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Development of China Carbon Emission Scenarios toward 2050

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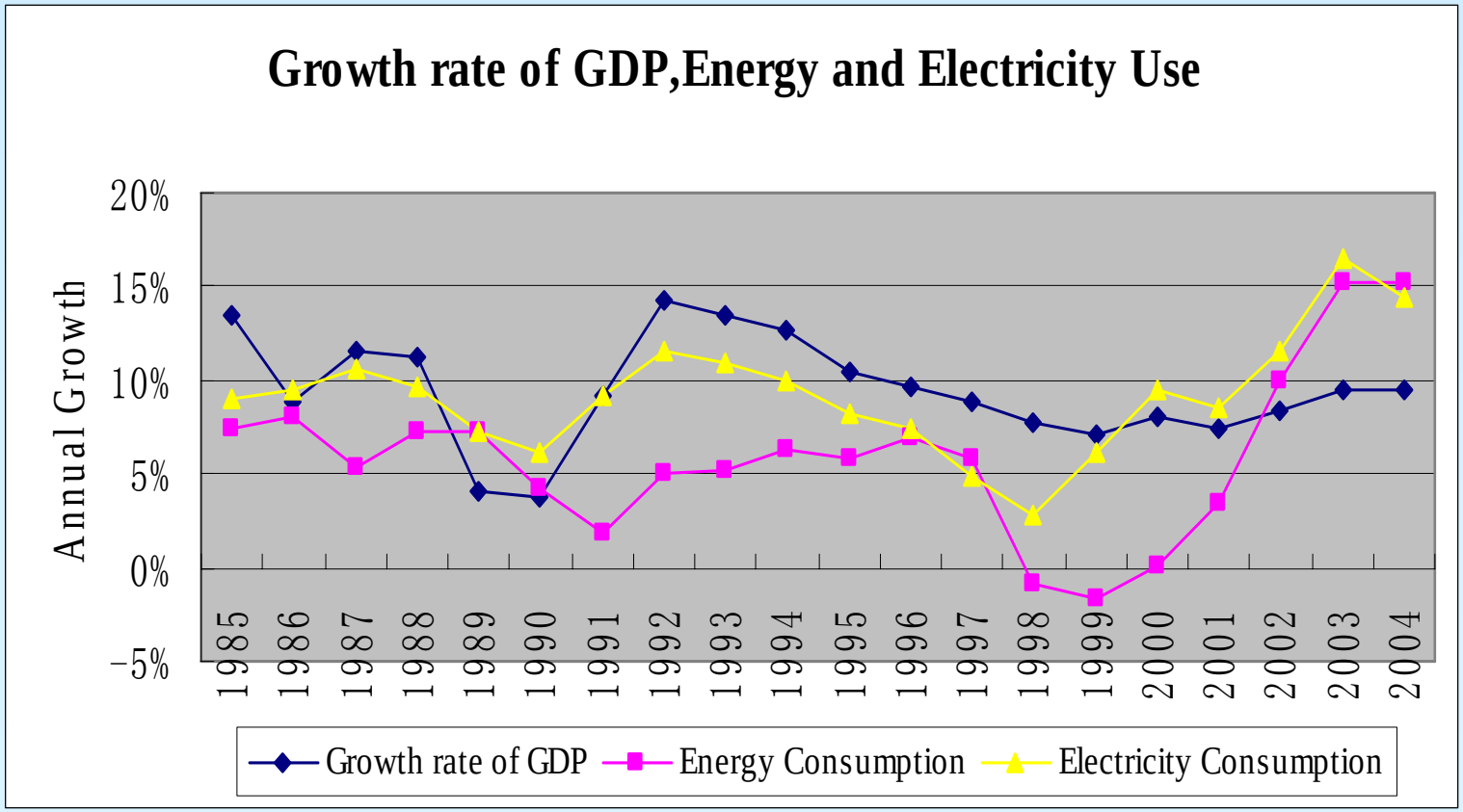
Background

- China is a developing country with high population and relatively low economy development level as a whole.
- Along with the rapid increase of economy, the energy demand grows very fast as well.
- The urbanization process has speed up, but the labor quality is still low and the employment pressure is very high
- The energy resource of China is dominated by coal, while oil shows a increase dependence on import and the exploitation and utilization of renewable and clean energy are still difficult.
- The technologies of energy transformation and utilization are still backward. The energy efficiency is low and the energy-saving potential is large.
- The ecological environment is vulnerable and it is still a big challenge to solve energy-related environment problems and reduce the greenhouse gas emission

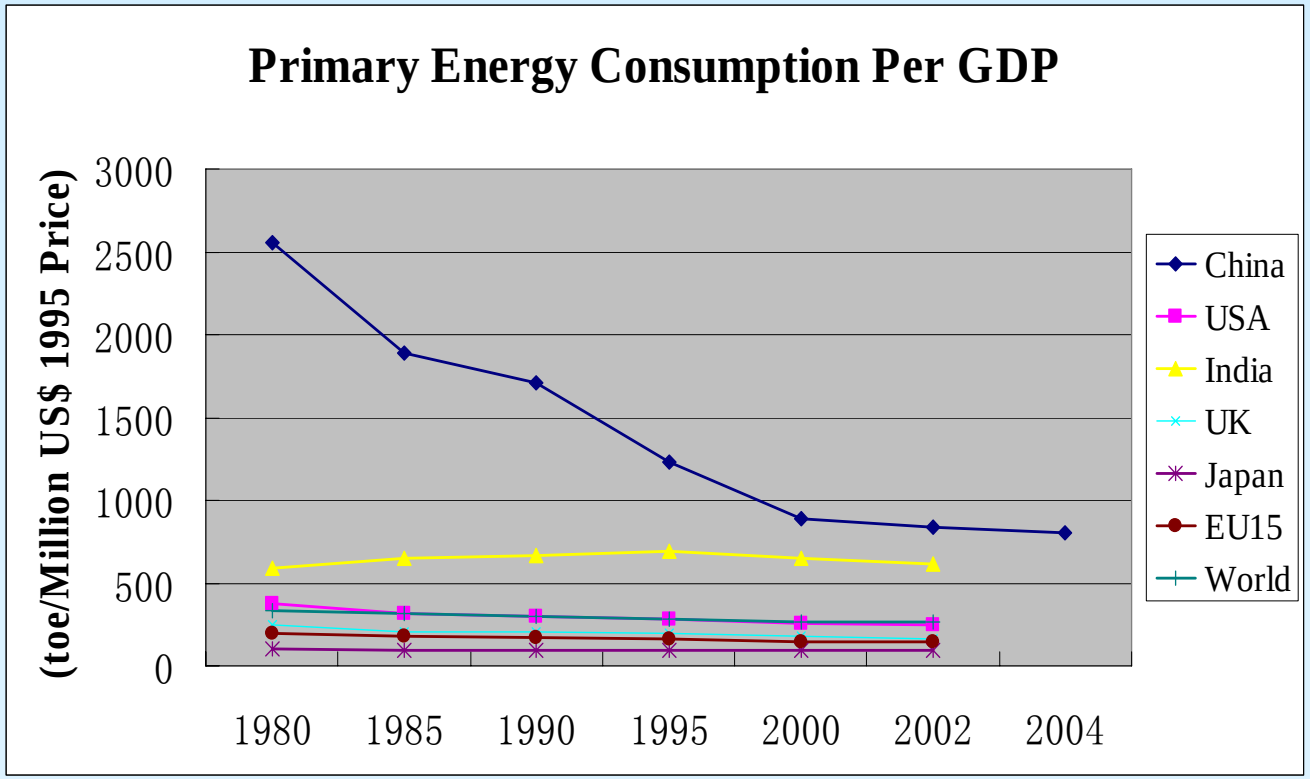
Characteristics of Energy Consumption in China

Energy consumption growing faster than GDP after 2001

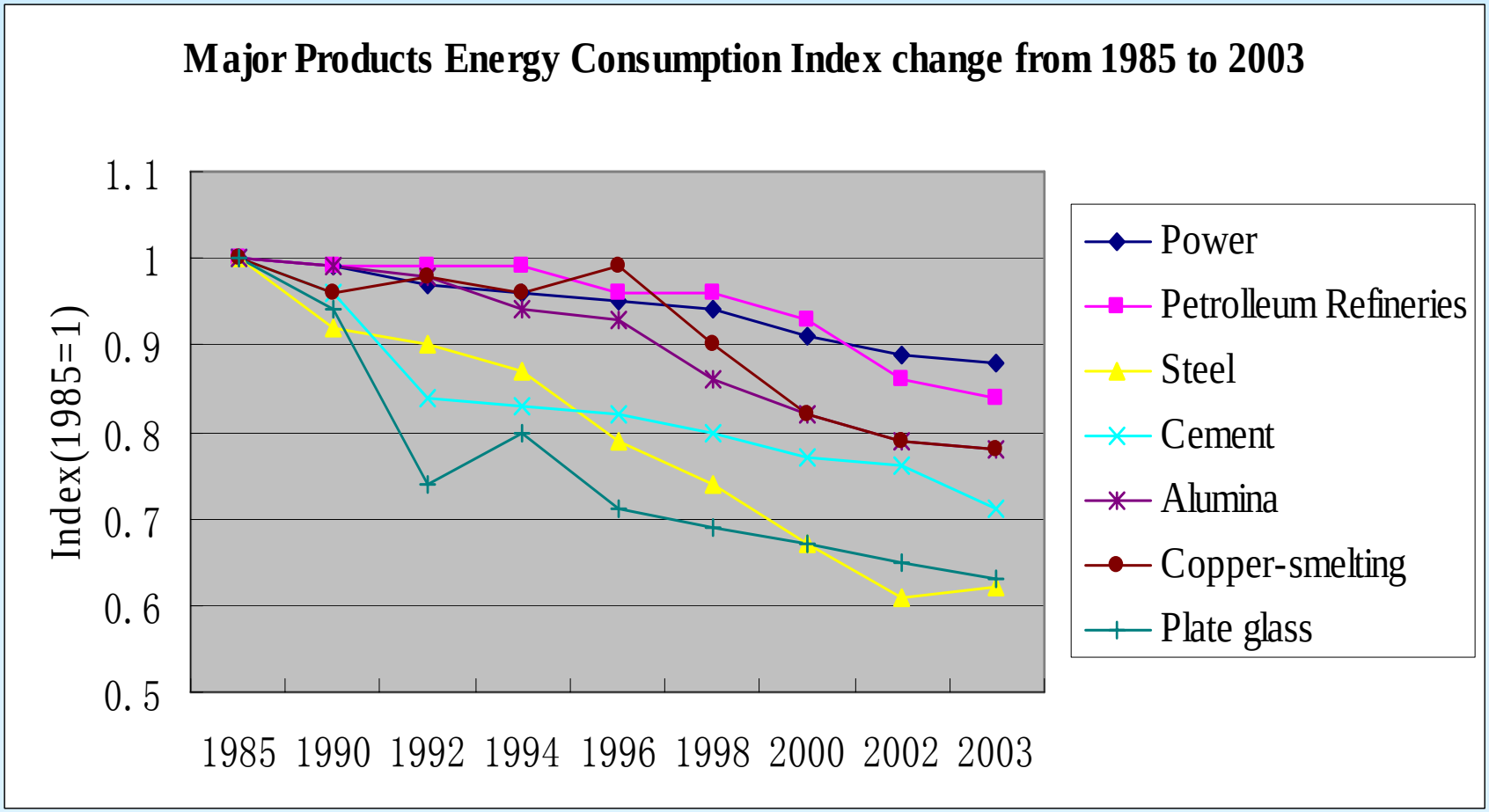


China's GDP Energy Intensity from 1980 to 2004

- GDP energy intensity is 837 toe/Million US$ for China in 2002, 3.19 times More than that of average world level, 3.35, 5.65, 9.3 and 1.35 times more than That UAS,EU,Japan and India.
- Energy conservation rate: 4.71% from 1980-2004
  5.14% from 1980-2000
  2.54% from 2000-2004



Energy-Efficiency of Energy Intensive Industries in China



Energy-Efficiency of Energy Intensive Industries in China

Energy Consumption Indicators of Major Products

	1990	2000	2004	Annual average descend rate	Differences than advanced world level
Power (gce/kWh)	427	392	379	0.95%	21.50%
Steel (kgce/t)	997	784	705	2.44%	15.60%
Cement (kgce/t)	201.1	181	157	1.75%	23.60%
Ethylene (kgce/t)	1580	1125	1004	3.19%	59%
Plate glass (kgce/wt.case)	34.8	30	26	2.10%	31%

Energy-Efficiency of Building Sector in China

- From 1994 to 2004, the building area increase, from 32.6 billion m^2 to 42.0 billion m^2,with an annually increasing rate of 29%. Since 2000, annual increased area has attained to 1.2-1.6 billion m^2

- In 2003, the energy consumption of building commodity is 376 Mtce, accounting for 31% of energy end us, which is approaching to the ratio of developed countries.

- The living area accounts for above 60% of total area and the energy use for heating, conditioning and lighting account for about 75% of building energy use. The energy use per unit area heating is about 2-3 higher times as that of developed countries with same climate condition.

Energy-Efficiency of Transportation Sector China

- Fuel economy level of motor vehicles was 25% lower than that of Europe, 20% lower than that of Japan, 10% lower than the overall level in the United States.
- Oil consumption per 100t-km of freight vehicle was 7.6L, more than double the amount for foreign advanced levels.
- Practical Oil consumption of motor vehicles practical was 30% higher than that of demarcated level.
- Oil consumption level of vessels for inland river transportation was 10-20% higher than that of foreign advanced level vessels.

Development strategies and energy-saving goals for China

In the next decades, China will

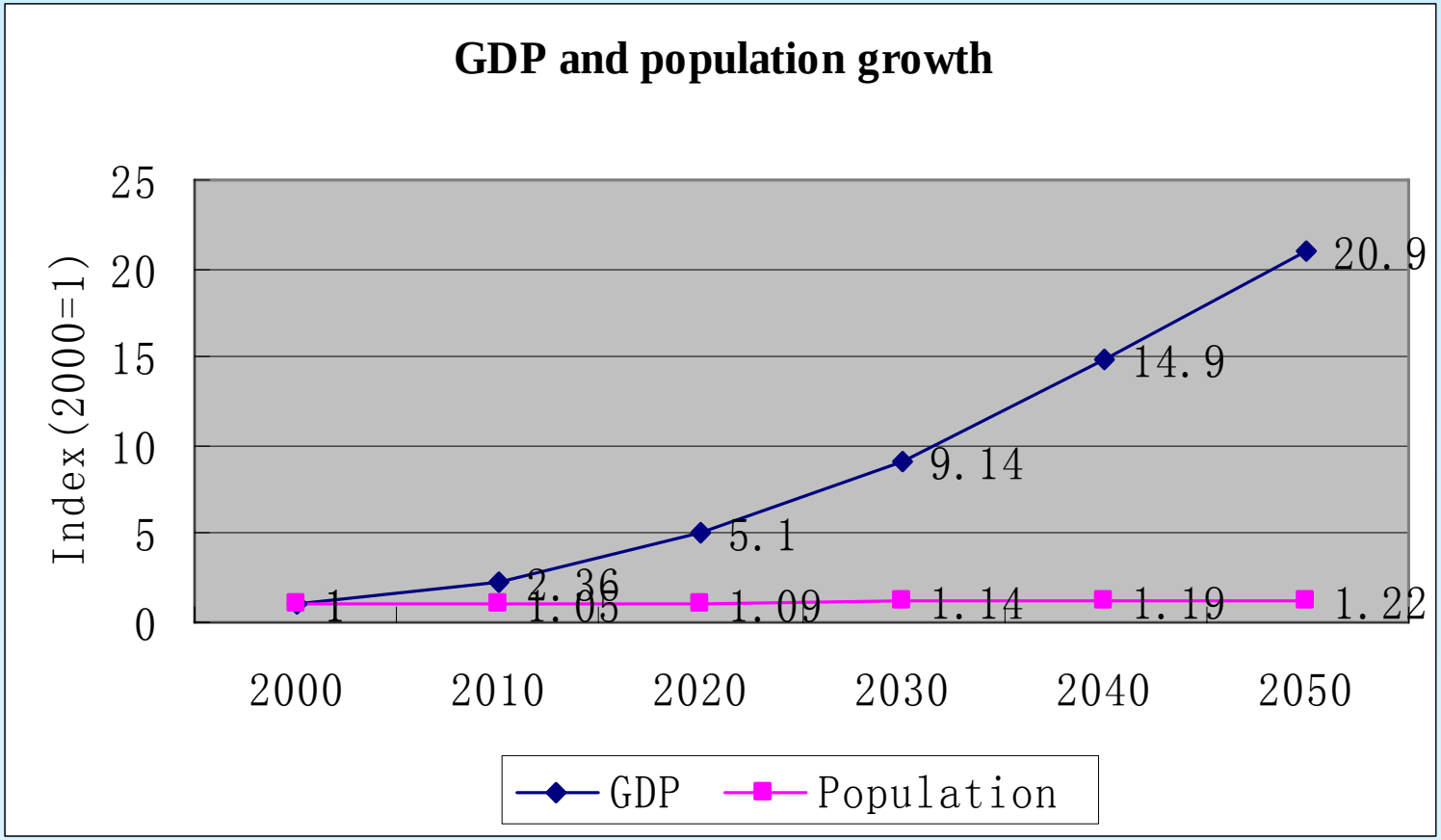
- Change the mode of economy development, insist on a economical, clean and secure development and achieve the sustainable development.
- Speed up the process of economy structure adjustment and urbanization and promote the coordinate development of urban and rural area.
- Achieve a multiple supply of energy and vigorously develop and utilize the new and renewable energy
- Promote the technology innovation, increase the energy utilization efficiency and increase the labor quality and self-innovation ability.
- Change the consumption style, develop the circular economy, and construct a saving society.
- Enhance the international cooperation, learn the international experiences and establish and improve the policy scheme
- Improve the environment and control the greenhouse gas emission

Development strategies and energy-saving goals for China

- 2000-2020: The Chinese government formulates the society and economy development goal for “eleventh-five-year-plan” period, i.e., the annual increase rate of GDP will maintain 8% from 2005 to 2020; the GDP per capita will double from 2000 to 2010; the per GDP energy consumption will decrease by 20% from 2005 to 2010

- 2020-2050: The annual GDP increase rate will be around 5%. The energy saving will be strengthened with an annual energy-saving rate of 3%. The clean energy technologies will be utilized broadly, the energy security will be ensured and the sustainable development will be achieved.

Economic Growth and Population in 2050

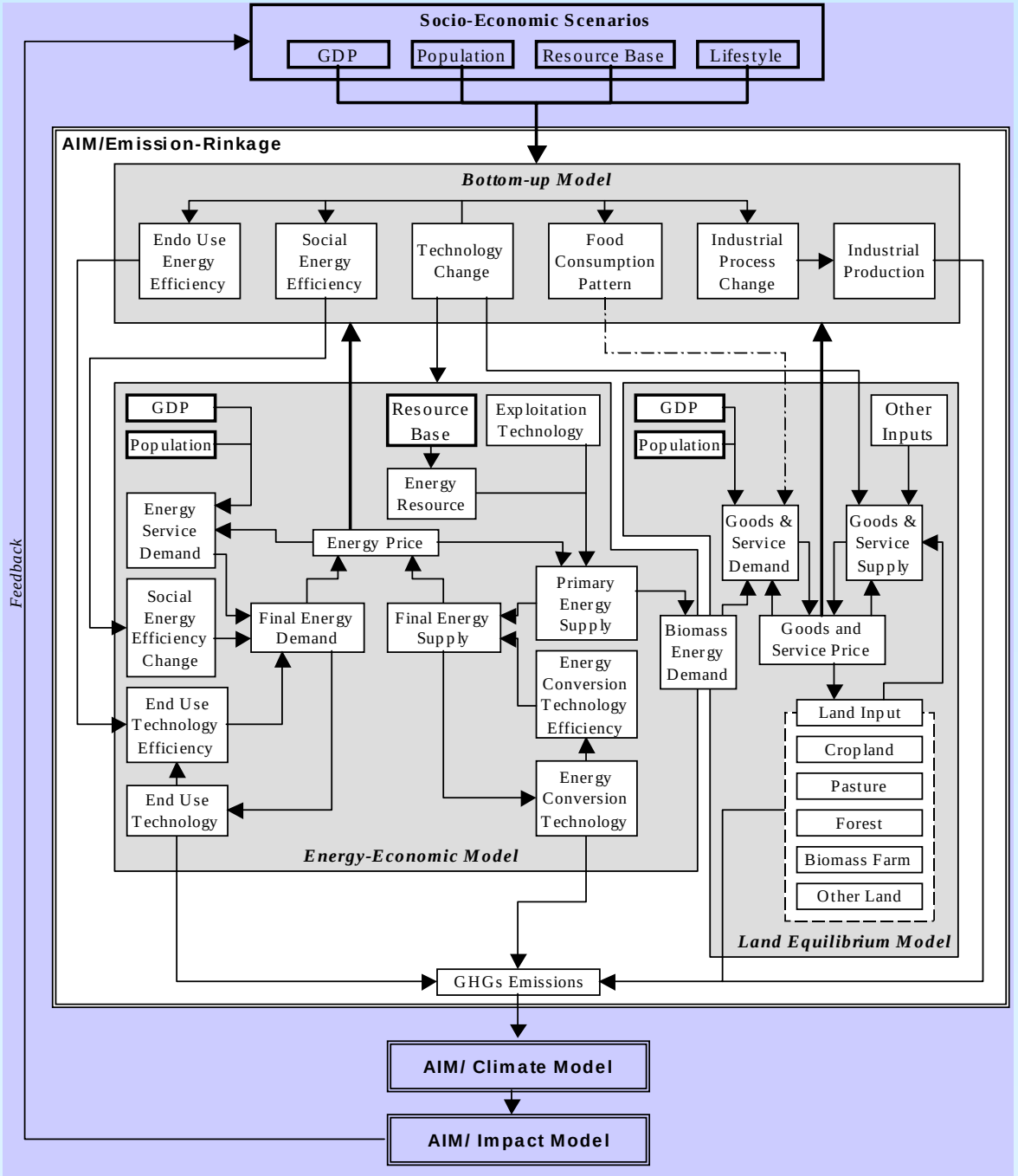


	2000	2010	2020	2030	2040	2050
GDP growth rate %		8.6	8	6.5	5	3.5

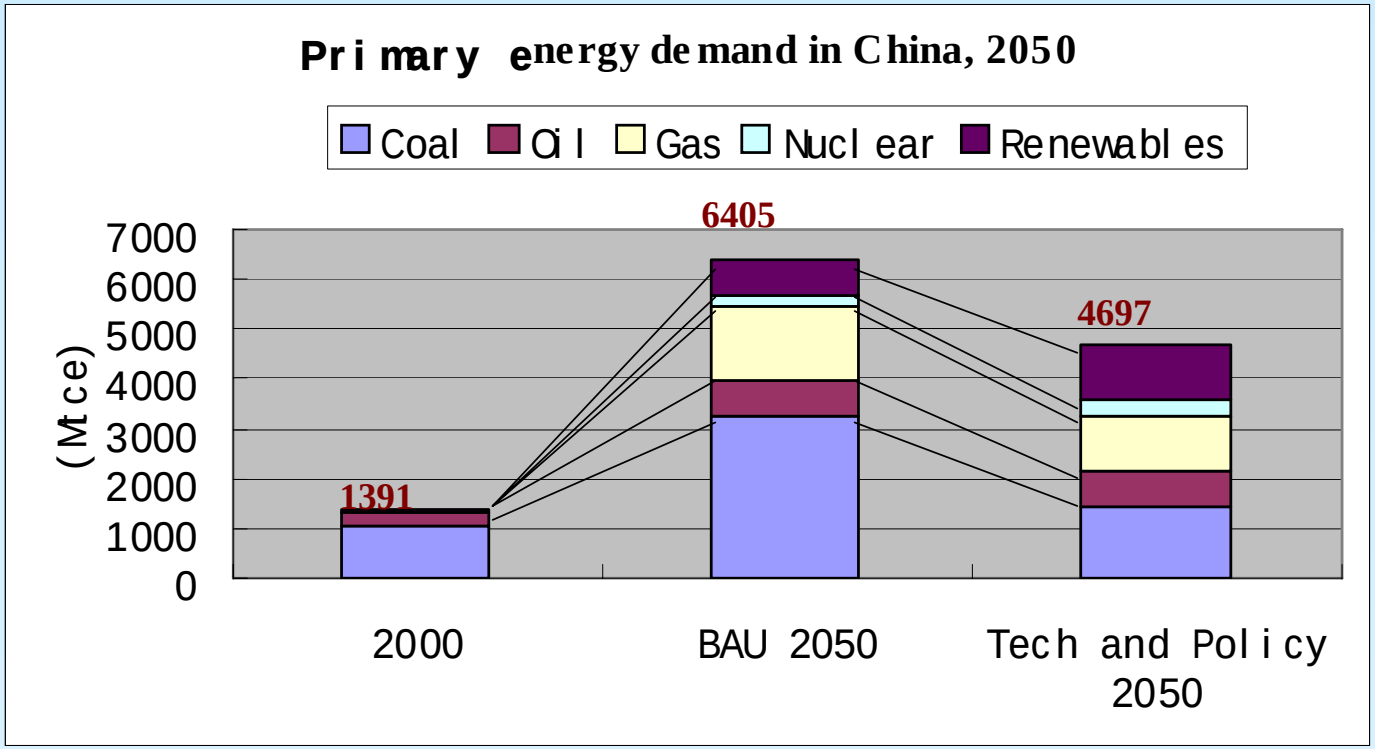
Energy demand and technology options (BAU and Policy scenario)

Options	Sector/options	Baseline scenario	Policy and technology scenario
Enhanced Energy Saving	Energy Intensive Products	Annual average energy saving rate 2.7%	Annual average energy saving rate 3.6%
	Building	Annual average energy saving rate 1.9%	Annual average energy saving rate 3.0%
	Transport	Annual average energy saving rate 1.5%	Annual average energy saving rate 2.8%
Renewable energy	Biomass	Annual average reduction rate of cost by 3.7%	Annual average reduction rate of cost by 5.9%
	Hydro	65% of technical potential by 2050	80% of technical potential by 2050
	Solar/wind	0.7yuan/kWh by 2050	0.5Yuan/kWh by 2050
Carbon Capture and Sequestration	Coal fired power plants	4% by 2050	15% by 2050
	Industry	1% by 2050	5% by 2050
Clean coal technology	Power generation	7% by 2050	35% by 2050
	Industry	5% by 2050	15% by 2050
Hydrogen	Power generation	Distributed power generation system by 3% in 2050	Distributed power generation system by 8% in 2050
	Transport	Fuel cell vehicle 5%	Fuel cell vehicle 15%
Transport	Vehicle	Hybrid vehicle diffusion start from 2010, 10% by 2030	Hybrid vehicle diffusion start from 2010, 70% by 2040
Policies	Carbon tax	No	50yuan/t-C in 2010, 200yuan/t-C in 2050
	Subsidy	No	Power from renewable energy 0.4yuan/kWh
	Investment Energy technology R&D	Annual average growth rate 4%	Annual average growth rate 6.2%

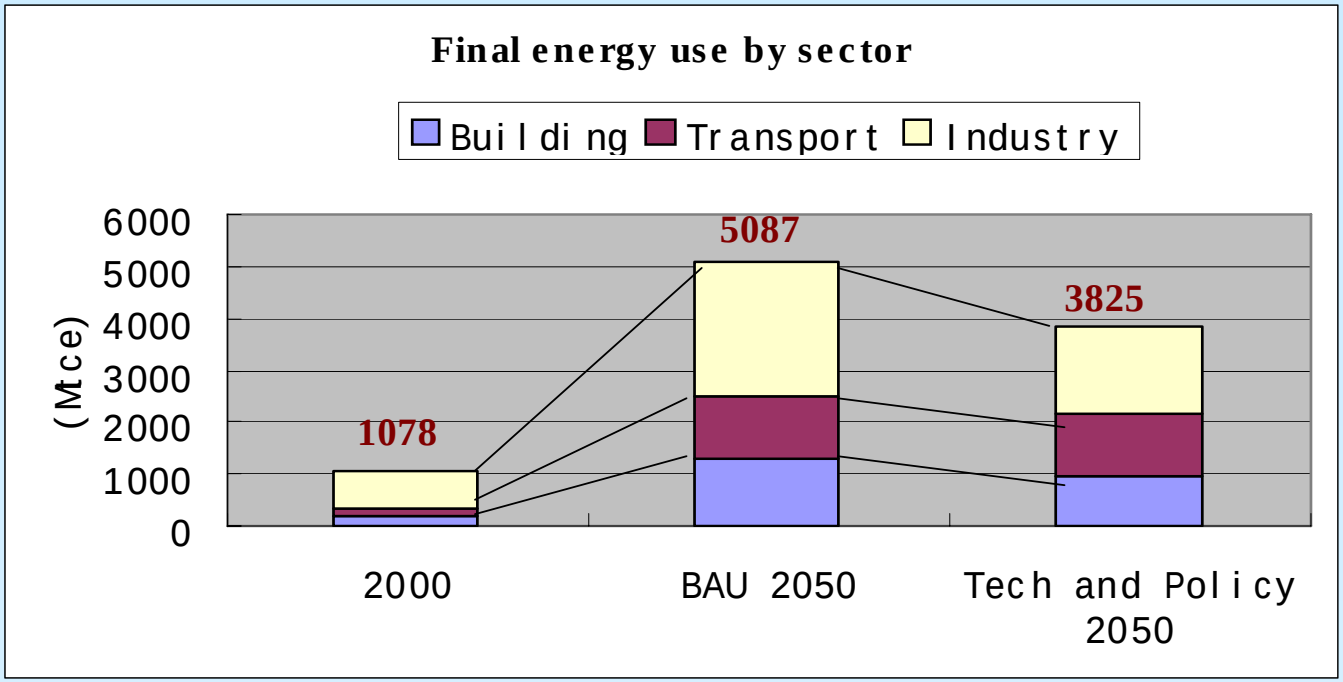
AIM-Emission Model



Modeling analysis result



- In policy scenario by 2050:
  - Primary energy demand:1700Mtce would be saved, accounting for 27%;
  - Share of coal would decrease to 30% from 50%;
  - Share of renewable energy would increase to 25% from 11%;
  - Energy structure would be diversified and balanced; ,

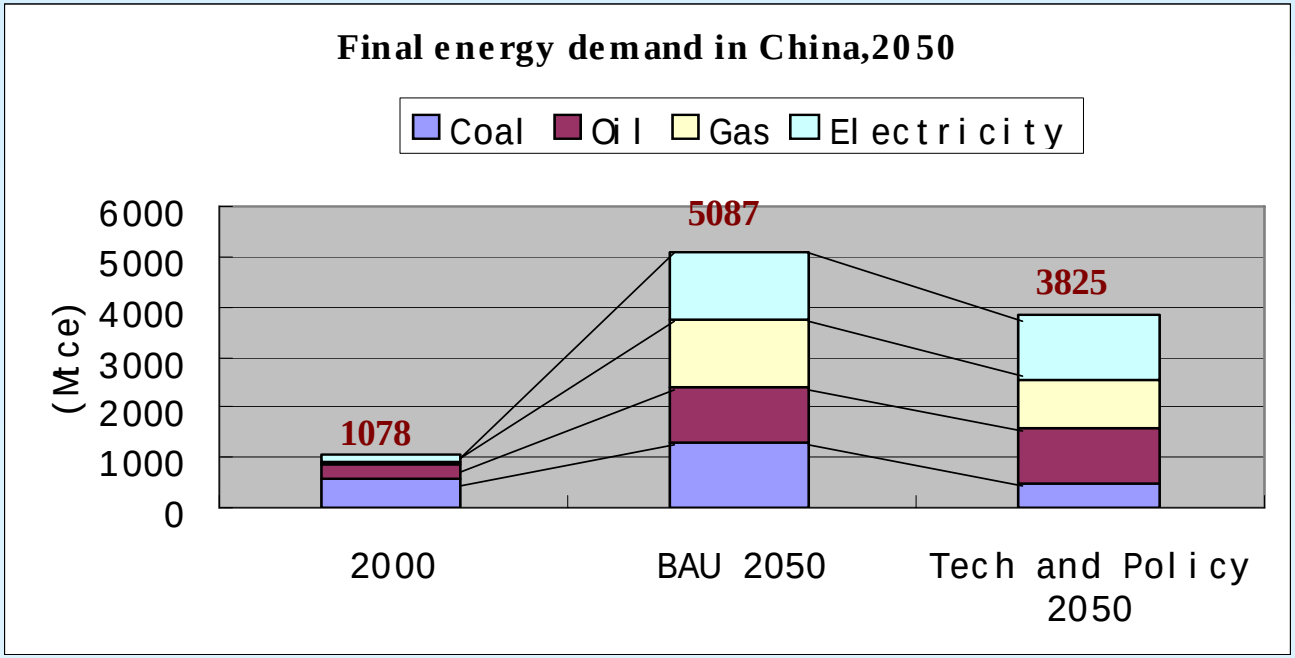


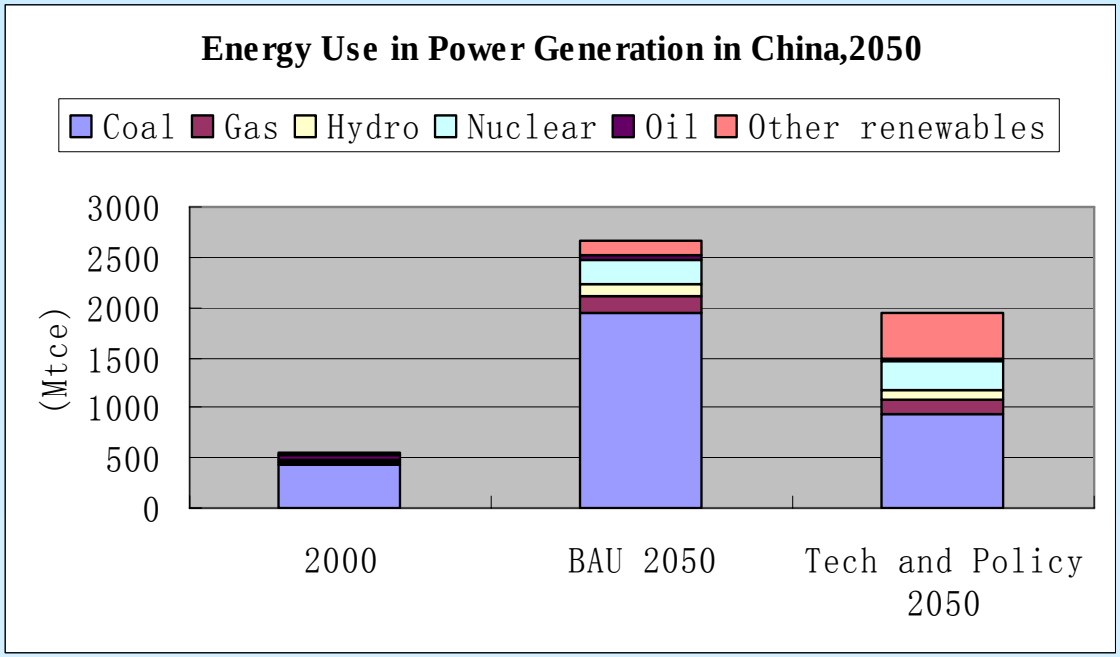
By 2050

- End-use energy consumption in industries, transportation and building would decrease by 35%, 5% and 24%, respectively;
- Share of industry drops from 55% to 44%; building drops from 26% to 24; However, transportation increases from 24% to 31%.

By 2050

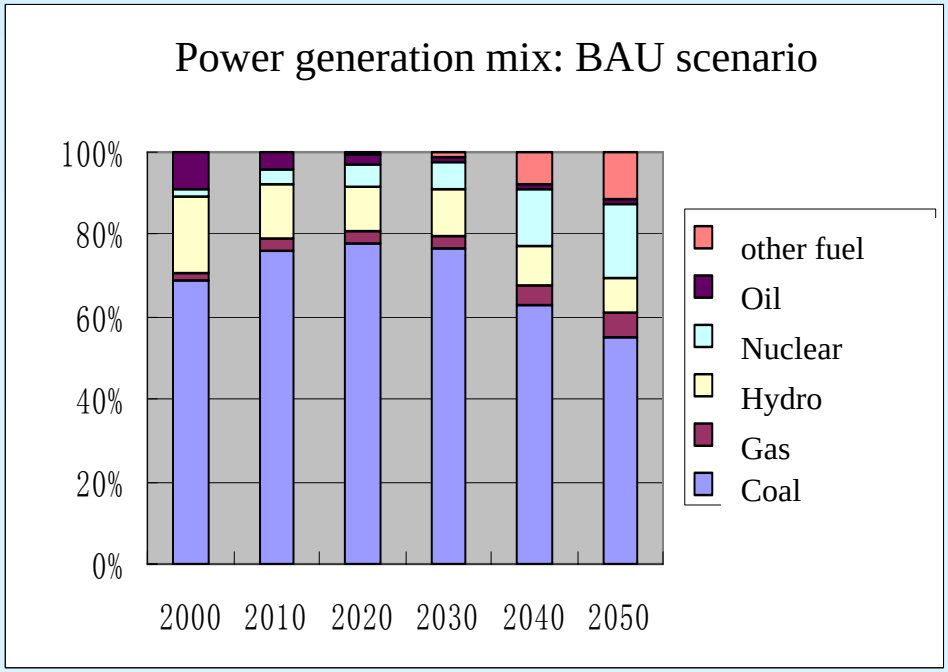
- 1200Mtce saved in policy case, accounting for 25%;
- Share of coal decreases from 26% to 13%;
- Power increase from 27% to 36%;
- Fuel oil would increase by 6%

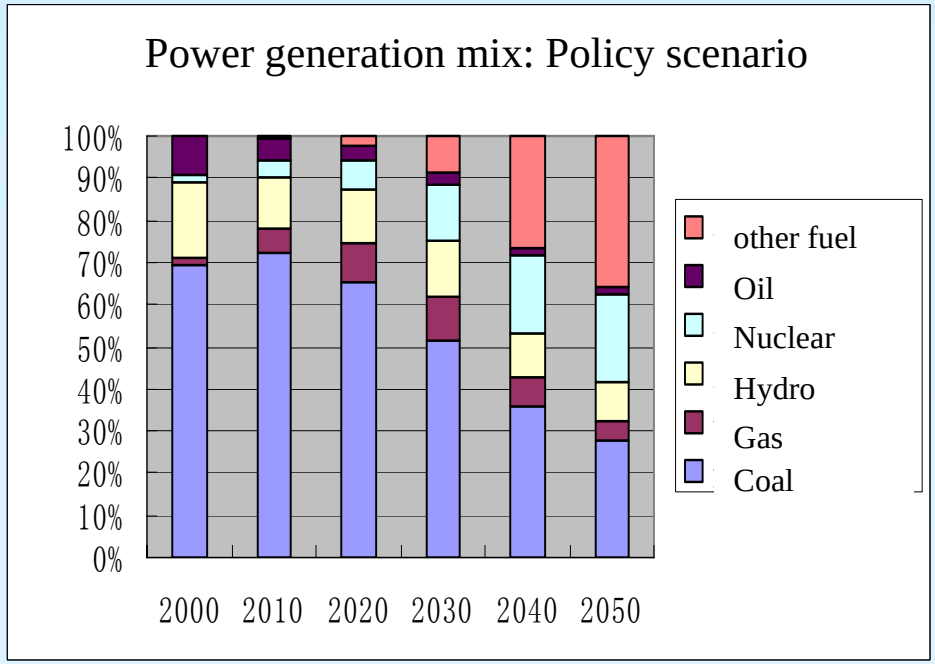


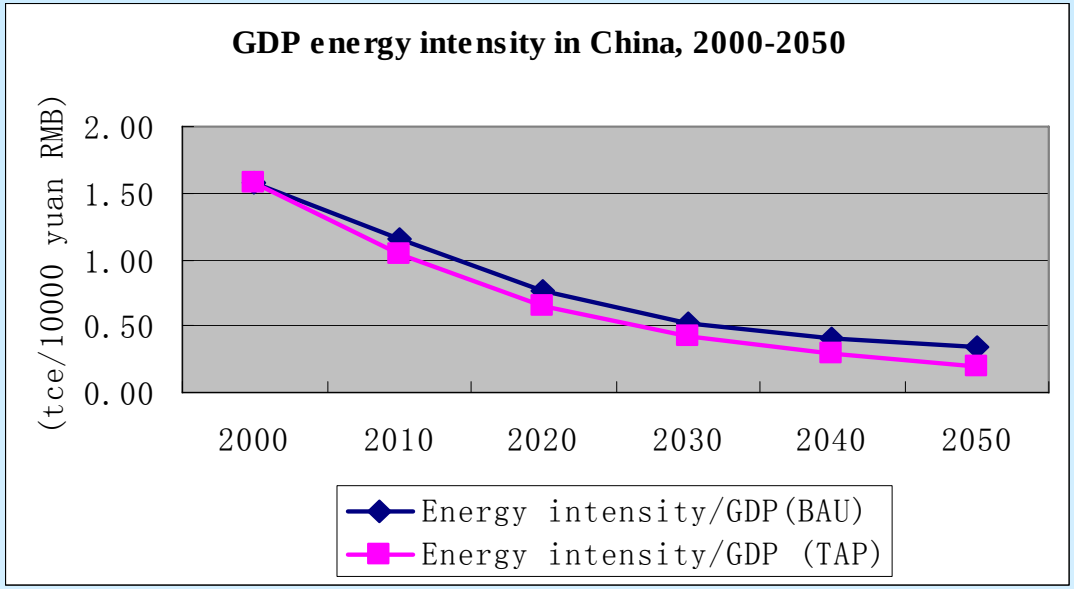


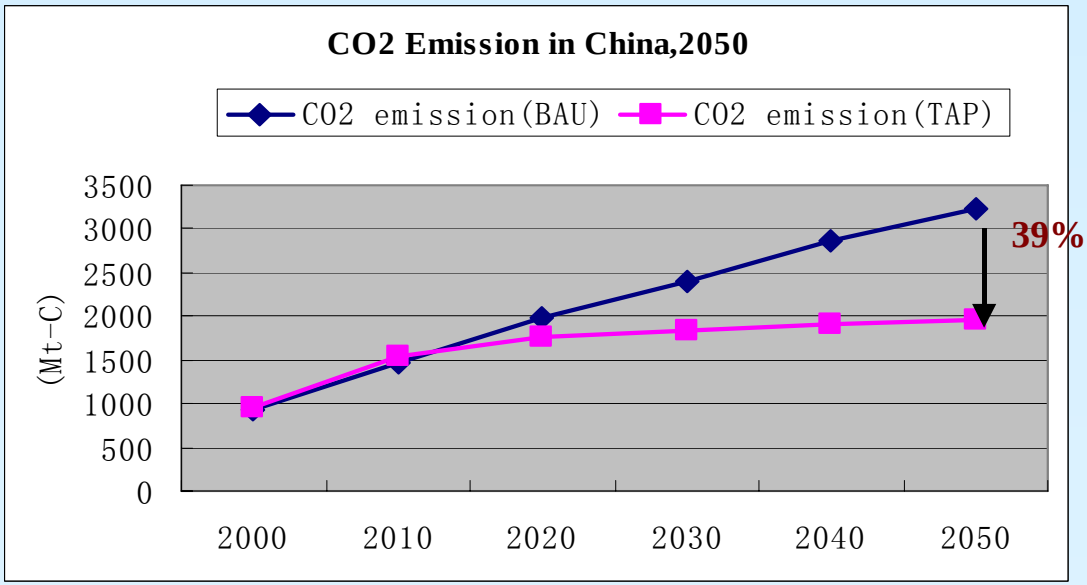
In policy case, by 2050

- Renewable energy generation would increase to 35%;
- Nuclear and hydro accounts for 30%;
- Alternative fuel to substitute fossil fuel amounts to almost 1000Mtce
- Generation efficiency would increase to 45% from 30%.









Energy demand will be reduced by 27% (1708Mtce) in 2050 by technology and policy scenario compared with baseline scenario .

Energy conservation ratio in 2000~2050

- **BAU**

  2000-2020：3.66%；
  2020-2050：2.76%

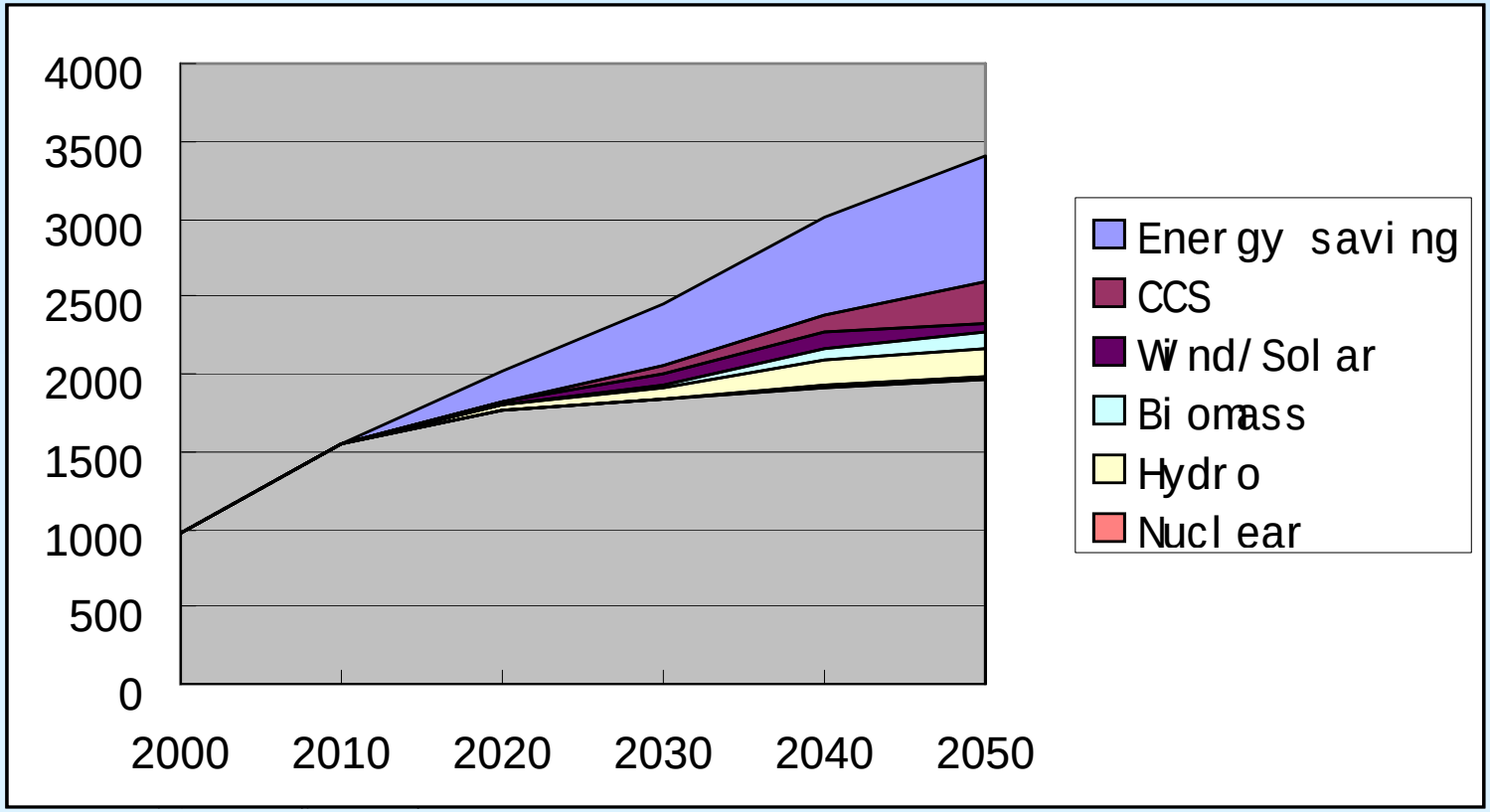
- **Policy case**

  2000-2020：4.54%；
  2020-2050：4.0%

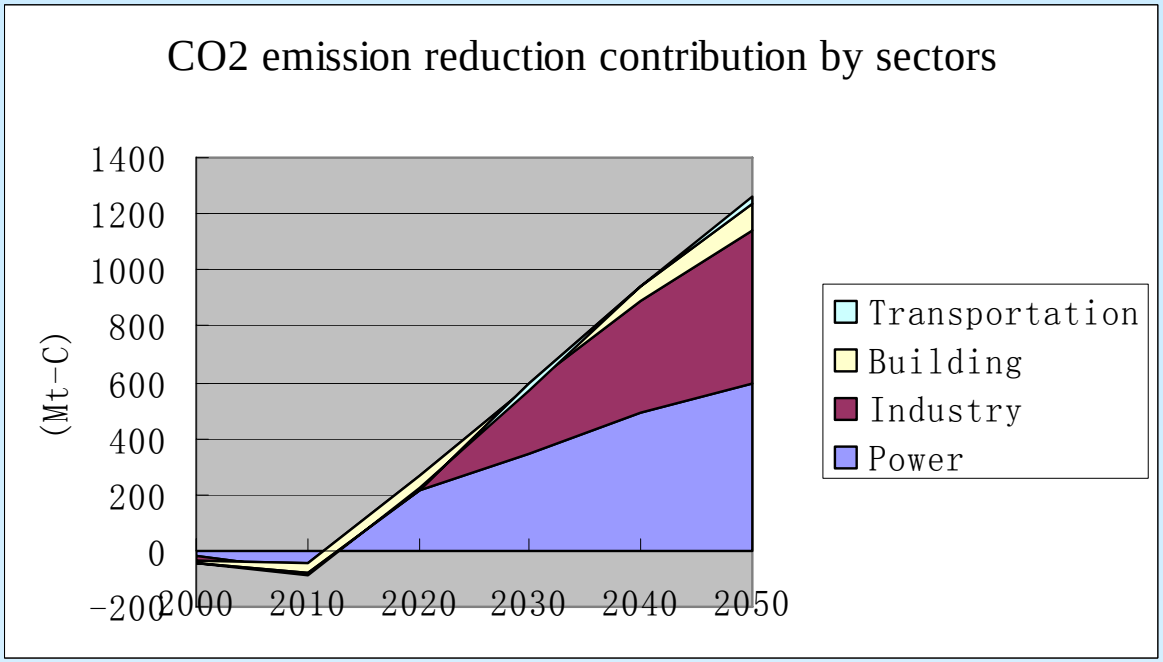
CO2 emission will be reduced 39% (1263Mt-C)in 2050 by technology and policy scenario compared with baseline scenario.

Contributions to CO2 emission reduction from policies, sectors, energy types, technologies

- CO_2 emission reduction contribution (Mt-C) by policies

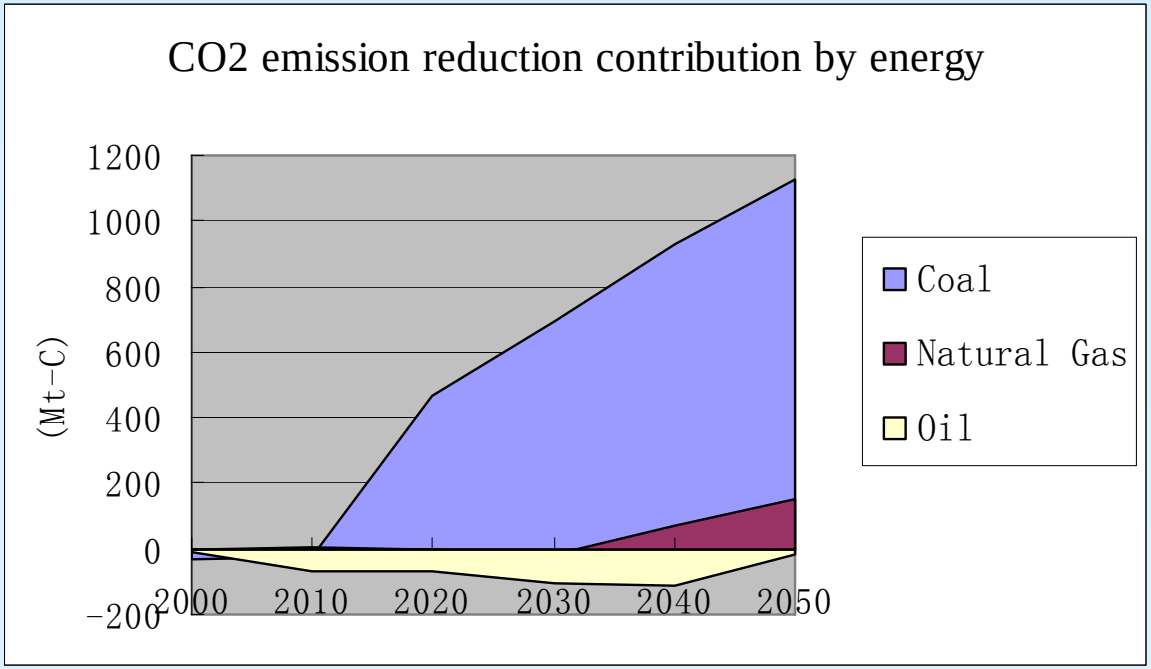


- Energy saving: 64%; CCS:20%; Wind, Biomass, Hydro and Nuclear:16%



CO_2 emission reduction contribution by sectors

- **Power：47%；**
- **Industry：43%；**
- **Building：7%；**
- **Transportation：3%**



CO_2 emission reduction contribution by energy

- **Coal：89%；**
- **Natural gas：12%；**
- **Oil：-1%**

Conclusion

- Energy Saving by technology progress and social efficiency improvement is key for future GHG emission reduction
- Technologies including modern renewable energy, advanced nuclear, clean coal+CCS should be emphasized for early R&D
- Fiscal energy policies including energy tax/carbon tax could be a good option
- Develop international collaboration and technology transfer

Thank you!

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