Coal in the low carbon scenario

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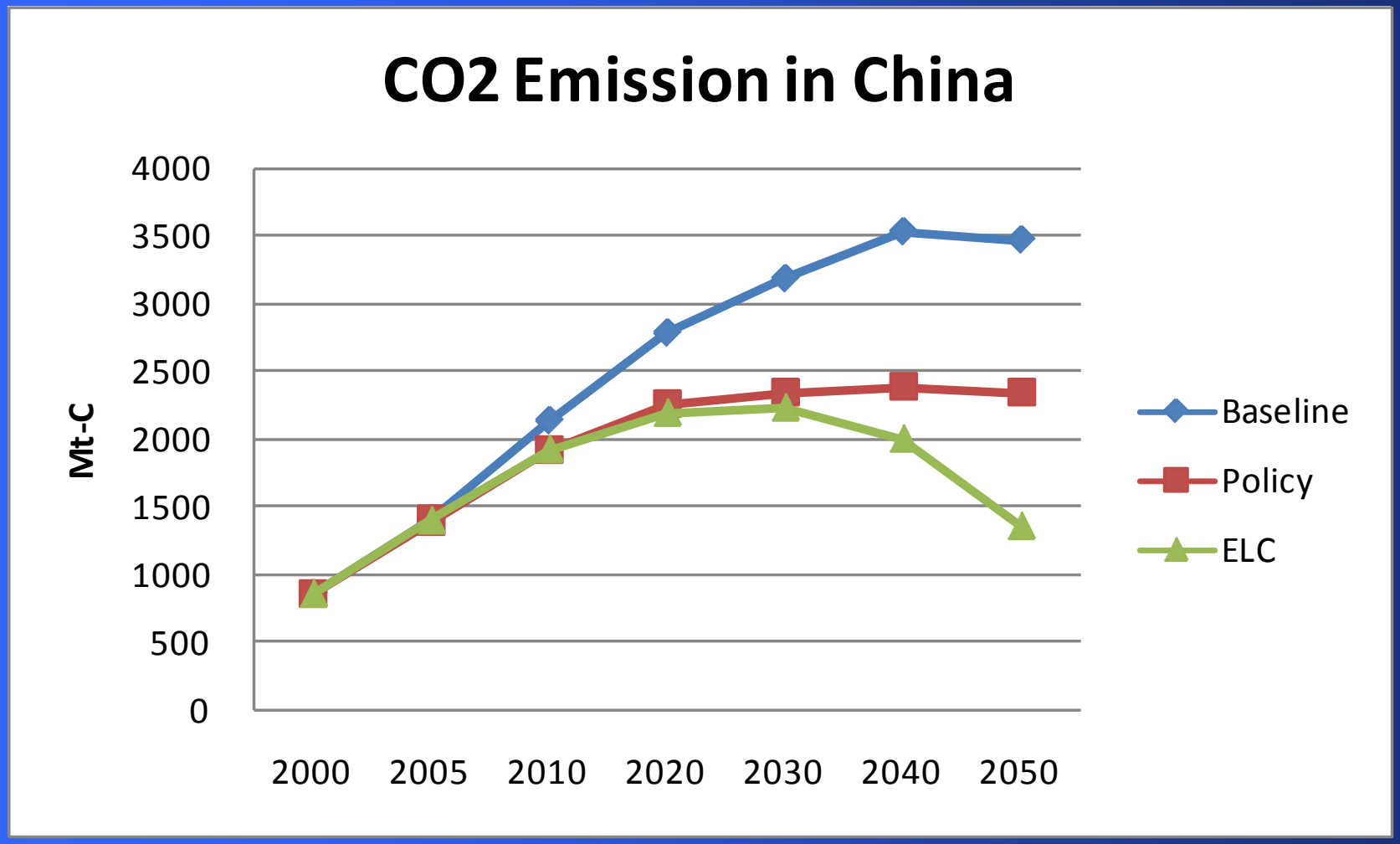
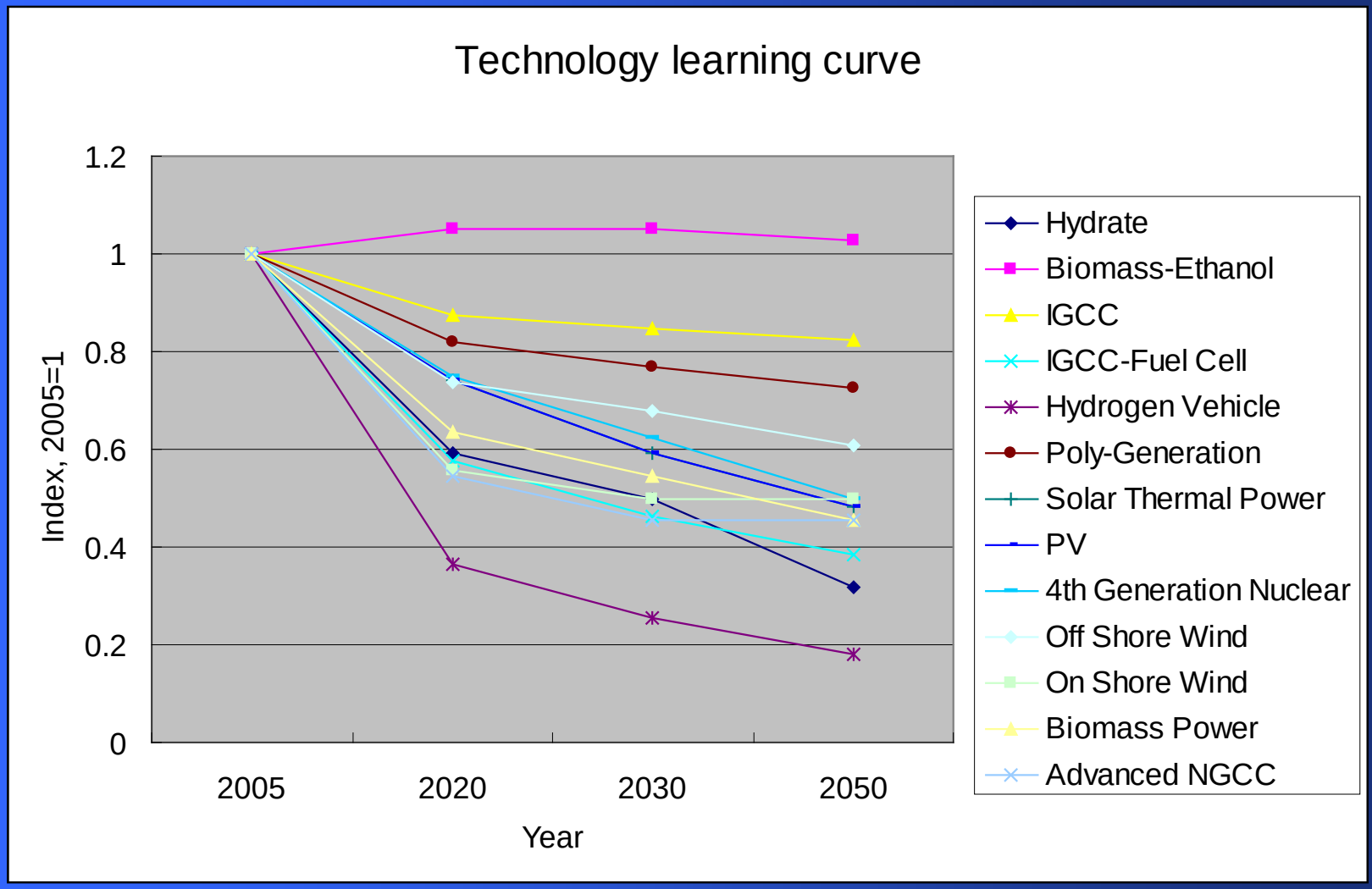

CO2 Emission in China
Mt-C
4000
3500
3000
2500
2000
1500
1000
500
0
2000
2005
2010
2020
2030
2040
2050
Baseline
Policy
ELC

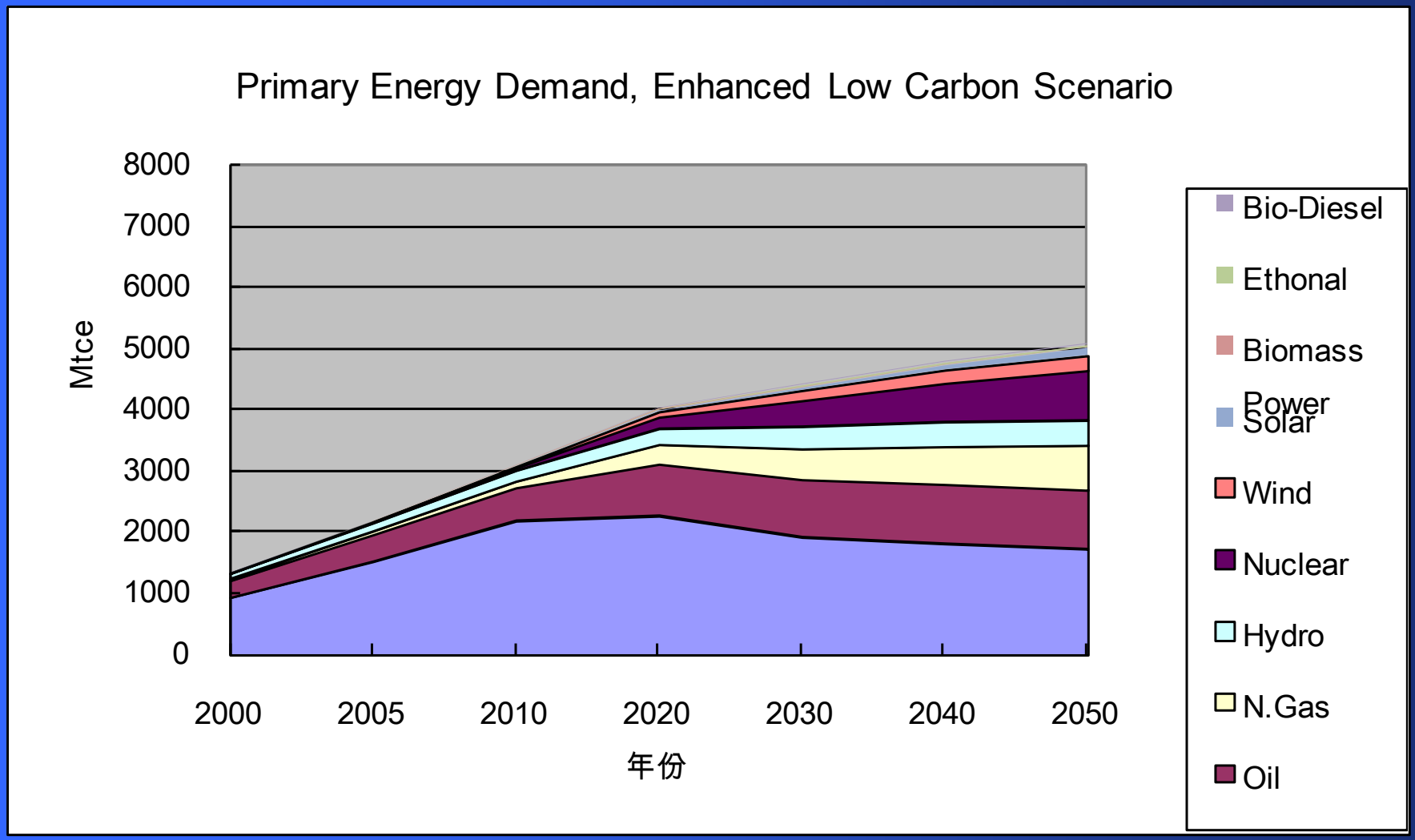
Products output in major sectors, Low Carbon and ELC

	Unit	2005	2020	2030	2040	2050
Steel	Million ton	355	610	570	440	360
Cement	Million ton	1060	1600	1600	1200	900
Glass	Million cases	399	650	690	670	580
Copper	Million ton	2.6	7	7	6.5	4.6
Ammonia	Million ton	8.51	16	16	15	12
Ethylene	Million ton	5.1	7.2	7	6.5	5.5
Soda Ash	Million ton	14.67	23	24.5	23.5	22
Casutic	Million ton	12.64	24	25	25	24
Paper	Million ton	62.05	110	115	120	120
Fertilize	Million ton	52.2	61	61	61	61
Aluminum	Million ton	7.56	34	36	36	33
Paper	Million ton	46.3	50	50	50	45
Calcium c	Million ton	8.5	10	8	7	4

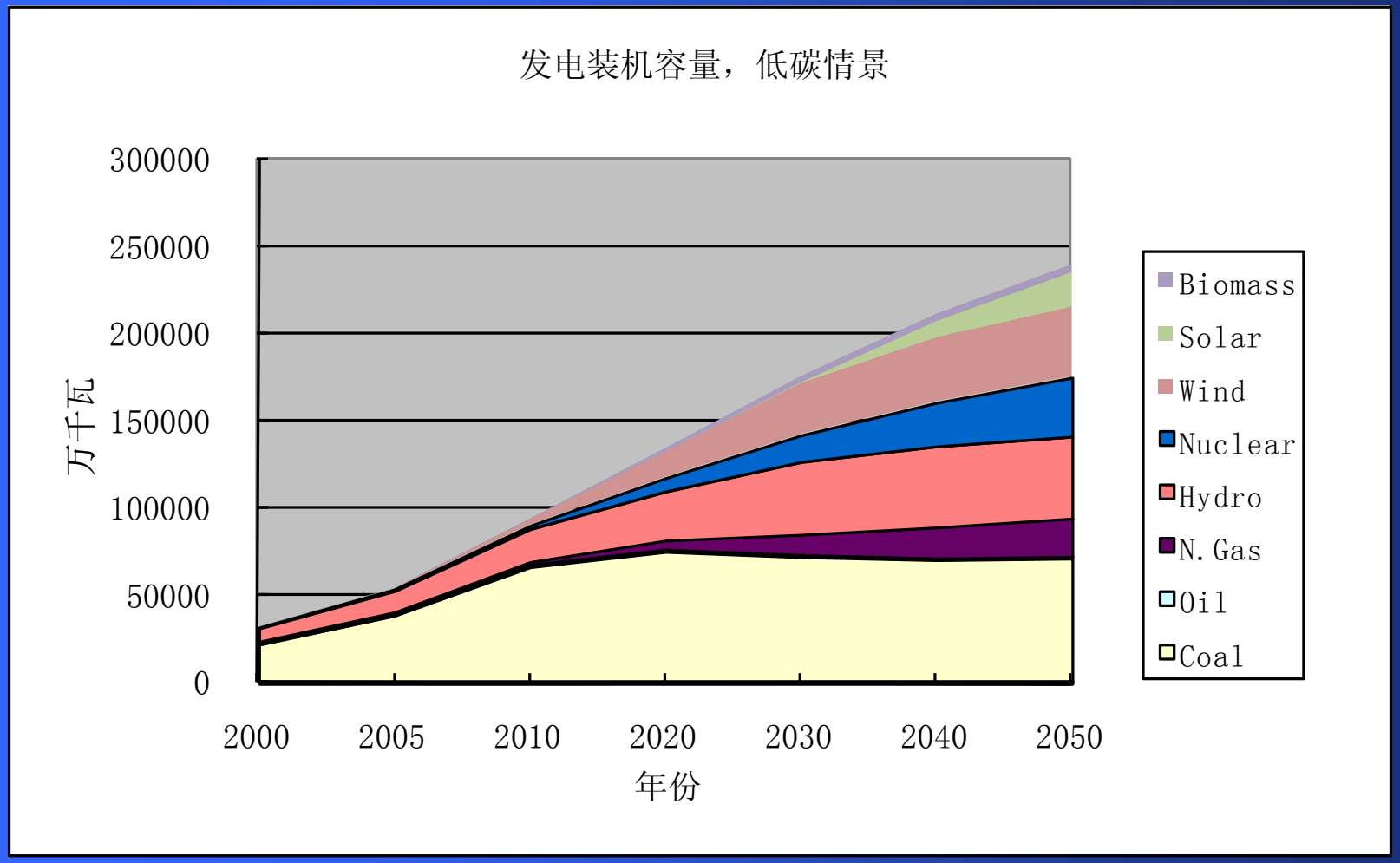
Unit energy use for key products, LCS Scenario

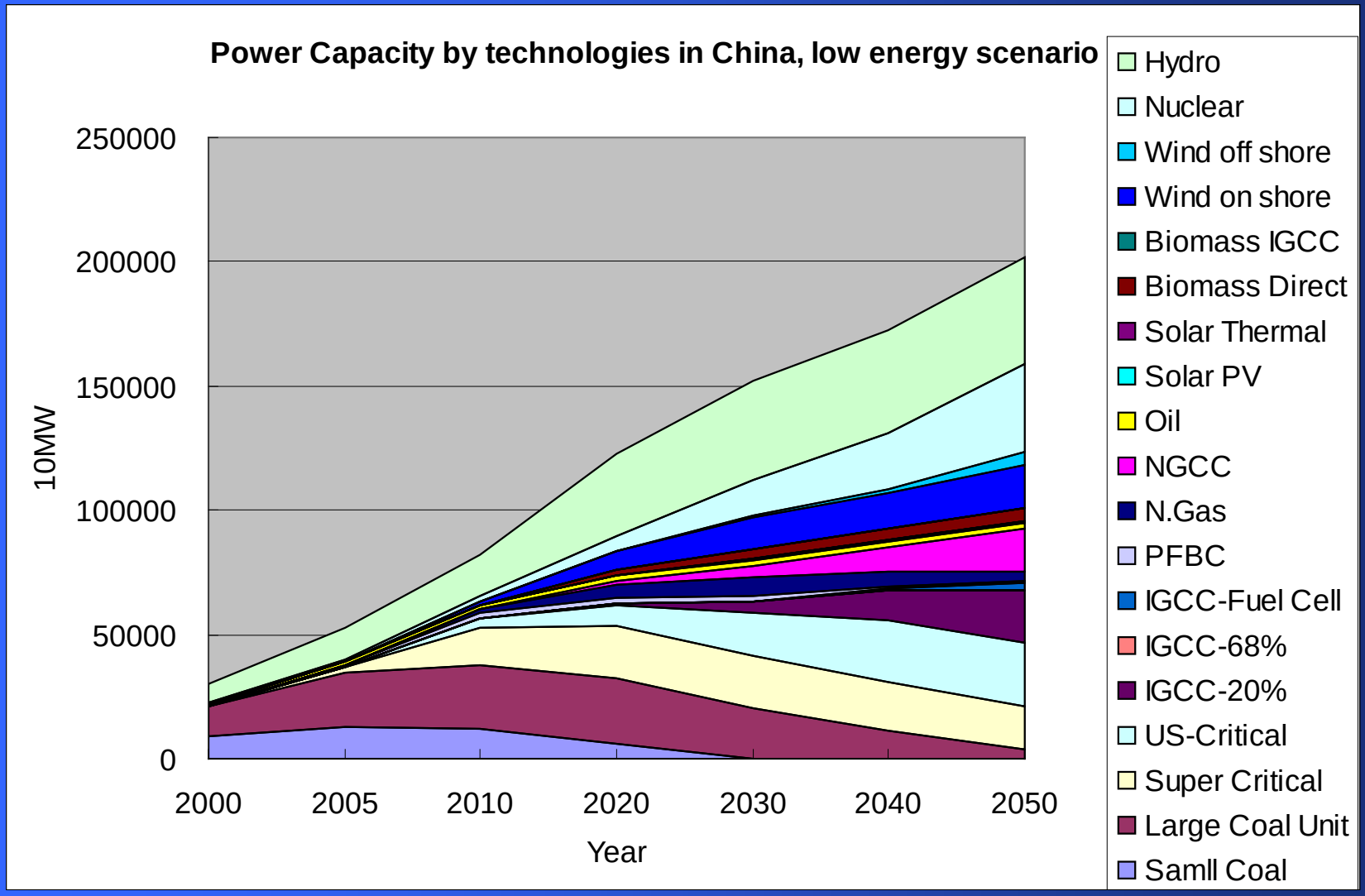
	Unit	2005	2020	2030	2040	2050
Steel	Kgce/t	760	650	564	554	545
Cement	Kgce/t	132	101	86	81	77
Glass	Kgce/Weight Cases	24	18	14.5	13.8	13.1
Brick	Kgce/万块	685	466	433	421	408
Ammonia	Kgce/t	1645	1328	1189	1141	1096
Ethylene	Kgce/t	1092	796	713	693	672
Soda Ash	Kgce/t	340	310	290	284	279
Casutic	Kgce/t	1410	990	890	868	851
Calcium carbide	Kgce/t	1482	1304	1215	1201	1193
Copper	Kgce/t	1273	1063	931	877	827
Aluminum	kWh/t	14320	12870	12170	11923	11877
Paper	Kgce/t	1047	840	761	721	686
Electricity fossil fuel	Gce/kWh	350	305	287	274	264

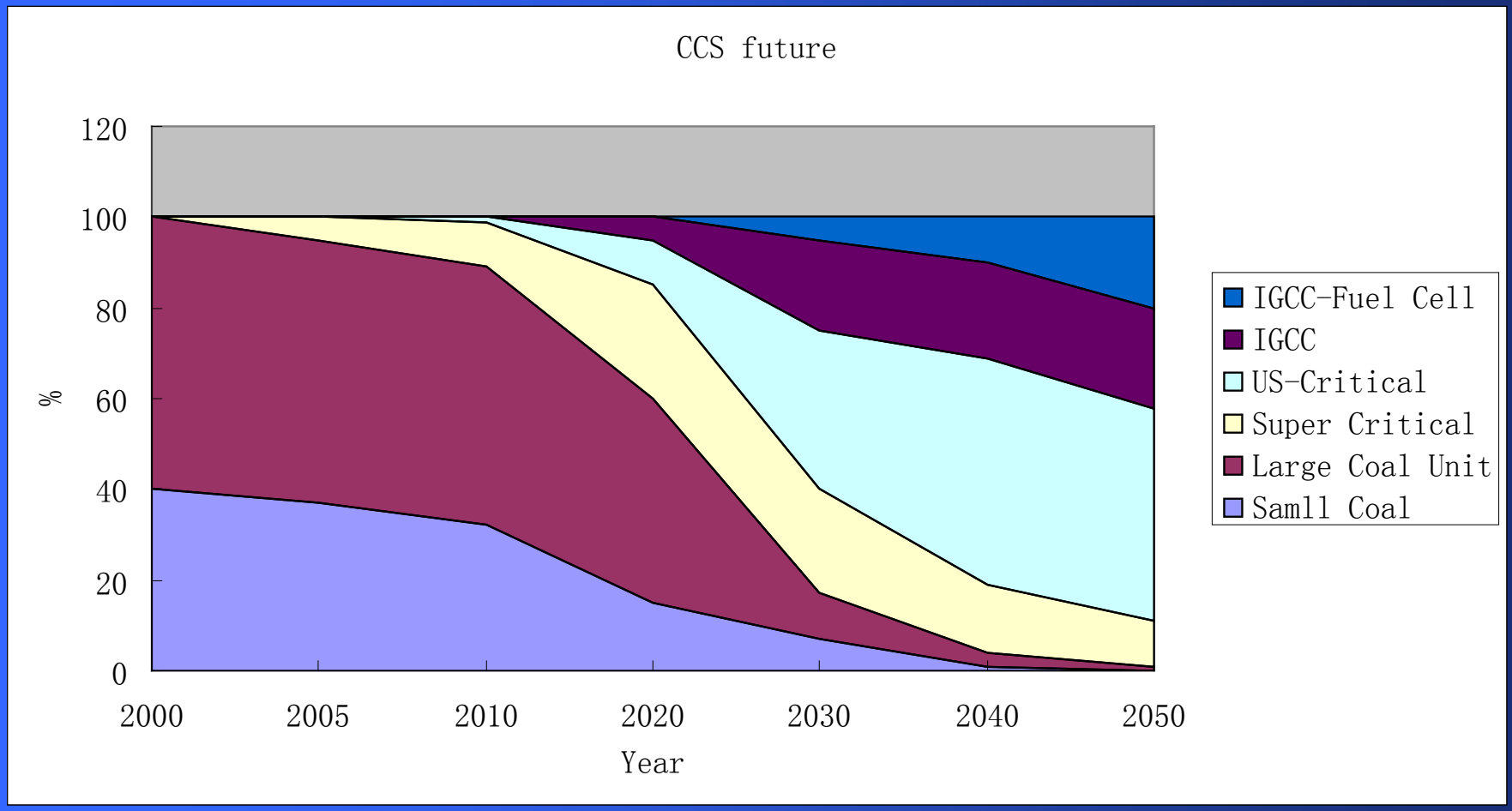

Technology learning curve
1.2
1
0.8
0.6
0.4
0.2
0
Index, 2005=1
2005
2020
2030
2050
Year
Hydrate
Biomass-Ethanol
IGCC
IGCC-Fuel Cell
Hydrogen Vehicle
Poly-Generation
Solar Thermal Power
PV
4th Generation Nuclear
Off Shore Wind
On Shore Wind
Biomass Power
Advanced NGCC


Primary Energy Demand, Enhanced Low Carbon Scenario
8000
7000
6000
5000
4000
3000
2000
1000
0
Mtce
2000
2005
2010
2020
2030
2040
2050
年份
Bio-Diesel
Ethonal
Biomass
Power Solar
Wind
Nuclear
Hydro
N.Gas
Oil

Installed Power Capacity, 10MW




Power Capacity by technologies in China, low energy scenario
250000
200000
150000
100000
50000
0
10MW
2000
2005
2010
2020
2030
2040
2050
Year
Hydro
Nuclear
Wind off shore
Wind on shore
Biomass IGCC
Biomass Direct
Solar Thermal
Solar PV
Oil
NGCC
N.Gas
PFBC
IGCC-Fuel Cell
IGCC-68%
IGCC-20%
US-Critical
Super Critical
Large Coal Unit
Samll Coal

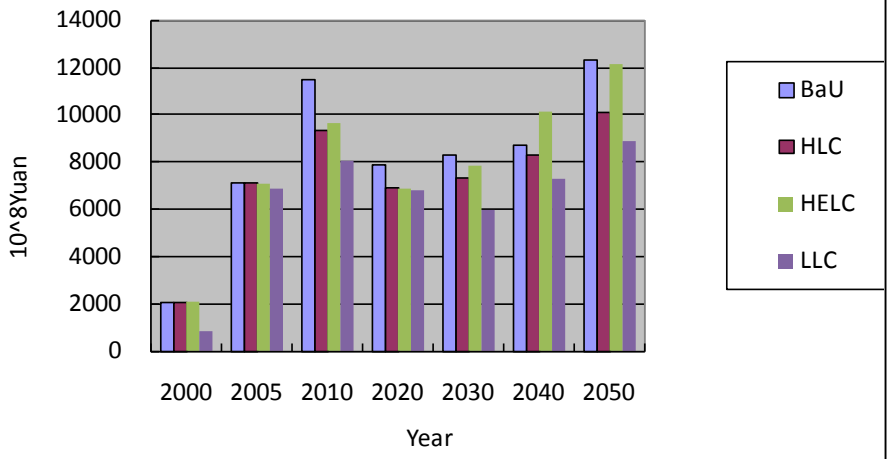

CCS future
120
100
80
60
40
20
0
%
2000
2005
2010
2020
2030
2040
2050
Year
IGCC-Fuel Cell
IGCC
US-Critical
Super Critical
Large Coal Unit
Samll Coal

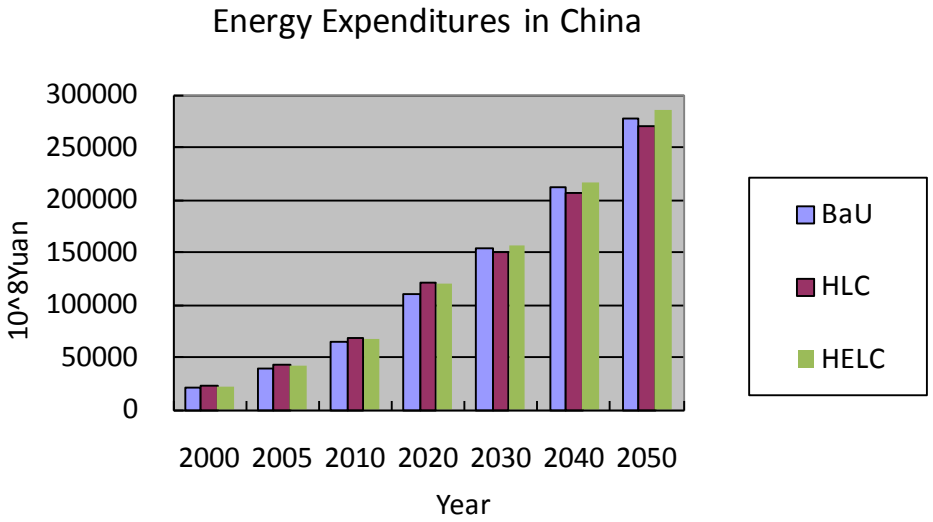
CCS

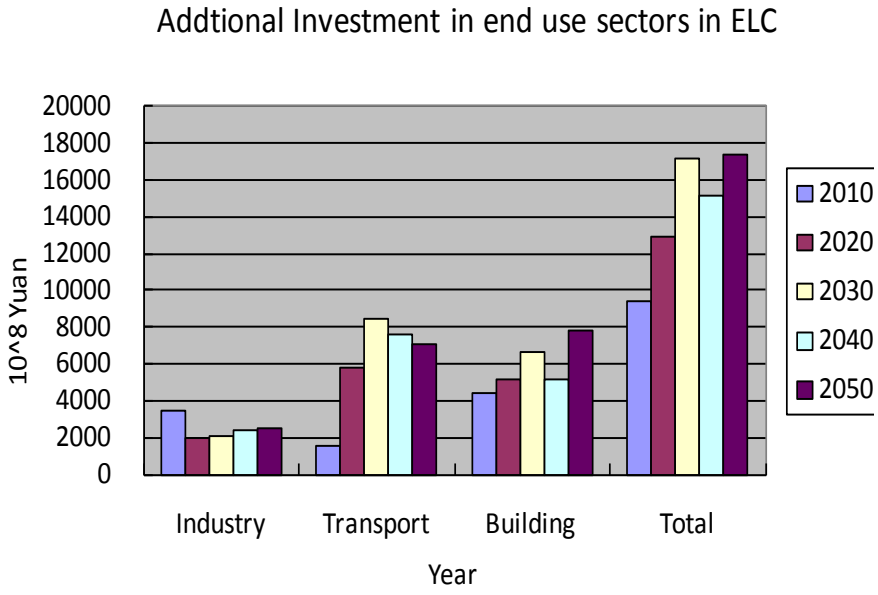
- CCS is crucial for China for deep cut on CO2
- By 2050, there I still more than 2billion ton coal use in China
- CCS is long-term technology, for negative emission
- Cost: electricity price increase 0.15-0.25yuan/kWh, by 2030 average electricity price increase 0.03yuan/kWh, 0.15yuan/kWh by 2050.
- Investment for CCS：3000yuan-5600yuan/kW
- IGCC+CCS efficiency loss could go down to 6%
- IGCC efficiency：48% for Greengen in 2011, 55% by 55% to 58%

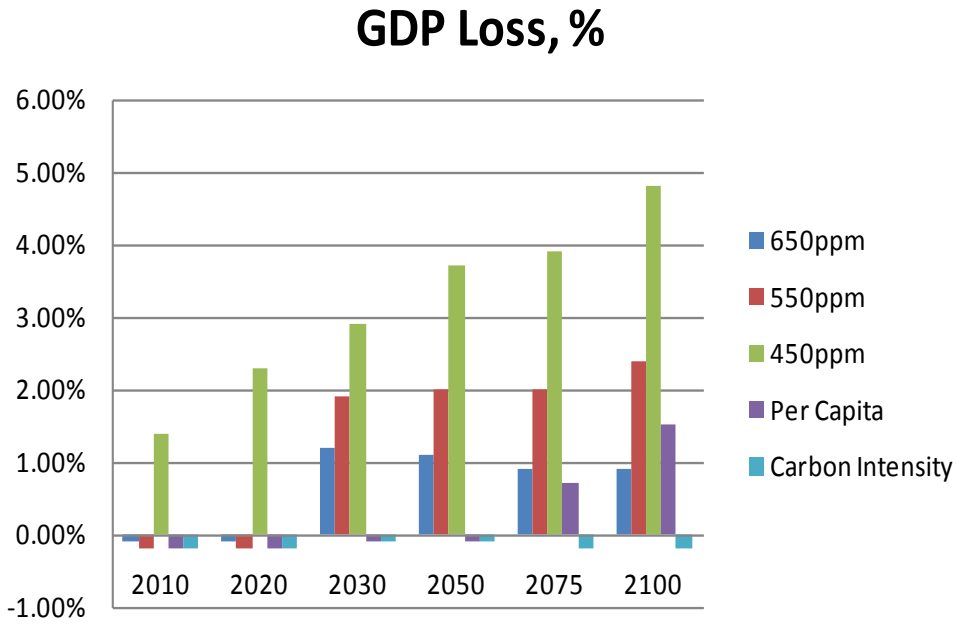
Case study for a 900MW IGCC unit with CCS

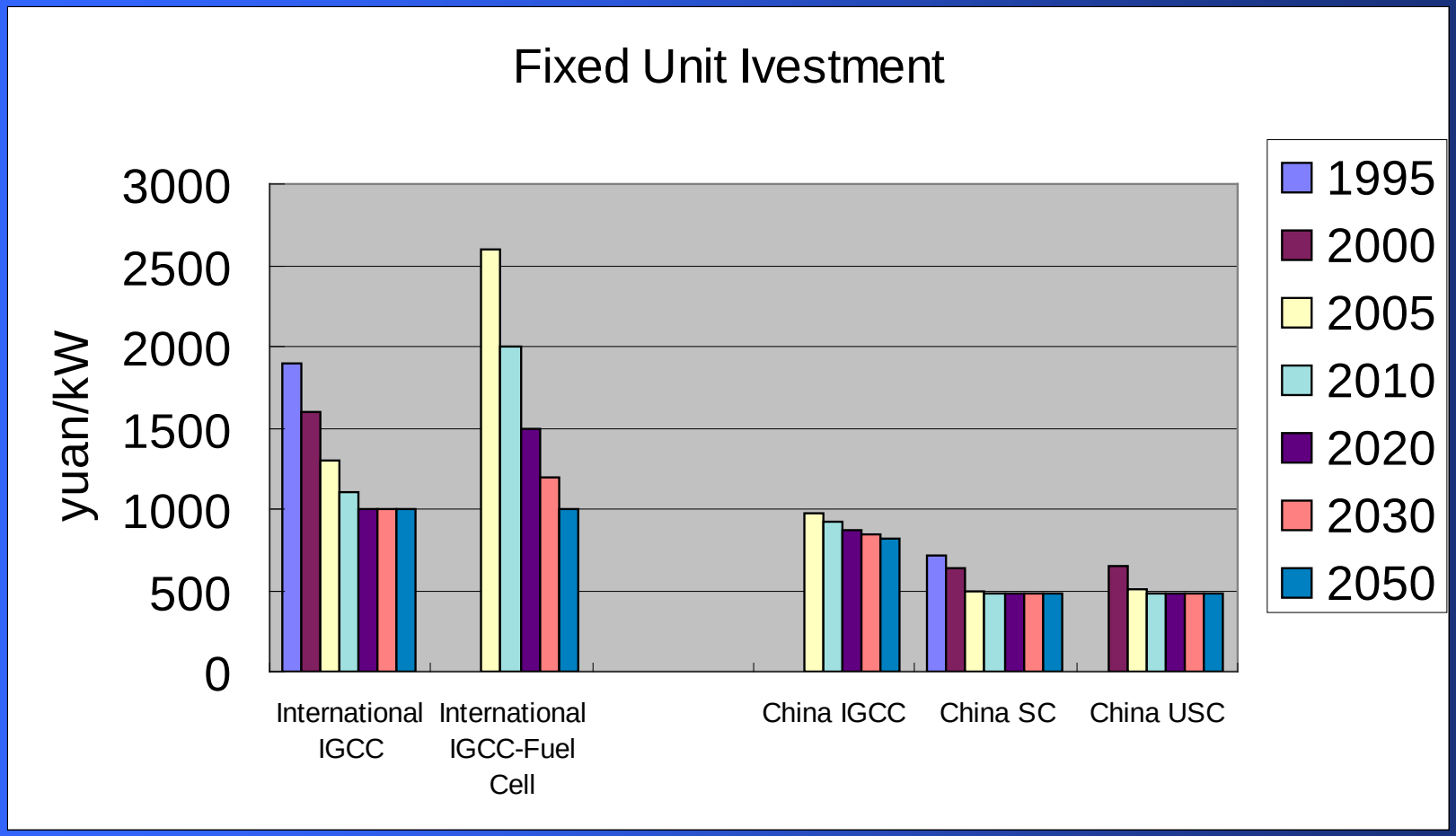
- Investment cost for IGCC: 2020 7500yuan/kW, 2030 6500yuan/kW
- CCS: 2020 4500yuan/kW, 2030 3200yuan/kW
- Capture rate: 2020 80%, 2030 90%
- Transport distance: 80km
- Transport cost: 2020 20yuan/t-CO2, 2030 10yua/t-CO2
- Cost for storage: 2020 15yuan/t-Co2, 2030 7yuan/t-CO2
- Interest rate: 8%
- Increased cost: 2020 0.28yuan/kWh, 2030: 0.19yuan/kWh

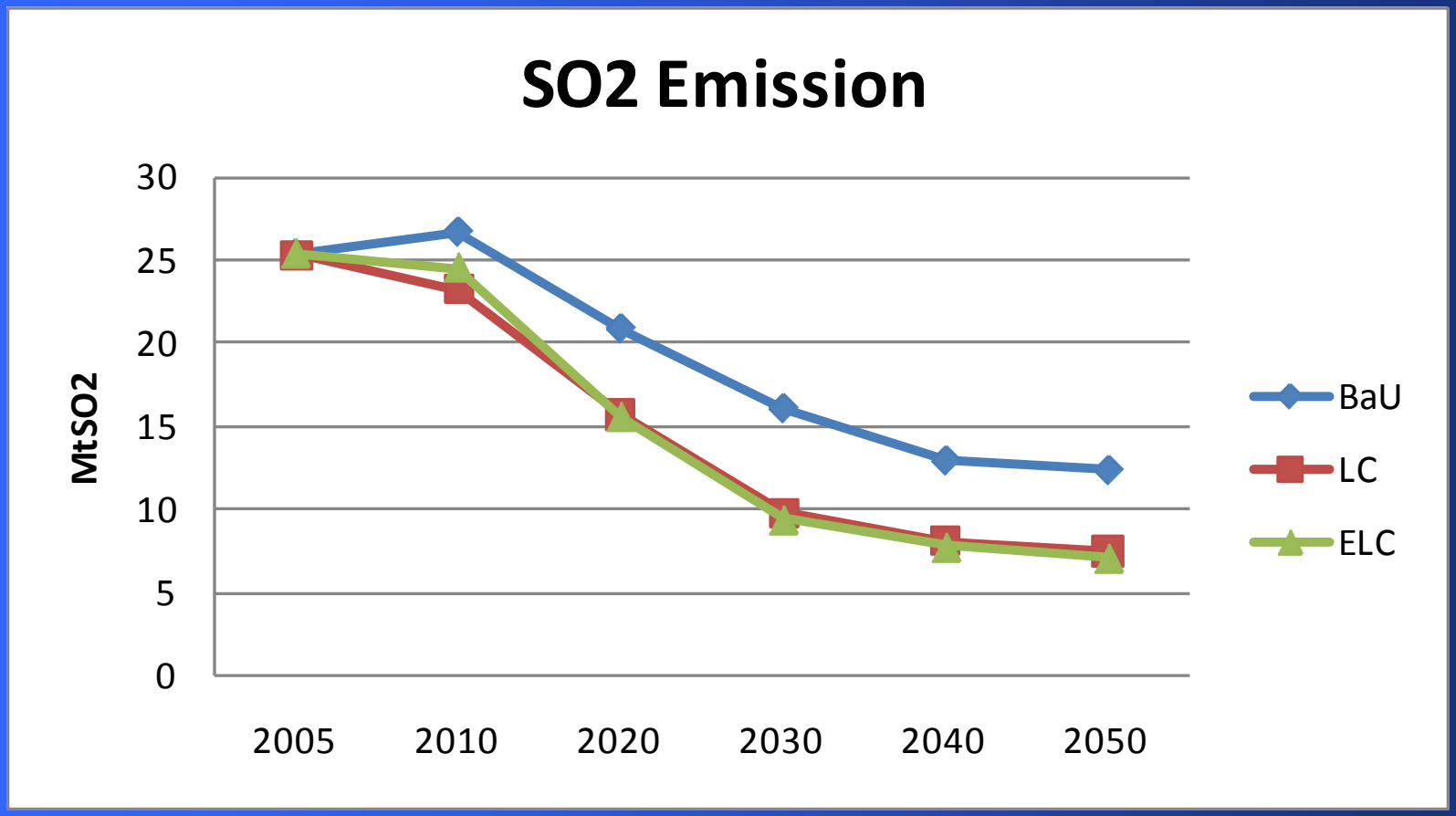

Investment in Energy Industry in China
14000
12000
10000
8000
6000
4000
2000
0
10^8Yuan
2000 2005 2010 2020 2030 2040 2050
Year
BaU
HLC
HELC
LLC

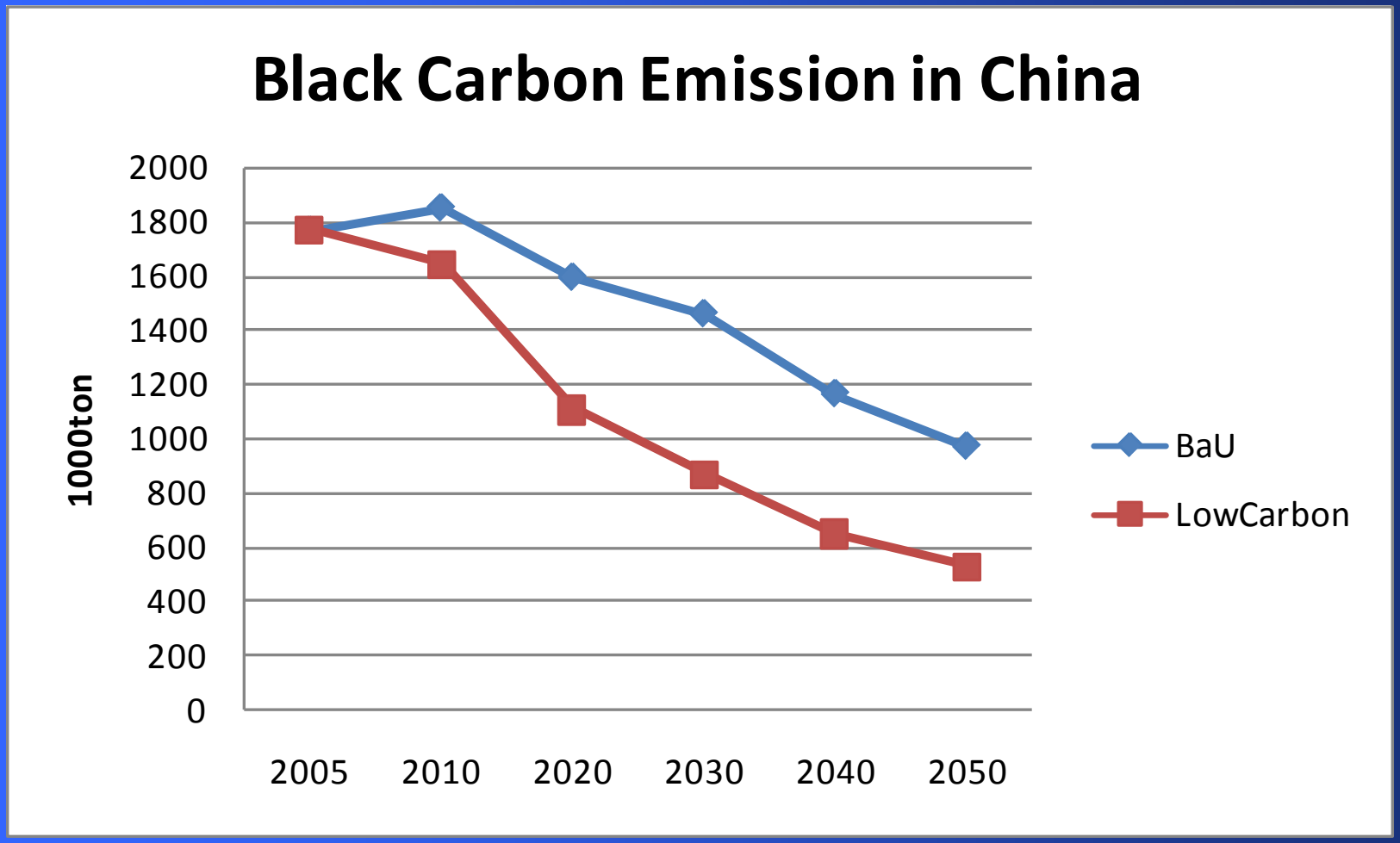

Energy Expenditures in China
300000
250000
200000
150000
100000
50000
0
10^8Yuan
2000 2005 2010 2020 2030 2040 2050
Year
BaU
HLC
HELC


Addtional Investment in end use sectors in ELC
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
10^8 Yuan
Industry
Transport
Building
Total
Year
2010
2020
2030
2040
2050

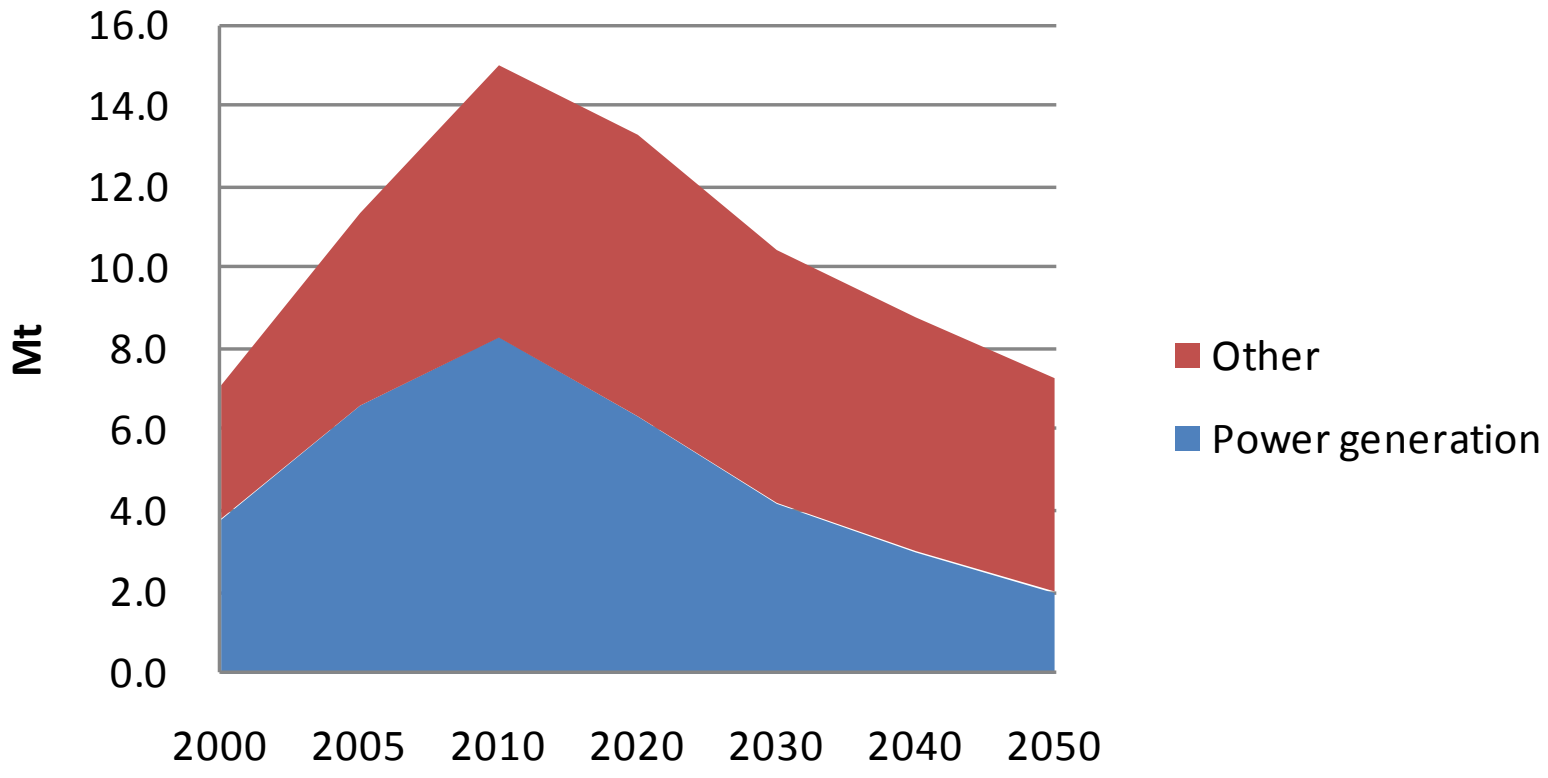

GDP Loss, %
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
-1.00%
2010
2020
2030
2050
2075
2100
650ppm
550ppm
450ppm
Per Capita
Carbon Intensity

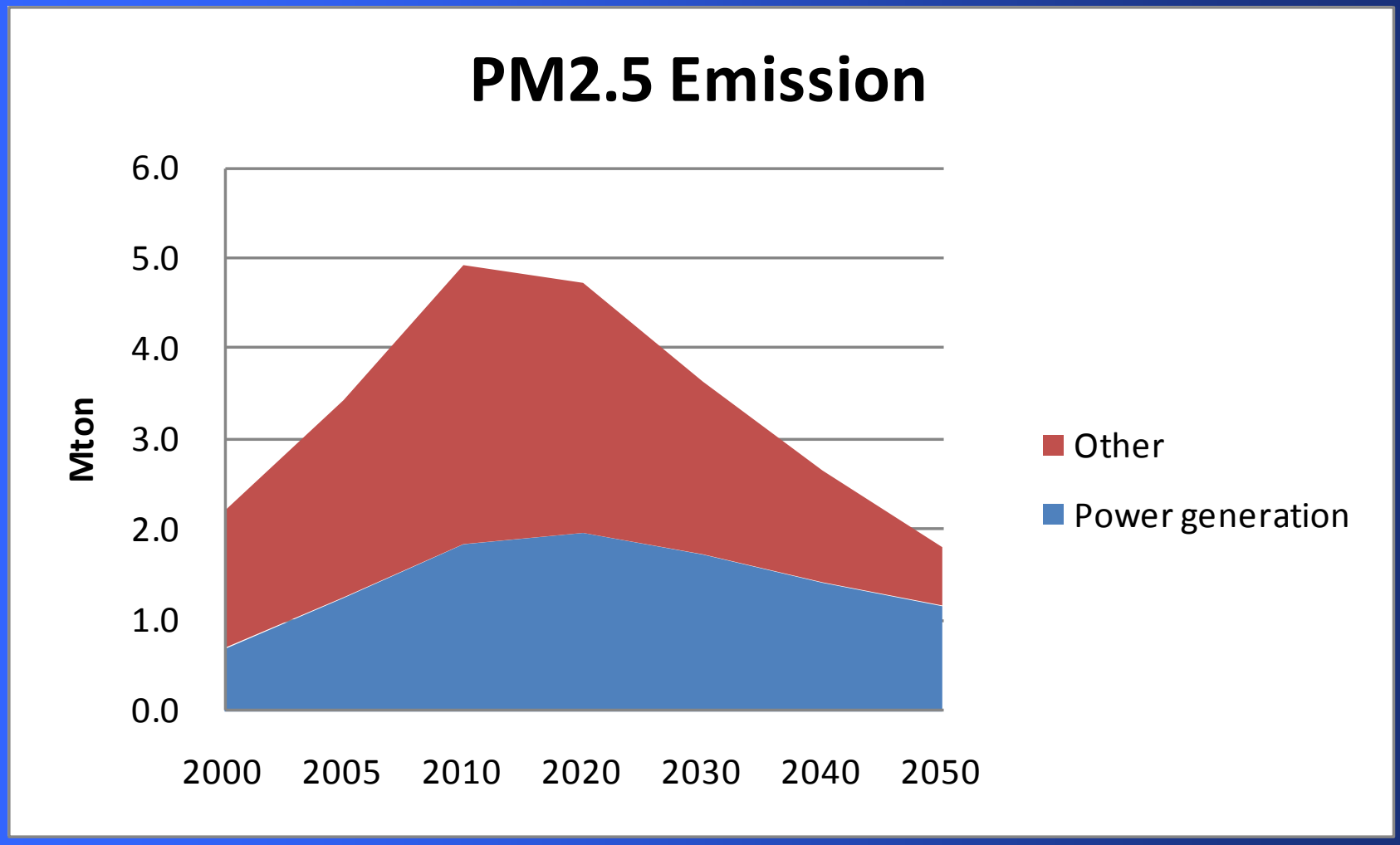

Fixed Unit Ivestment
yuan/kW
3000
2500
2000
1500
1000
500
0
International IGCC
International IGCC-Fuel Cell
China IGCC
China SC
China USC
1995
2000
2005
2010
2020
2030
2050

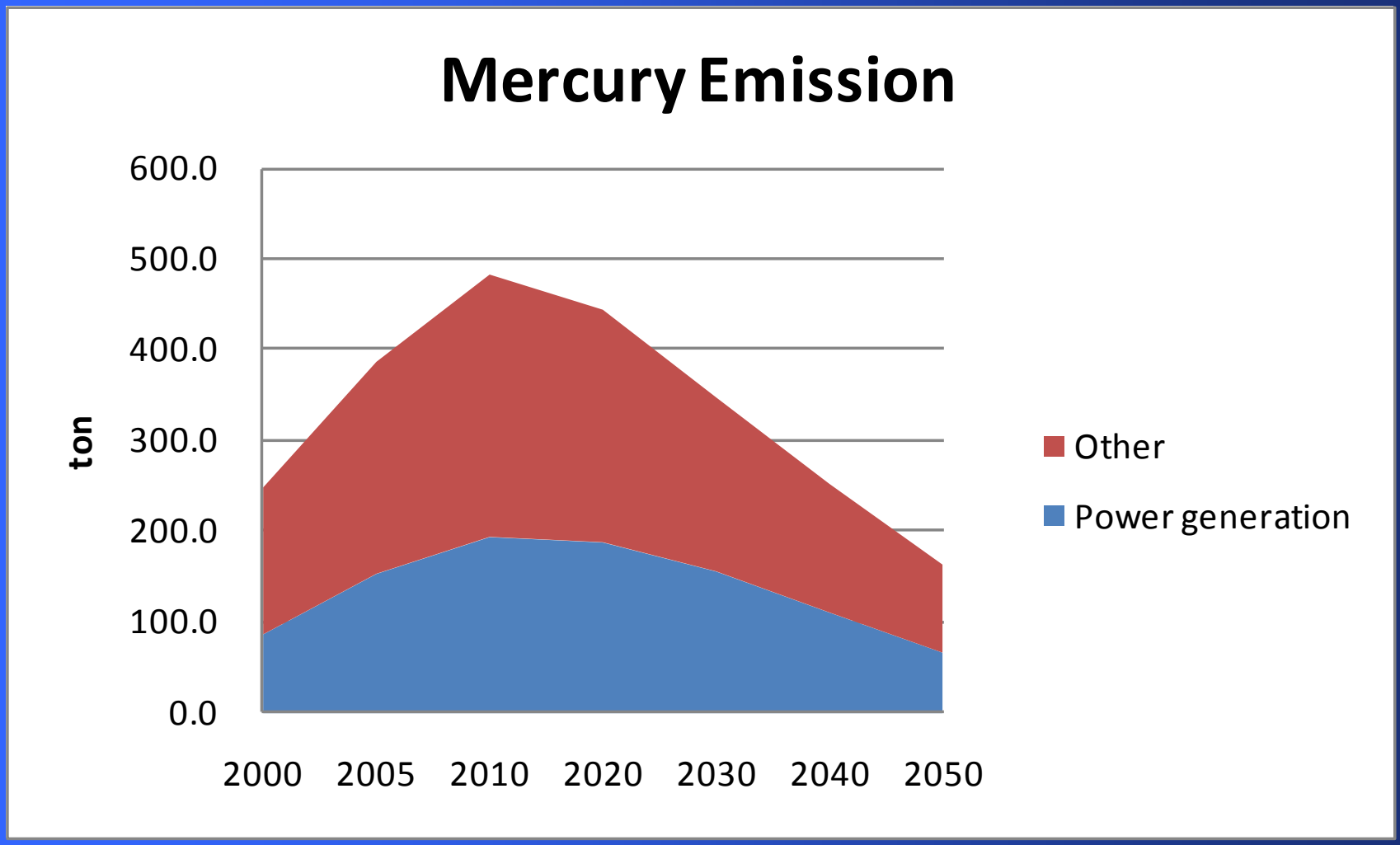

SO2 Emission
MtSO2
30
25
20
15
10
5
0
2005
2010
2020
2030
2040
2050
BaU
LC
ELC


Black Carbon Emission in China
1000ton
2000
1800
1600
1400
1200
1000
800
600
400
200
0
2005
2010
2020
2030
2040
2050
BaU
LowCarbon

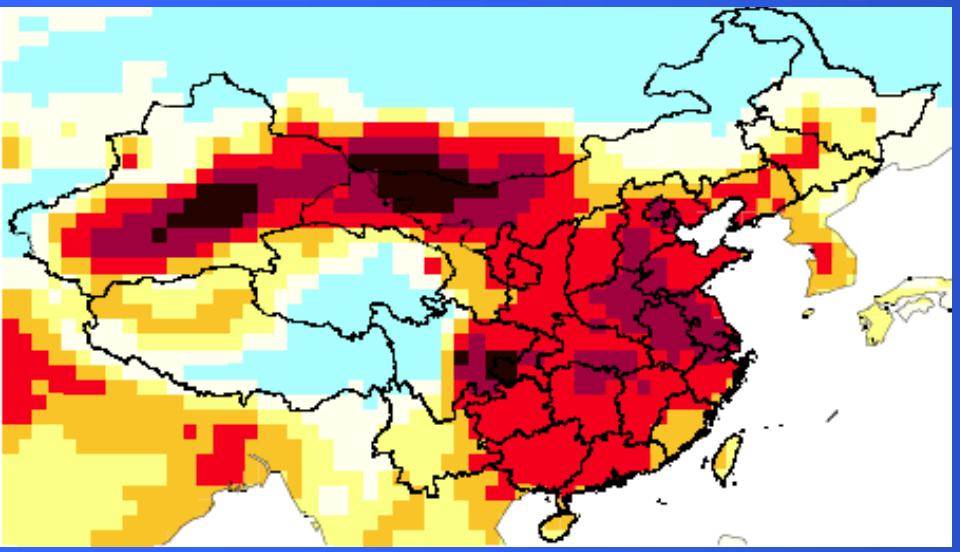
NOx Emission in China, ELC scenario

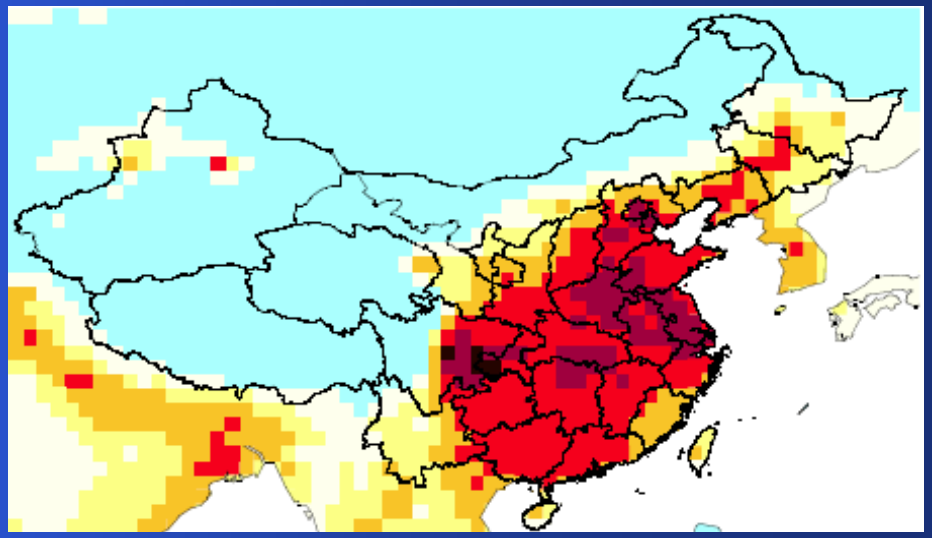



PM2.5 Emission
Mton
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000
2005
2010
2020
2030
2040
2050
Other
Power generation


Mercury Emission
600.0
500.0
400.0
300.0
200.0
100.0
0.0
ton
2000
2005
2010
2020
2030
2040
2050
Other
Power generation

Computed annual mean PM2.5 concentrations in China for the baseline projection in 2030; left panel: including natural sources and soil dust, right panel: from anthropogenic sources only (used for health impact calculation)

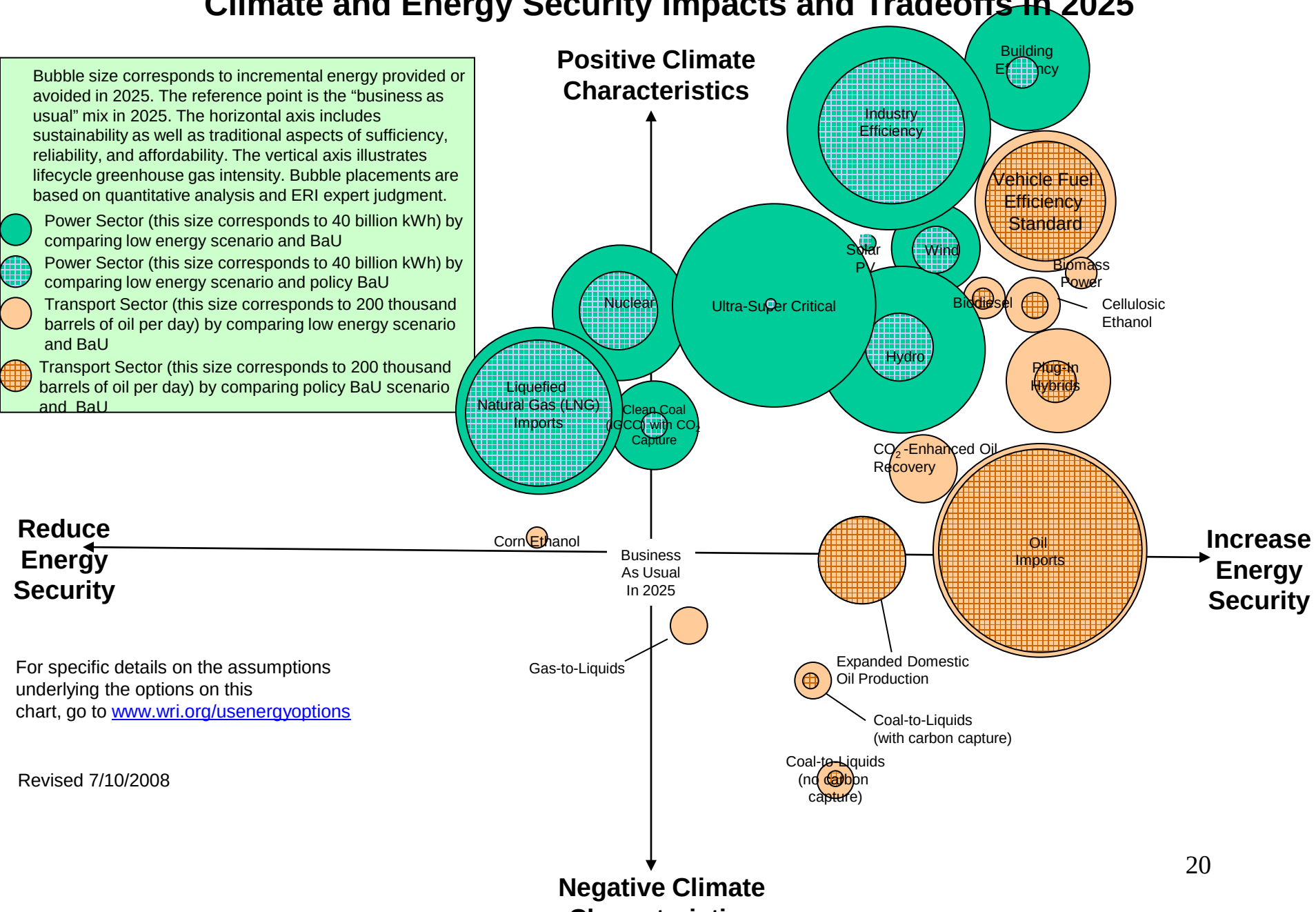




A Snapshot of Selected China Energy Options Today: Climate and Energy Security Impacts and Tradeoffs in 2025

Bubble size corresponds to incremental energy provided or avoided in 2025. The reference point is the "business as usual" mix in 2025. The horizontal axis includes sustainability as well as traditional aspects of sufficiency, reliability, and affordability. The vertical axis illustrates lifecycle greenhouse gas intensity. Bubble placements are based on quantitative analysis and ERI expert judgment.

- Power Sector (this size corresponds to 40 billion kWh) by comparing low energy scenario and BaU
- Power Sector (this size corresponds to 40 billion kWh) by comparing low energy scenario and policy BaU
- Transport Sector (this size corresponds to 200 thousand barrels of oil per day) by comparing low energy scenario and BaU
- Transport Sector (this size corresponds to 200 thousand barrels of oil per day) by comparing policy BaU scenario and BaU



For specific details on the assumptions underlying the options on this chart, go to www.wri.org/usenergyoptions

Revised 7/10/2008

28 key technologies in the enhanced low carbon scenario in China

No.	Sector	Technology	Description	Note
1	Industry technology	High energy efficiency equipment	High efficiency furnace, kiln, waste heat recovery system, high efficiency process technologies, advanced electric motor	Nearly in market
2		New manufacture process technology for cement and steel		
3		CCS	In cement, steel making, refinery, ethylene manufacture	
4	Transport	Super high efficiency diesel vehicle	Advanced diesel hybrid engine	
5		Electric car		
6		Fuel cell car		
7		High efficiency aircraft	30% higher energy efficiency	
8		Bio-fuel aircraft		
9	Building	Super high efficiency air-conditioner	With COP>7	
10		LED lighting		
11		In house renewable energy system	Solar PV/Wind/Solar hot water and space heating	
12		Heat pumps		Mature
13		High isolation building		Mature
14		High efficiency electric appliance		Mature before 2030
15	Power generation	IGCC/Poly-Generation	With efficiency above 55%	
16		IGCC/Fuel cell	With efficiency above 60%	
17		On shore Wind		Mature
18		Off shore wind		Mature before 2020
19		Solar PV		
20		Solar Thermal		
21		4^{th} Generation Nuclear		
22		Advanced NGCC	With efficiency above 65%	
23		Biomass IGCC		
24		CCS in power generation		
25	Alternative fuels	Second generation bio-ethanol		
26		Bio-diesel	Vehicles, ships, vessels	
27	Grid	Smart grid		
28	Circulating tecnologies	Recycle, reuse, reducing material use		

Table 4. Major policies announced recently

Classification	Policies
Administration	Establishing energy conservation and emission reduction steering group chaired by Prime Minister (June 2006); Distributing targets to each province (September 2006)
Overall National Policies	Synthesizing Working Program for Energy Conservation and Emission Reduction (June 2007); Revised Energy Conservation Law (October 2007); Integrated Resource Utilization Guidance (January 2007); Guidance for Accelerating Energy Conservation Service Industry (2008); Guidance Catalog for industry structure change (annual)
Monitoring	Implementation Program of Energy Intensity Per GDP Statistic Index System (Nov. 2007), Implementation Program of Unit Energy Use Per GDP Exam (Nov. 2007), Implementation Program of Unit Energy Use Per GDP Monitoring (Nov. 2007)
Pricing/Financing	Differentiating energy prices for key energy-intensive industries
Standardization	Second catalog of energy efficiency labeling for consumer products (Sep. 2006); Third catalog of energy efficiency labeling for consumer products (January 2008)
Industry	1000 large energy users monitoring program by national government (April 2006); extending provincial large energy user monitoring program (April 2006); closure of small-size industry in energy intensive sectors including cement, steel, non-ferrous, chemistry etc. (June 2006); approval for new projects based on energy efficiency standard (January 2007)
Transport	Light Vehicle Fuel Efficiency Standard (Sep. 2007)
Buildings	11th Five Year Plan for Energy Conservation in Buildings (February 2006); Building Efficiency Standard Implementation (June 2007)
Power generation	Closure of small power plants (January 2007), regulation for newly installed coal-fired power plants to be most advanced power plants