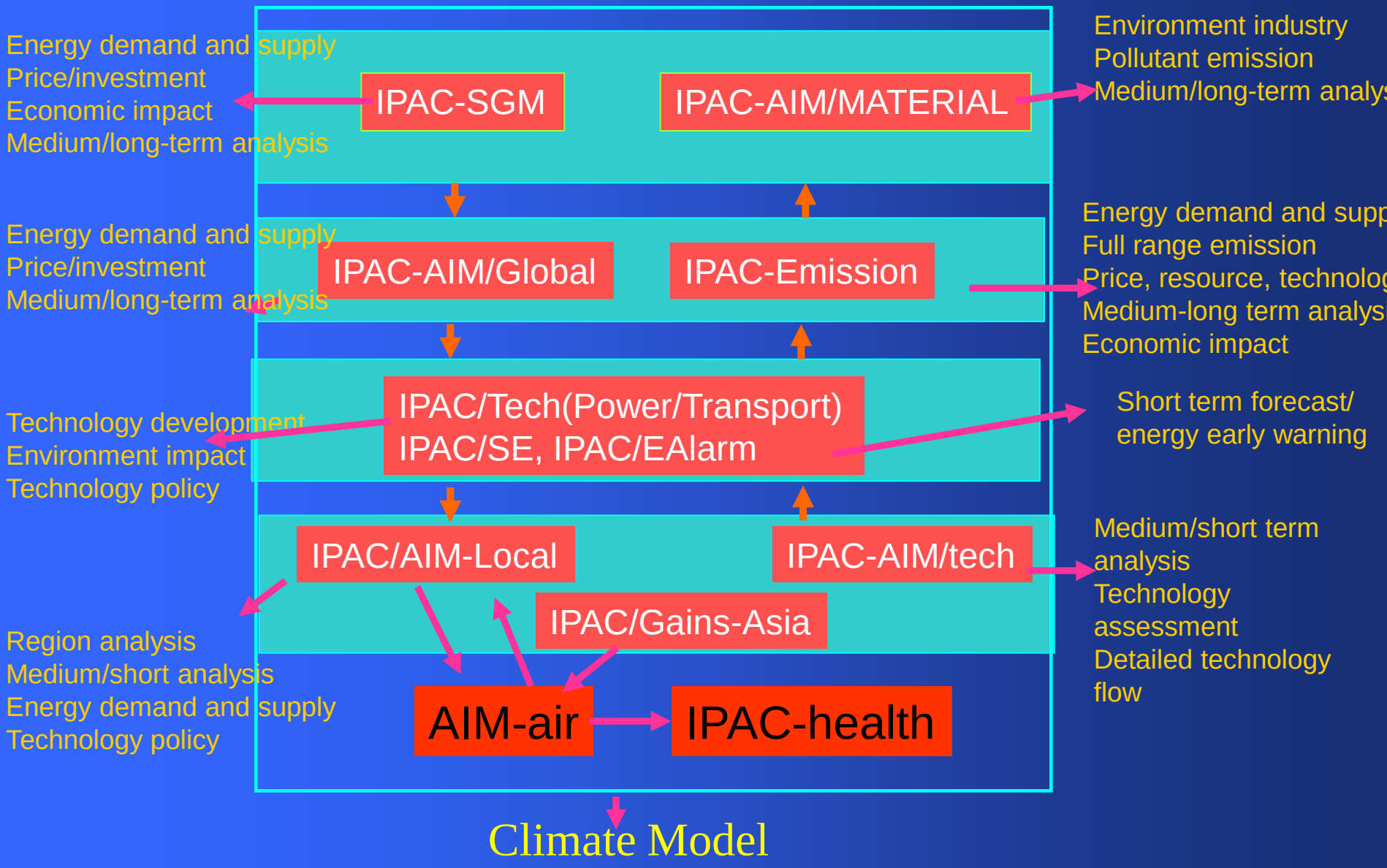
China's Energy and CO_2 Emission Scenario by 2050:

A Policy Roadmap

Energy Research Institute, China

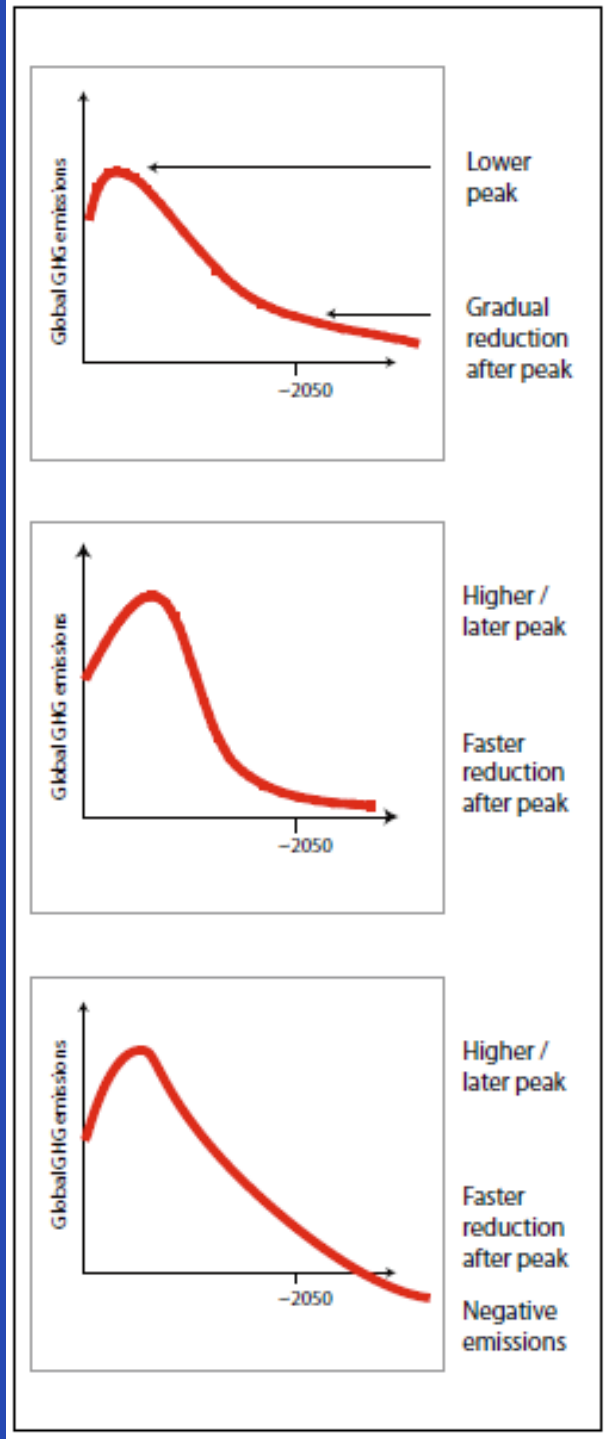
Framework of Integrated Policy Model for China (IPAC)



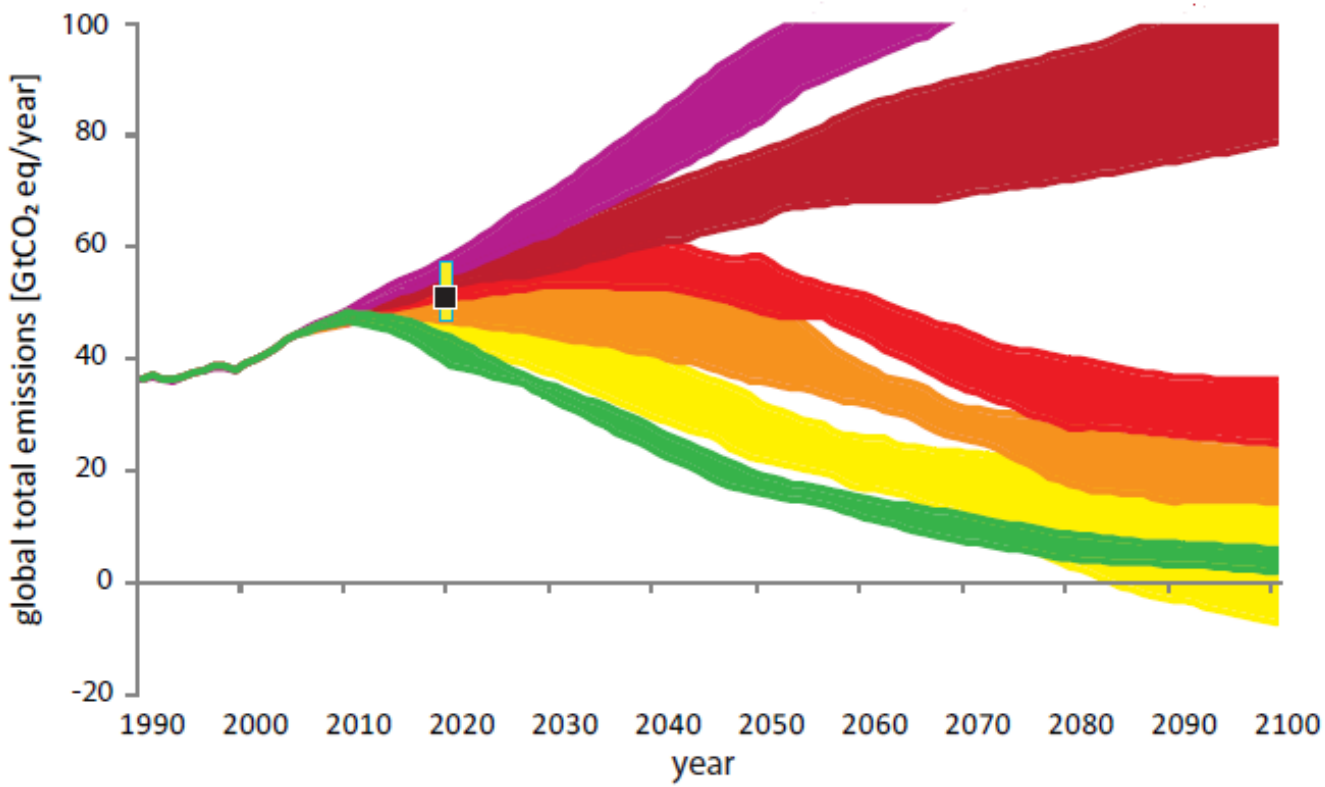
Copenhagen Accord

To achieve the ultimate objective of the Convention to stabilize greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, we shall, recognizing the scientific view that the increase in global temperature should be below 2 degrees Celsius, on the basis of equity and in the context of sustainable development, enhance our long-term cooperative action to combat climate change.

Global Emission: 2 degree



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



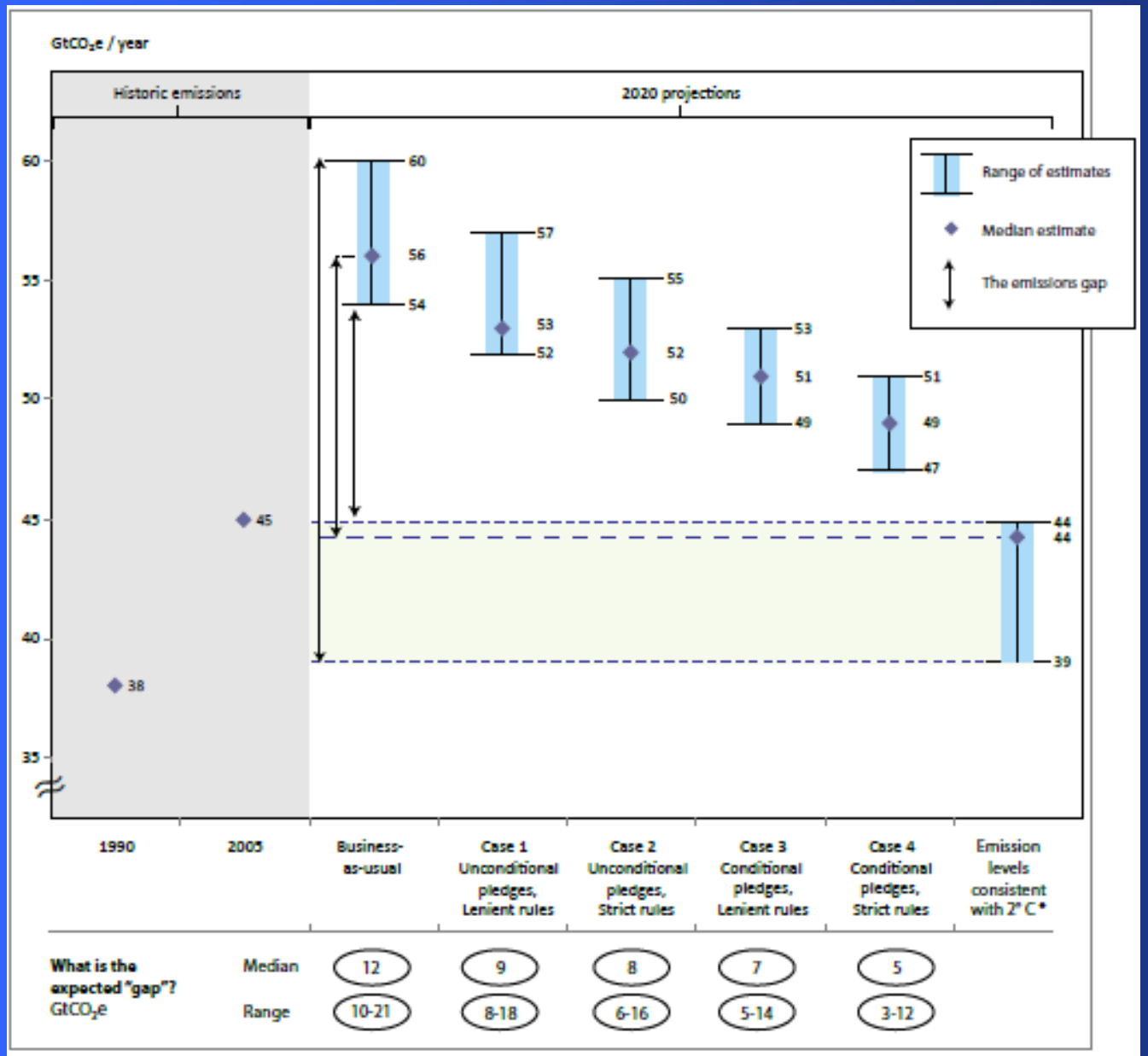
Legend:

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

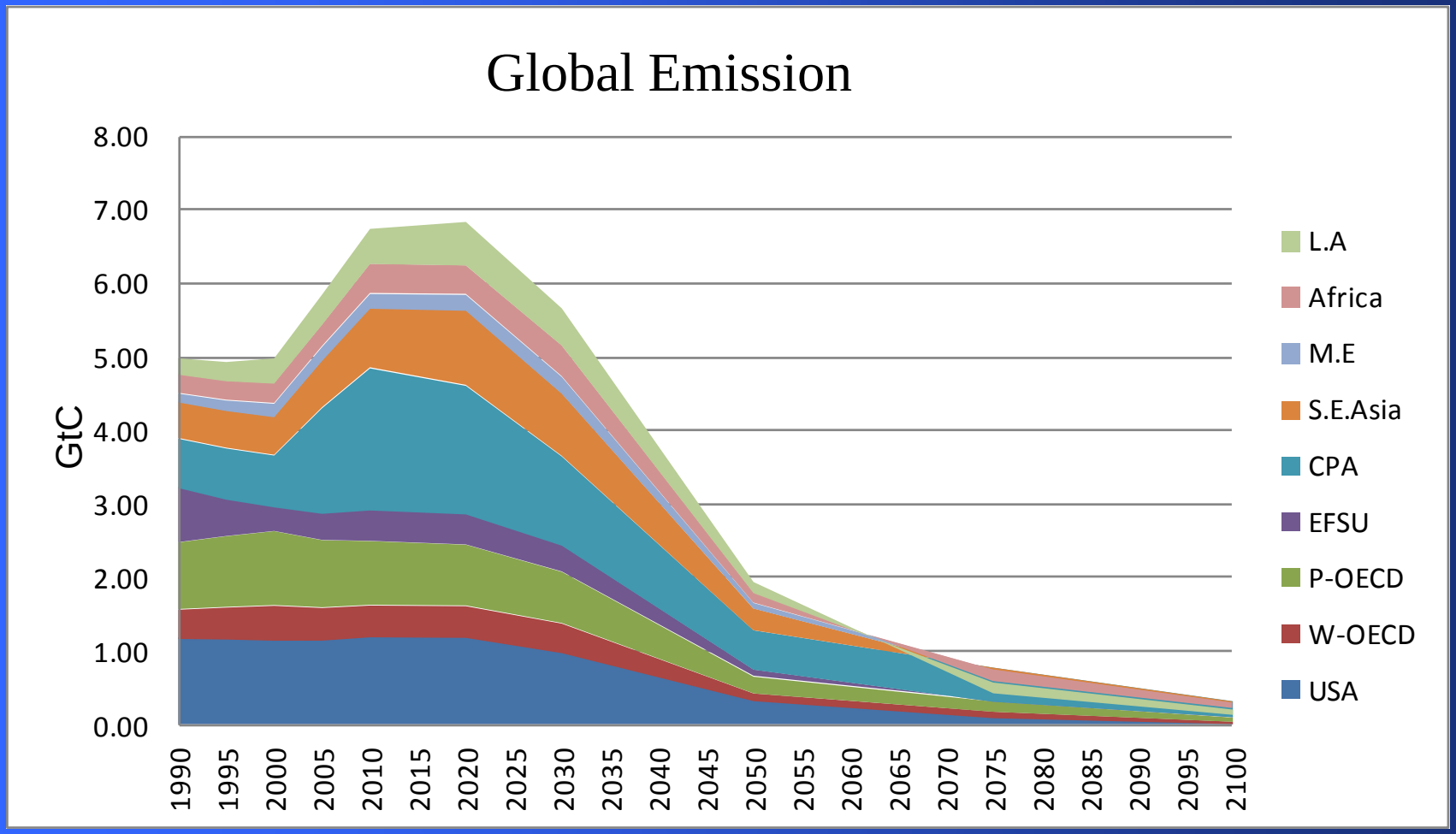
- T > 5°C
- 4°C < T < 5°C
- 3°C < T < 4°C
- 2.5°C < T < 3°C
- 2°C < T < 2.5°C
- T < 2°C

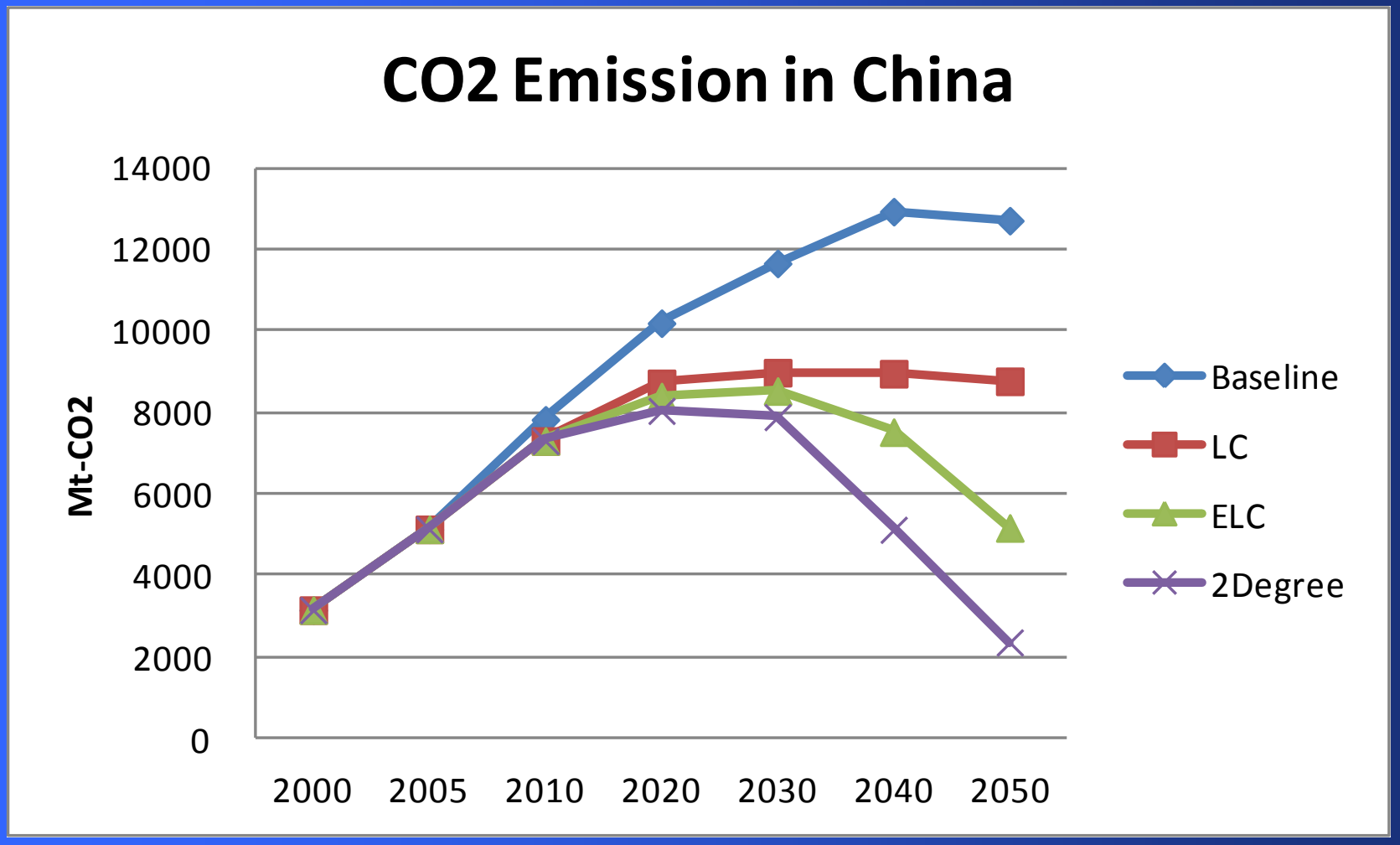
- range of pledge cases
- median range of pledge cases

Copenhagen Commitment: the GAP



* A "likely" chance of limiting warming to 2° C by 2100


Global Emission
GtC
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
2080
2085
2090
2095
2100
L.A
Africa
M.E
S.E.Asia
CPA
EFSU
P-OECD
W-OECD
USA


CO2 Emission in China
Mt-CO2
14000
12000
10000
8000
6000
4000
2000
0
2000
2005
2010
2020
2030
2040
2050
Baseline
LC
ELC
2Degree

Policies and Actions for Addressing Climate Change

- Improving Management Systems and Working Mechanisms
  - Carbon intensity target in 12th FYP was decomposed to all provinces
  - A target responsibility assessment system for local government

- Strengthening Strategic Studies and Plan Formulation
  - the overall target, phased tasks, implementation methods and safeguarding measures of low-carbon development by 2020, 2030 and 2050
  - National Plan for Addressing Climate Change (2013-2020)
  - Provincial Plans

- Promoting Legislation on Climate Change
  - have set up a leading group for drafting laws on addressing climate change
  - some respective laws have been issued, such as methods in Shanxi and Qinghai province and management in Shenzhen special economic zone

Policies and Actions for Addressing Climate Change

- Improving Relevant Policy Systems
  - Work Division Scheme for the Work Plan for Controlling Greenhouse Gas Emissions during the 12th Five-Year Plan Period
  - Issued a series of policy papers on addressing climate change, improve China's policy system in this regard:
    - the Action Plan for Addressing Climate Change in Industry (2012-2020)
    - the National Plan for the Development of Science and Technology on Climate Change during the 12th Five-Year Plan Period
    - the Interim Measures on Low-carbon Products Certification Management
    - the Plans for Energy Development during the 12th Five-Year Plan Period
    - the Plans for the Development of Energy-Efficient and Environmental-Protection Industries during the 12th Five-Year Plan Period
    - the Suggestions on Speeding up the Development of Energy-Efficient and Environmental-Protection Industries
    - the Industrial Energy Efficiency during the 12th Five-Year Plan Period
    - the 2013 Implementation Plans for Industrial Energy Efficiency and Green Development
    - the Action Plan for Green Architecture
    - the National Eco-system Protection during the 12th Five-Year Plan Period

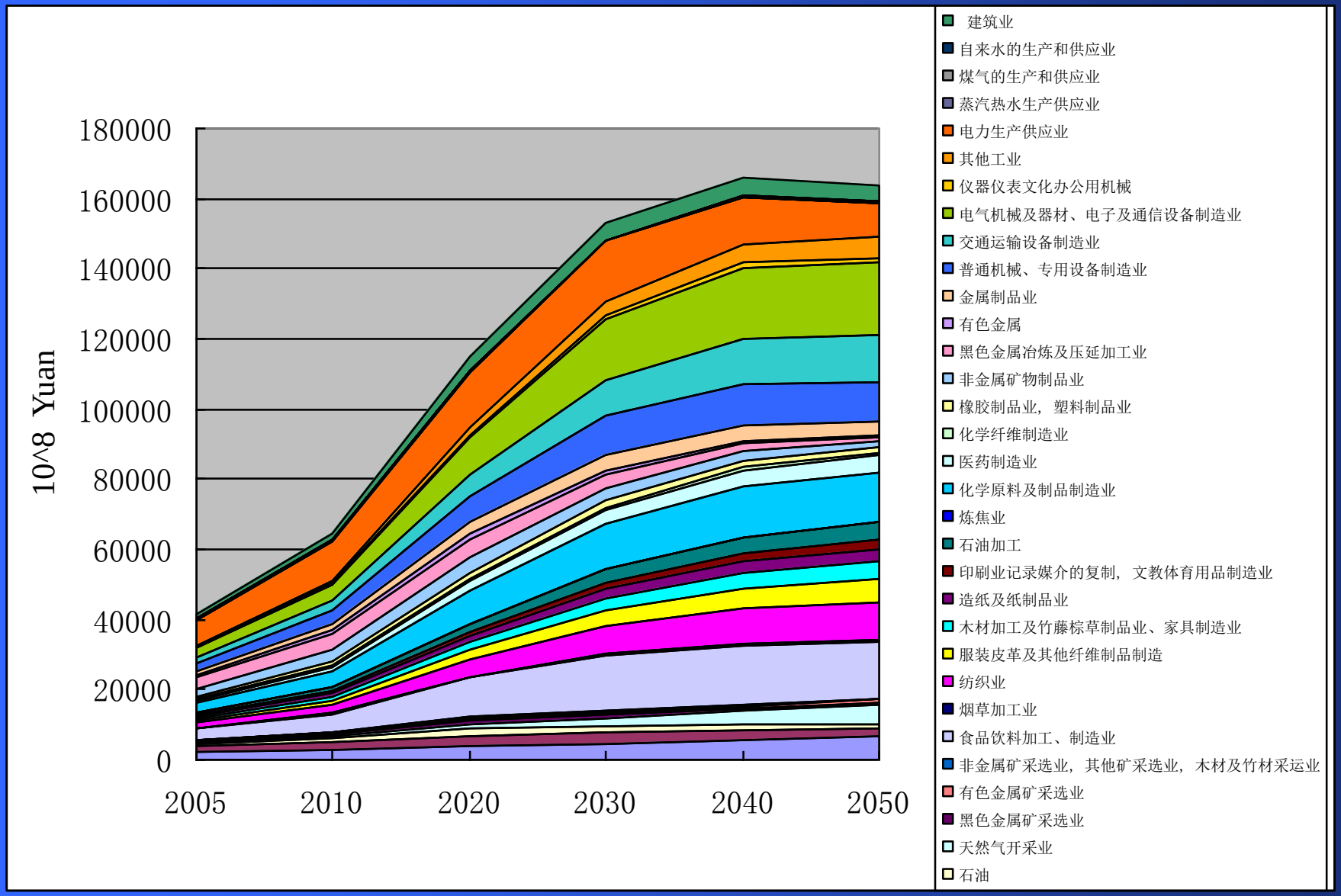
Recent Policies for Mitigation

- Economic structure optimization policies
  - NDRC's industry policies
  - Investment control
  - Carbon tax/other taxes: within 12th Five Year
  - Emission trading: domestic, and international
- Energy structure
  - Clean utilization of fossil fuel: Natural gas (Shale gas etc.)
  - Renewable energy power generation oriented policies
    - New scenario by 2020: wind 250GW, solar: 50 to 80GW
    - More policies on pricing, especially on distributed power generation, feed-in tariff
- Energy efficiency policies
  - 12th FYP target: to the local government
  - Sector policies: including construction and transport
  - Improving energy efficiency standard and labeling scheme
  - Expanding energy conservative technologies and products
- Increasing forest carbon sinks
- Other GHG control: agriculture, non-CO2

What's the future of China's low carbon policy: key factors

- Economic structure optimization policies
- Energy efficiency policies
- Renewable energy/nuclear power generation oriented policies
- CCS
- Low carbon consumption/ lifestyle
- Land use emission reduction policies: so far relatively poor
- Can we pay for it? Cost and benefit

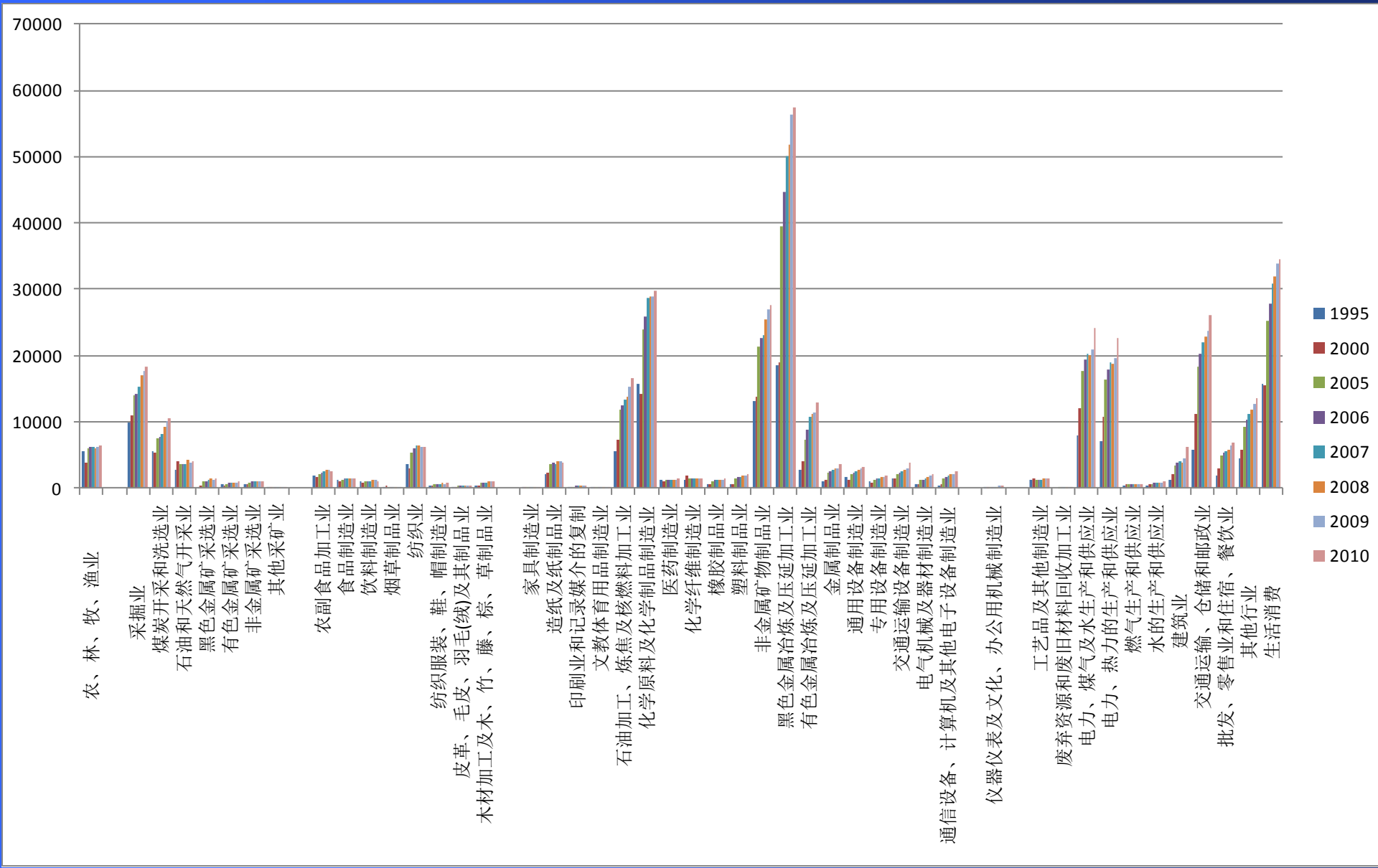
Investment by industrial sectors



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

分部门能源消费量, Energy demand by sector, 1995-2010

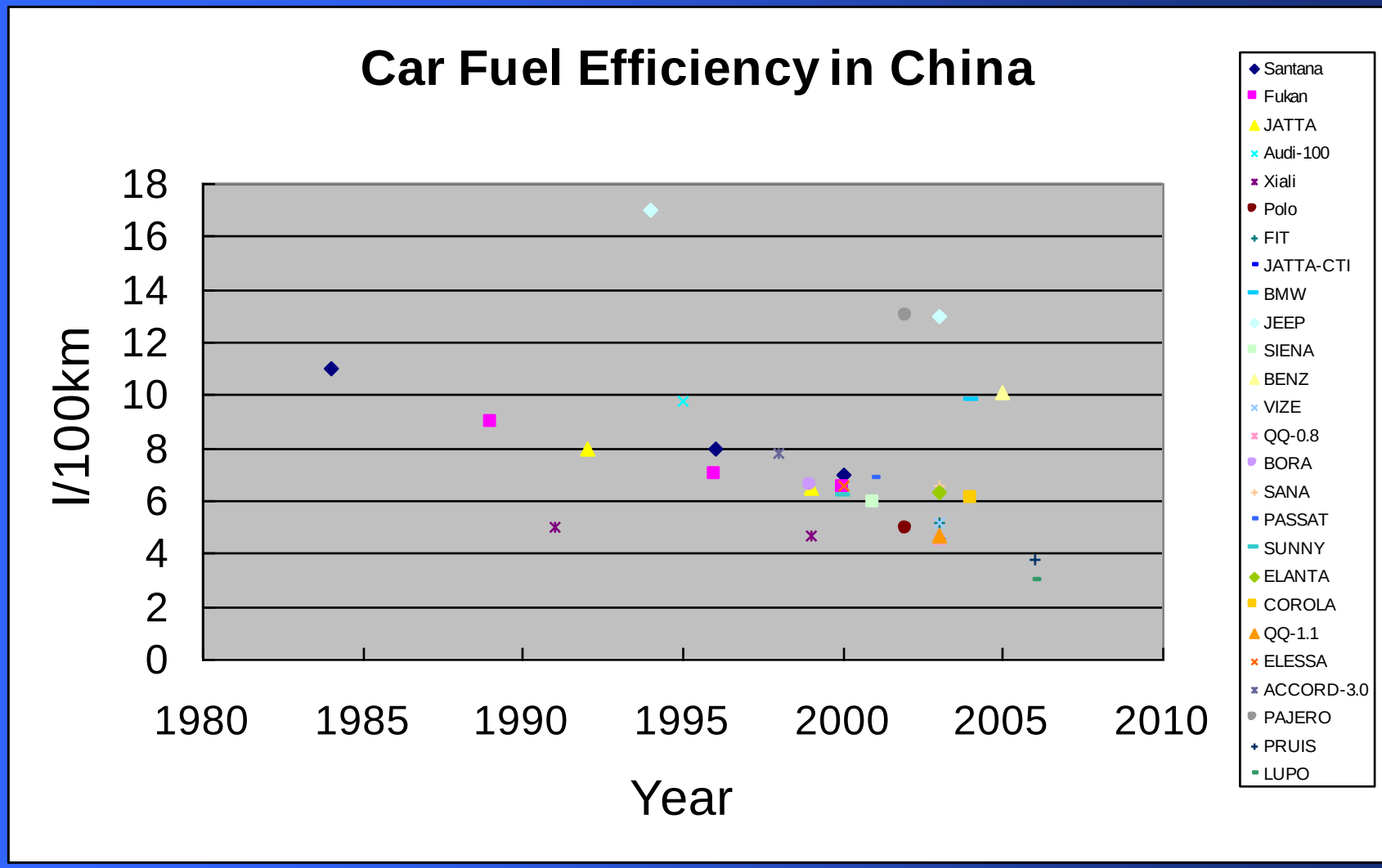


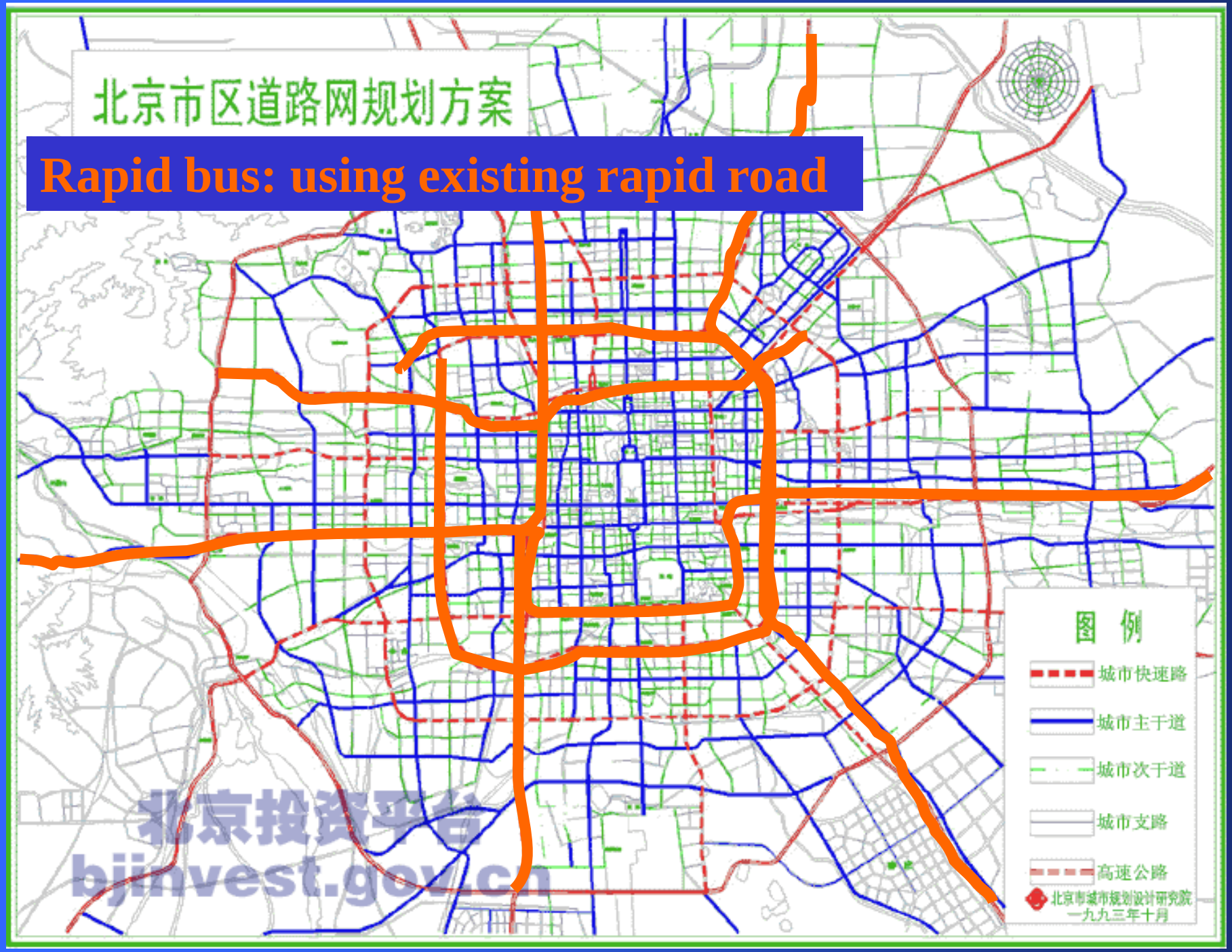
Unit energy use for key products, LCS Scenario

	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

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 engin size of family cars, litter		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%


Car Fuel Efficiency in China
l/100km
0
2
4
6
8
10
12
14
16
18
1980
1985
1990
1995
2000
2005
2010
Year
Santana
Fukan
JATTA
Audi-100
Xiali
Polo
FIT
JATTA-CTI
BMW
JEEP
SIENA
BENZ
VIZE
QQ-0.8
BORA
SANA
PASSAT
SUNNY
ELANTA
COROLA
QQ-1.1
ELESSA
ACCORD-3.0
PAJERO
PRUIS
LUPO


北京市区道路网规划方案
Rapid bus: using existing rapid road
图 例
城市快速路
城市主干道
城市次干道
城市支路
高速公路
北京市城市规划设计研究院
一九九三年十月
北京投资平台
bjinvest.gov.cn

Stockholm: bicycle is coming back

Low Carbon House in 2050: comfortable and energy saving

Solar Energy

Solar PV

(25-47% 的家庭拥有屋顶光伏电池,
转换效率接近30%

Eco-Life style

减少10-20% 能源需求

Planting on top

High efficiency lighting
【LED】

减少50%照明需求,
普及率 100%

Solar energy for hot water and space heating

普及率: 20-60%
（目前 6%）

Energy monitor system
(Electric Appliance)

High insulation system

减少 60% 采暖需求,
普及率70%

Super High Efficiency Air-Con

COP =8,
普及率 100%

Fuel cell

普及率 0-20%

Heat pump

COP＝5
普及率 30-70%

Standby energy use

降低1/3 ,
普及率100%

Public information
Public consumption change

High efficiency electric appliance
Reduce energy use, and higher life level

360buy 京东商城 回首页

平板电视机 搜索

热门搜索：新一代APU 跑步机 老板烟机 和田新枣 华为Y210 聚焦十八大 诺基亚800

我的京东 去购物车结算

全部商品分类 首页 服装城 迷你挑 团购 夺宝岛 在线游戏 办中银京东卡

全部结果 > “平板电视机”

所有类目

大家电 (313)

平板电视 (277)

相关搜索：平板电视 | 电视机 | 电视 | 液晶电视 | 平板电脑 | 冰箱

“平板电视机” 找到321件相关商品

360buy 京东商城 网购上京东 省钱又放心

全部商品分类 首页 服装城

全部结果 > “LED平板电视机”

所有类目

大家电 (253)

平板电视 (248)

家电配件 (5)

“LED平板电视机”

品牌：京东方 夏普（ 长虹（

价格：0-219

品类：LED背

推广商品

乐华（ROWA）LED23C310A 23英寸 LED液晶电视 USB+HDMI 液晶显

¥999.00

排序：相关度 销量

库存：全国 仅显

360buy 京东商城 网购上京东 省钱又放心

灯泡

热门搜索：新一代APU 跑步机 老板烟机 和田新枣 华

全部商品分类 首页 服装城 迷你挑 团购 夺宝岛

全部结果 > “灯泡”

所有类目

灯具 (691)

节能灯 (143)

LED灯 (365)

装饰灯 (15)

台灯 (10)

氛围照明 (13)

吸顶灯 (76)

应急灯/手电 (2)

五金电器 (2)

吊灯 (58)

落地灯 (7)

五金家装 (40)

改装配件 (84)

家装建材 (97)

礼品 (9)

相关搜索：节能灯泡 | 节能灯 | 灯 | led灯泡 | 台灯 | 灯管

“灯泡” 找到1068件相关商品

品牌：飞利浦（Philips） 格润莱特 翰源

麦辉（MAWUI） 莱威光电（LIONWAY） 欧司

蒙特丽 亮朵 倍航

价格：0-69 70-199 200-499 500-1199 1200以上

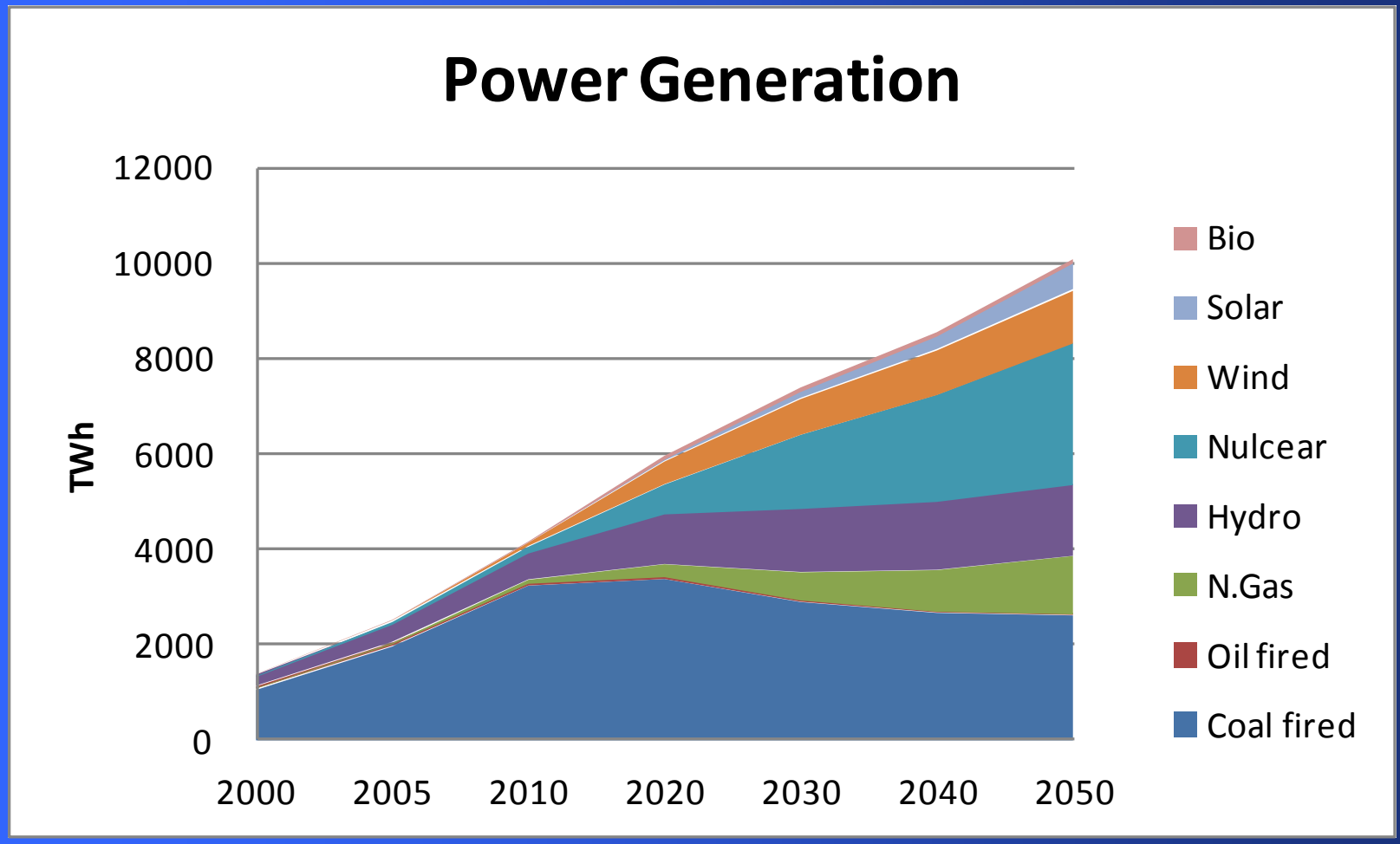
排序：相关度 销量 价格 评论数 上架时间

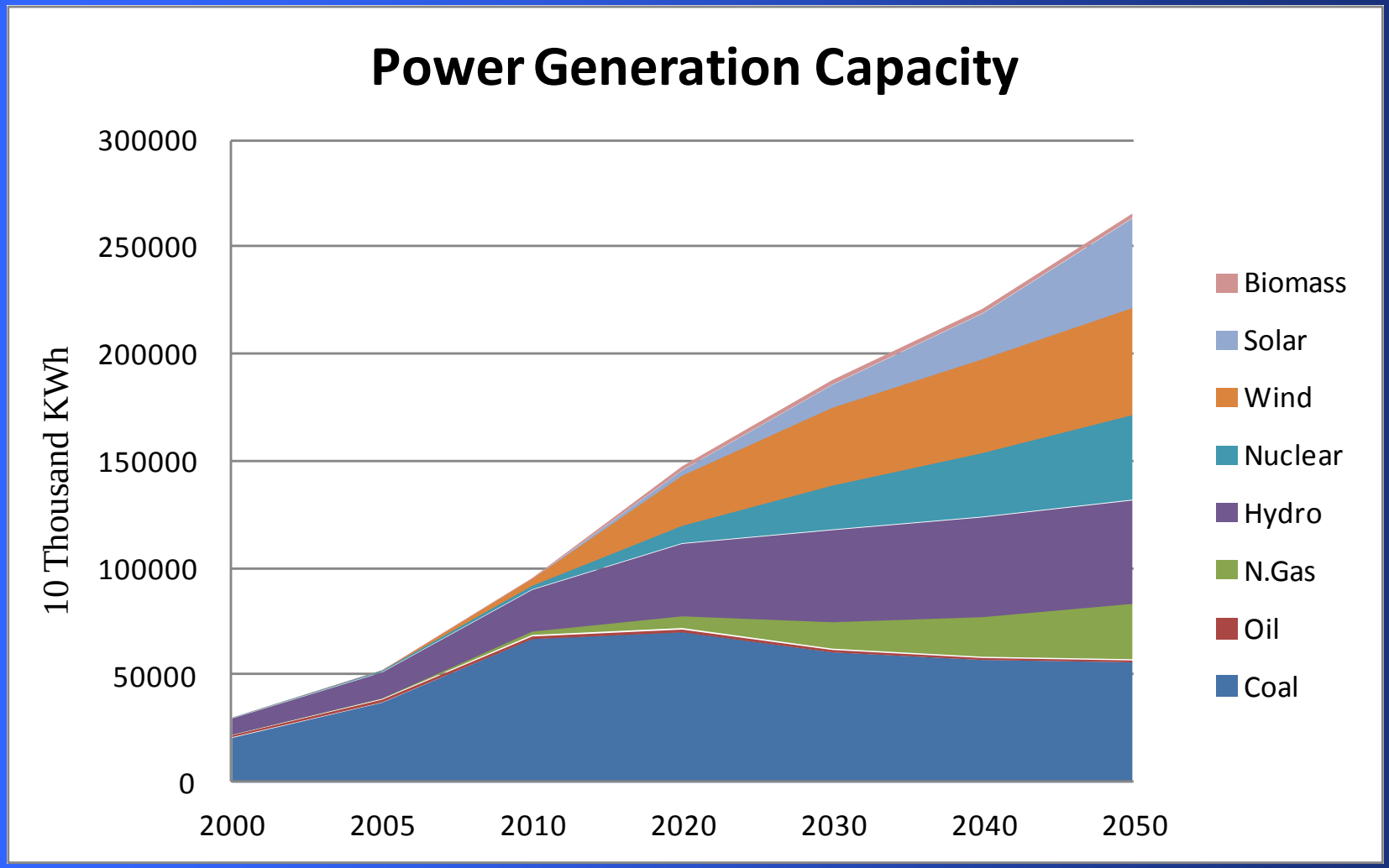
库存：全国 仅显示有货 商品类型：全部 京东配送 第


CHANGHONG
"接链者·传奇" BCD-186DHA

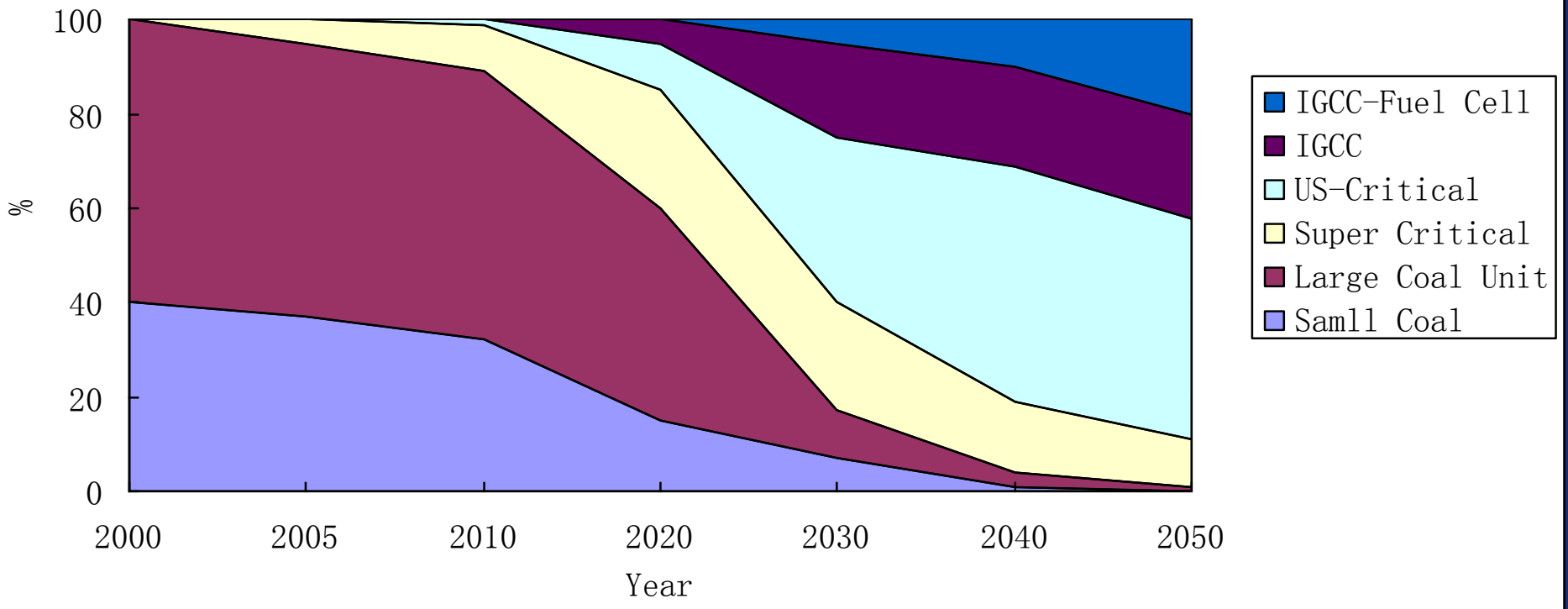

中国能效标识
CHINA ENERGY LABEL
生产者名称 合肥美菱股份有限公司
规格型号 BCD-186DHA
耗能低
1
2
中 等
3
4
耗能高
5
1级
耗电量（千瓦时/24小时） 0.25
冷藏室容积（升） 132
冷冻室容积（升） 54
依据国家标准：GB 12021.2-2008

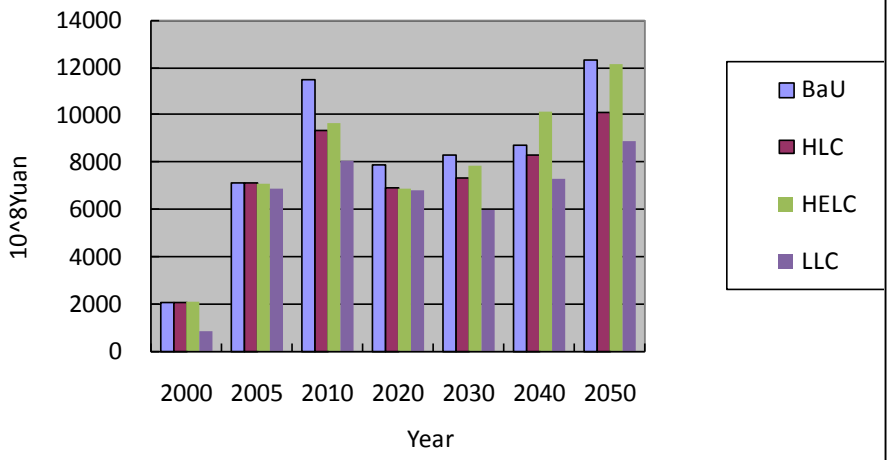

桑普
23 10:59 AM

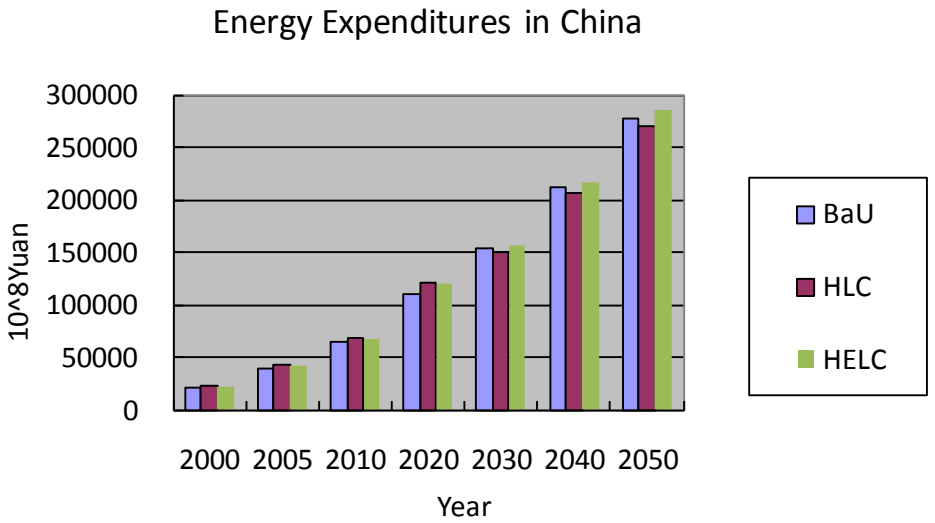

Power Generation
12000
10000
8000
6000
4000
2000
0
TWh
2000
2005
2010
2020
2030
2040
2050
Bio
Solar
Wind
Nulcear
Hydro
N.Gas
Oil fired
Coal fired

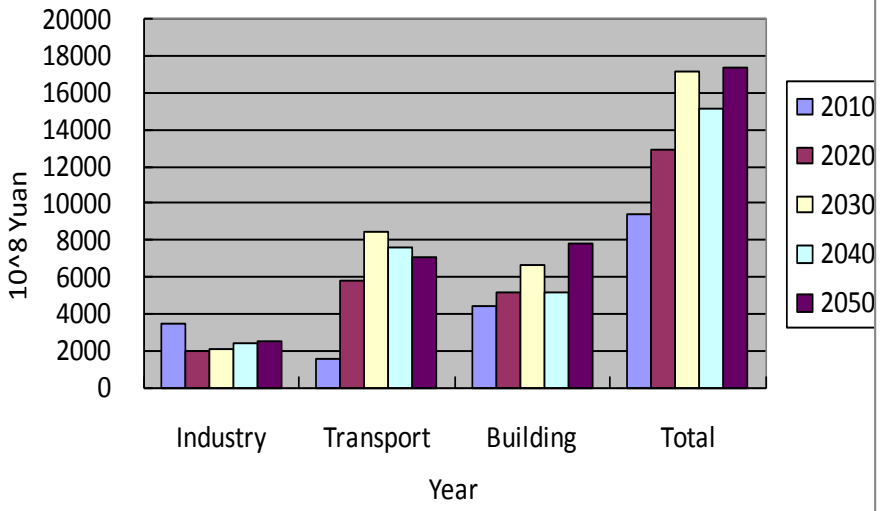

Power Generation Capacity
10 Thousand KWh
300000
250000
200000
150000
100000
50000
0
2000
2005
2010
2020
2030
2040
2050
Biomass
Solar
Wind
Nuclear
Hydro
N.Gas
Oil
Coal

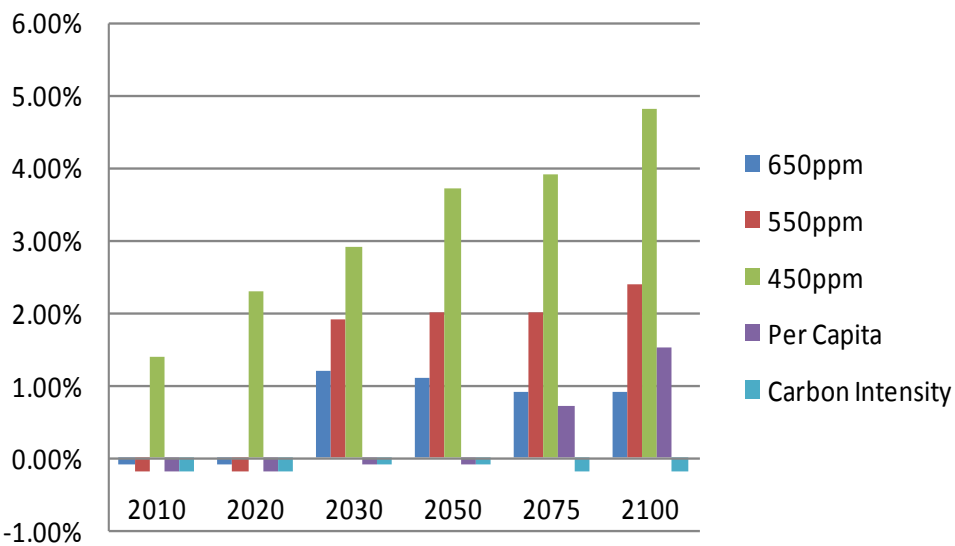
CCS future


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
Saml1 Coal

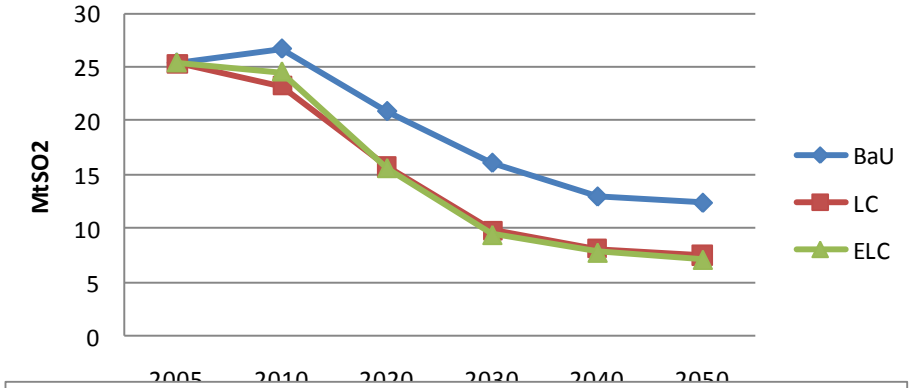

Investment in Energy Industry in China
14000
12000
10000
8000
6000
4000
2000
0
10^8Yuan
2000 2005 2010 2020 2030 2040 2050
Year
BaU
HLC
HELC
LLC


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

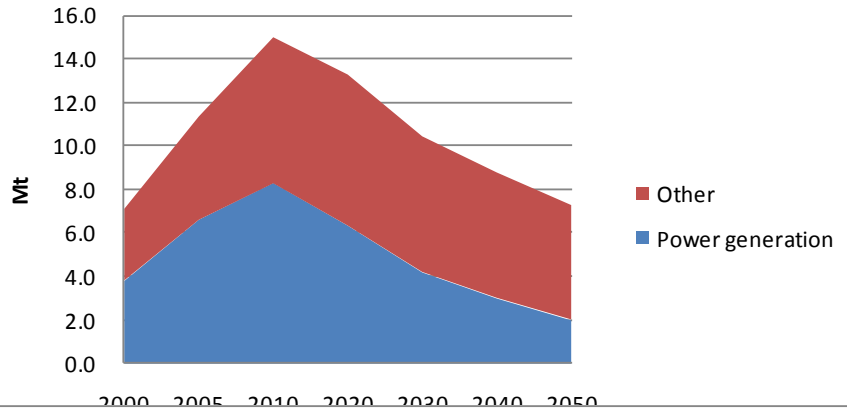

Addtional Investment in end use sectors in ELC
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
10^8 Yuan
Industry
Transport
Building
Total
Year
2010
2020
2030
2040
2050


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

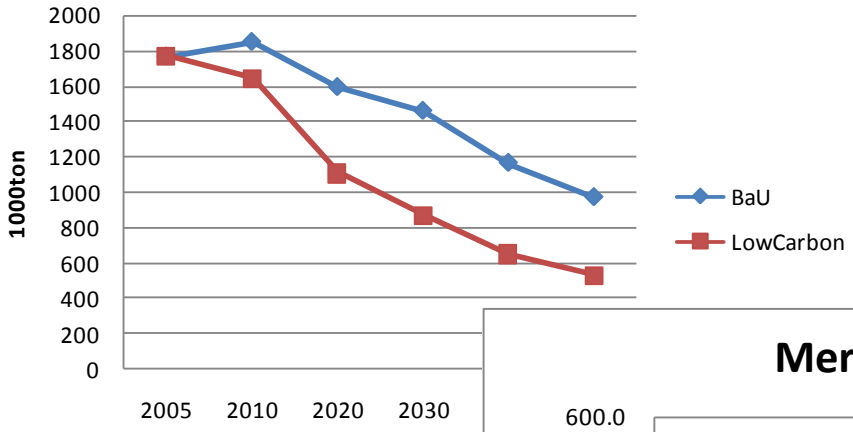
SO2 Emission



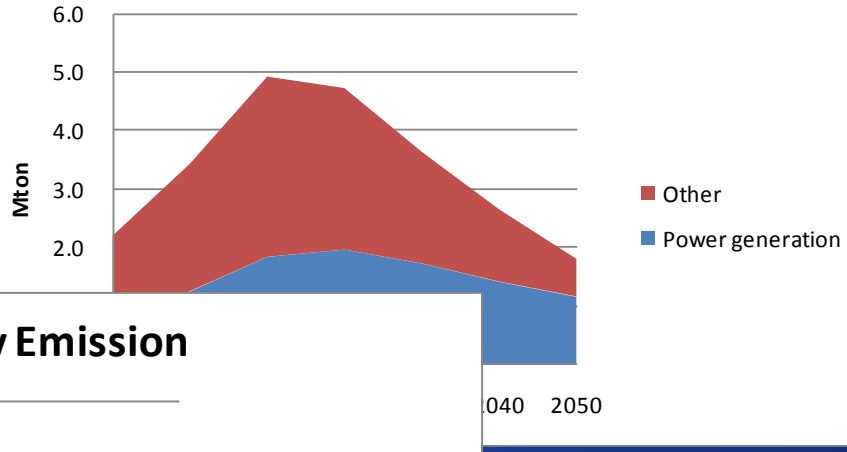
NOx Emission in China, ELC scenario



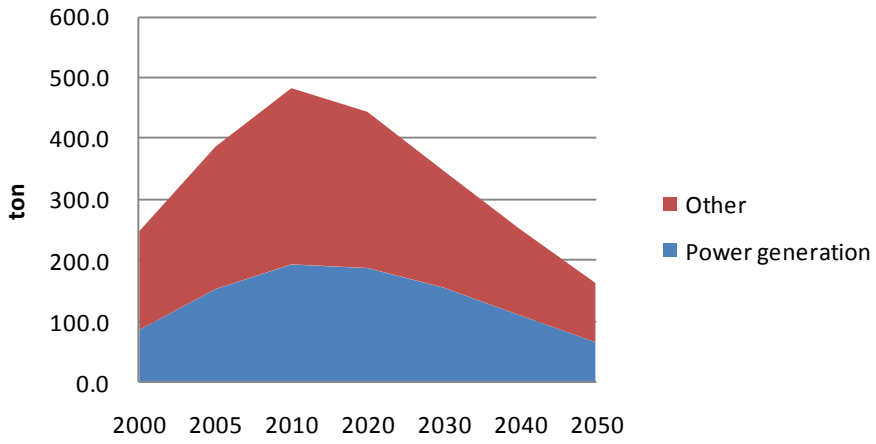
Black Carbon Emission in China

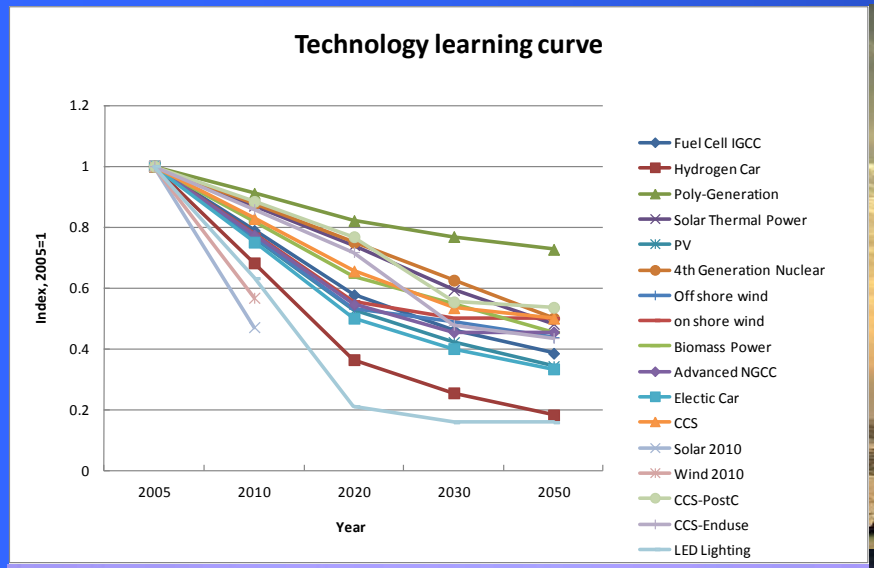


PM2.5 Emission



Mercury Emission





By 2020, Wind 200GW to 250GW, Solar 50WG

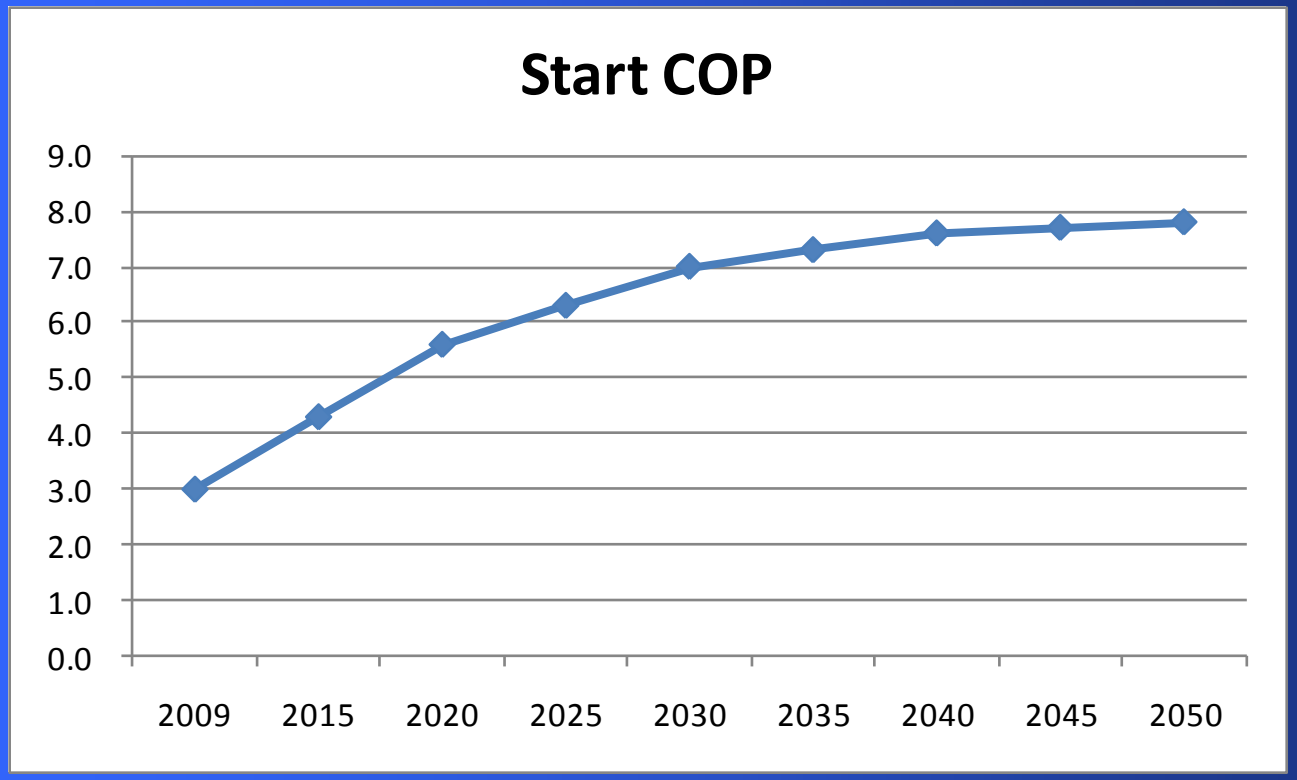
Price: US$38000
Subsidy: US$15000(Shanghai), no need to apply number plate(cost US$10000)
US$18000(Beijing), no need to apply number plate(By Oct. 2012, 1.1 million people apply for 20000number plates per month),

Good news

- Technology progress is much faster than our model says: learning curve effects
- High GDP growth could support low carbon development in China: all cost analysis in models are very small compared with GDP
  - By 2015, GDP in China could reach 75trillion 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
- China's low carbon related technology manufacture is getting leading in the world: benefit for economy
- Local environment issues will be a very strong factor to go to clean production, nearly match with low carbon development

Policy roadmap: Super high efficiency air conditioner

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



影响电动汽车发展的主要制约因素分析

Major Constraints Factors Analysis

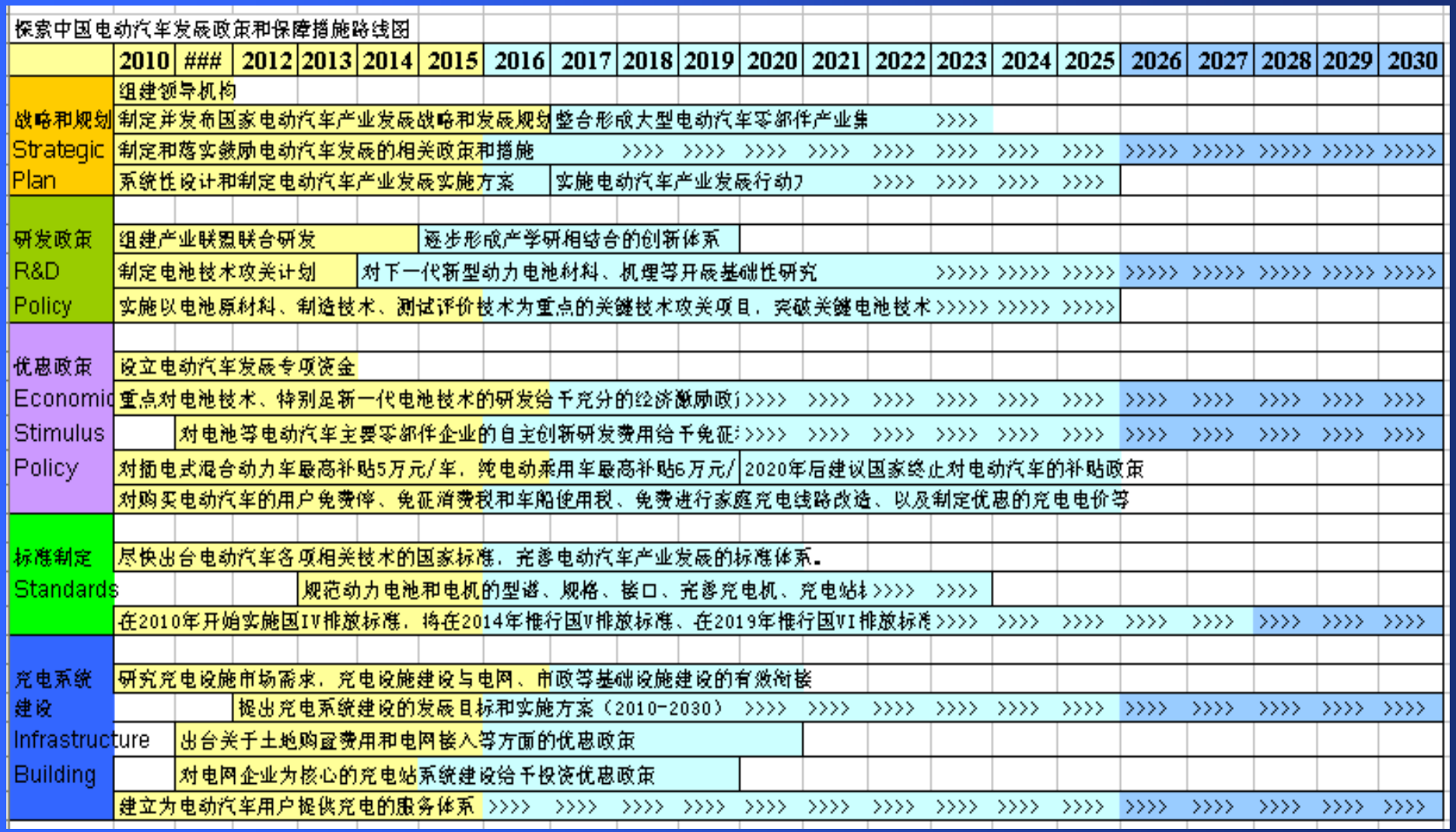
电动汽车实现经济性的趋势分析 Trend Analysis on EVs

电动汽车与先进汽油和柴油车成本变化趋势分析					
	2006-2010	2011-2015	2016-2020	2021-2025	2026-2030
电动汽车Evs					
电池充满电时总容量kWh	16	24	48	80	112
电力销售价格（元/kWh）	0.48	0.60	0.75	0.94	1.18
单位里程耗电量（kWh/km）	0.18	0.13	0.08	0.08	0.07
单位里程耗电费用（yuan/km）	0.09	0.08	0.06	0.08	0.08
电动汽车燃料成本（yuan/car）	43200	39067	30104	37694	41299
单位电池容量成本(USD/kWh)	750	375	130	75	30
Evs车电池组成本(yuan/car)	80400	60300	41808	40200	22512
电池组寿命（年）	3.6	5	11	22	22
电池组更换次数（set/year)	4.1	2.8	1.4	0.7	0.7
EVs全寿期电池成本（yuan/car）	413256	226728	99503	67938	38045
EVs全寿期电耗和电池总成本（yuan/car）	456456	265795	129607	105632	79345
每年费用（yuan/car）	30430	17720	8640	7042	5290
先进汽油汽车ICE					
汽油销售价格（yuan/liter)	6.6	8.5	10.2	11.0	11.8
柴油销售价格（yuan/liter)	6.4	8.3	9.9	10.6	11.4
单位里程耗汽油（L/km）	0.050	0.039	0.031	0.024	0.020
单位里程耗柴油（L/km）	0.047	0.038	0.030	0.024	0.020
全寿期行驶里程（km)	500000	500000	500000	500000	500000
先进汽油车燃料成本（yuan/car）	165000	167550	158356	133574	117738
先进柴油车燃料成本（yuan/car）	150400	155333	149317	128100	114170
每年费用	11000	11170	10557	8905	7849
比较（Evs车费用－ICE车费用）	291456	98245	-28749	-27941	-38394

电动汽车发展技术路线图
Electric Car Roadmap

电动汽车发展路线图					
	2006-2010	2011-2015	2016-2020	2021-2025	2026-2030
电动汽车发展目标					
电动汽车拥有量（万辆）	很少量	125	800	5000	9400
电动汽车年销售市场（万辆）	很少量	25	80	500	941
电动汽车技术进步					
最高时速(km/h)	85	120	140		
续航距离(km)	112	130	200	350	400
百公里耗电kWh/100km	16-18	13-14.3	10	8	
电池技术进步					
电池能量密度（Wh/kg，Wh/L）	90－125Wh/kg	150Wh/kg；150Wh/L	225Wh/kg；200Wh/L	500Wh/kg；460Wh/L	700Wh/kg
电池总能量（kWh）	16kWh	24kWh	40-48kWh	80－93kWh	112－124kWh
电池组寿命	1000次	1500次（5.4年）	3000	3800次（13年）	结合超级电容器
电池成本$/kWh(元/kWh）	$750/kWh(5025)	$375/kWh(2513)	$107/kWh(717)	$75/kWh(503)	$30/kWh(201)
充电站技术和建设进程					
充电站发展计划（国网和南网）	新建充电站325个；充电桩1.87万个。	新建充电站4325个；充电桩2.48万个。	新增充电站1万个，充电桩3万个。		
充电站系统建设进程	常规充电（充电桩）设施建设，更换电池方式试点。布局主要在居民小区或大型办公场所停车场。	常规充电为主，快充和更换电池示范。布局主要在机场、火车站、医院、购物中心、加油站等公共场所建快充和更换电池站。	常规充电为主，快充和更换电池为辅，形成充电站网络系统雏形。按电动汽车单次充电行驶里程，考虑充电站的布局和建设。太阳能充电站示范。	完善充电站网络系统。太阳能充电站占有一定市场。先进电网通讯（V2G）技术提高谷电利用率。移动式充电站示范。	完善充电站网络系统。太阳能充电站占有5-10%市场份额。移动式充电站得到应用。

电动汽车发展政策路线图建议
Suggesting Policy Roadmap



Natural Gas Scenarios

- In 2010,Natural Gas use 107.2BCM, while 12.2BCM imported.
- In our low carbon scenario: by 2030, 370BCM
- NEA’s planning: 260BCM by 2015

POWER_BOX by Baosteel

2kW wind
10kW Solar PV

1.5m/s
Physical process

Renewable Energy

- Renewable Energy Planning 2006: wind 30GW, Solar 2GW by 2020
- 2009 Energy Bureau: Wind 80WG
- 2010 Energy Planning: Wind 150 GW, Solar 20GW by 2020

- Now: Wind 200GW to 300GW, Solar 50WG to 80 GW

- Based on the conclusion from Chinese Academy for Engineering, grid in China could adopt these renewable energy power generation in short term.

Thank you !

kjiang@eri.org.cn
hecm@eri.org.cn