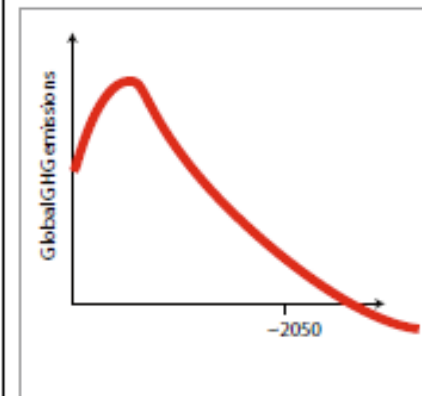
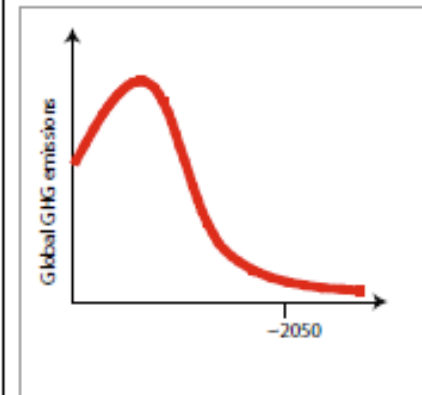
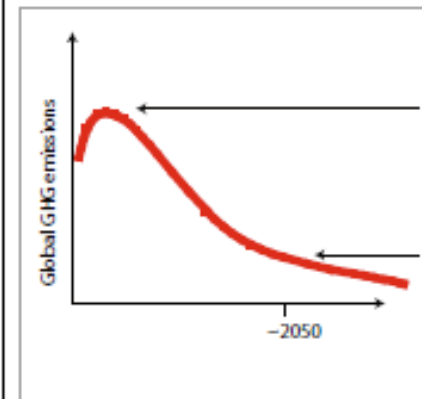


Energy Security Issues

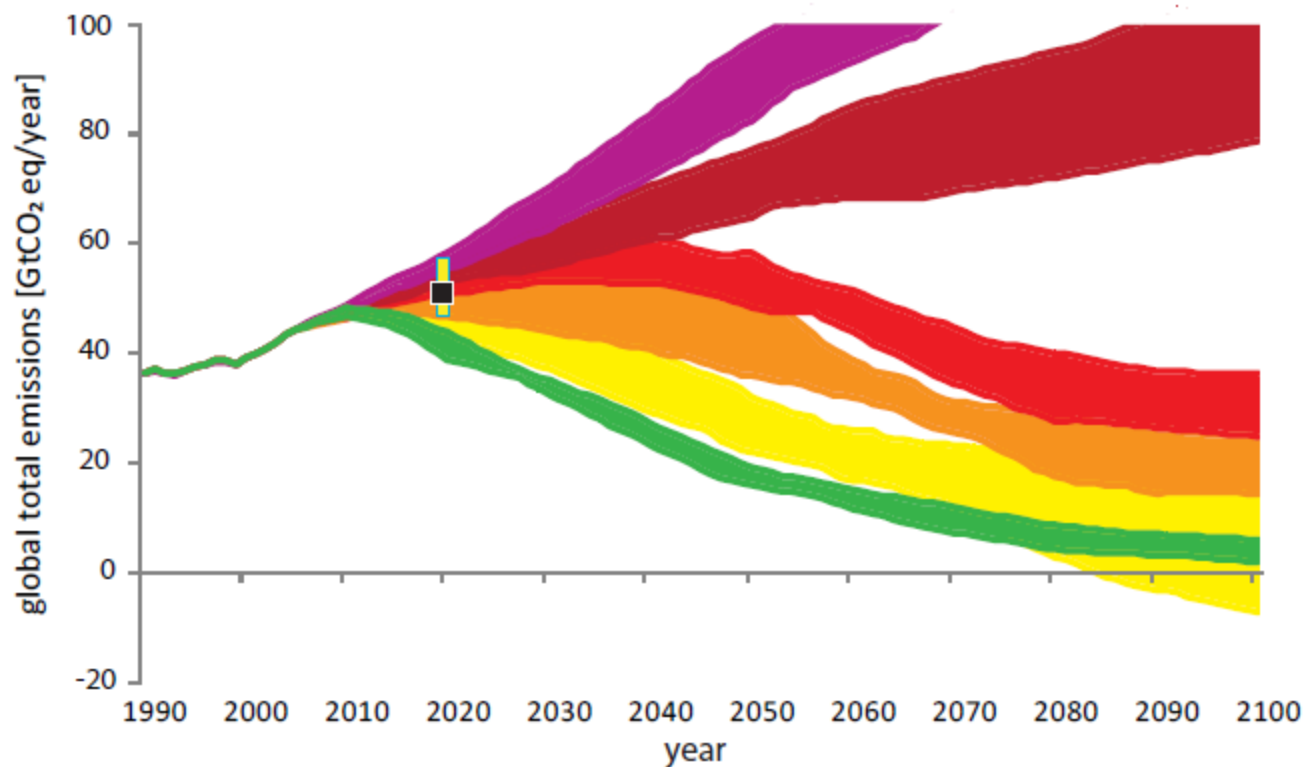
- Low Carbon Development and Technology Innovation -

Kejun JIANG
Kjiang@eri.org.cn
Energy Research Institute, China

Global Emission: 2 degree



**Likely avoided temperature increase of IAM scenarios.
Bar superimposed in 2020 shows expected emissions from the pledges.**



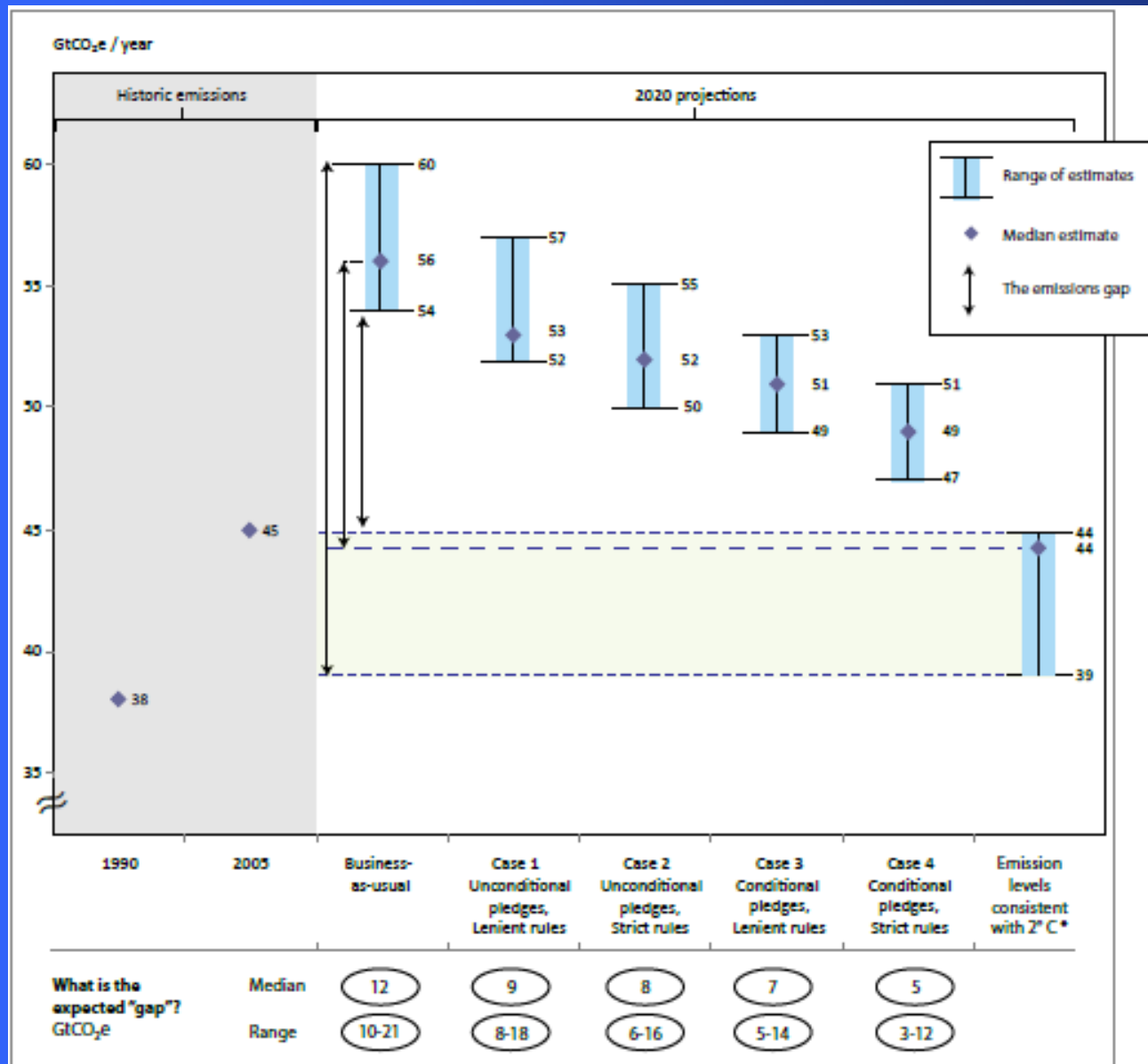
Legend:

Emission levels consistent with a likely temperature increase (T) in the 21st century of:

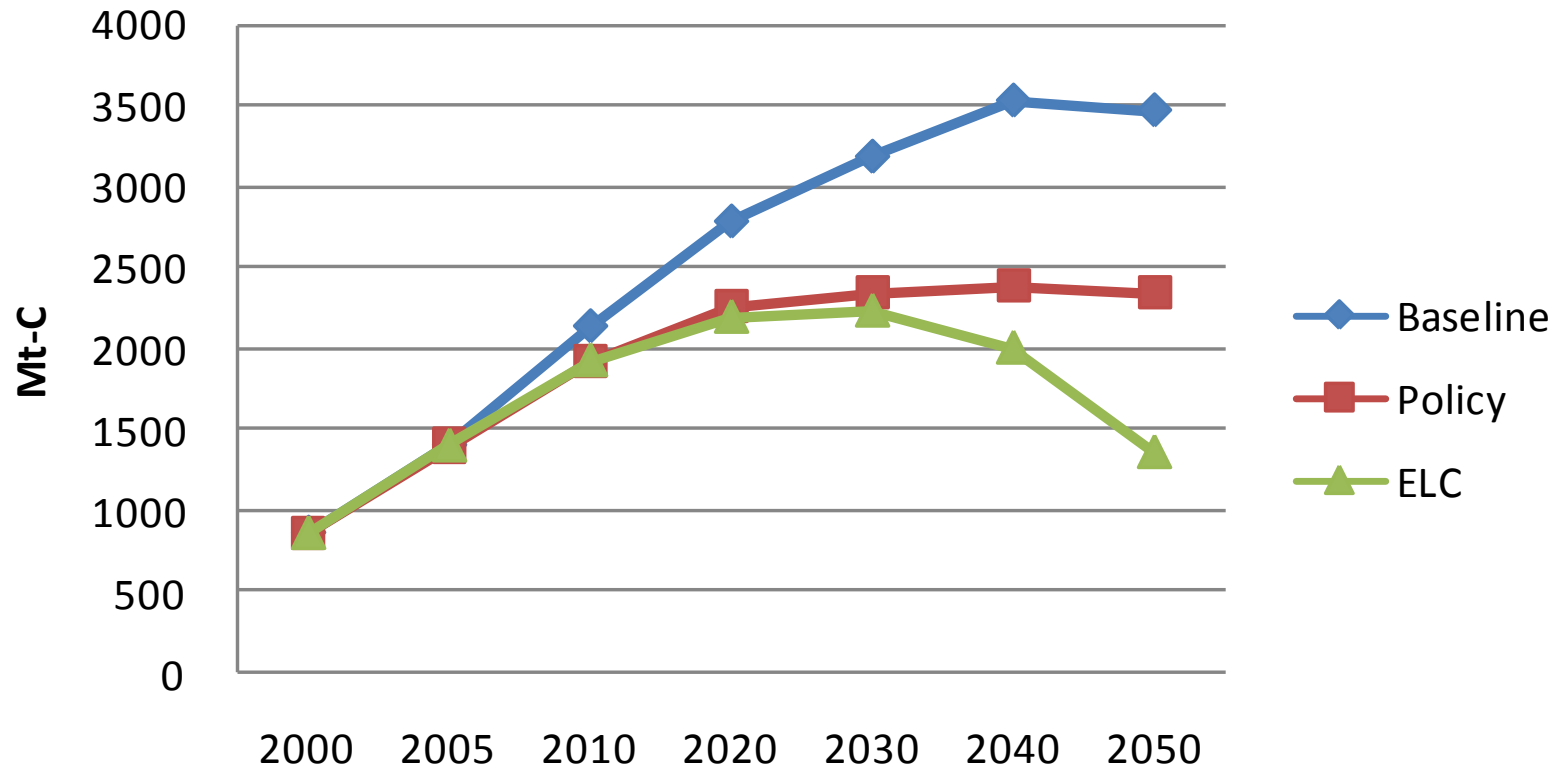
- T > 5°C
- 4°C < T < 5°C
- 3°C < T < 4°C
- 2.5°C < T < 3°C
- 2°C < T < 2.5°C
- T < 2°C

range of pledge cases
median range of pledge cases

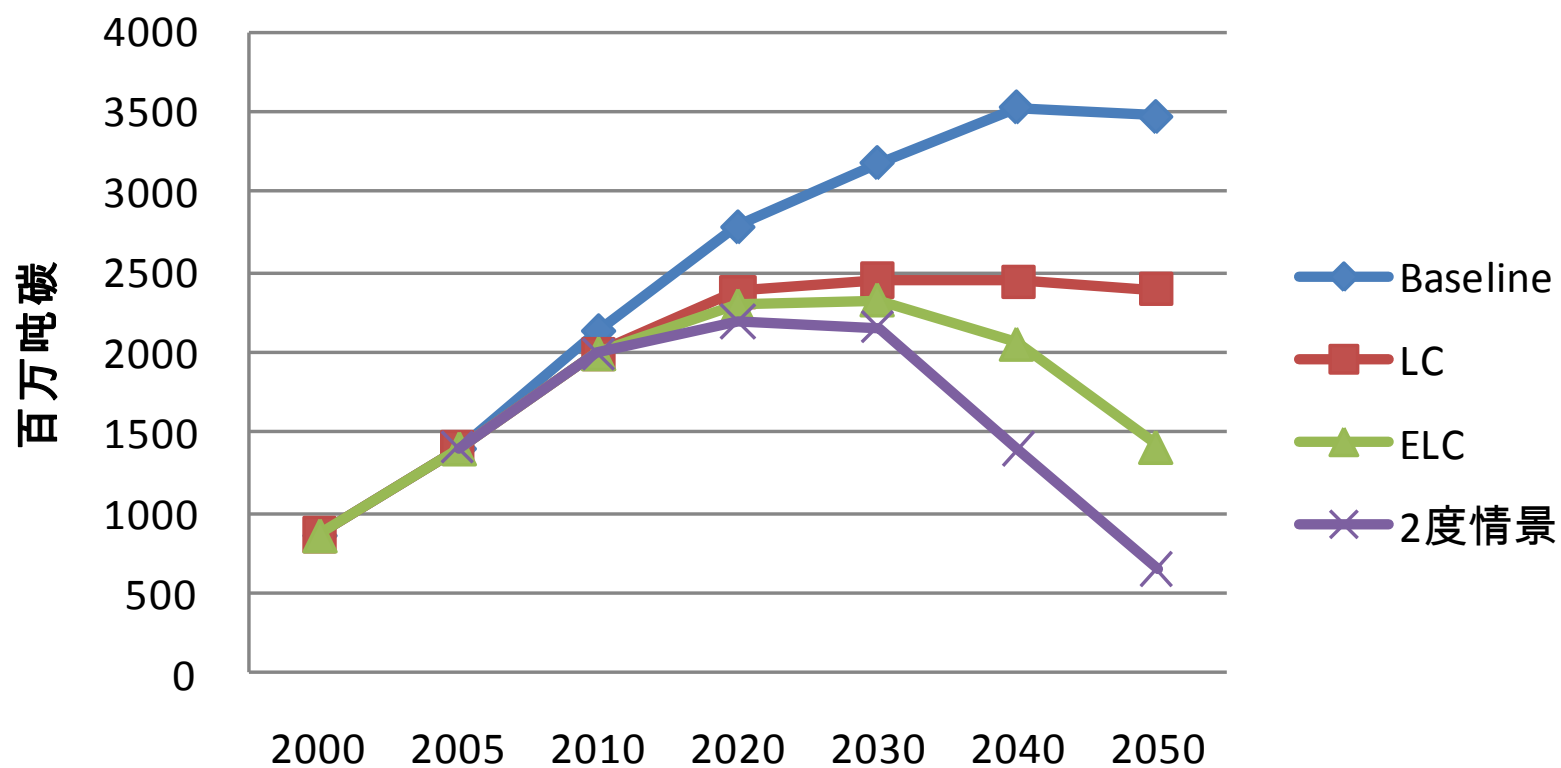
Copenhagen Commitment: the GAP



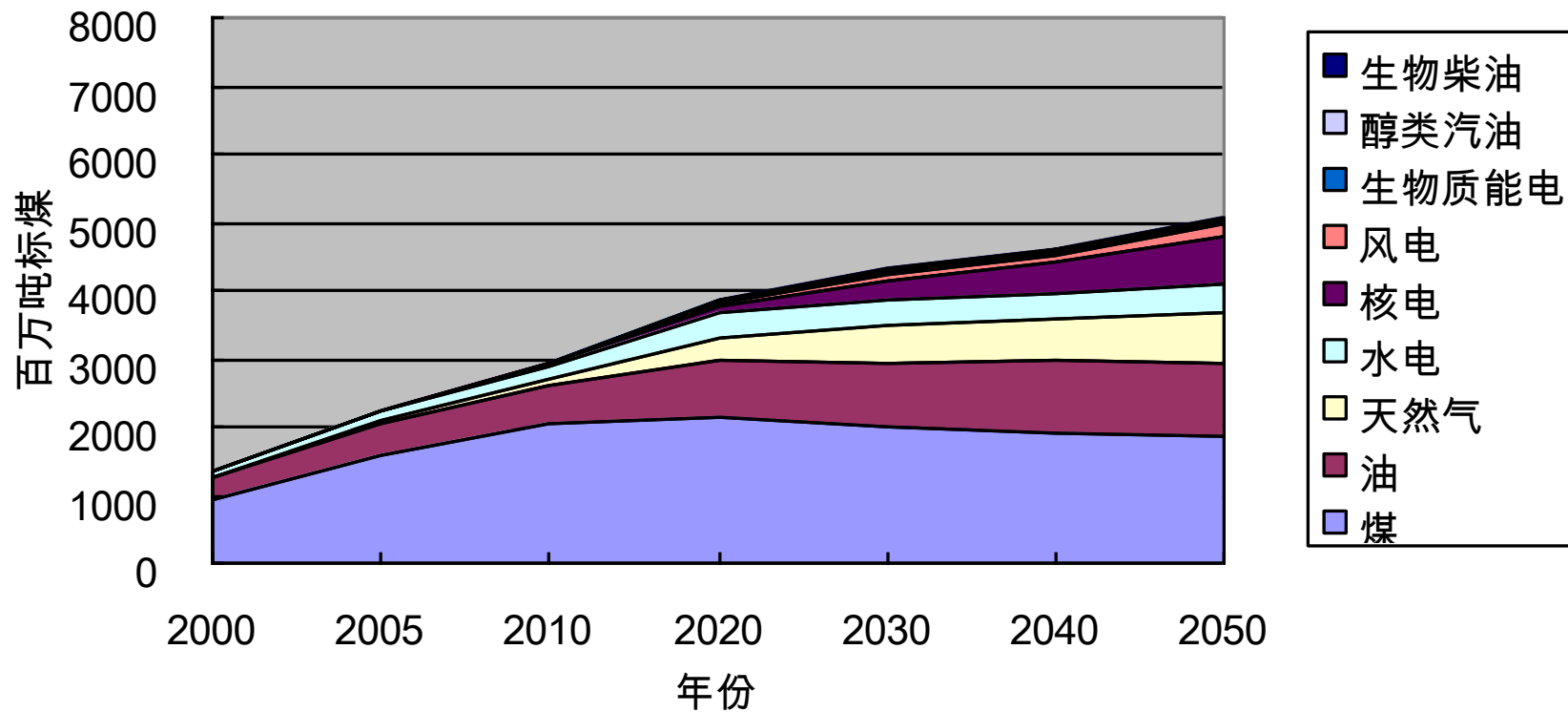
CO2 Emission in China



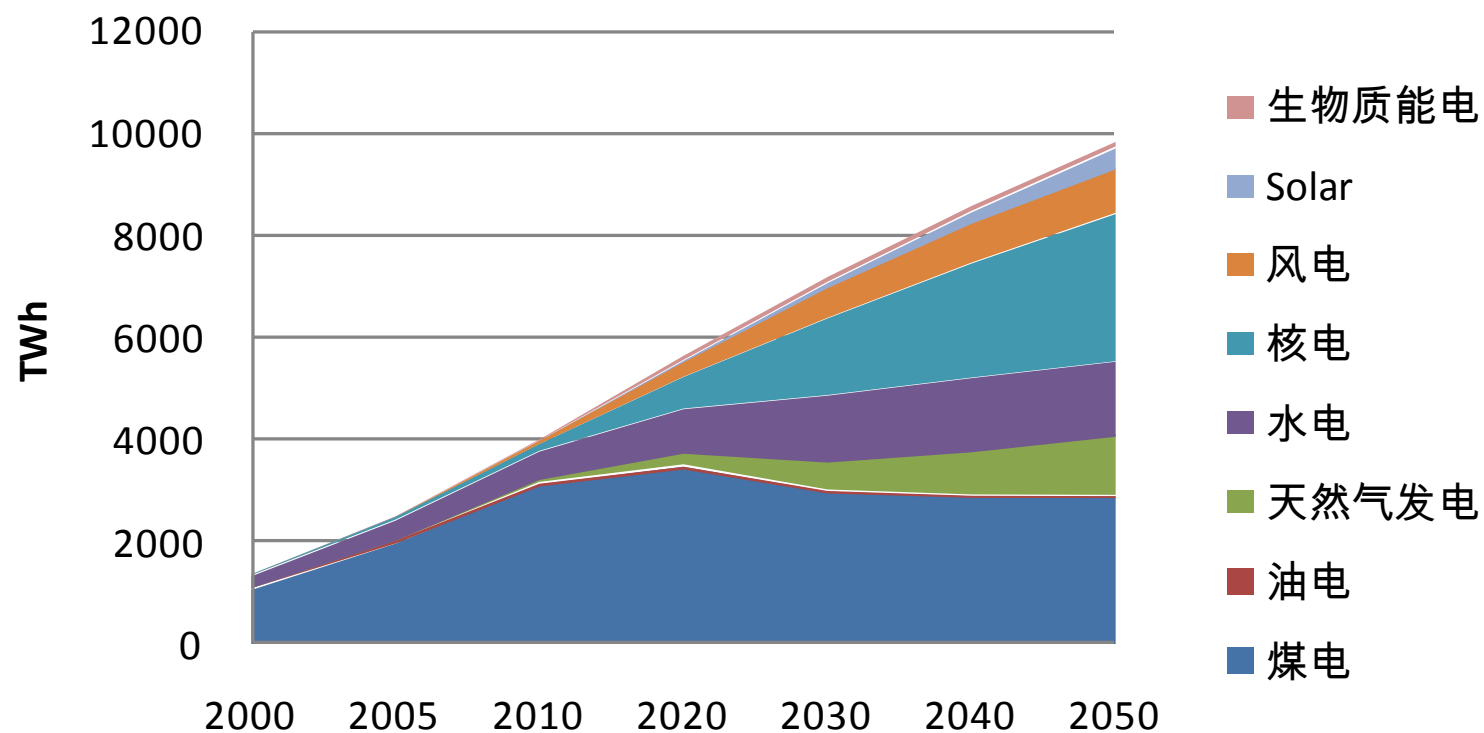
CO2 排放量



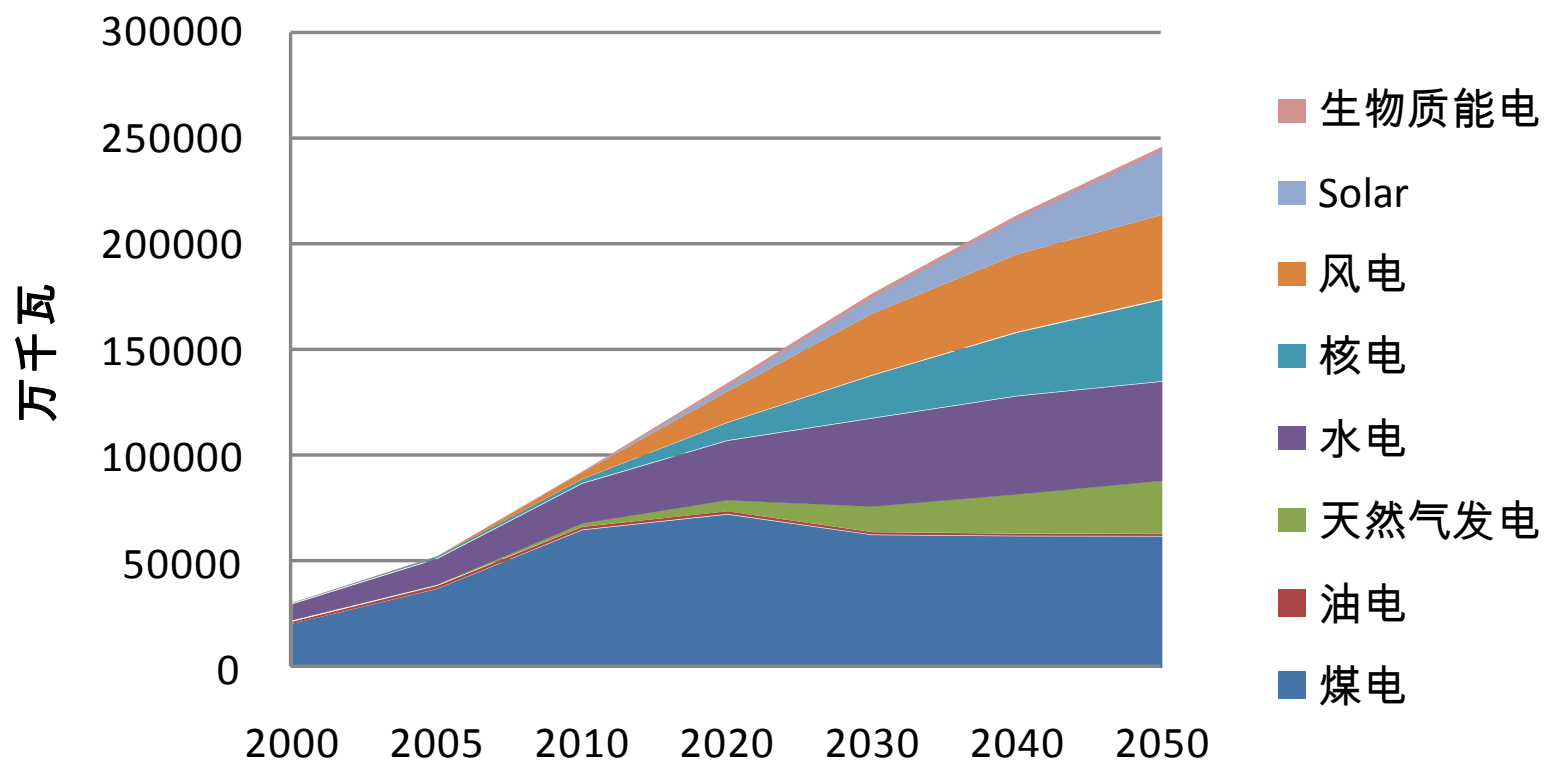
一次能源需求量，低碳情景



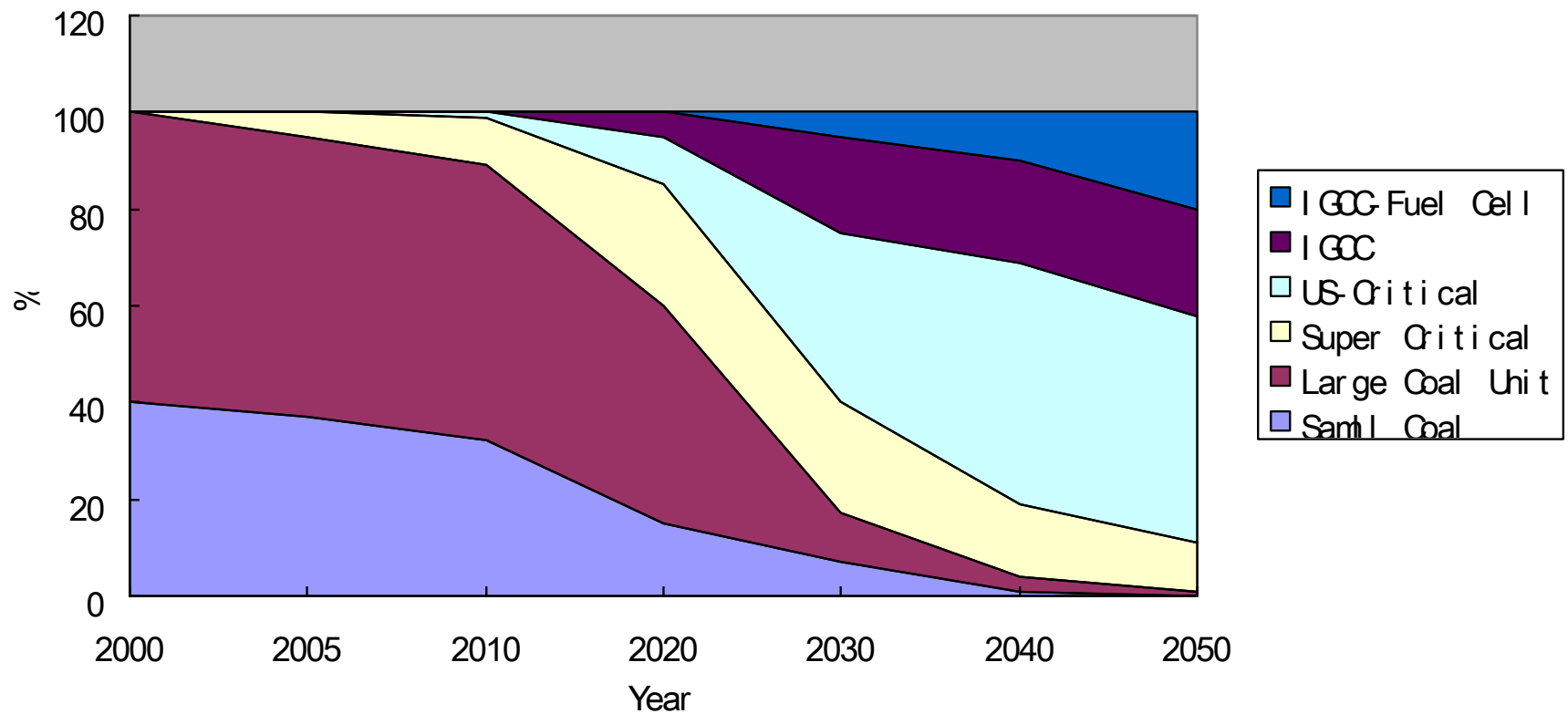
发电量



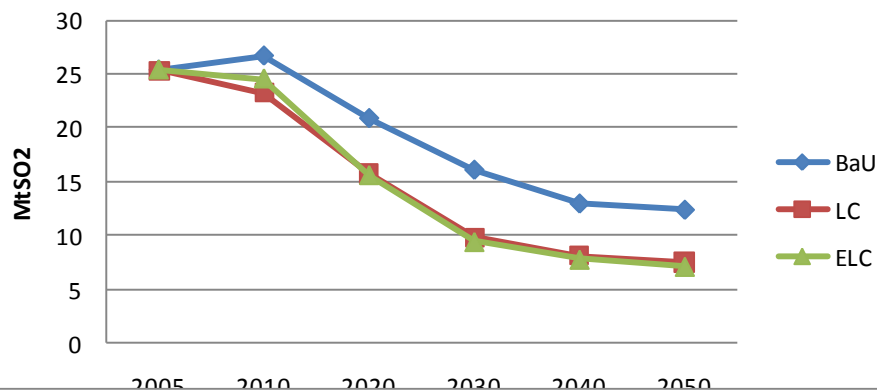
发电装机容量



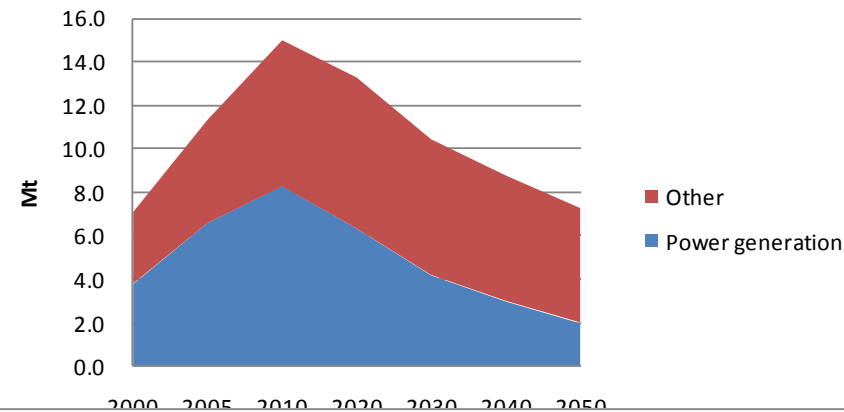
COS future



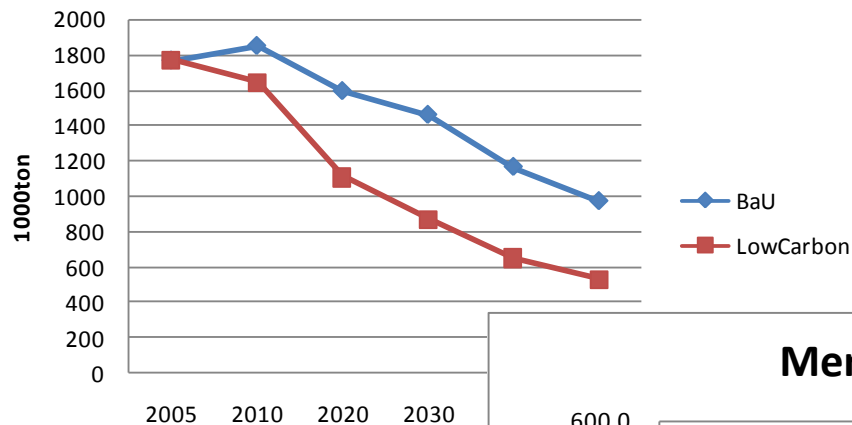
SO2 Emission



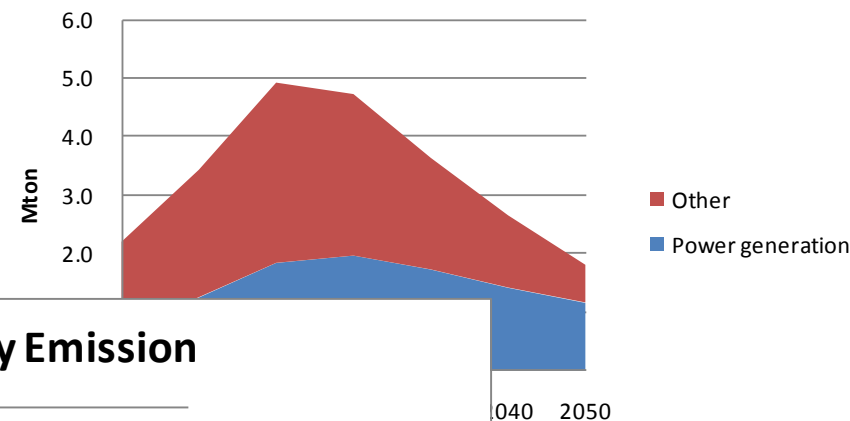
NOx Emission in China, ELC scenario



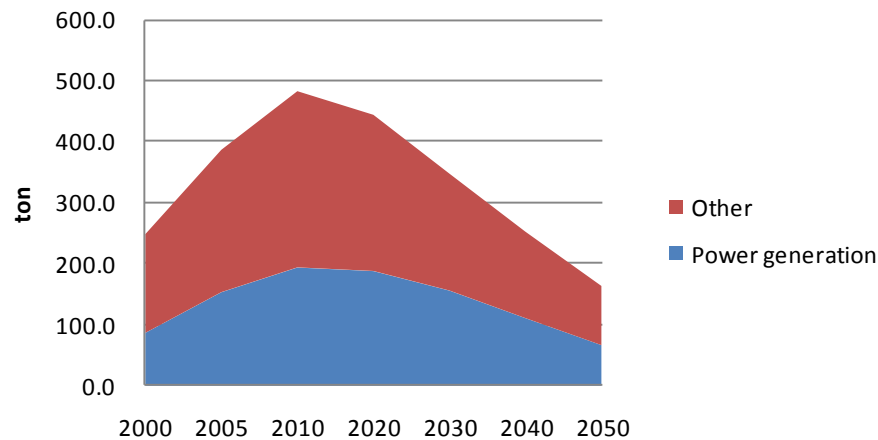
Black Carbon Emission in China



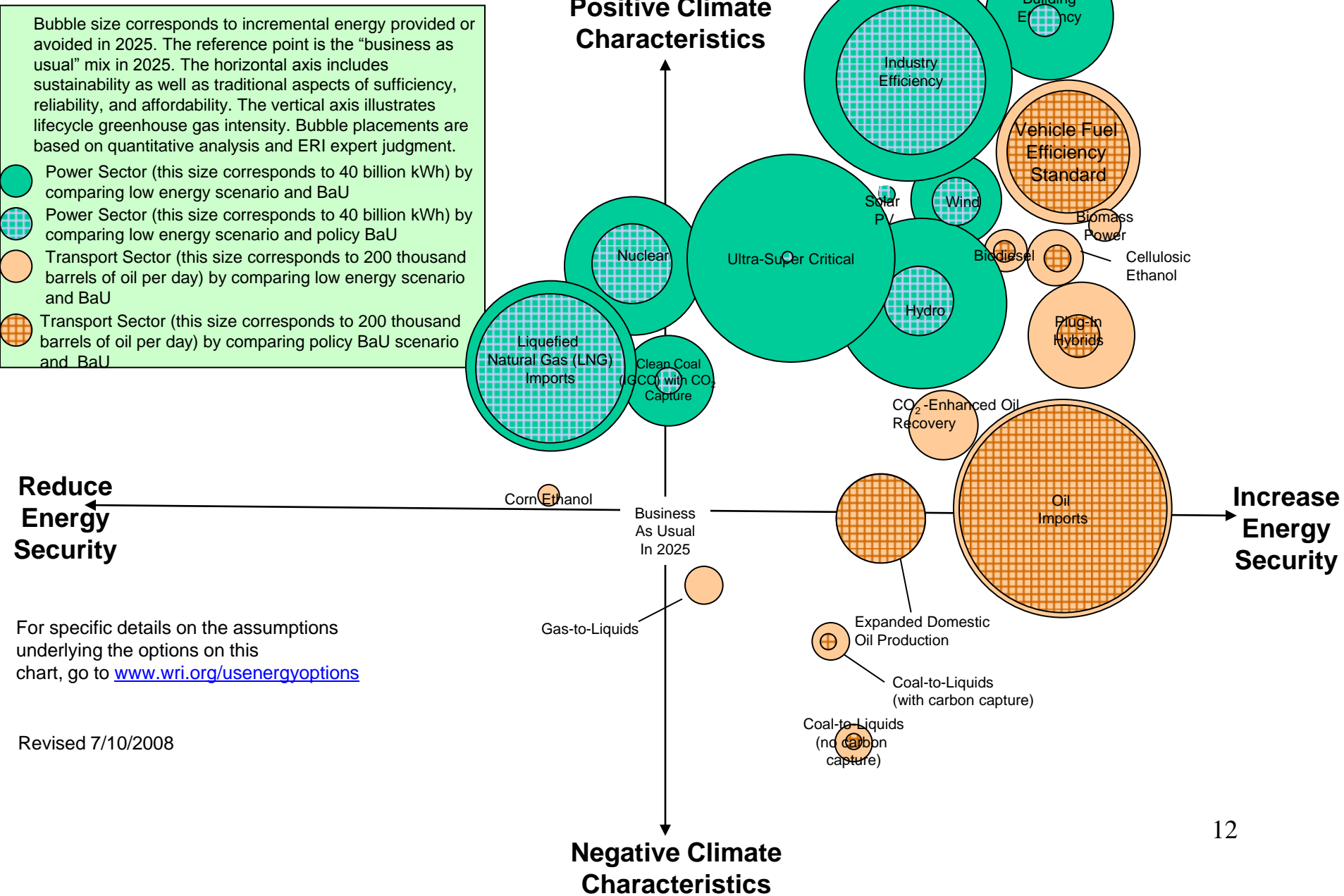
PM2.5 Emission



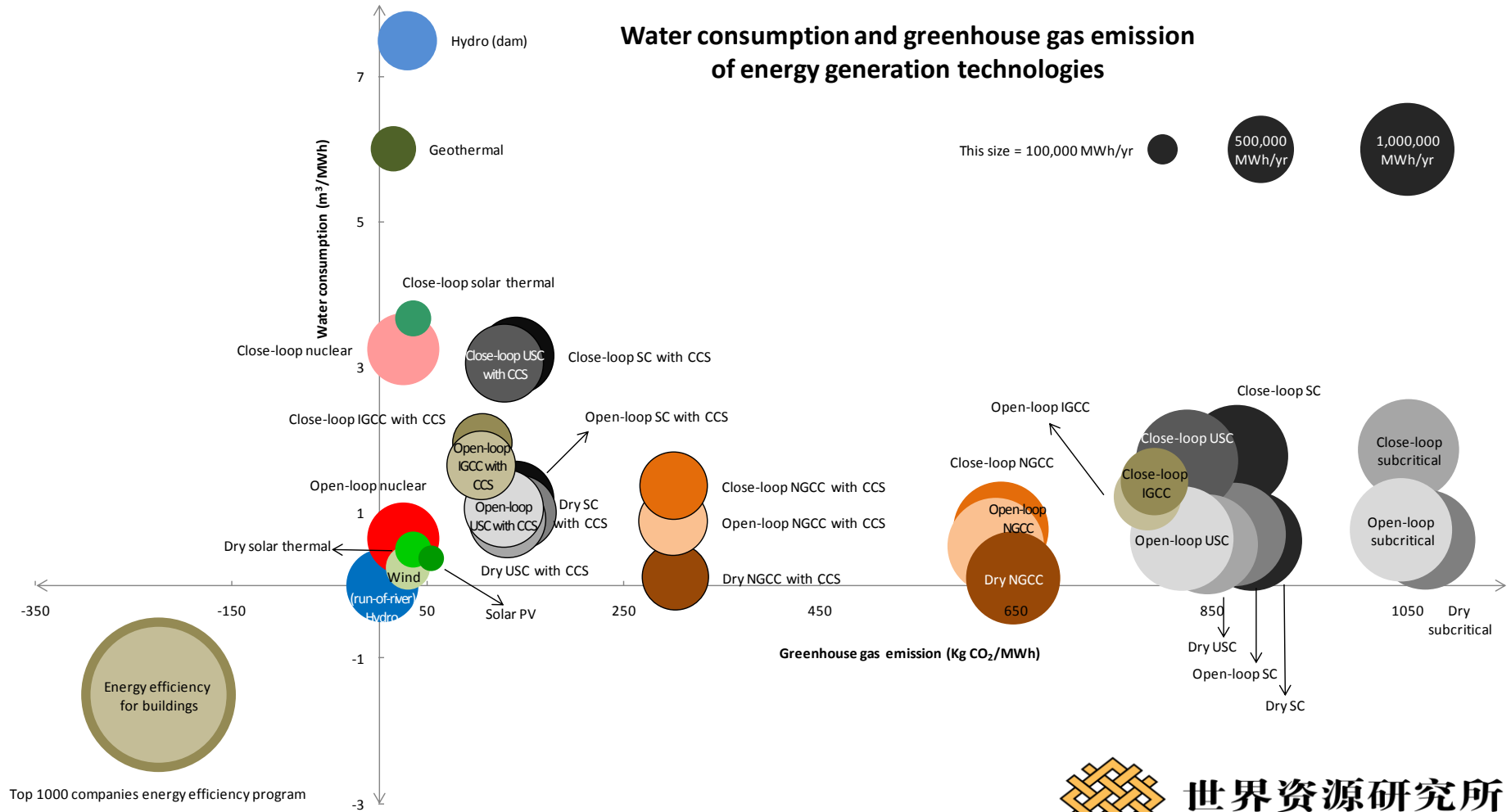
Mercury Emission



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



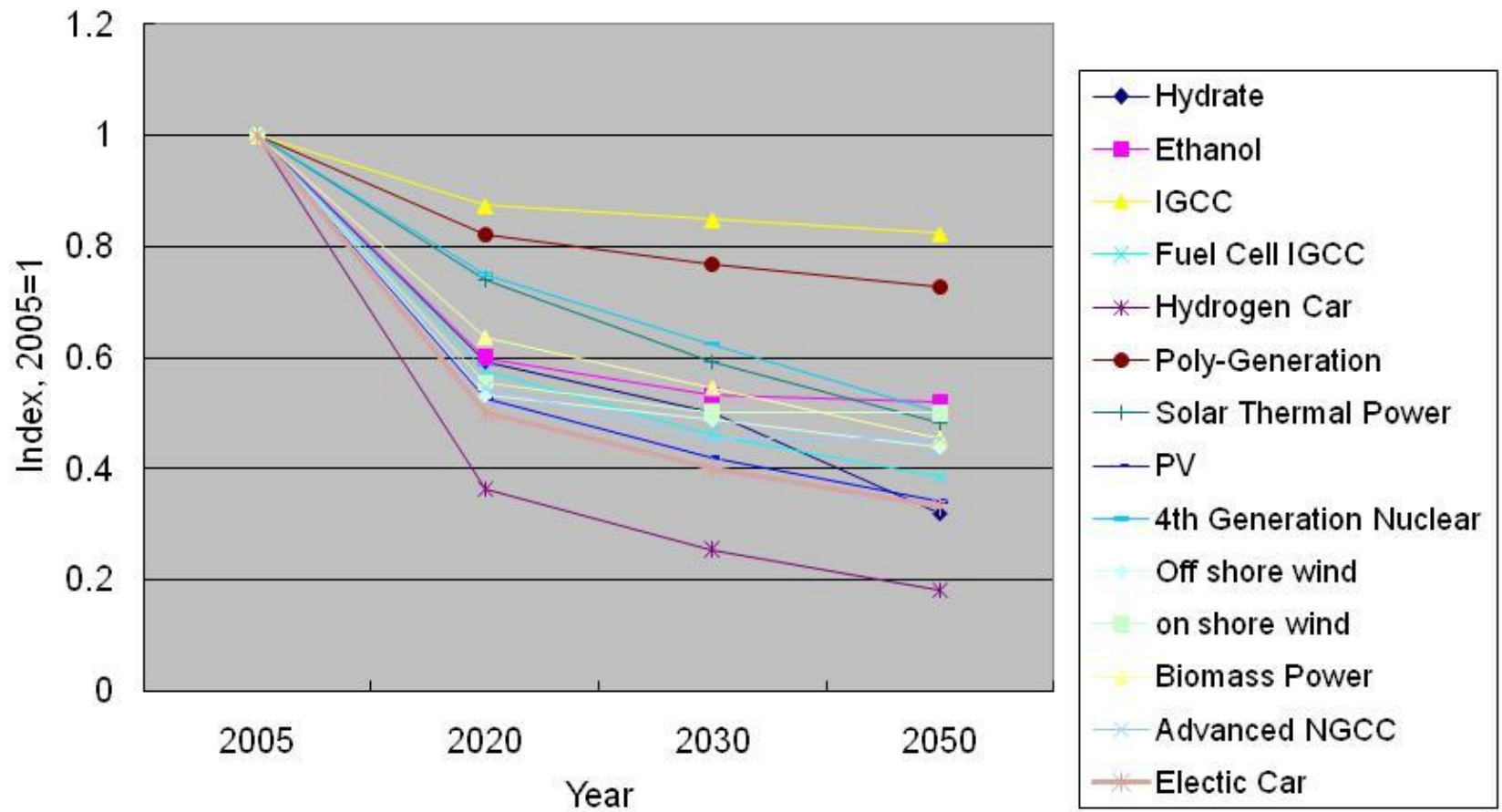
Water consumption and greenhouse gas emission of energy generation technologies



28 key technologies in the enhanced low carbon scenario in China

No.	Sector	Technology	Description	Note
1	Industry technology	High efficiency energy 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 technologies	Recycle, reuse, reducing material use		

Technology learning curve

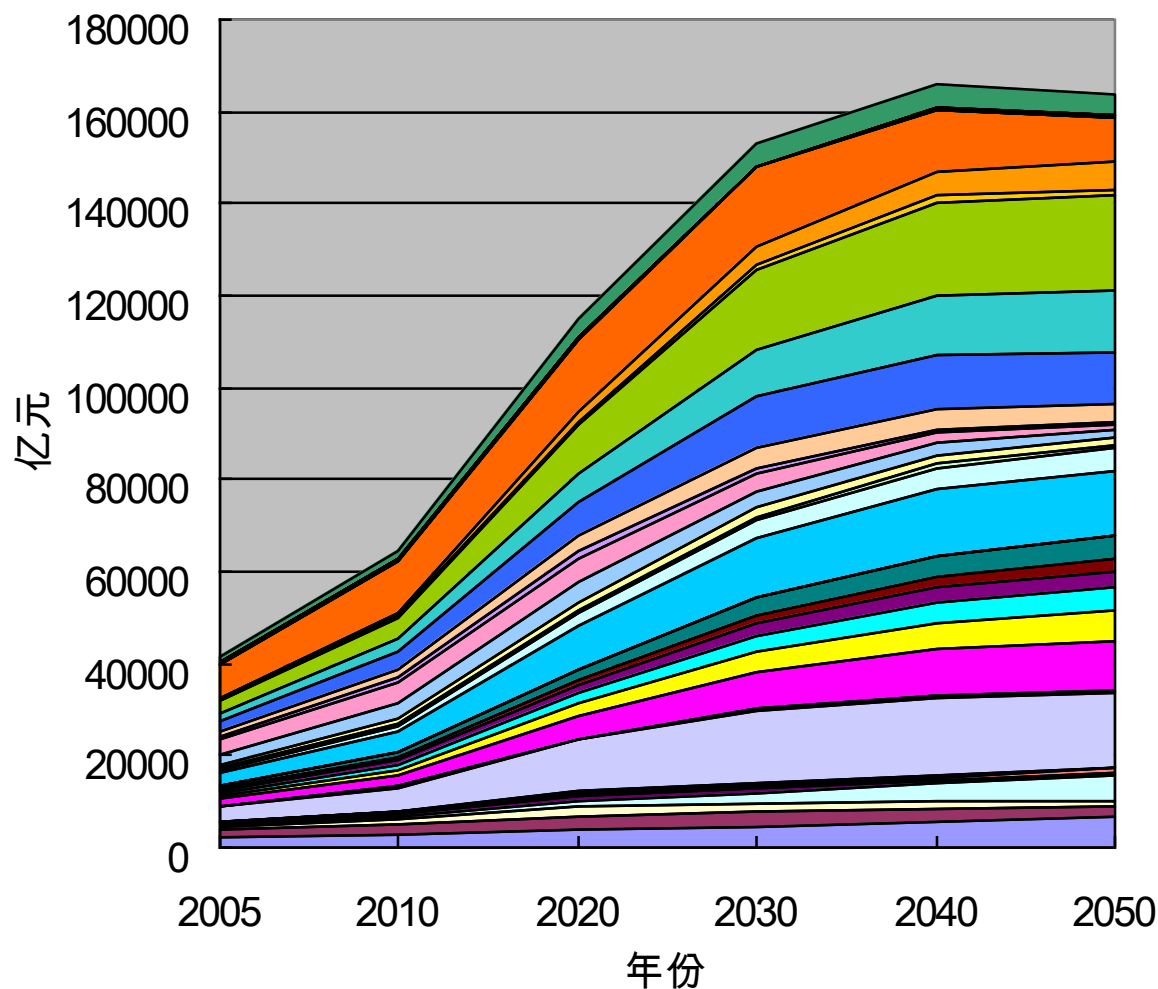


Stockholm: bicycle is coming back



Investment by industrial sectors

工业分部门投资



- 建筑业
- 自来水的生产和供应业
- 煤气的生产和供应业
- 蒸汽热水生产供应业
- 电力生产供应业
- 其他工业
- 仪器仪表文化办公用机械
- 电气机械及器材、电子及通信设备制造业
- 交通运输设备制造业
- 普通机械、专用设备制造业
- 金属制品业
- 有色金属
- 黑色金属冶炼及压延加工业
- 非金属矿物制品业
- 橡胶制品业, 塑料制品业
- 化学纤维制造业
- 医药制造业
- 化学原料及制品制造业
- 炼焦业
- 石油加工
- 印刷业记录媒介的复制, 文教体育用品制造业
- 造纸及纸制品业
- 木材加工及竹藤棕草制品业、家具制造业
- 服装皮革及其他纤维制品制造
- 纺织业
- 烟草加工业
- 食品饮料加工、制造业
- 非金属矿采选业, 其他矿采选业, 木材及竹材采运业
- 有色金属矿采选业
- 黑色金属矿采选业
- 天然气开采业
- 石油

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

太阳能利用

2050年的低碳住宅 舒适和节能

光伏电池

(25-47% 的家庭拥有屋顶光伏电池，
转换效率接近30%)

生态生活教育

减少10-20% 能源需求

屋顶植被

太阳热利用

普及率: 20-60%
(目前 6%)

能源检测系统 (家用电器)

超高效空调

COP = 8,
普及率 100%

待机电源耗电

降低1/3，
普及率100%

高效照明 【如 LED照明】

减少50%照明需求，
普及率 100%

高效绝热

减少 60% 采暖需求，
普及率70%

燃料电池

普及率 0-20%

热泵采暖

COP = 5
普及率 30-70%

向公众提供经济和环境
信息促使大家成为
低碳消费

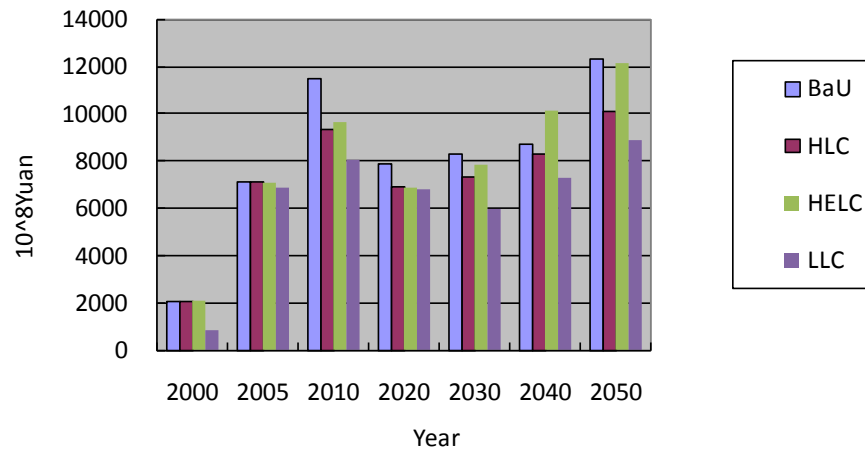
高效家用电器

减少能源需求，支持舒适和安全生活方式

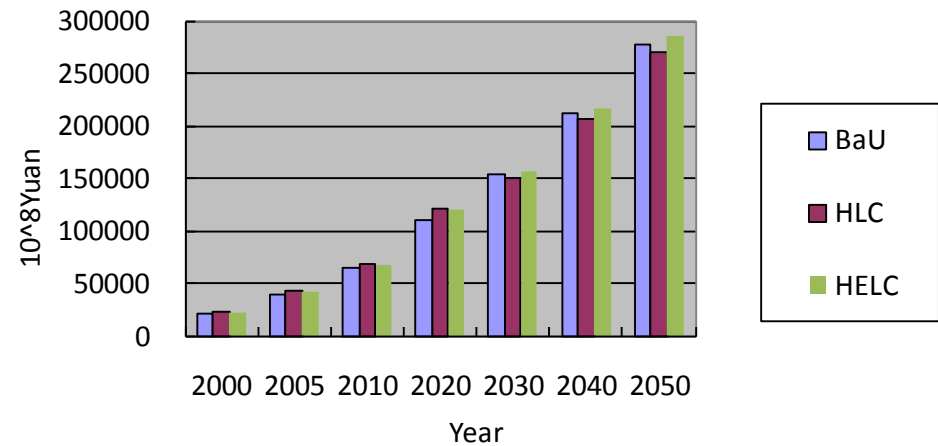
Transport, Low carbon scenario

		2005	2010	2020	2030	2040	2050
Family car ownership, per 100HH	Urban	3.37	14	36	65	77	78
	Rural	0.08	0.2	8	38	70	90
Family car annual travel distance, km		9500	9500	9300	8635	8300	7480
Average engine size of family cars, liter		1.7	1.6	1.6	1.6	1.5	1.4
Fuel efficiency of car, L/100km		9.2	8.9	7.1	5.9	4.8	4.1
Share of MRT in total traffic volume, %		0.011	0.016	0.025	0.046	0.1	0.21
Share of Biofuel, %		1.10%	1.30%	4.1%	7.70%	12%	13%
Share of electric car, %		0%	0.12%	3.2%	6.80%	12.5%	19.8%
Share of fuel cell car, %		0%	0%	0.80%	1.60%	4.70%	7.90%

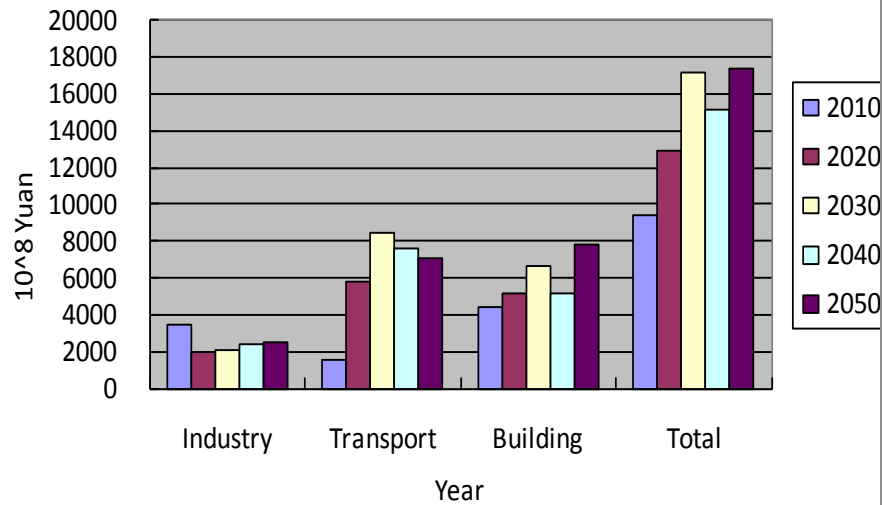
Investment in Energy Industry in China



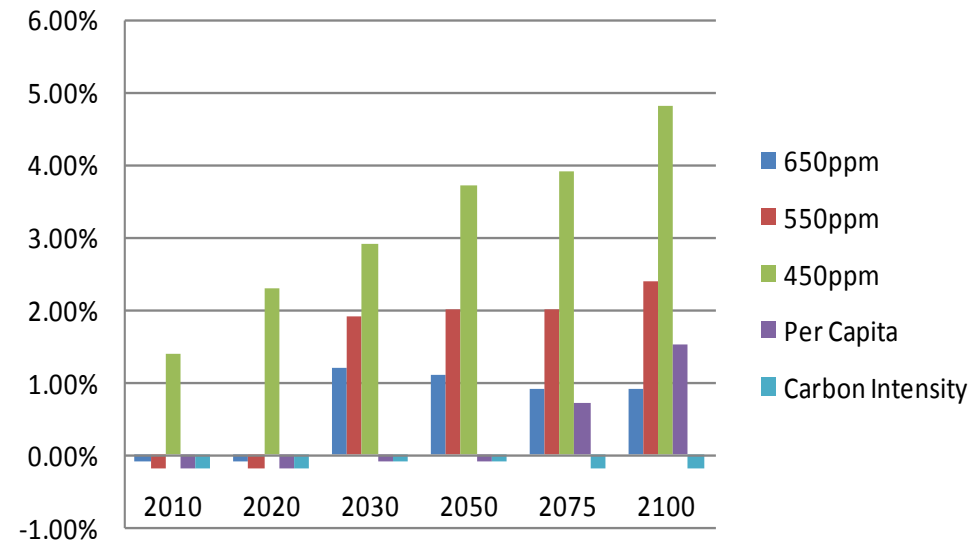
Energy Expenditures in China



Additional Investment in end use sectors in ELC



GDP Loss, %



Good News: Rapid GDP growth could provide strong support

- By 2015, GDP in China could reach 75 trillion Yuan (in current value)
- Newly added accumulated GDP is 450 Trillion Yuan
- Cumulated GDP is 860 Trillion Yuan
- All the investment need in all modeling study is much small

Policy roadmap: Super high efficiency air conditioner

- Efficiency Standard: COP, MEPS
- Government Planning
- Subsidy

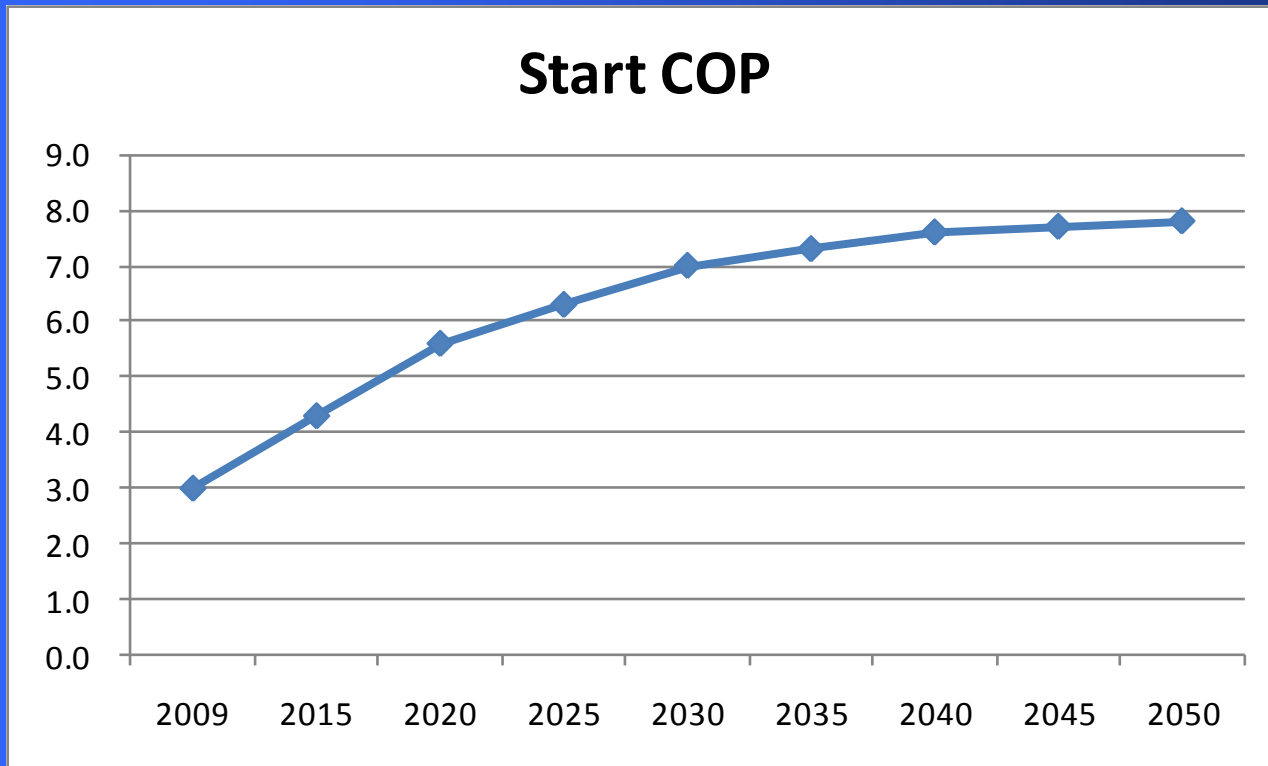


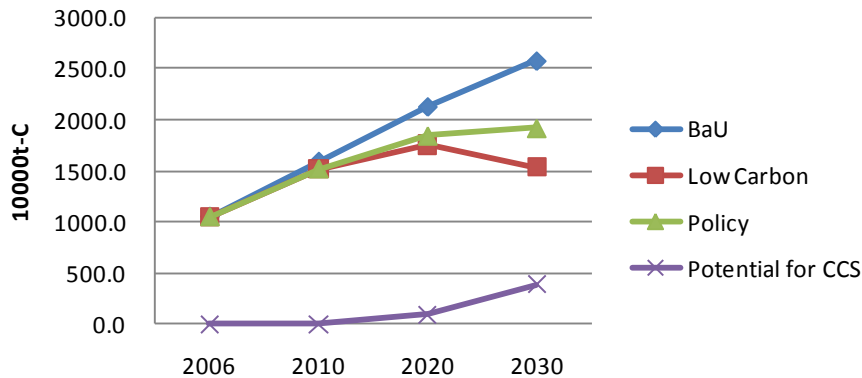
Table 4. Major policies announced recently

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	11 th 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

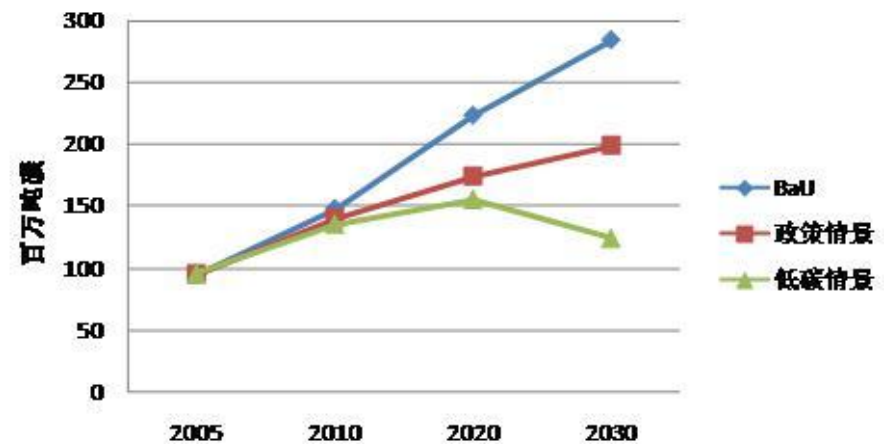
Recent Policy Progress under consideration

- Pilot phase low carbon cities and provinces: 8 cities and 5 provinces
- Carbon tax: under discussion
- Domestic Emission trading: 6 pilot provinces and cities
- Energy and CO2 targets in 12th Five Year Plan: national and provincial
- Cap on energy demand: national and provincial, under discussion
- Low carbon technology priority list: under preparing

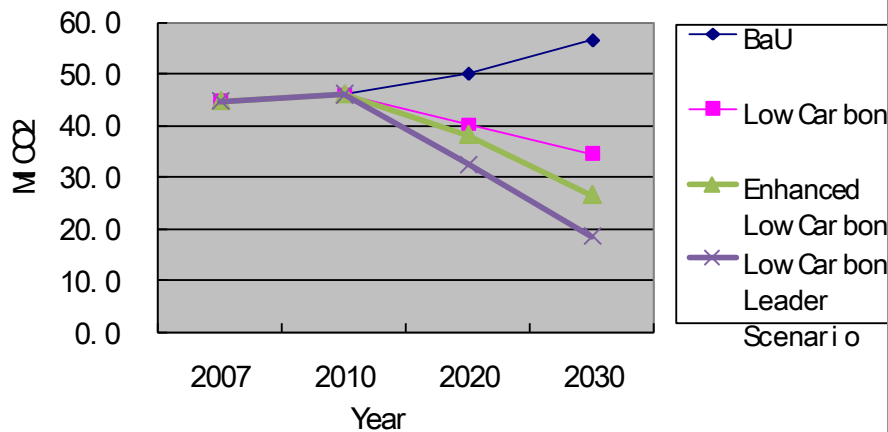
CO2 Emission from energy use: Jilin City



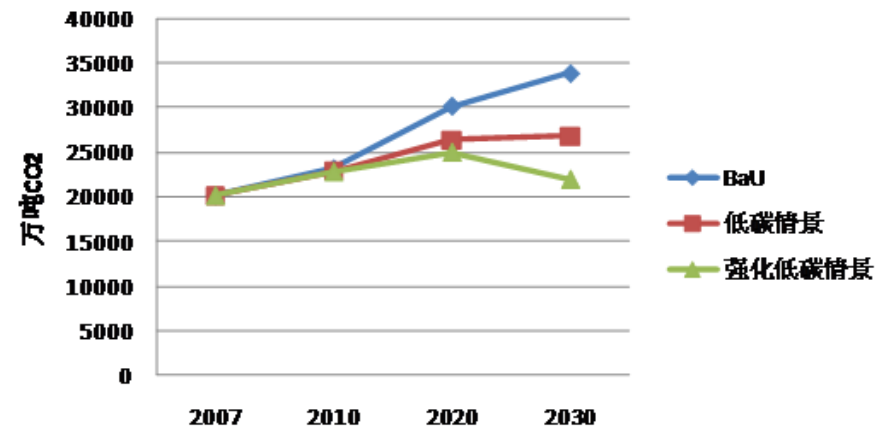
Guangdong CO2 排放量



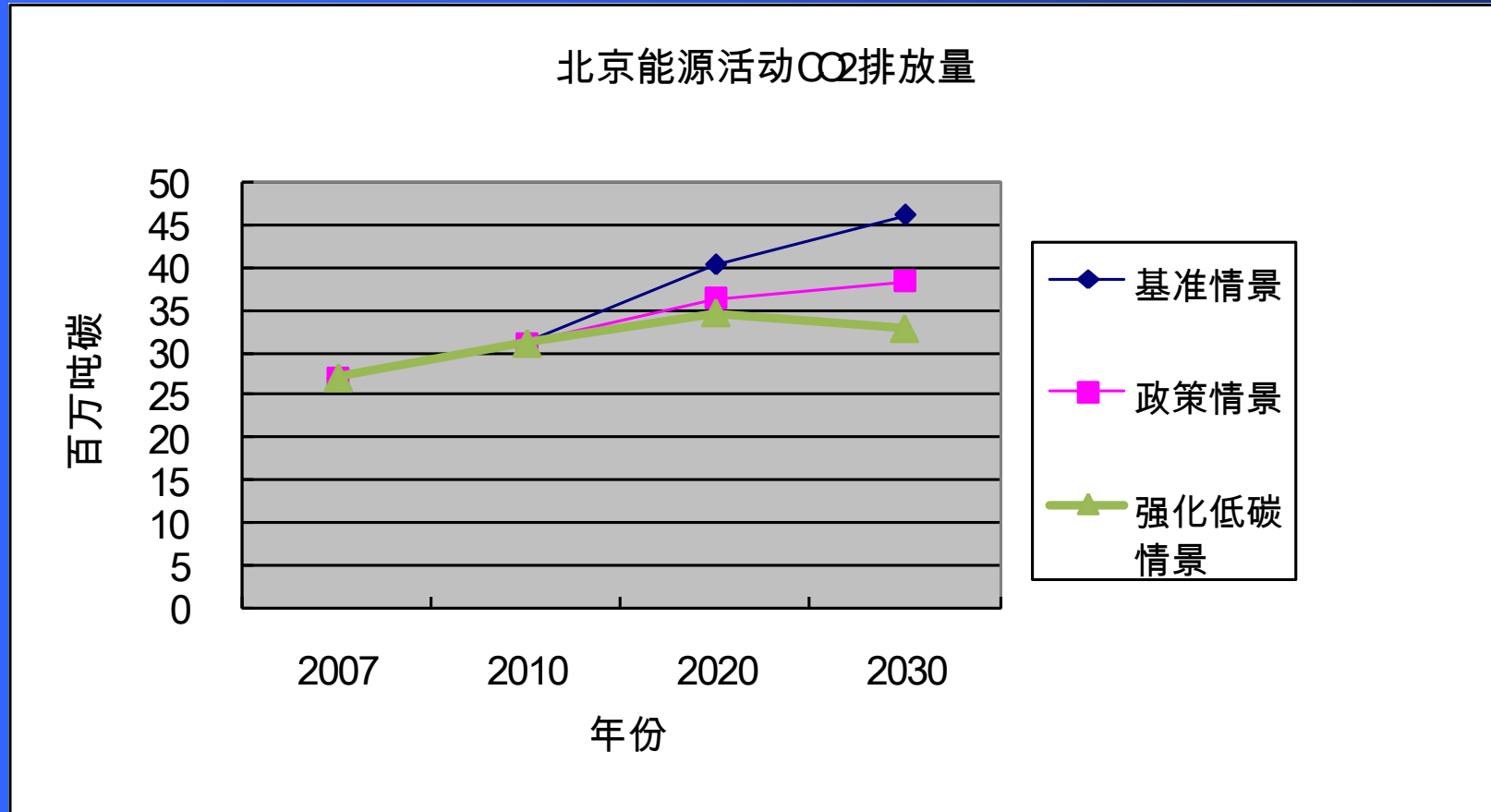
CO2 Emission in Hong Kong



Shanghai 上海 CO2 排放量

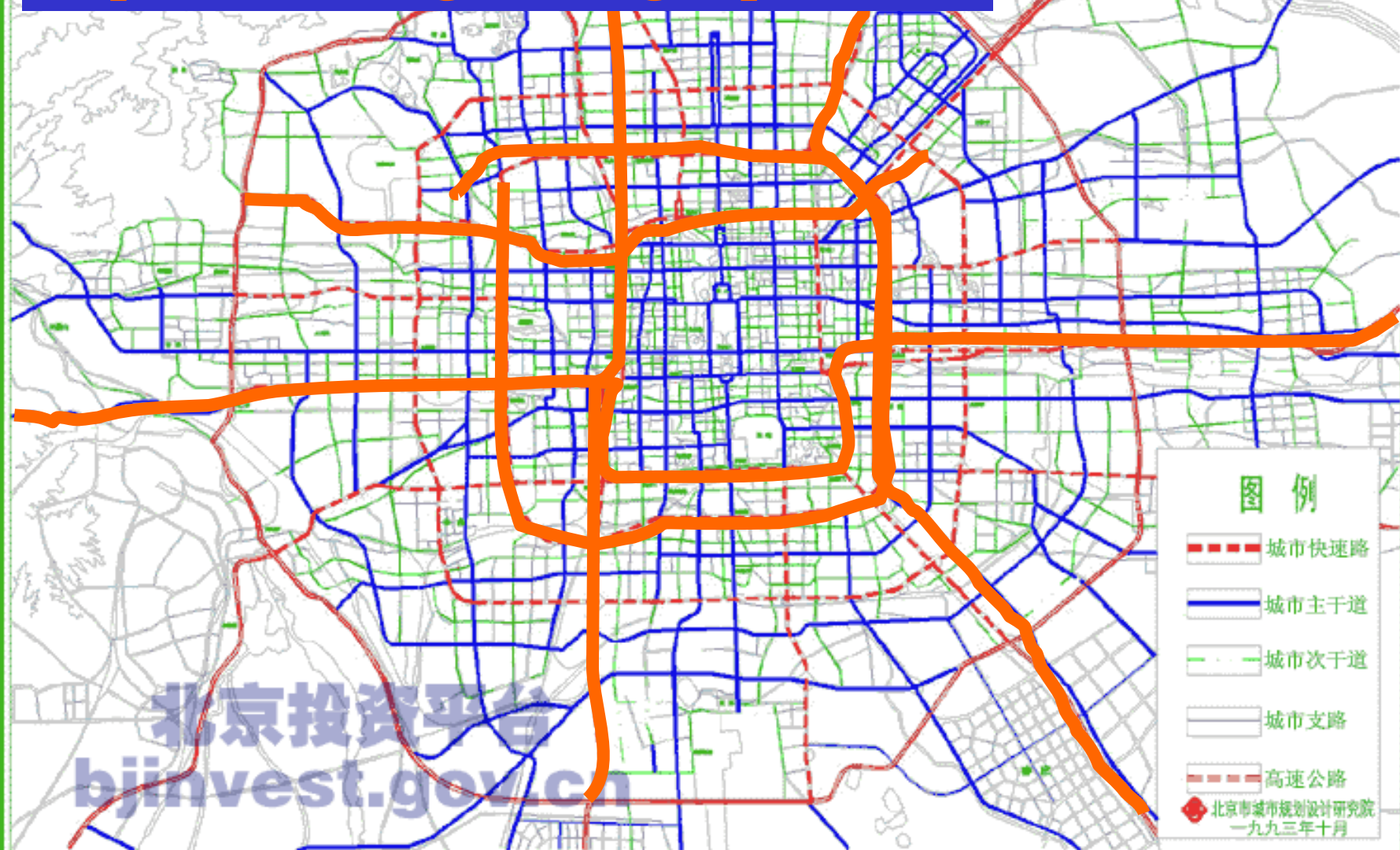


Beijing CO2 emission from energy activities



北京市区道路网规划方案

Rapid bus: using existing rapid road







POWER_BOX by Baosteel

2kW wind

10kW Solar PV

