generation (TWh)	2047	2370	2723	2790
Hydro power generation (TWh)	397	436	485	585
Wind power generation (TWh)	1	3	6	13
Nuclear power generation (TWh)	53	55	62	68
Power industry CO₂ emission intensity (gCO₂/kWh)	766.8	772.4	760.3	716.6
Thermal power industry carbon emission intensity (gCO₂/kWh)	935.8	933.2	914.7	887.8

Renewable Energy and Nuclear Power

➤ Installation:

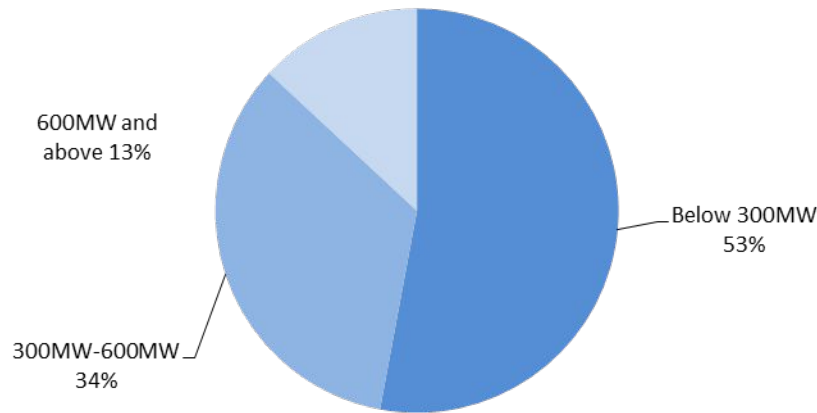
- Renewable energy: **226GW** in 2009;
- Hydro: **200GW** in 2010 (**20GW** added each year);
- Wind power was **25.8GW in 2009** (annual growth of **130%** from 2006 to 2009)

➤ Generation:

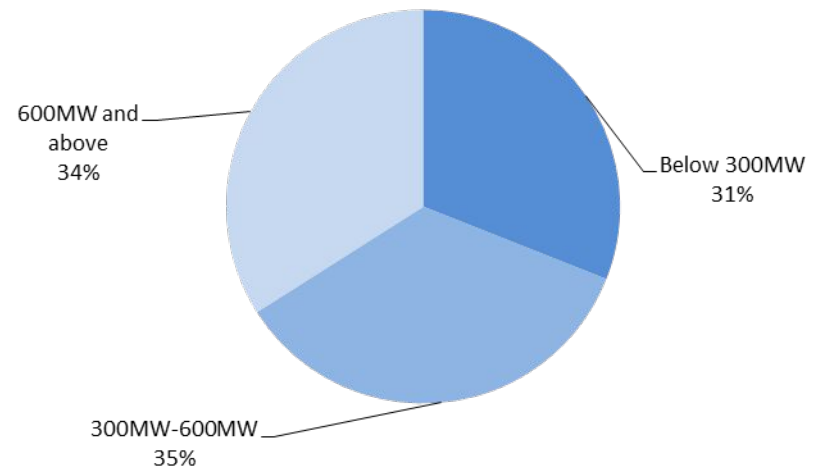
- Renewables and nuclear power: **18.5%** of national total in 2009.
- The electricity generated by hydro, wind and nuclear power increased from 2005's **451.4TWh** to 2009's **666.7TWh**, **47.7% higher than** 2005 level,
- The growth rate surpassed that of thermal power (**36.3%**).

Thermal Power: Structure and Efficiency

Thermal power units structure in 2005

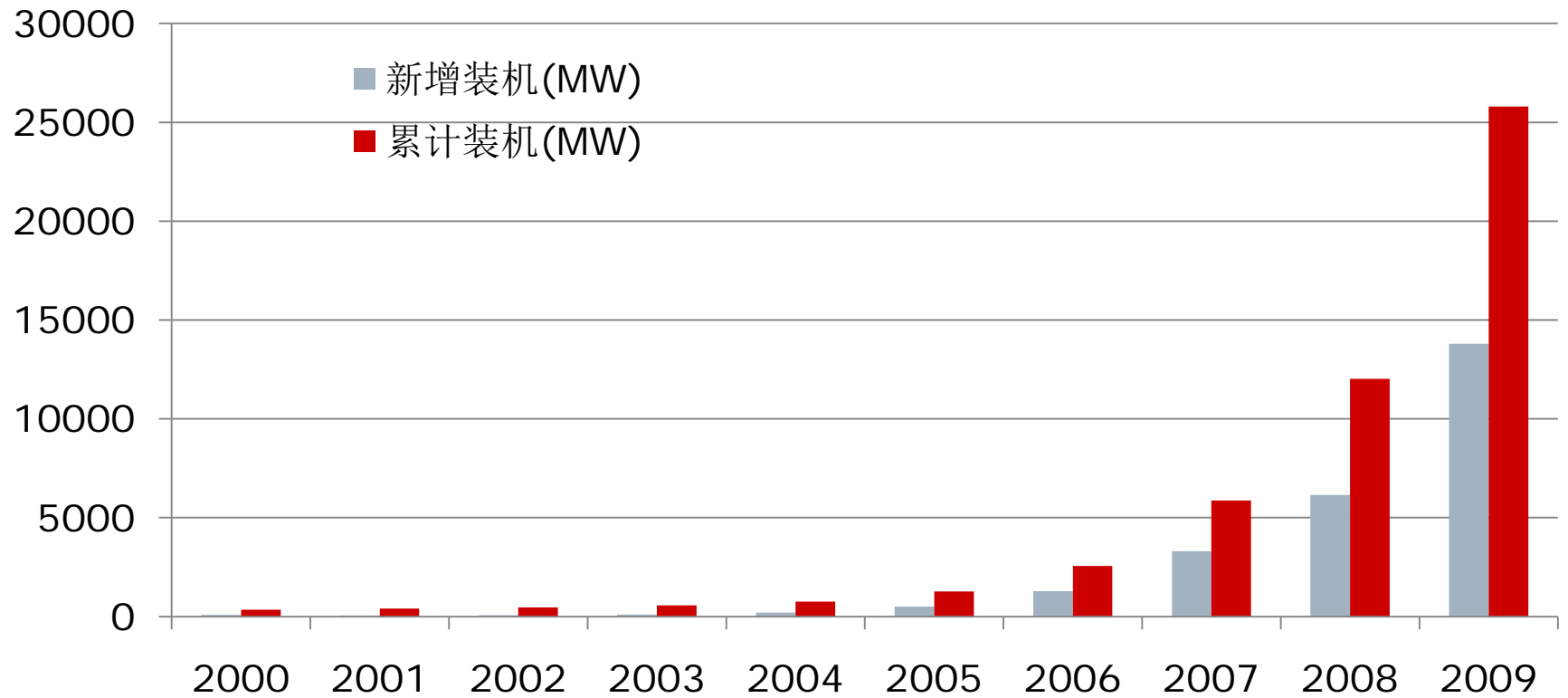


Thermal power units structure in 2009



- **Closure of small and inefficient power plants: 72 GW, 20%** more than total capacity of UK. **26.17GW** closed in 2009 alone.
- **Structural change:** 34% of units larger than **600MW** in 2009 as compared to **13%** in 2005; and proportion of units smaller than **300MW** decreased from **53%** to **31%**, respectively.

Wind Power Installation



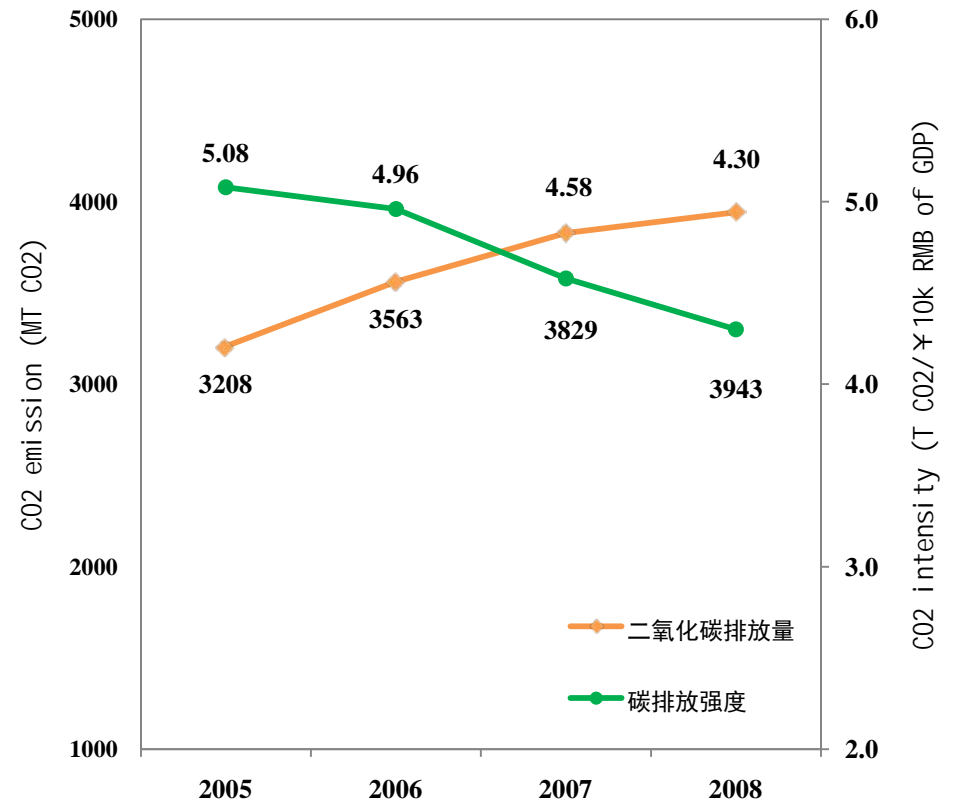
The Manufacturing Industry

Manufacturing sector

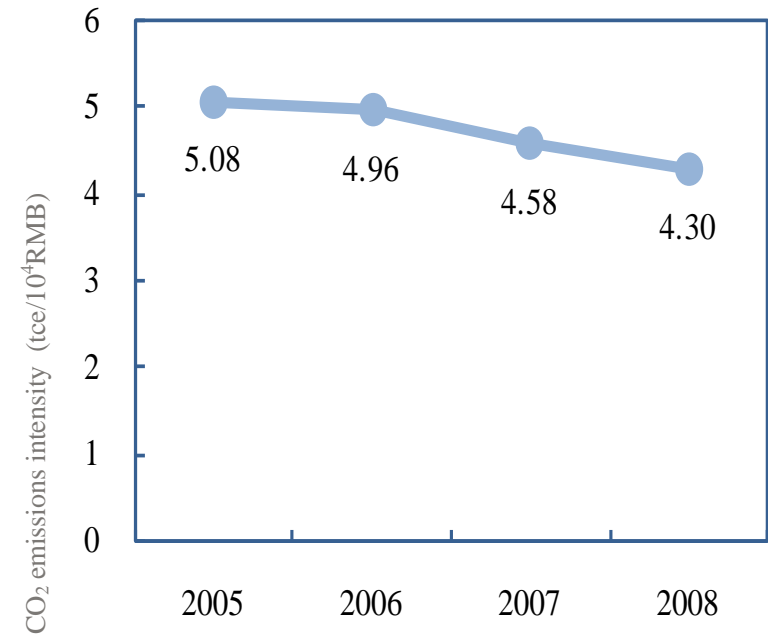
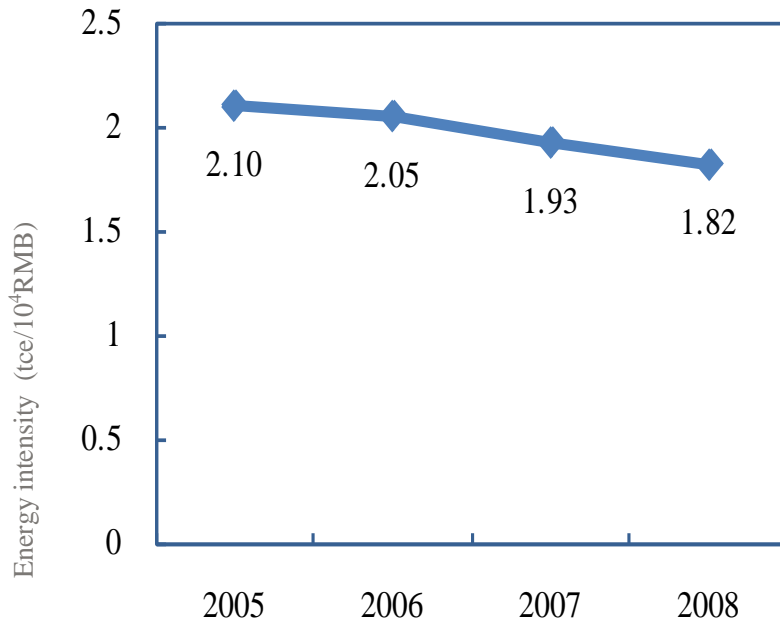
Energy consumption and CO₂ emission increased rapidly, but energy efficiency and carbon productivity also improved.

Key policies:

- Top 1000 Energy-Consuming Enterprises Program
- Plant Closure Program
- Ten Key Energy Conservation Projects



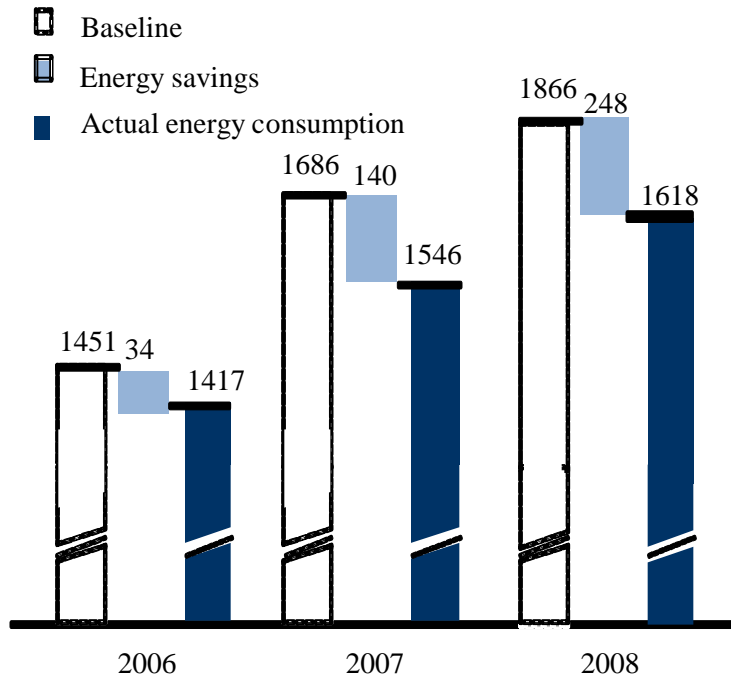
Energy and Carbon Intensity (Per unit IVA)



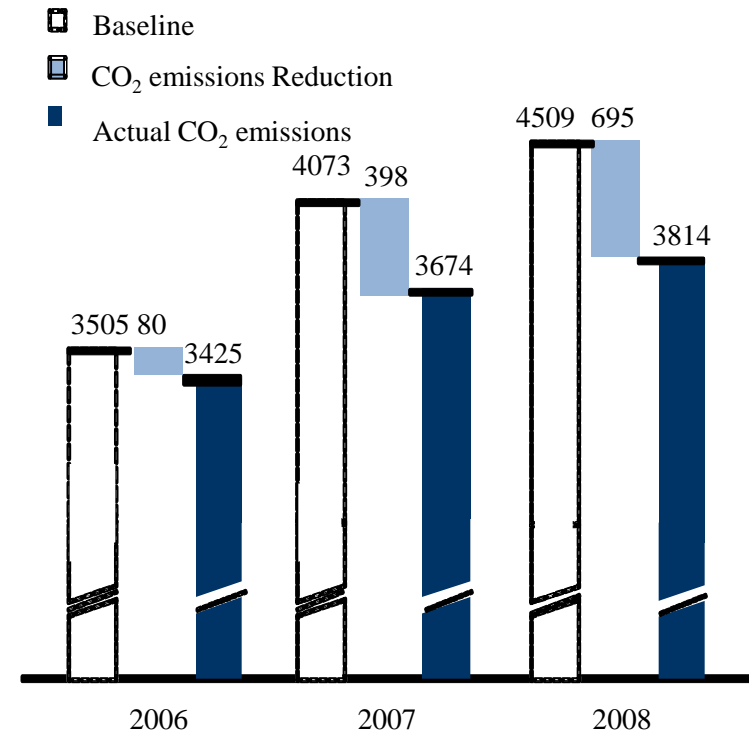
- 2005~2008, energy intensity decreased **13.3%**, an **4.6%** average annual reduction.
- 2005~2008, carbon intensity decreased **14.8%**, a **5.4%** average annual reduction.

Energy Savings in Manufacturing Sector

Mtce Savings



MtCO₂ Savings



- 2006~2008, the industrial sector achieved cumulative energy savings of **421Mtce** (frozen 2005 energy intensity baseline).
- 2006~2008, the industrial sector achieved aggregate CO₂ emission reduction of **1170MtCO₂**.

Manufacturing Sector Policy and Energy Saved

Policy	Energy savings, 2006-2009	Contribution to 20% EI reduction
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Top 1000 Energy Consuming Enterprises	132Mtce (exceeds target)	27%
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Ten Key Energy Conservation Projects	140 Mtce (2006-2008)	29%
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Small Plant Closures	110 Mtce	22%
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The Building Sector

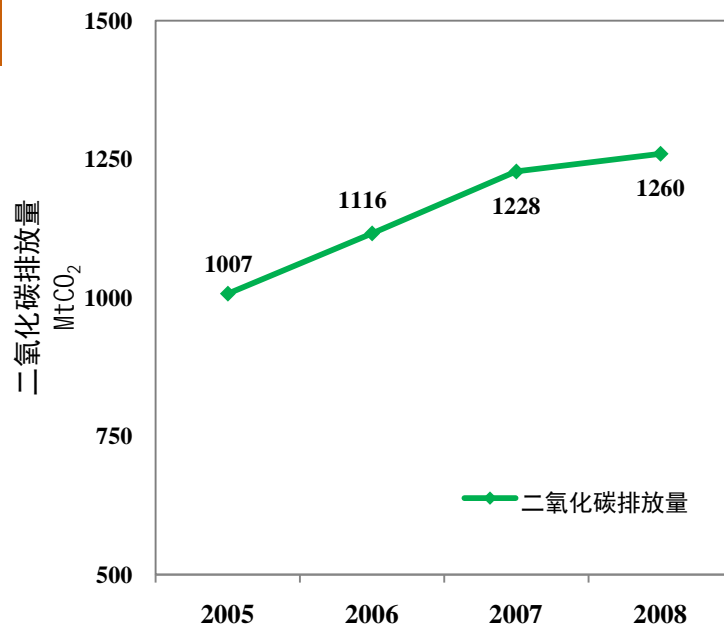
Building

Energy consumption and CO₂ emissions up rapidly; but efficiency improvement is modest.

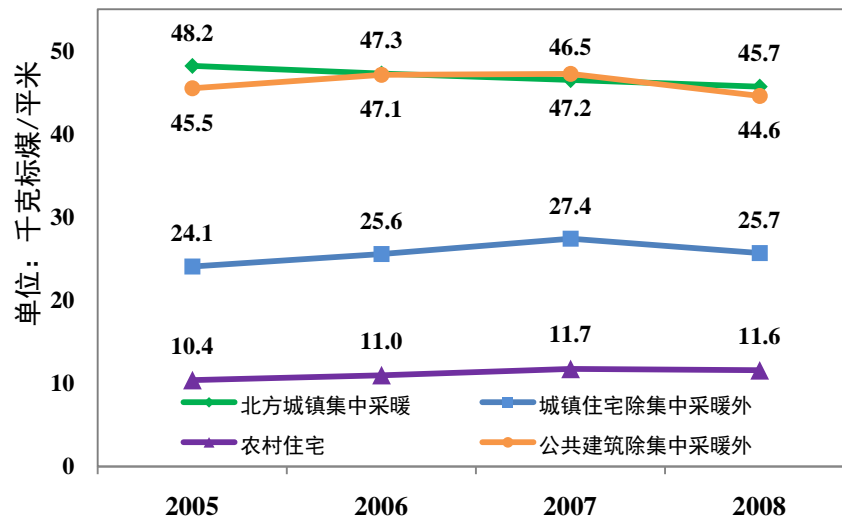
Key policies:

- District heating
- Building codes

建筑部门的二氧化碳排放及其碳排放强度

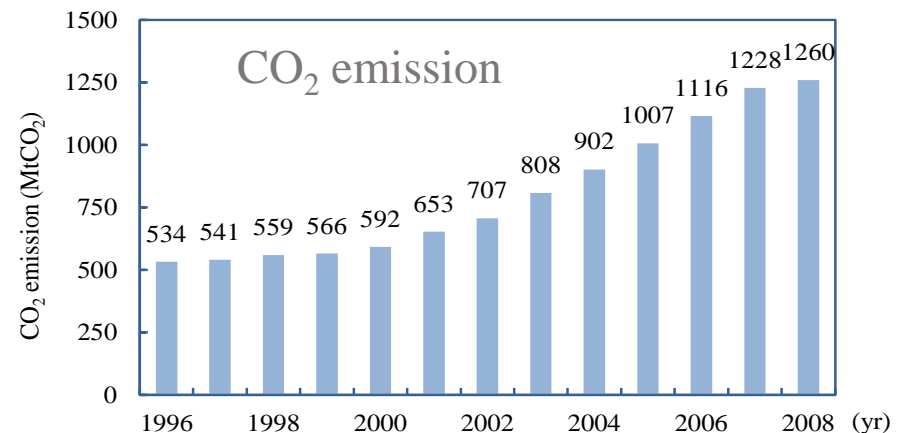
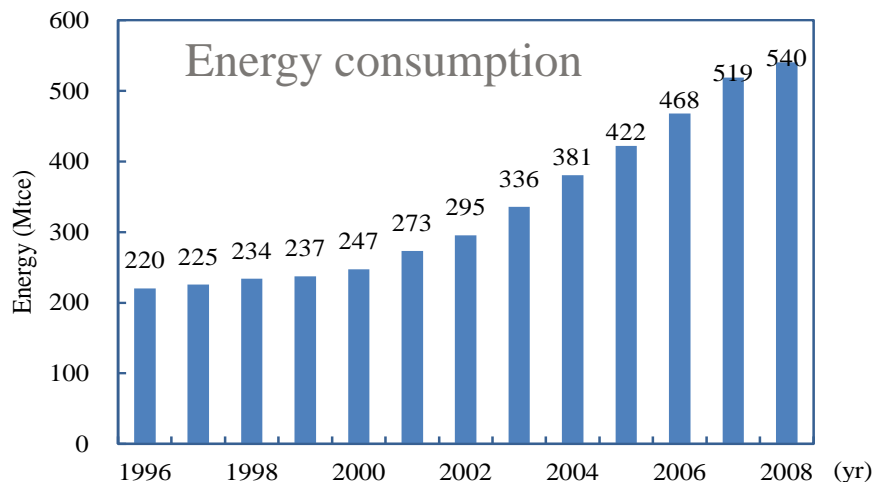


不同建筑类型的单位建筑碳排放



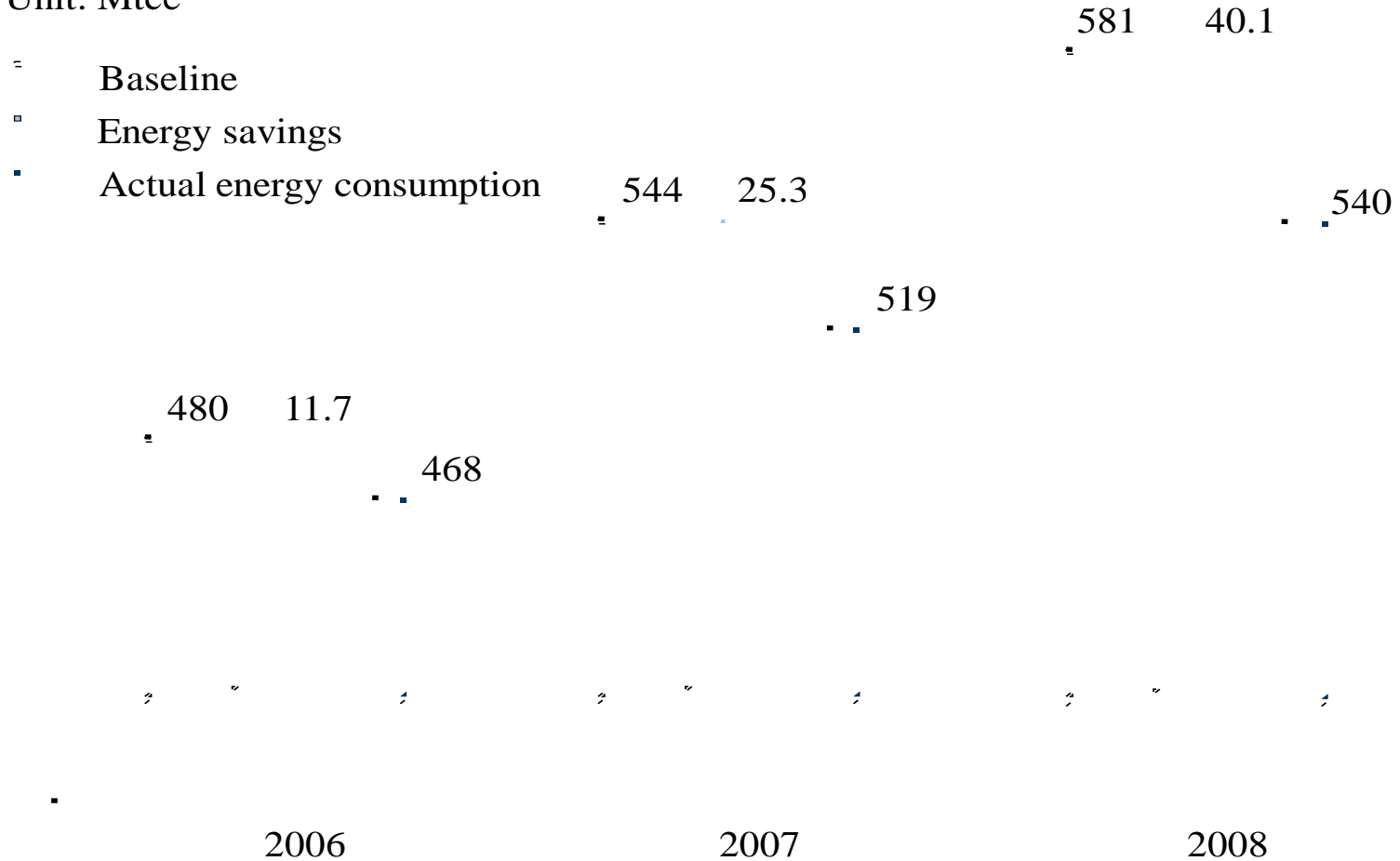
Growth of CO₂ emission slowing down

- In **2008**, China's building sector
 - Energy consumption: **540 Mtce**, **18.4%** of China's total
 - CO₂ emission **1260 MtCO₂**, **19.8%** of China's total
- 2006~2008 Growth rate
 - Energy consumption: **8.6%**
 - CO₂ emission: **7.8%**



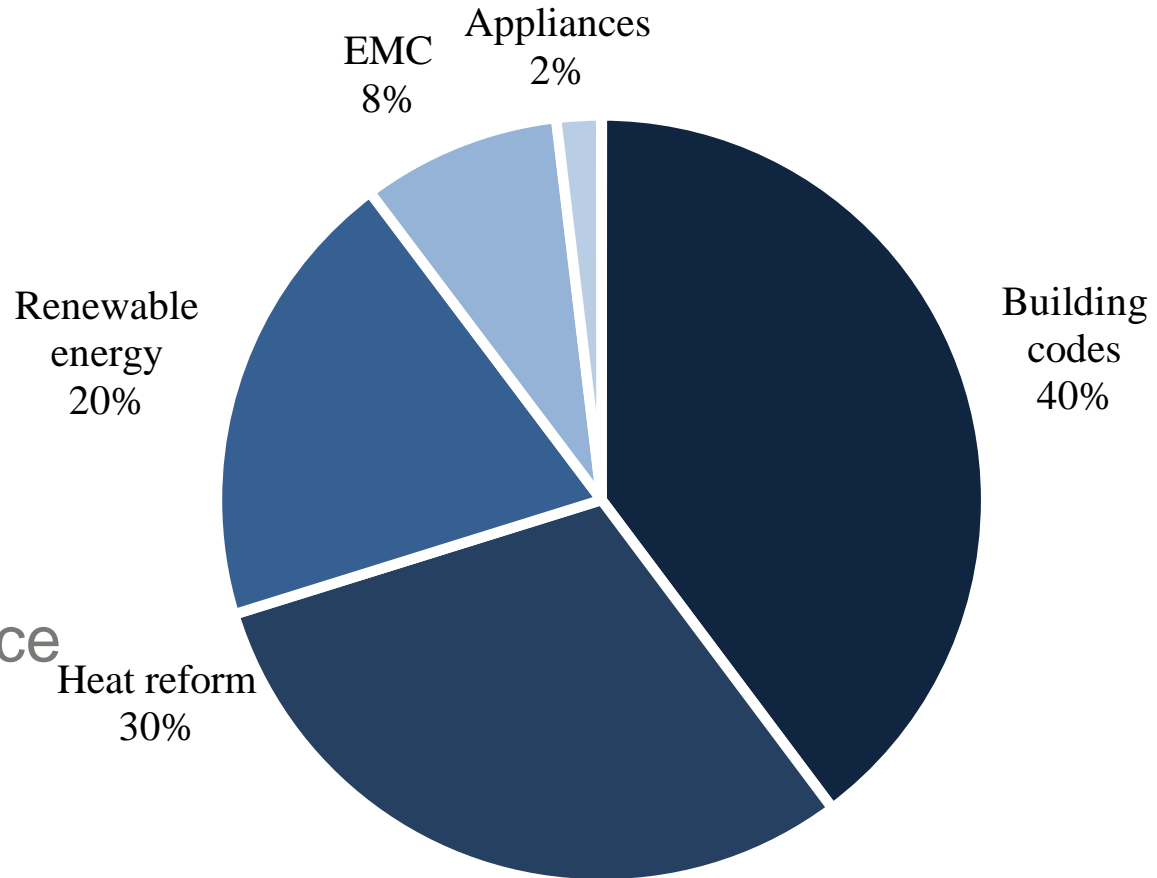
75% of the energy saving targets by 11th FYP fulfilled in first three years

Unit: Mtce



Energy saving by policy clusters

- The implementation of building codes
- Heat reform in north urban China
- Renewable energy application
- Energy management contract
- More efficient appliance



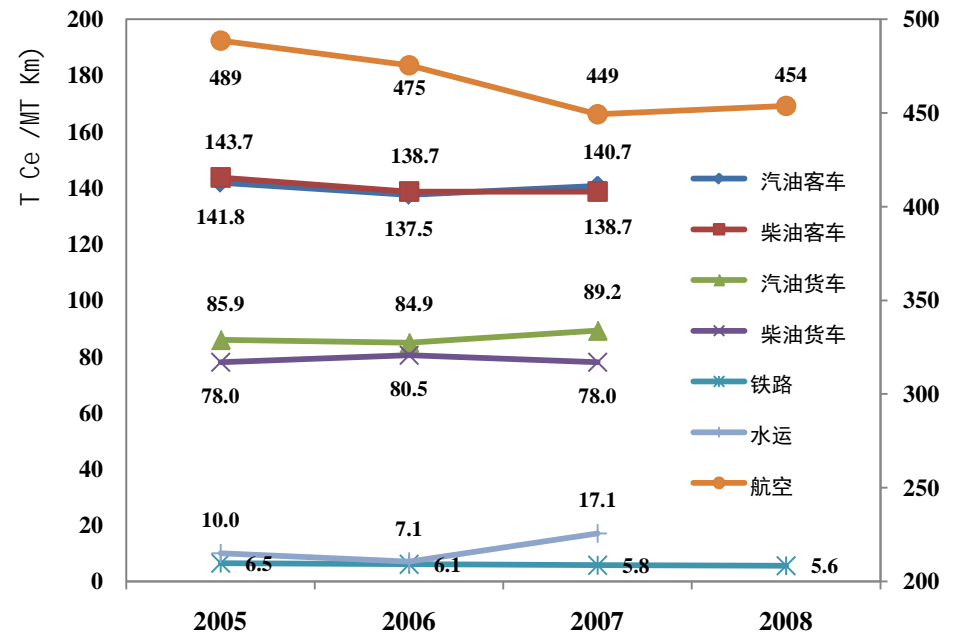
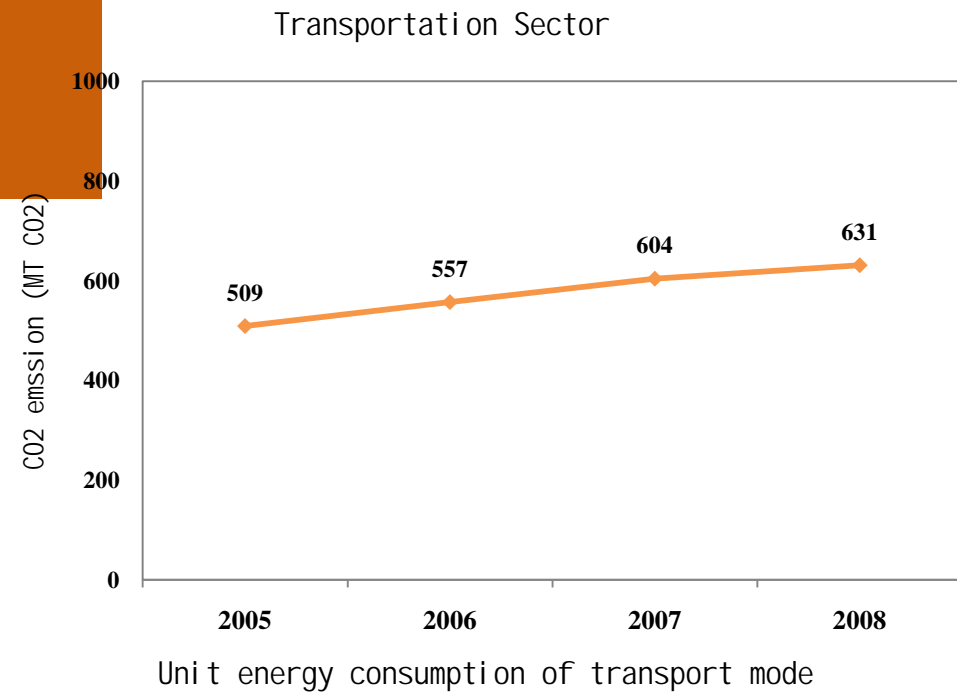
The Transportation Sector

Transport also challenging

Energy consumption and CO₂ emissions up rapidly; but efficiency modest.

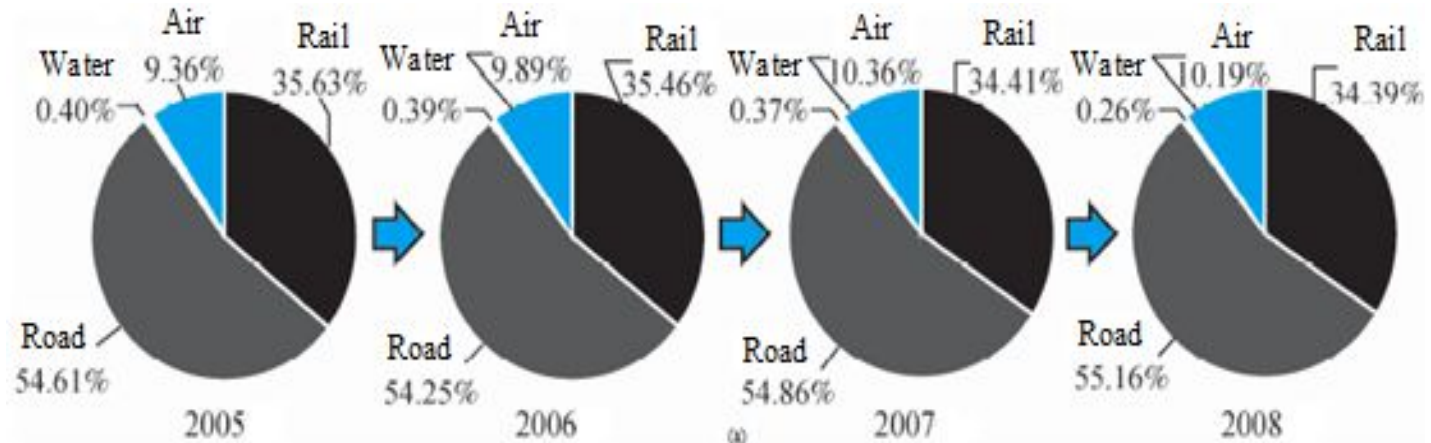
Key policies:

- Fuel economy standards
- Public transportation prioritization

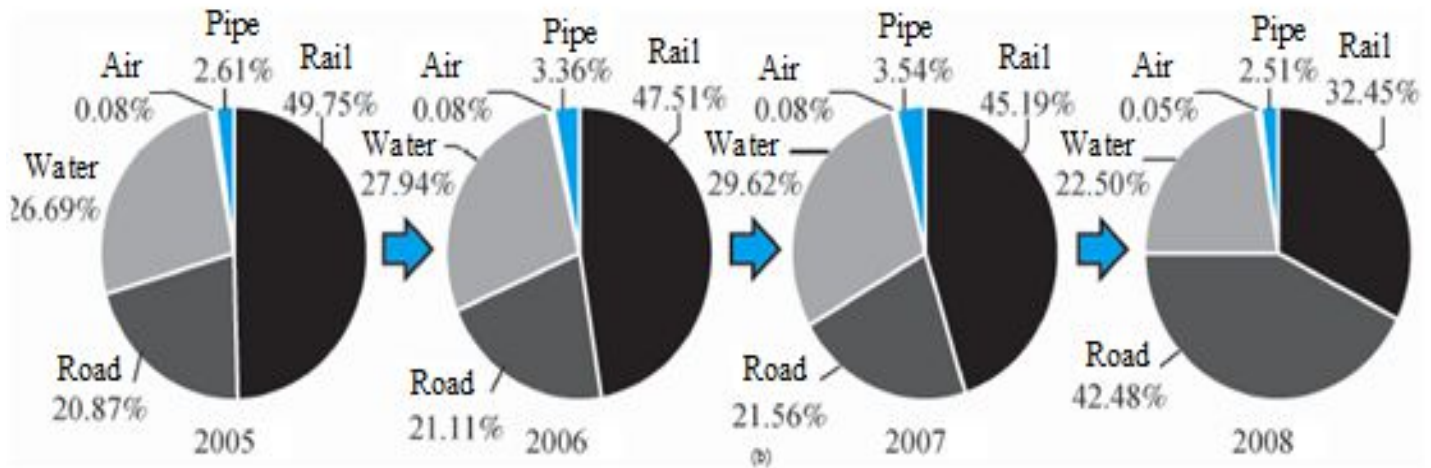


Change of Transportation Mode

Passenger Transport



Freight Transport



(a) Passenger mode share change, passenger-kilometers travelled

(b) Freight mode share change, ton-kilometers travelled

(Sources: China Transportation Yearbook)

The Agriculture and Forestry Sector

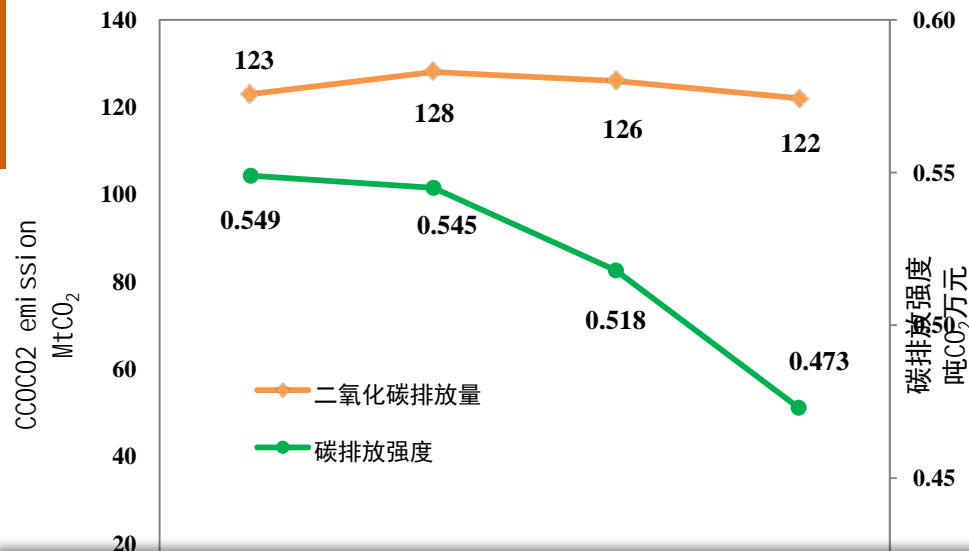
Good news in ag and forestry

Agriculture: direct energy emissions declined, non-CO₂ emissions stable.
 Afforestation added 420MtCO₂ per year to carbon sinks.

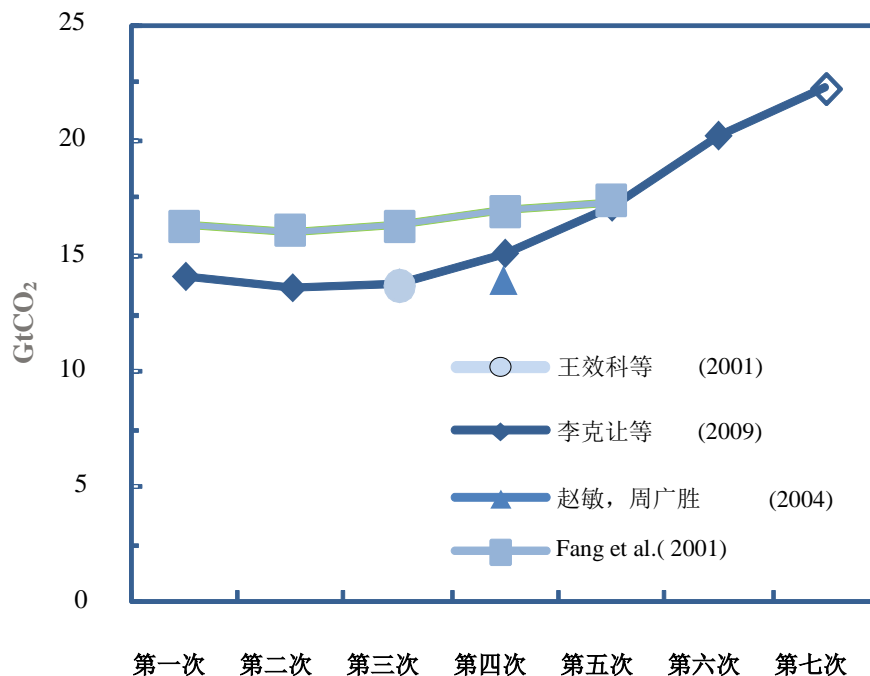
Key policies:

- Logging ban
- Afforestation

Carbon emission and intensity in agriculture

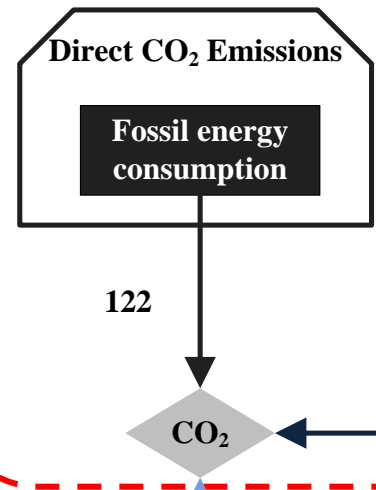


Carbon storage in forestry

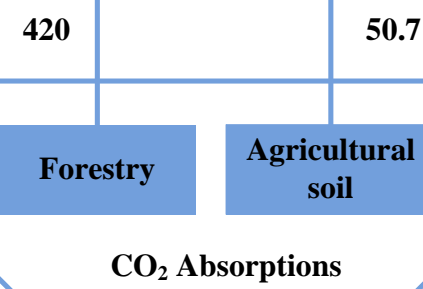
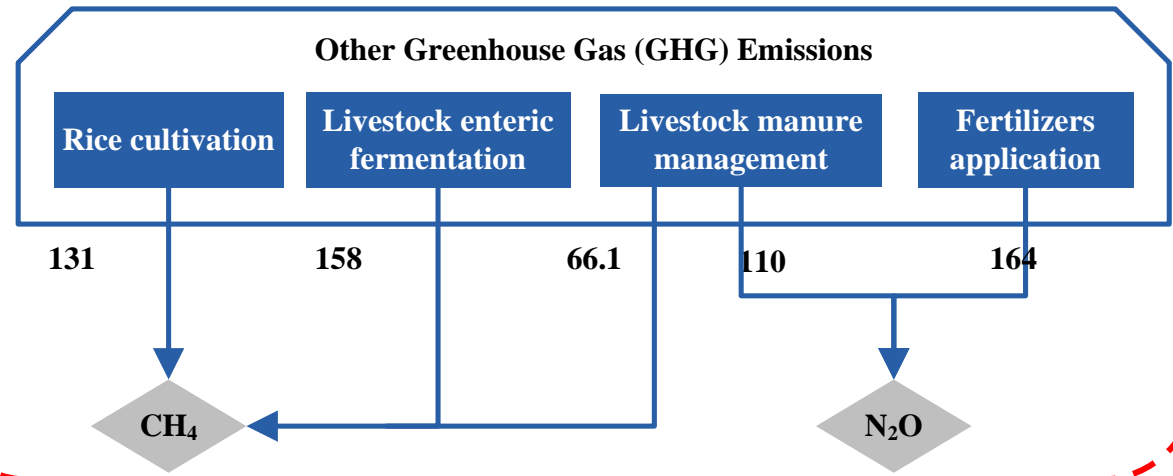


GHG Emissions/Absorptions of the Agriculture and Forestry Sector

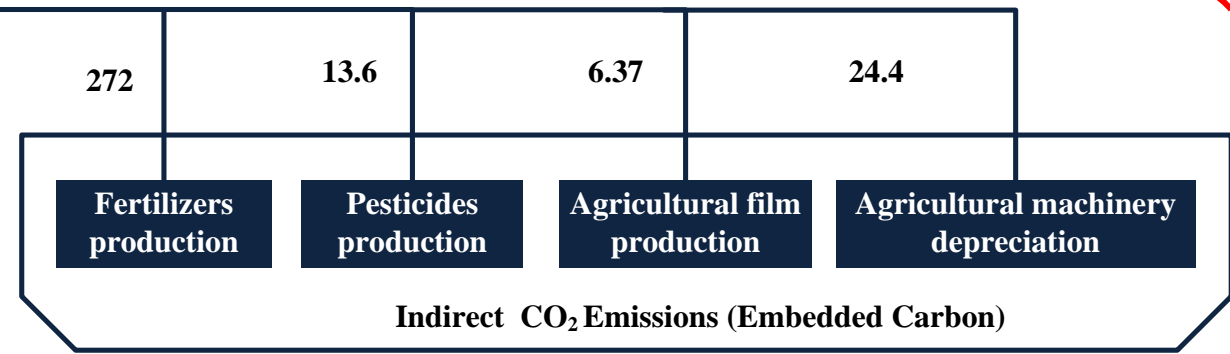
Direct CO₂ Emissions



Other Greenhouse Gas Emissions



CO₂ Absorptions



Indirect Embedded CO₂ Emissions

Key Takeaway: Energy efficiency has reduced carbon emission

- ❑ China's carbon emissions intensity fell largely as a result of energy intensity decrease, effect of energy mix was insignificant.
- ❑ Policies that target emissions (not just energy) would accelerate reduction of carbon intensity.



Key Takeaway: Effective but not efficient policies

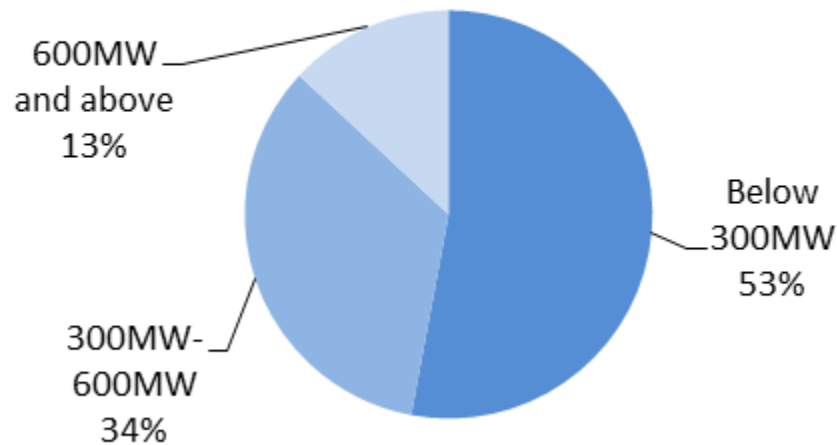
- ❑ The most effective policies were top-down administrative measures such as the target responsibility system.
- ❑ More cost-effective policies are needed to achieve future targets.



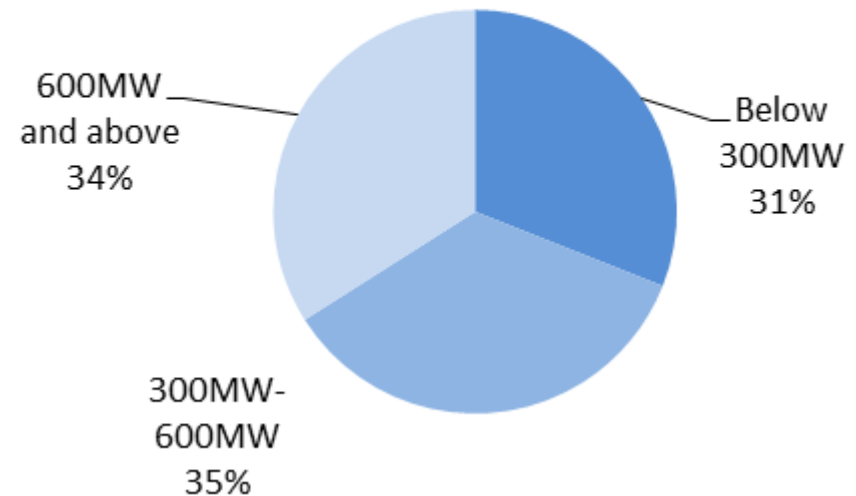
Key Takeaway: Low-hanging fruit picked

Much of the low-hanging fruit for reducing energy intensity has been picked (e.g., small plant closures). Economic structure has improved. Further reductions in energy intensity during the 12th FYP period will be more challenging.

Thermal power units structure in 2005



Thermal power units structure in 2009



12th FYP: Towards A Low Carbon, Green Economy

- A national consensus
- Restructuring of economy
- Emission reduction, not just energy efficiency
- Consumption side management
- Market-based instruments:
 - ETS pilot
 - Energy Performance Contracting
 - Carbon tax
- Coal (energy) consumption cap and trade

Challenges for the 12th FYP

- ❑ GDP growth
- ❑ Structure: Export and Urbanization
- ❑ Technology: International and Domestic R&D and deployment
- ❑ Financing low carbon development
- ❑ Market instruments



Implications for US (and US-China Cooperation)

- ❑ Size of emissions and rate of growth are issues that must be addressed
- ❑ Strong political will and leadership are key to progress
- ❑ Restructuring of economy towards higher value, lower emissions industries could affect US-China economic interactions
- ❑ Emissions from consumption sectors in U.S. and China are of growing concern
- ❑ Opportunity for best-practice sharing in energy, building energy efficiency and other sectors.



Thank you very much for your attention!

