

Sector Approaches: A Case Study for China's Power Generation

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Background of this Presentation

Based on following studies:

- **Application of Sector Based Approach on China's Power Generation Industry**
- **Embedded Energy In Heavily Traded Goods: A Cross Region Comparison**
- **Post-Kyoto Options for China: A road map**
- **GHG Mitigation Potential for key sectors in China**
- **Low Carbon Scenario for China up to 2050**

What is Sector Based Approach: Wide range of definition

Japan Proposal: sector based approach is one way to set up national cap.

IEA, IISD, ECOFYS Proposal: Set up sector based target with various indicators

Other proposals: policy, CDM etc.

Sectoral approaches: Wide range of definitions

(1) Quantitative emissions reduction targets

- National target: Triptych, Multi-sector convergence
- National sectoral target: fixed, dynamic or intensity target
- Trans-national sectoral target: uniform base-level intensity, identical/non-identical % cuts over current emission

(2) Sectoral crediting mechanisms

- No-lose sectoral targets (CCAP 2006)
- Policy-based commitment (Lewis and Diringer 2007)
- Sectoral approaches to CDM
 - Sectoral CDM (Saminiego and Figueres 2002, Cosbey et al. 2005);
 - No-lose countrywide policies and measures CDM (Michaelowa et al. 2003);
 - Policy-based CDM (Ghana and other DCs 2005, Bosi and Ellis 2005)

Sectoral approaches: Broad range of definitions

(3) Technology-based

- Technology R&D agreements (Barret 2003)
- International agreement on energy efficiency (Ninomiya 2003)

(4) Sustainable development (no-crediting mechanisms)

- Harmonized Policies and Measures (PAMs)
- Sustainable Development Policies and Measures (SD-PAMs)

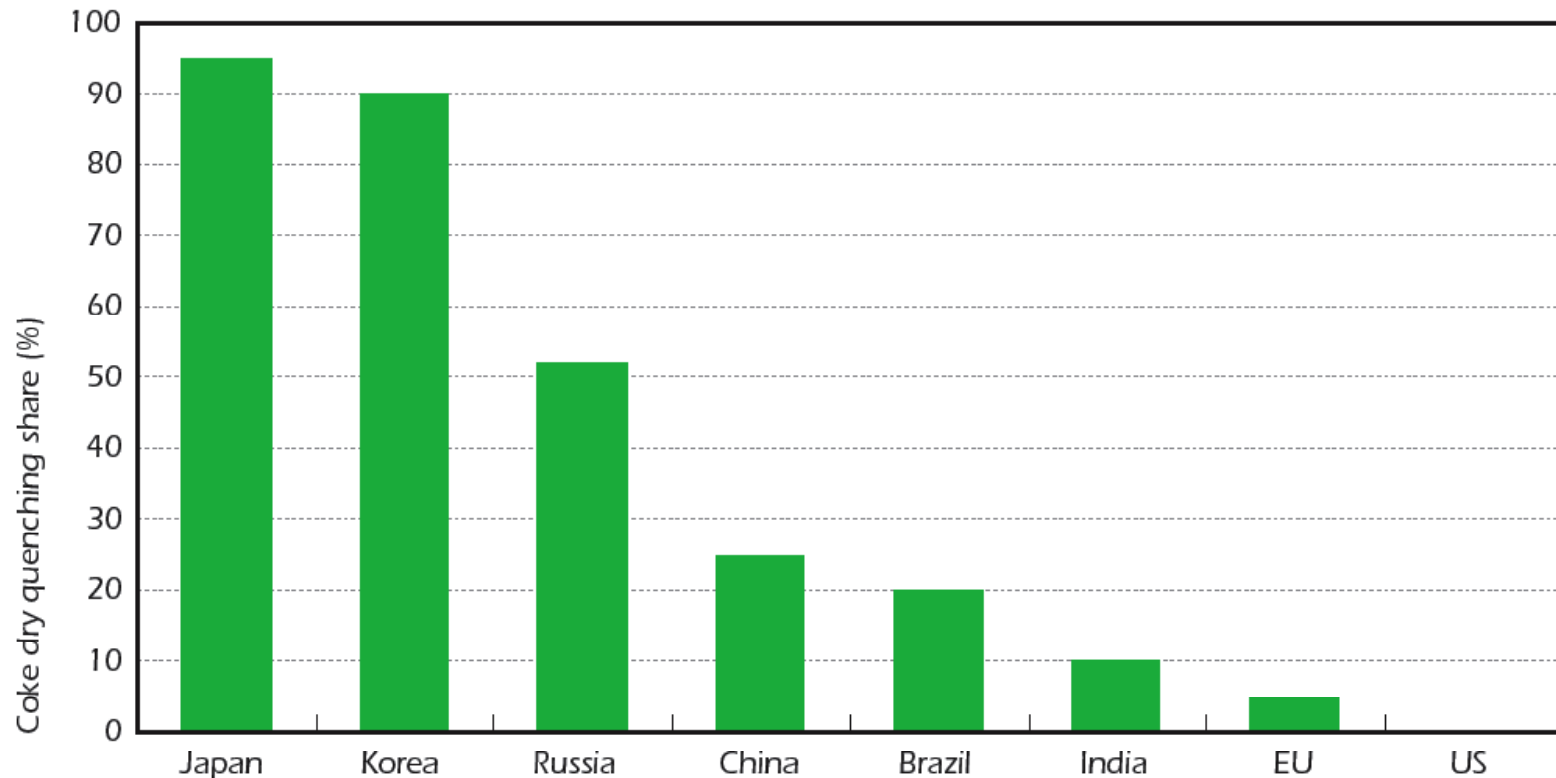
Our definition

Sector based approach is a regime by setting up sector based quantitative reduction target, including emission reduction target, or energy efficiency target.

This is a bottom up approach to realize mitigation potential.

For example, case of Coke Dry Quenching (CDQ)

Global diffusion rate

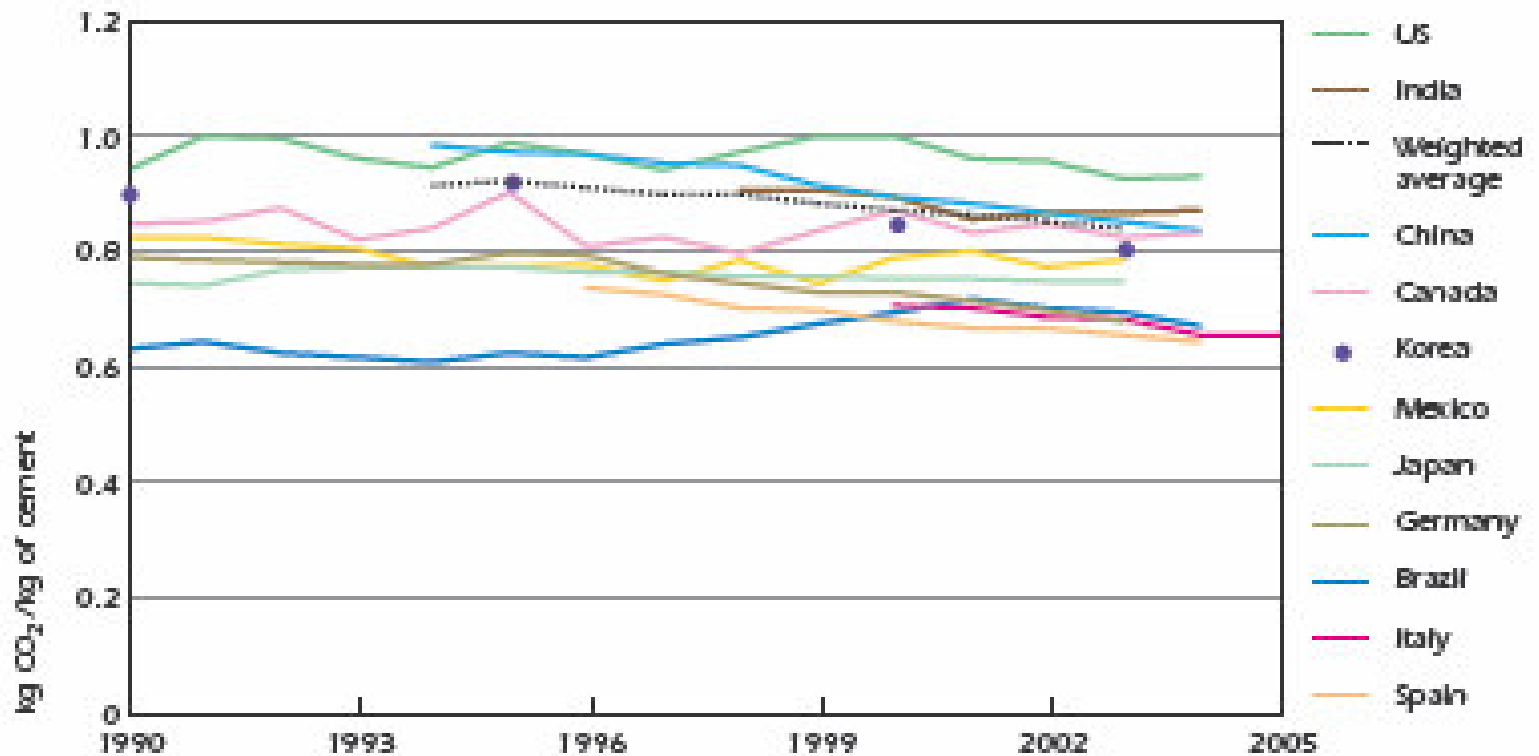


Sources: IISI communication; Institute of Energy Economics Japan (IEEJ) (2006).

Source: IEA (2007) "Tracking Industrial Energy Efficiency and CO₂ Emissions" p.112.

For example, case of Cement

Process and Energy (including electricity) CO₂ Emissions per tonne of Cement by Country, 1990-2005



Note: Includes impact of electricity generation from waste heat in Japan. Boundary definitions may differ by country.

Sources: As for Figures 6.4, 6.5, 6.8 and 6.9; IEA statistics.

Source: IEA (2007) "Tracking Industrial Energy Efficiency and CO₂ Emissions" p.141.

Merits *(from developing country perspective)*

Achieving Sustainable Development:

- Helps to deliver co-benefits by focusing on sectors with more SD benefits, and by engaging agencies besides environmental ministries
- Can improve data accumulation (Sterk and Wittneben 2005)

Simplifying negotiations:

- Easier to agree among small number of key countries
- Easier to agree targets in specific sectors compared to a comprehensive economy-wide target

Broadening the scope of sectors:

- Sectors (e.g., transportation, LULUCF) which are not covered under the Kyoto Protocol and are not suitable for project-based CDM, and important sectors for Asia (e.g., electricity, aluminium) can be covered (IISD 2005)
- Cement and electricity have high relevance to Asia (IEA 2007)

Reducing transaction costs:

- As compared with project-based approach

Demerits

Sectoral approaches do not necessarily reduce emission under growing economy

Differences of approaches in each country add to confusion

- EU: Sectoral absolute target based on NAP of EU ETS
- US: Voluntary industry action
- Japan: Keidanren's Voluntary Action Plan

Even among the same sectors, interests and target level is different between big and small industries

Free rider and leakage problems for non-participants

Concern for inflation of credits in case of crediting

Indicators for targets

- Unit energy use per output, ex energy use per ton of steel
- Penetration rate of advanced technologies, ex. Share of CDQ
- Sector emission targets
- Sector policies: comparable among countries

Different in setting up target between DC&DD

- Developed countries(DD) set up target with best practice, such as top-runner program in Japan
- Developing countries(DC) set up lower target, such as no-regret target, or world average
- Can join Emission Trading
- DC and get financial support

Proposed sectors/products

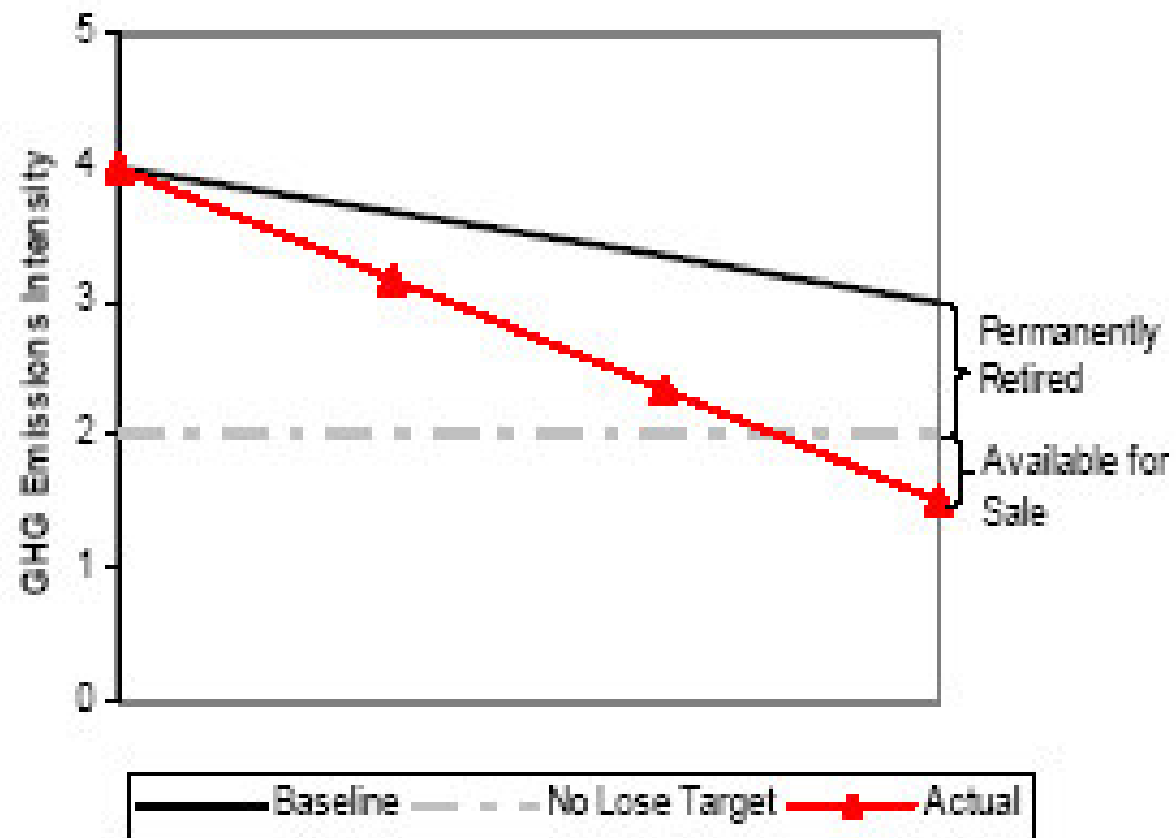
Energy intensive industries:

- Steel, cement, aluminum, copper, zinc&lead, ammonia, ethylene, paper and pulp, textile

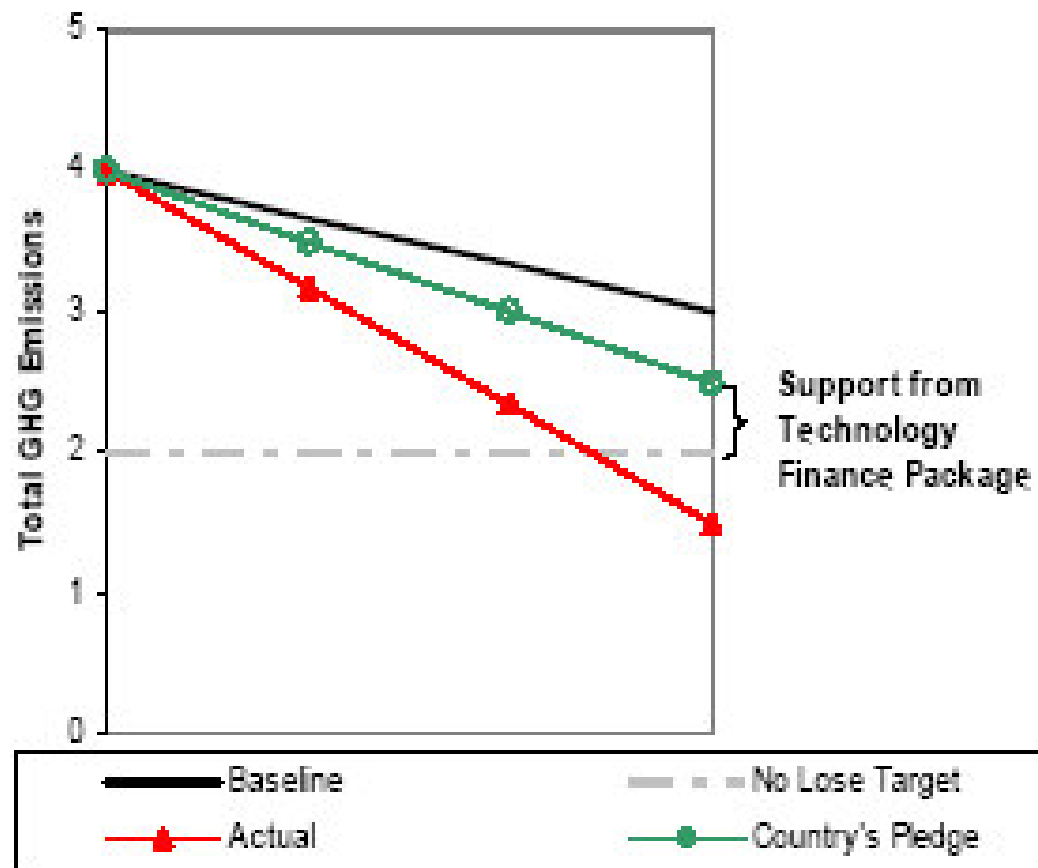
Energy Industry:

- Power generation
- Heat supply

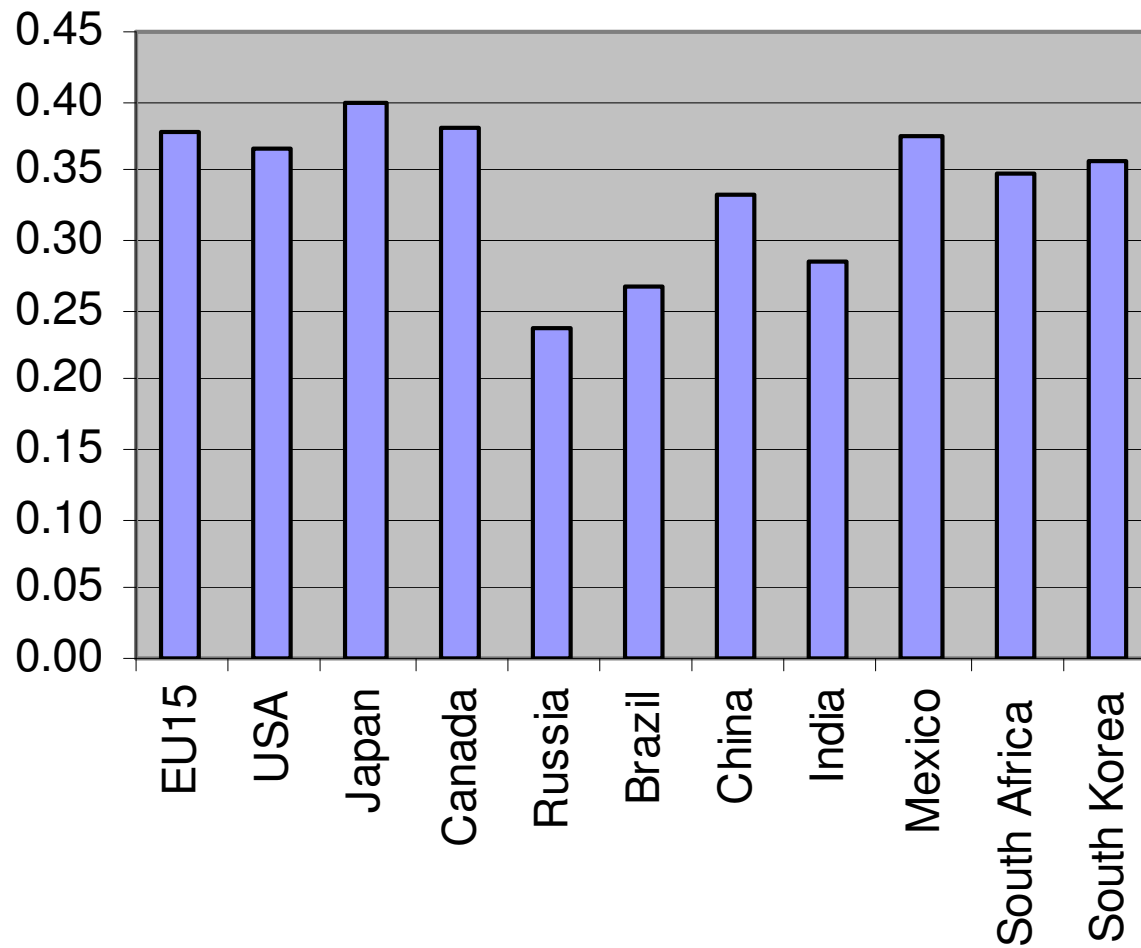
Joining ET



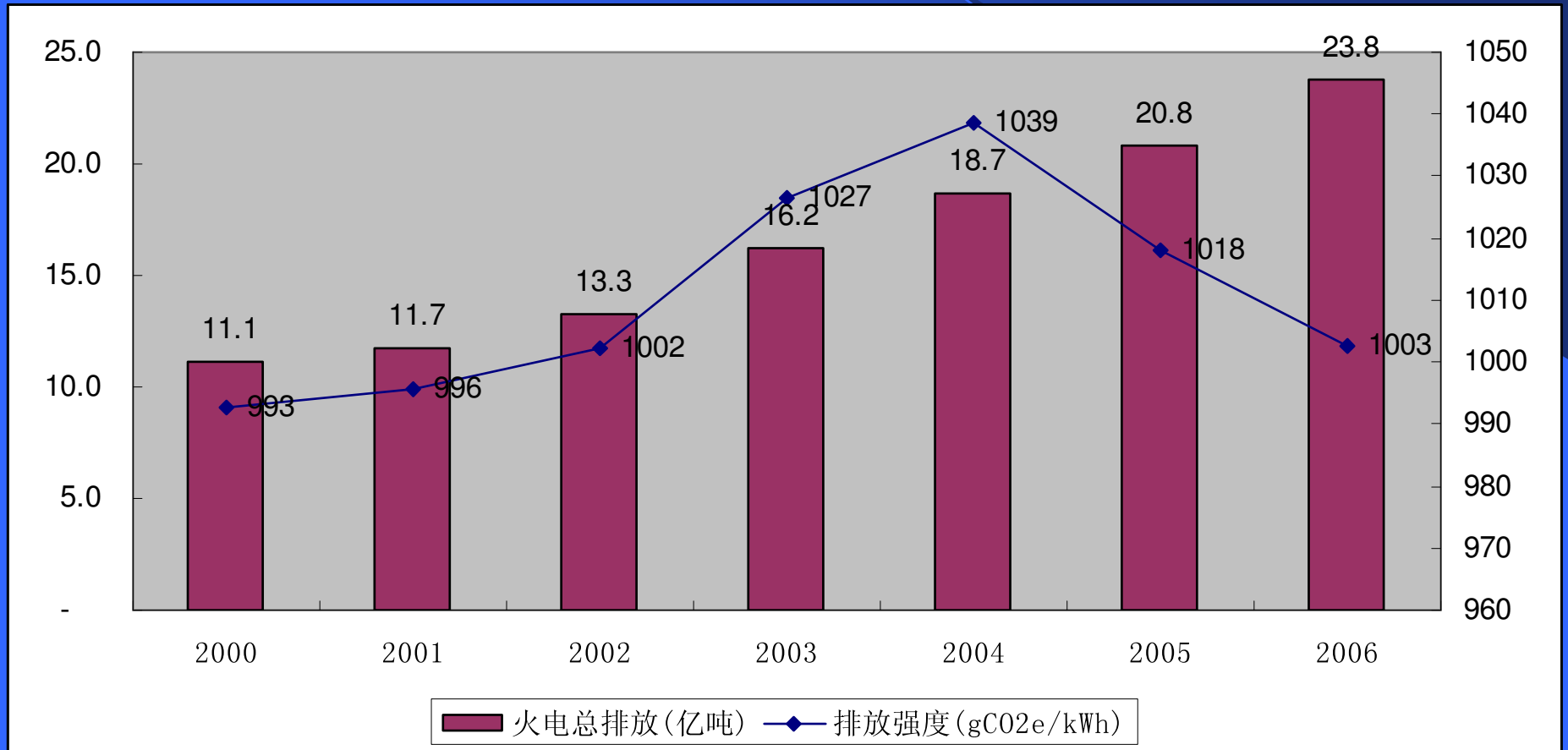
Financial support



Generation efficiency coal



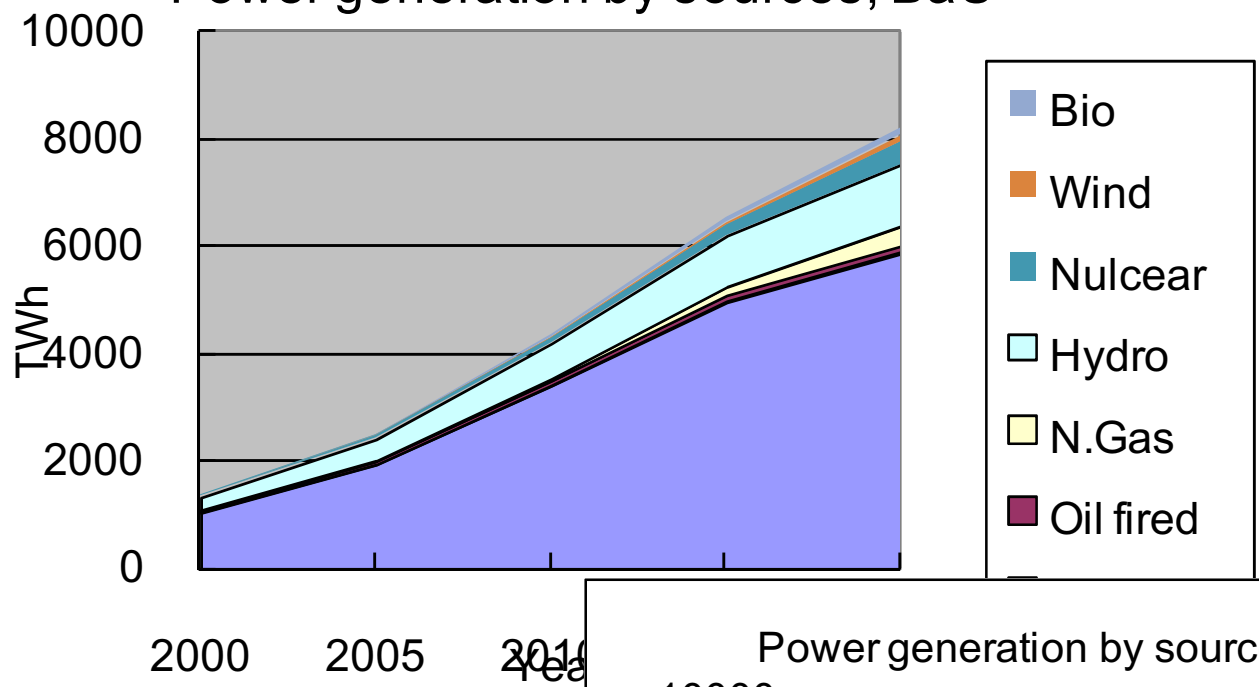
CO2 emission in China's power generation, 10⁸t-CO₂, gCO₂/kWh



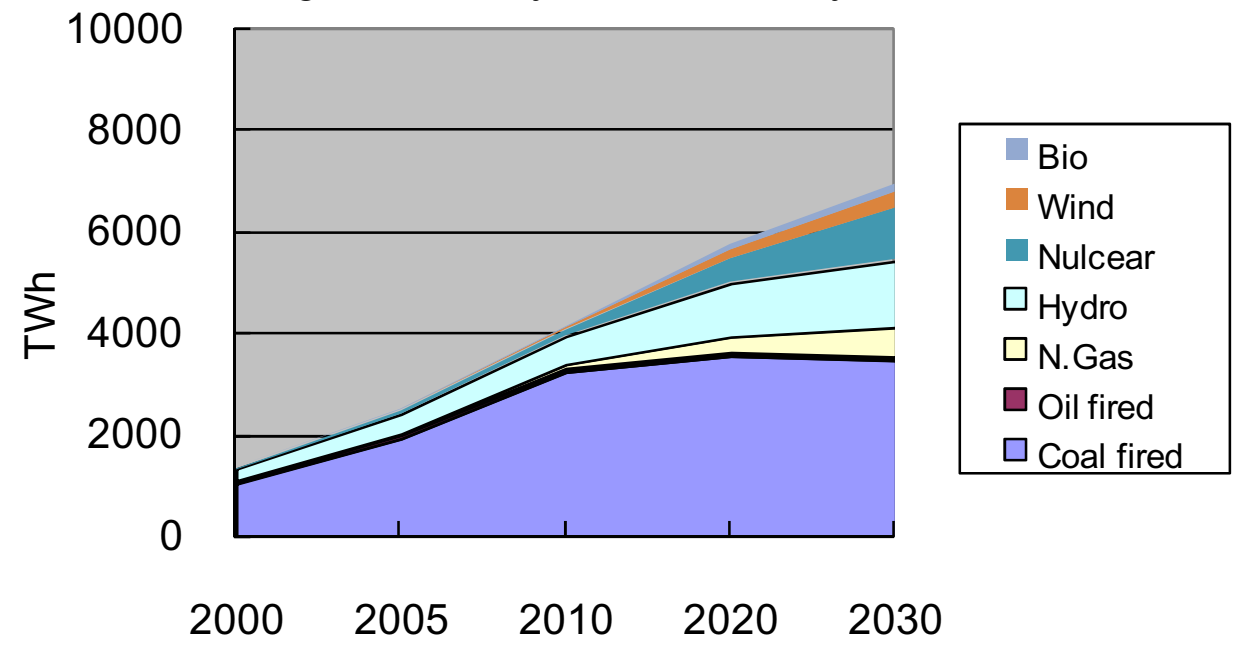
Coal fired power generation technologies factors

Technology	Statuses	Effi.	Coal use (gce/kWh)	Emission (gCO _{2e} /kWh)	Installed Capacity in 2006
Small Coal		30%	410	1138	17000
Low para. Of sub-critical	Major component	35%	351	976	15300
High para. Of sub-	Major component	39%	315	876	6970
CFBC	Commer./Demons.	Around 40%	Around 300	Around 850	30
PFBC	Demons.	Around 45%	Around 273	Around 759	1.5
Low para. Of super critical	Commer.	40%	307	854	3780
High para. Of super	Commer.	42%	293	814	
Ultra-super critical	Commer./Demons.	43%	286	795	300
IGCC low para.	Demons.	45%	273	759	0
IGCC high para.	Demons.	55%	223	621	0
Coal as		34%	364	1011	43400

Power generation by sources, BaU



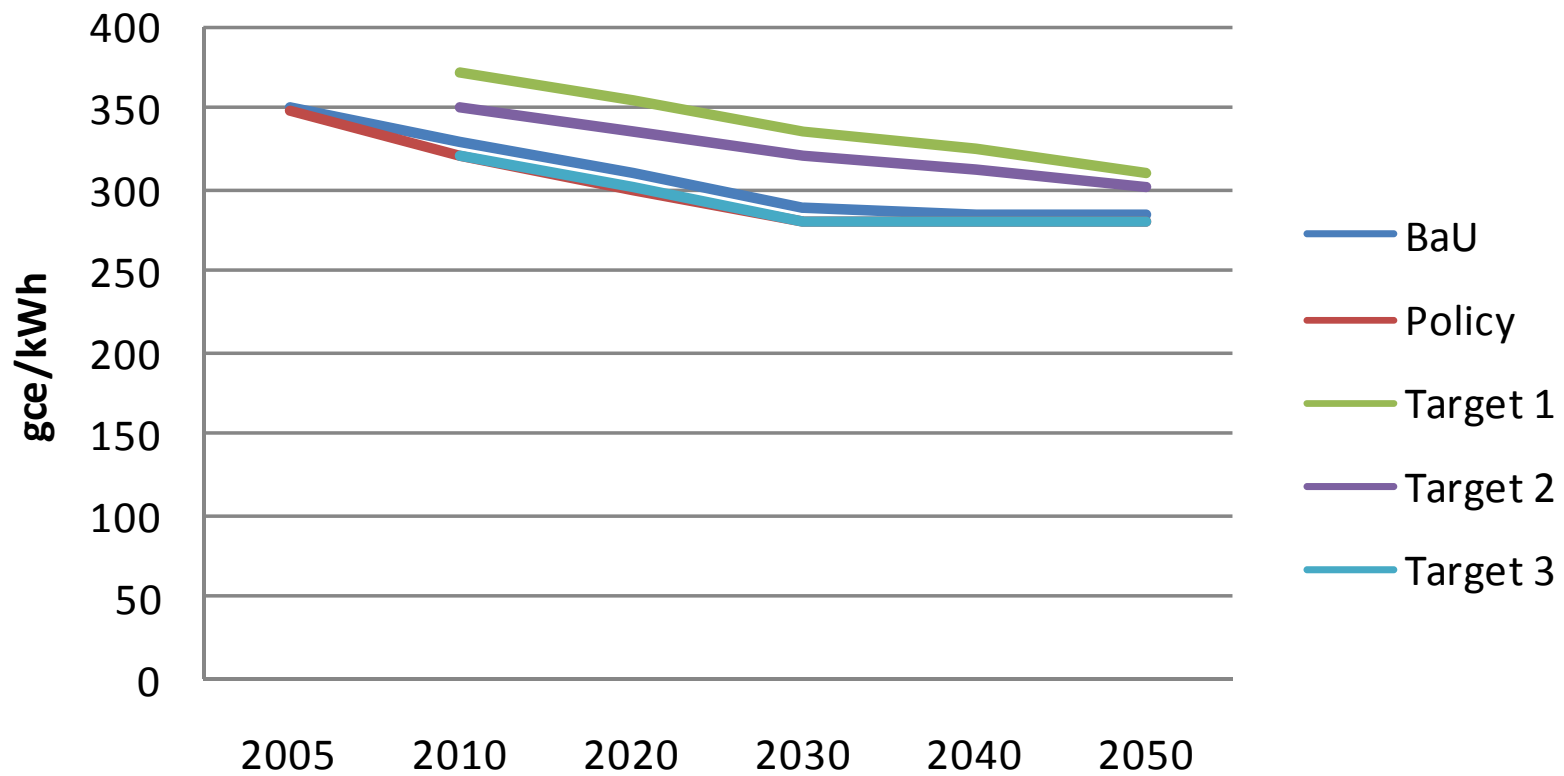
Power generation by sources, Policy Scenario



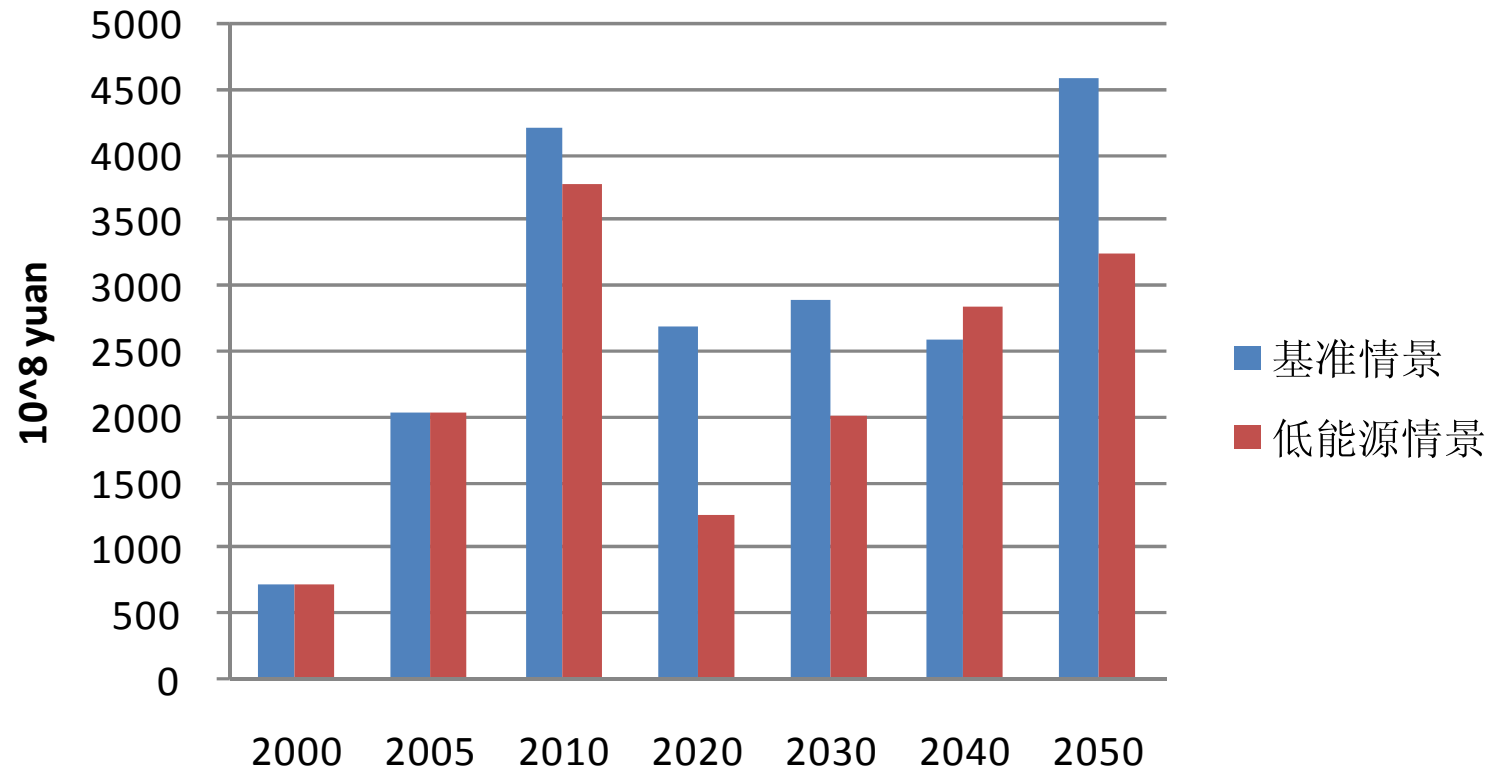
Targets

- Target 1: Take global average
- Target 2: Take average of developed countries 10 years ago
- Target 3: best effort of China

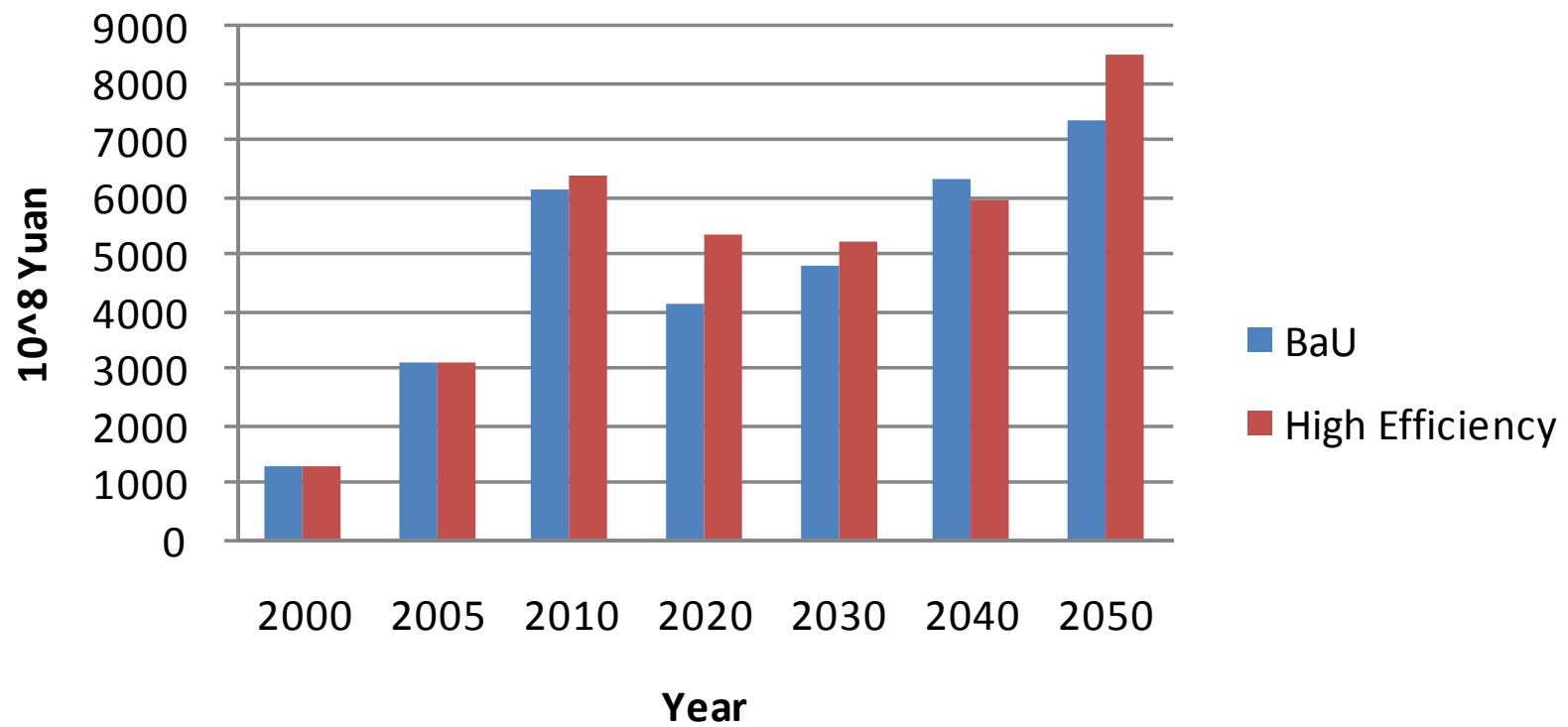
Energy use compaision



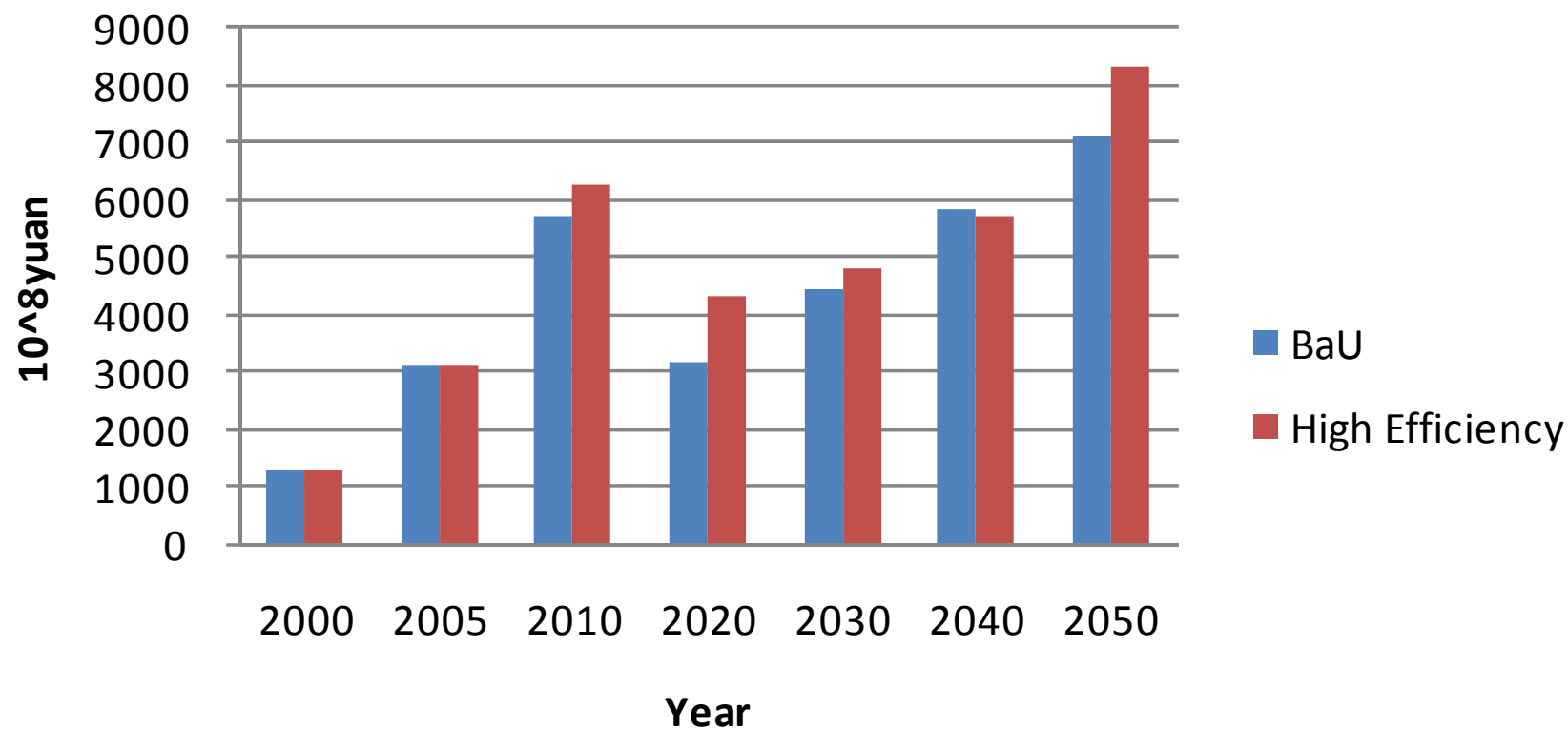
Investment On Fossil Fuel Power Generation



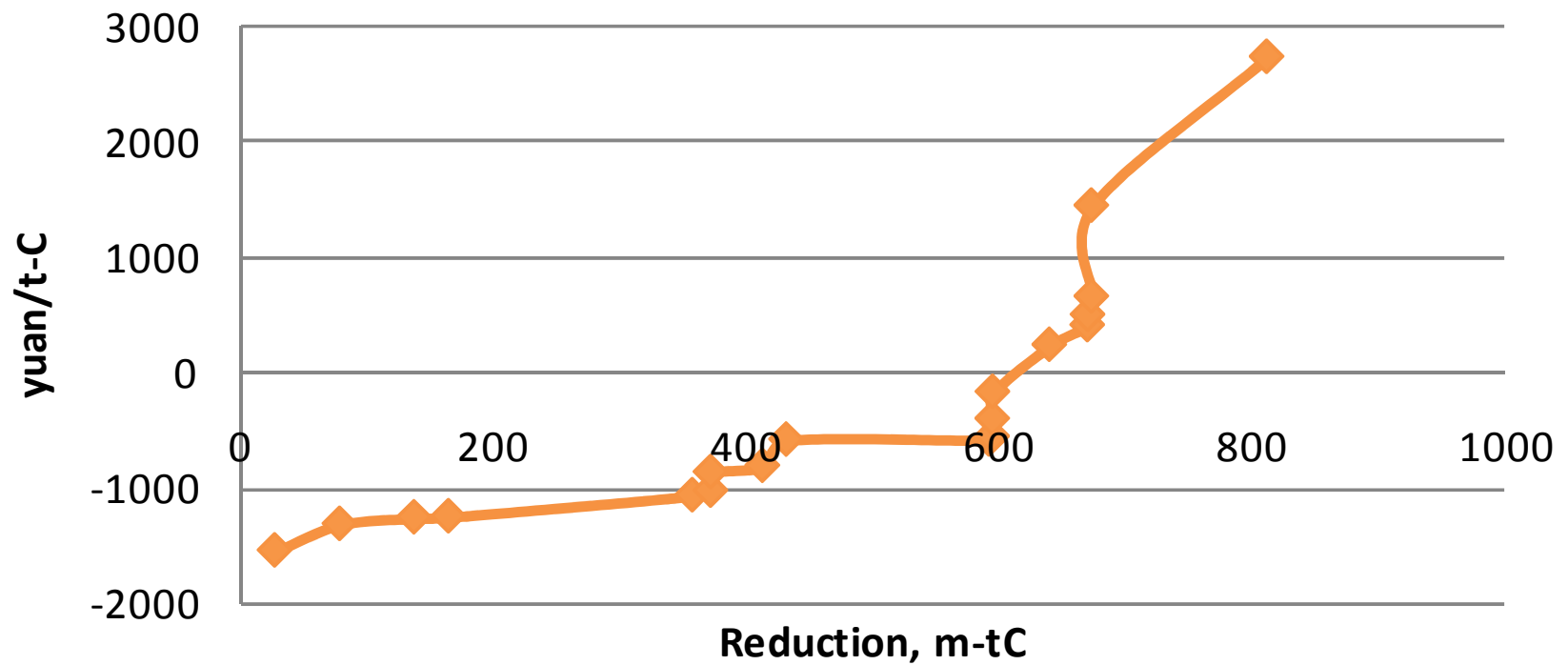
Investment on fossil fuel power generation in BaU electricity demand



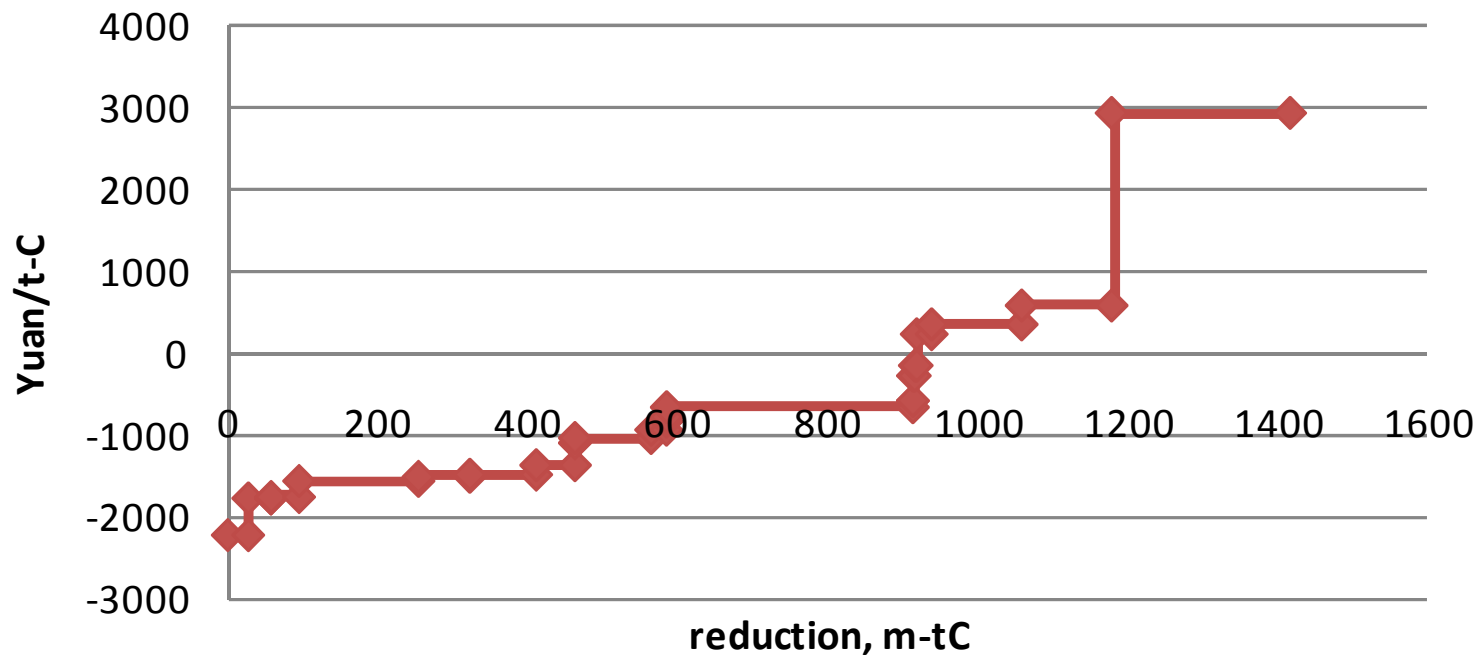
Investment on fossil fuel power generation in BaU electricity demand



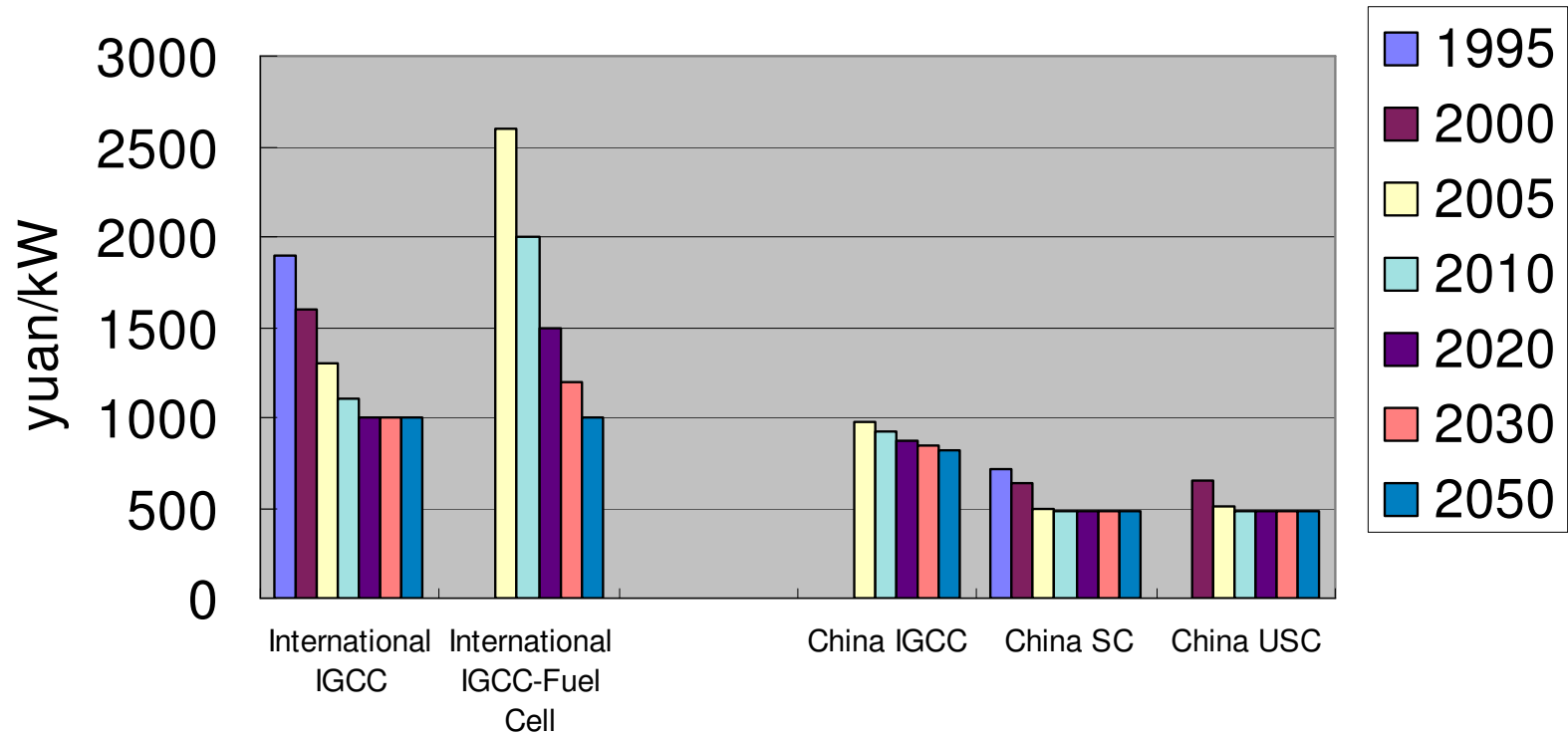
Cost curve for power generation in China, 2030



Cost curve in power generation in China, 2050



Fixed Unit Investment



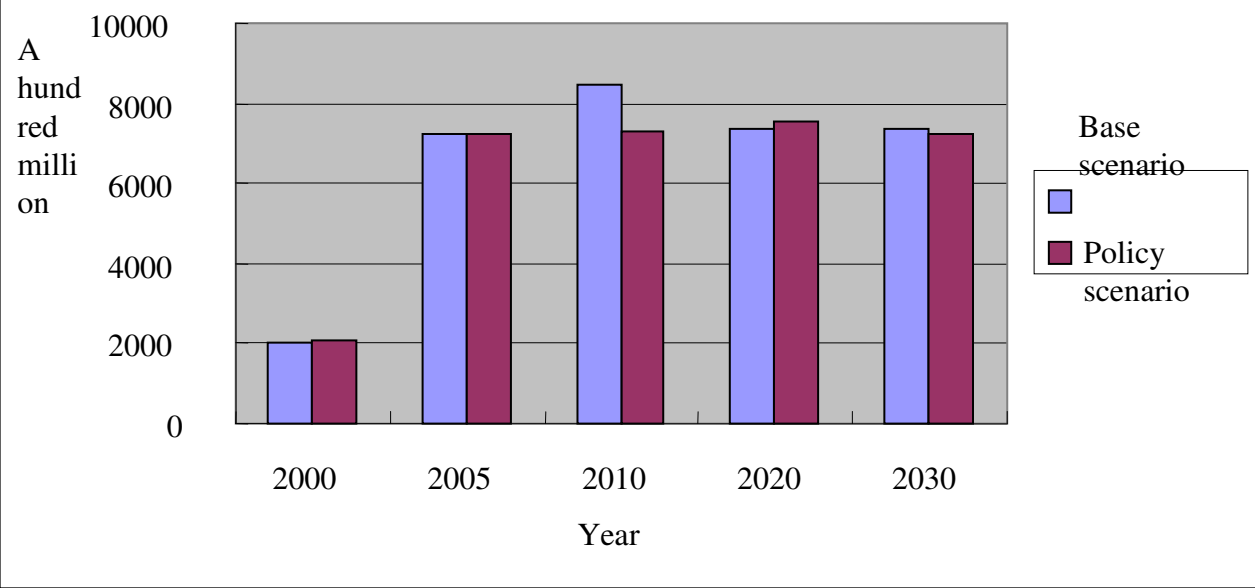
GDP and Its Growth Rate Projection in China from 2000 to 2030

		2000	2005	2010	2020	2030
Low Economic Growth	GDP, billion Yuan	9800	18395.6	28827.1	59413.5	106401
	Billion \$, by exchange rate	1195	2271	3744	7716	13818
	Billion \$, by PPP		9349	14650	30195	54075
	Growth rate, %		9.48	7.6	6.7	5.4
Structure	Primary industry	16.4	12.4	11	9	8
	Secondary industry	50.2	47.3	49	47	45
	Tertiary industry	33.4	40.3	40	44	47
High Economic Growth	GDP, billion Yuan	9800	18395.6	29091.5	63390.4	123538
	Billion \$, by exchange rate	1195	2271	3778	8233	16044
	Billion \$, by PPP		9349	14785	32216	62784
	Growth rate, %		9.48	9.6	8.1	6.9
Structure	Primary industry	16.4	12.4	11	9	7
	Secondary industry	50.2	47.3	51.5	50	45
	Tertiary industry	33.4	40.3	36	40	48

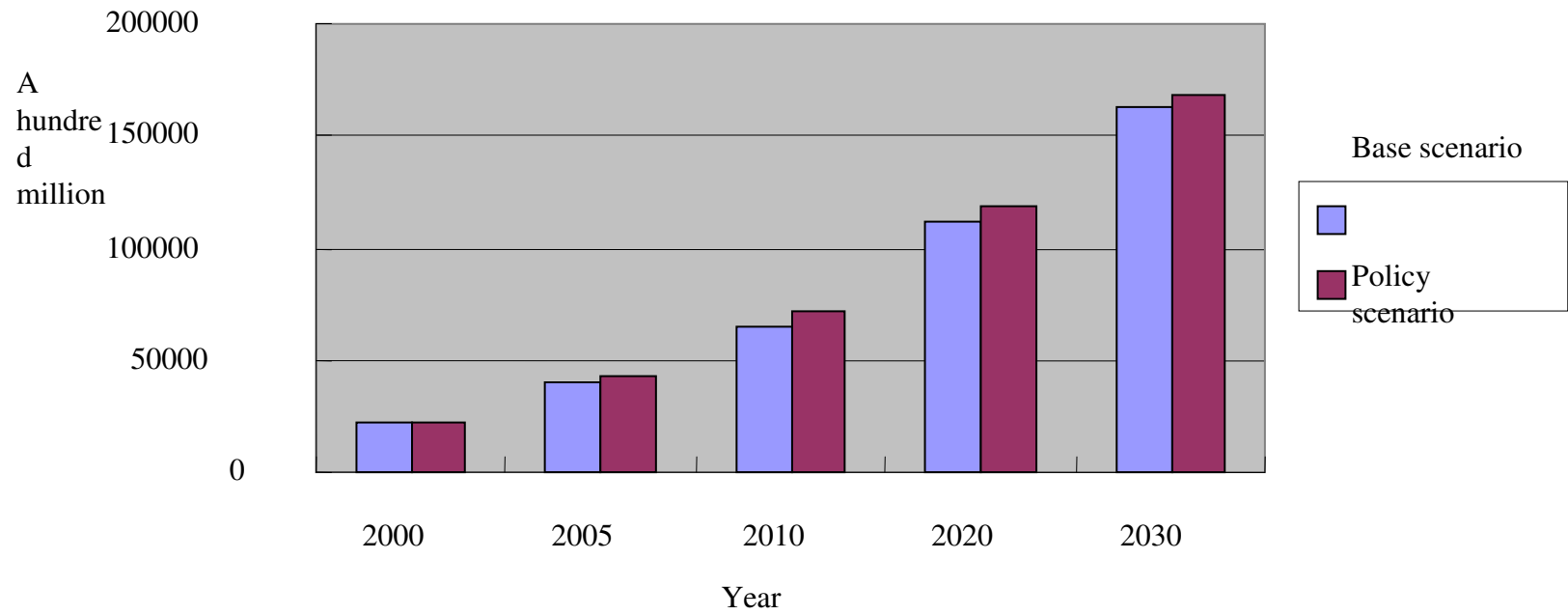
China's GDP Per Capita Projection

		2000	2005	2010	2020	2030
Low Economic Growth	Yuan	7632	14064	20665	40009	71219
	\$, by exchange rate	927	1780	2684	5196	9249
	\$, by PPP	3879	7148	10502	20333	36195
High Economic Growth	Yuan	7632	14064	20854	42687	82689
	\$, by exchange rate	927	1780	2708	5544	10739
	\$, by PPP	3879	7148	10598	21694	42024

Investment Demand of Energy Industry



National Energy Expenses



Climate and Development

China has established national policies to promote creating an innovative country. The development of new technology to prevent climate change is the same as key technology listed in the national technology development program. Because global manufacturing is moving to China, and because there is more financial support for new technology development driven by the growth of national economy ability, there is greater opportunity to realize the goal of an innovative country. China has already marched into the world front row in the field of advanced coal electricity generation technology.

Low Carbon Scenarios(LCS)

If comparing with existing policies for China to reach 20% energy intensity reduction target in 11th Five Year Plan, low carbon policies is not much new in the area of energy. Very few policies are necessary for LCS China which is outside te policy package nowadays, such as carbon tax, CCS. But now carbon tax is getting to be one of topics for policy making, and China is also working much on CCS.



Chinese Made Green Car

Paper and Reports

- Energy and Emission Scenarios for China 2030
- Energy and Emission Scenarios 2050
- Clean Coal Technology Development Perspective in China
- Embedded Carbon in Traded Goods
- Energy Efficiency Improvement in China
- Low Carbon Scenario for China up to 2050
- Opportunities for China in Climate Change Action
- Application of Sector Based Approach in China's Power Generation Sector
- Embedded Carbon in Heavily Traded Goods: Comparison Among Regions
- China's Energy Technology R&D: ready in frontier?