Haze, Low carbon and Energy structure adjustment

JIANG Kejun

Energy Research Institute, NDRC
kjiang@eri.org.cn

北京空气污染严重 各大医院呼吸科门诊爆满(图)

2014年02月22日13:30　法制晚报　我有话说(78人参与)

上午在北京大学人民医院呼吸科，不长的楼道坐满候诊的病人摄/法制晚报记者 林晖

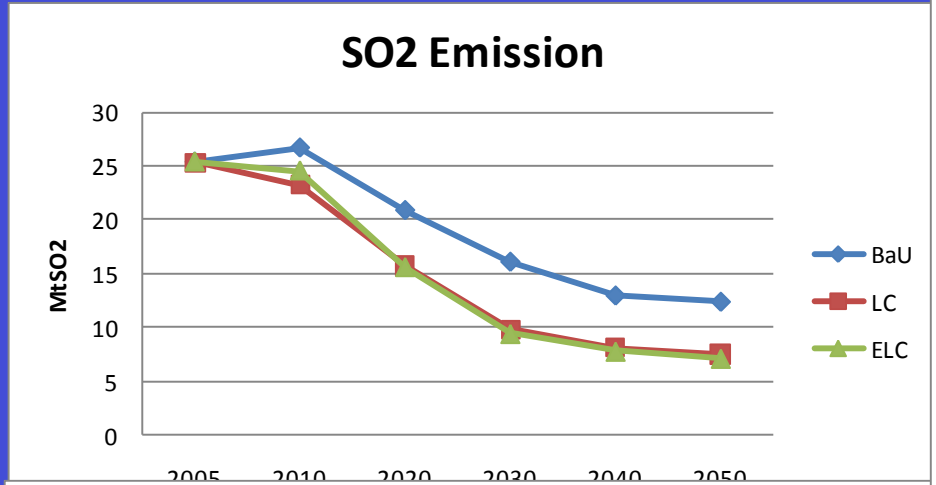
Primary Source of $PM_{2.5}$

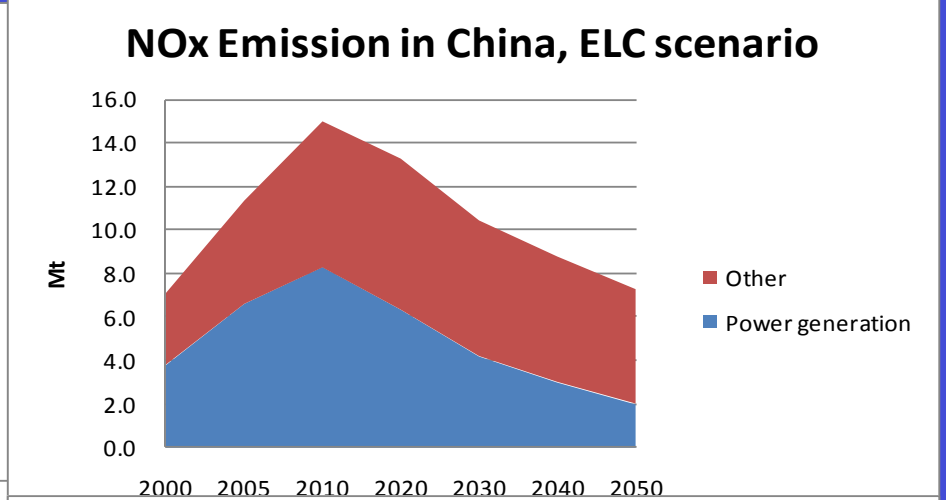
- Coal combustion: 18-33%
- Vehicle emission: 10-25%
- Cooking emission: 13%
- Other emission sources: 40-45%

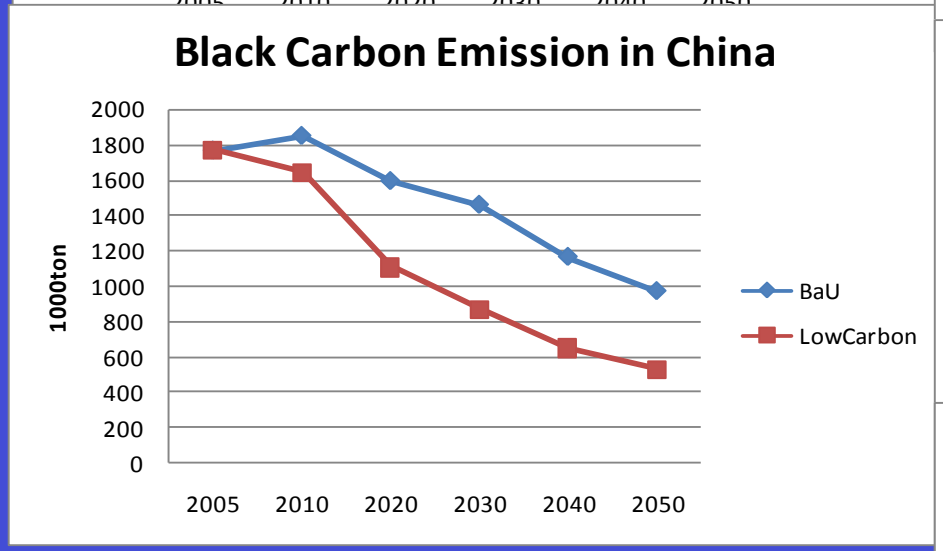
  including dust from road and building site, chemical production, industrial process (industrial dust and volatilization of organic compounds), decoration, household, and straw burning

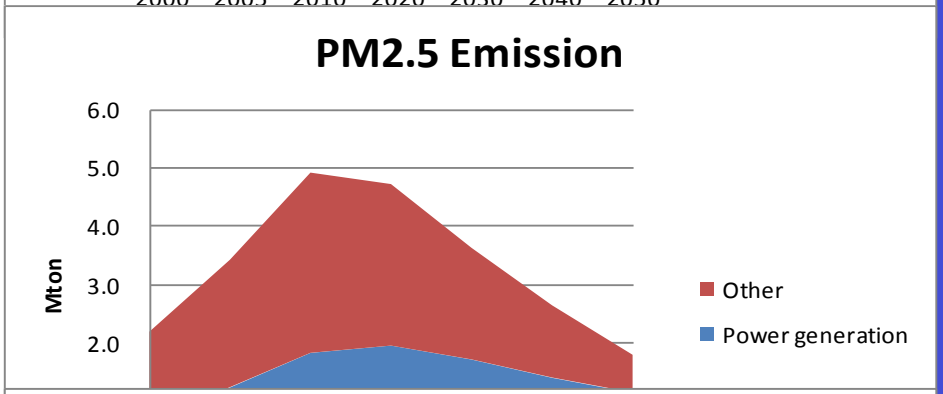
Secondary sources of PM2.5: SO2, NOx

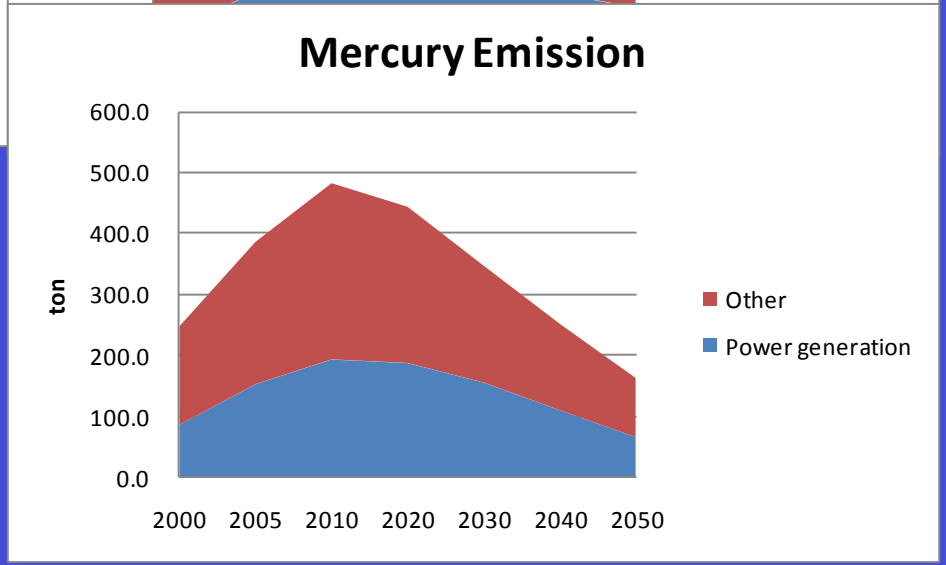
- Coal combustion: 70-80%
- Natural gas combustion: 5-10%
- Vehicle emission: 20-25%









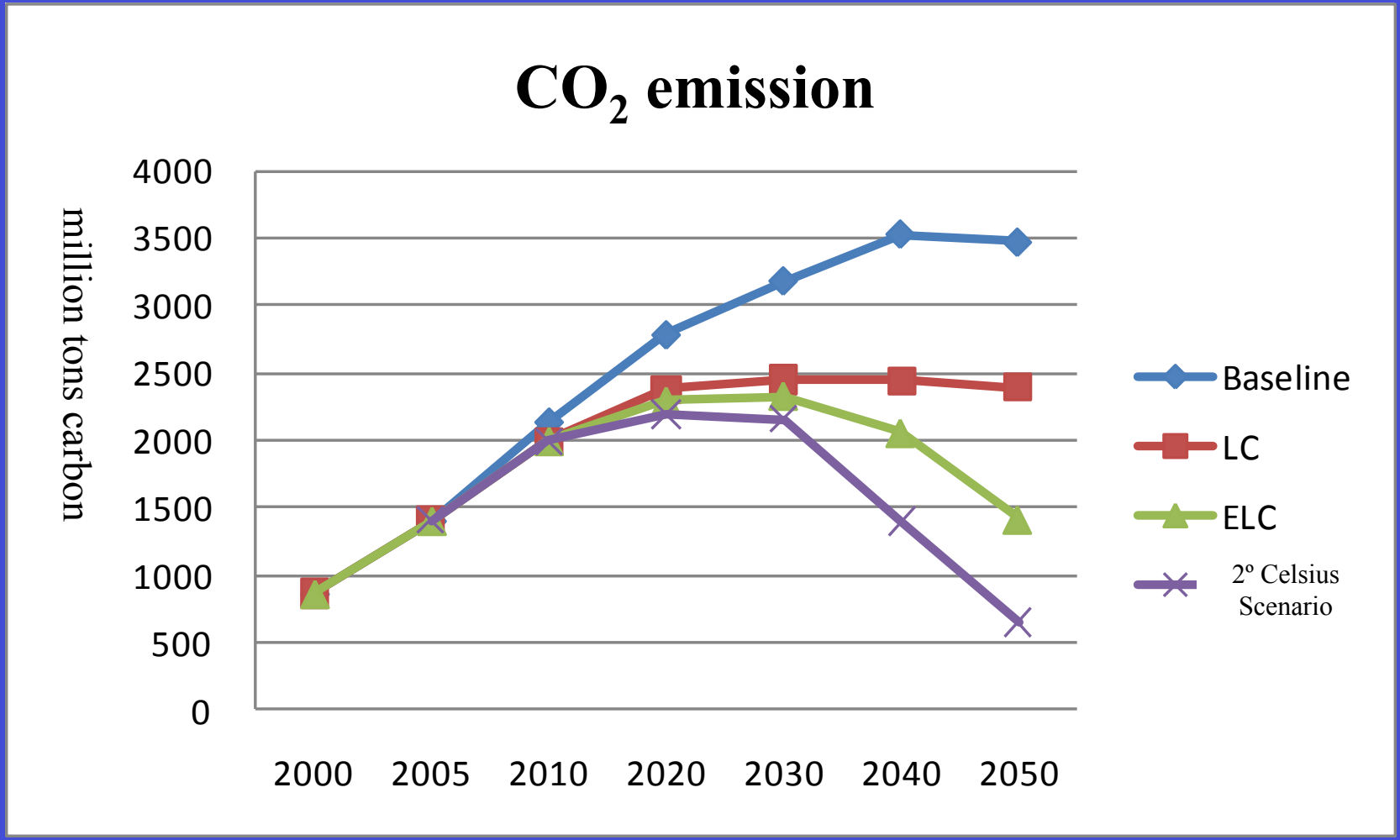


Consistency of CO_2 reduction and local pollutants reduction

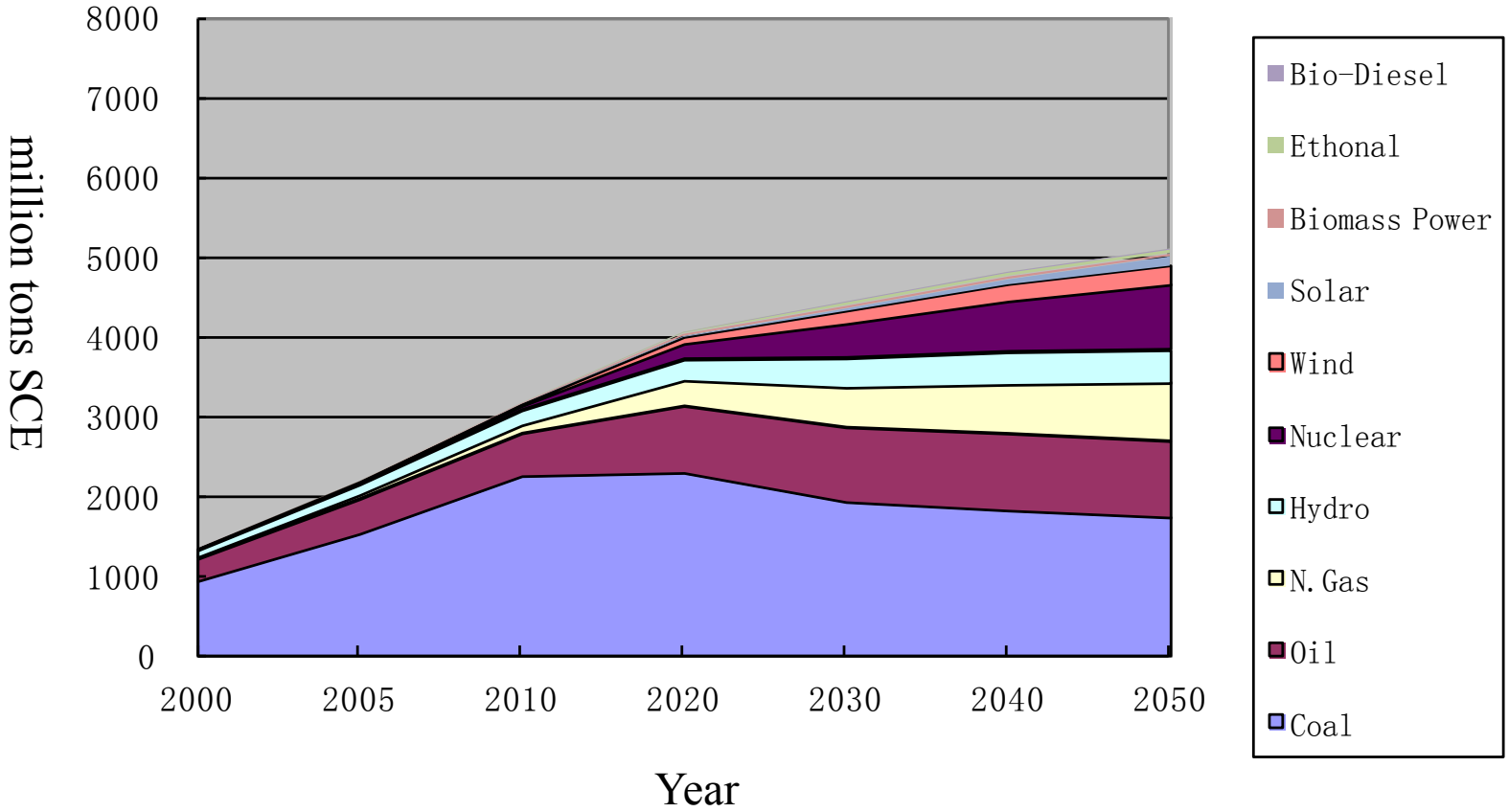
Contribution to ecological civilization construction

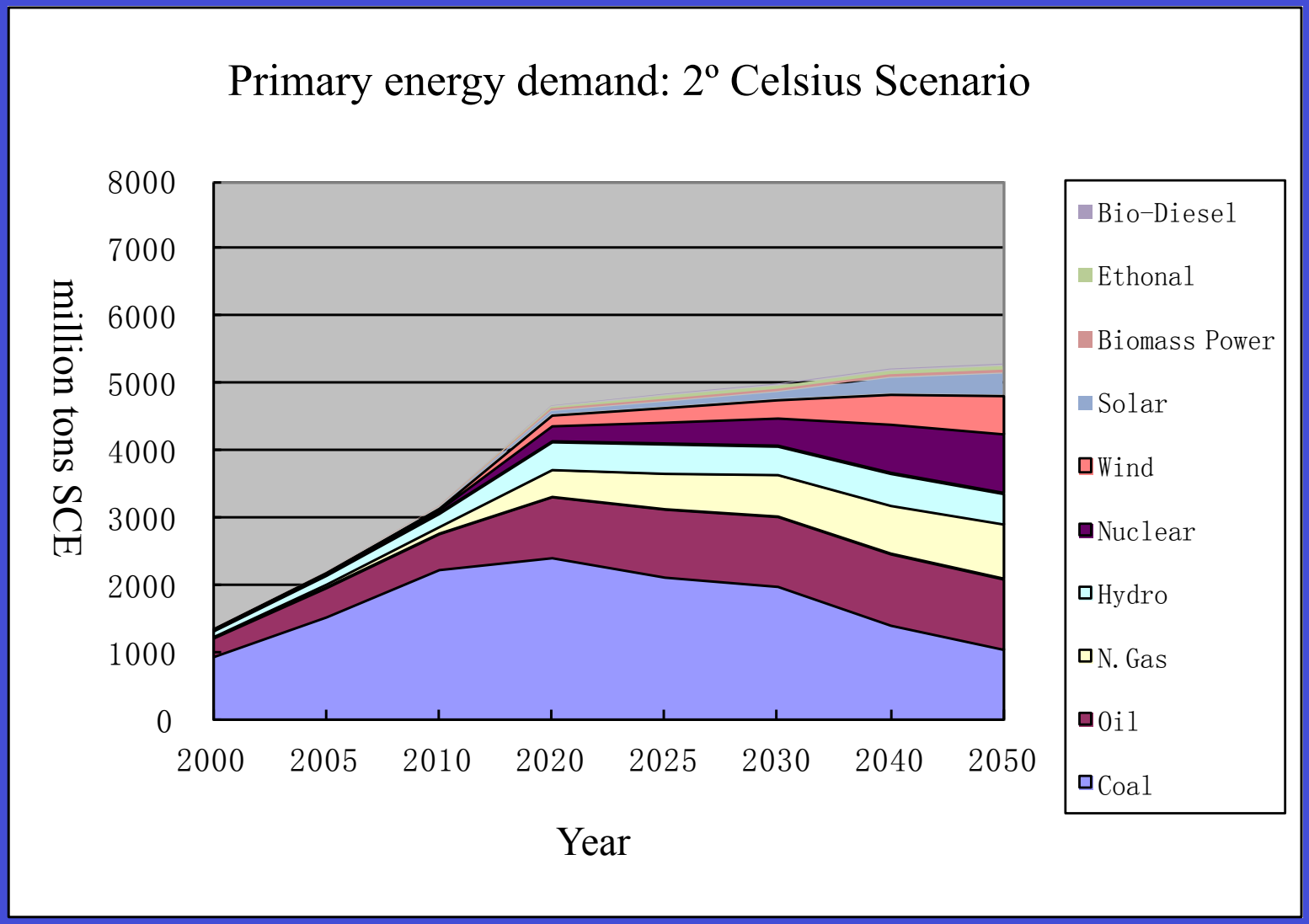
Beautiful China

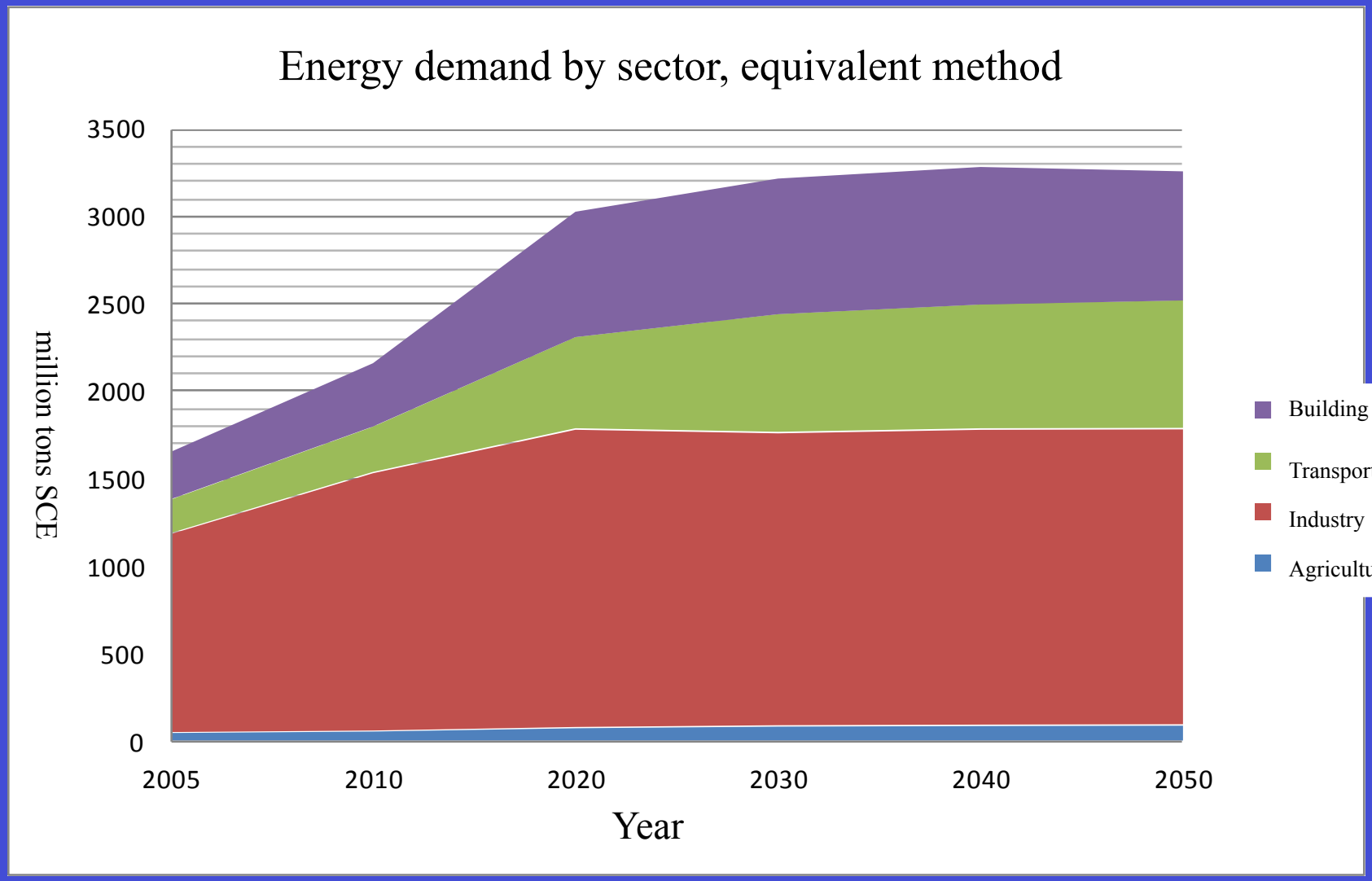
- Enhanced Low Carbon Scenario: Emissions will back to the level of 2005 by 2050.
- 2º Celsius Scenario: Emission will change after 2020, and are reaching the peak.
- The feasibility of 2º Celsius Scenario is under study.

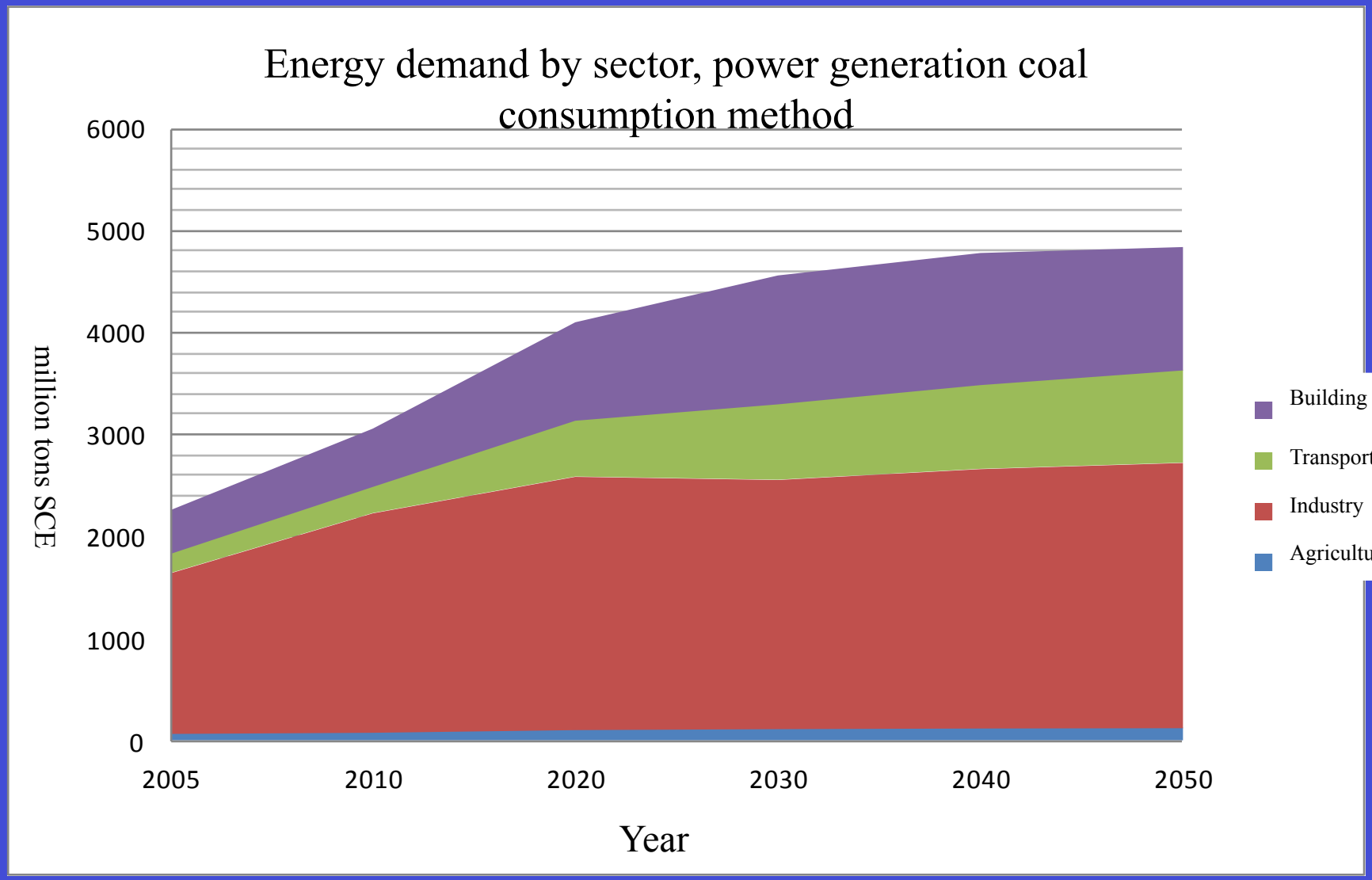


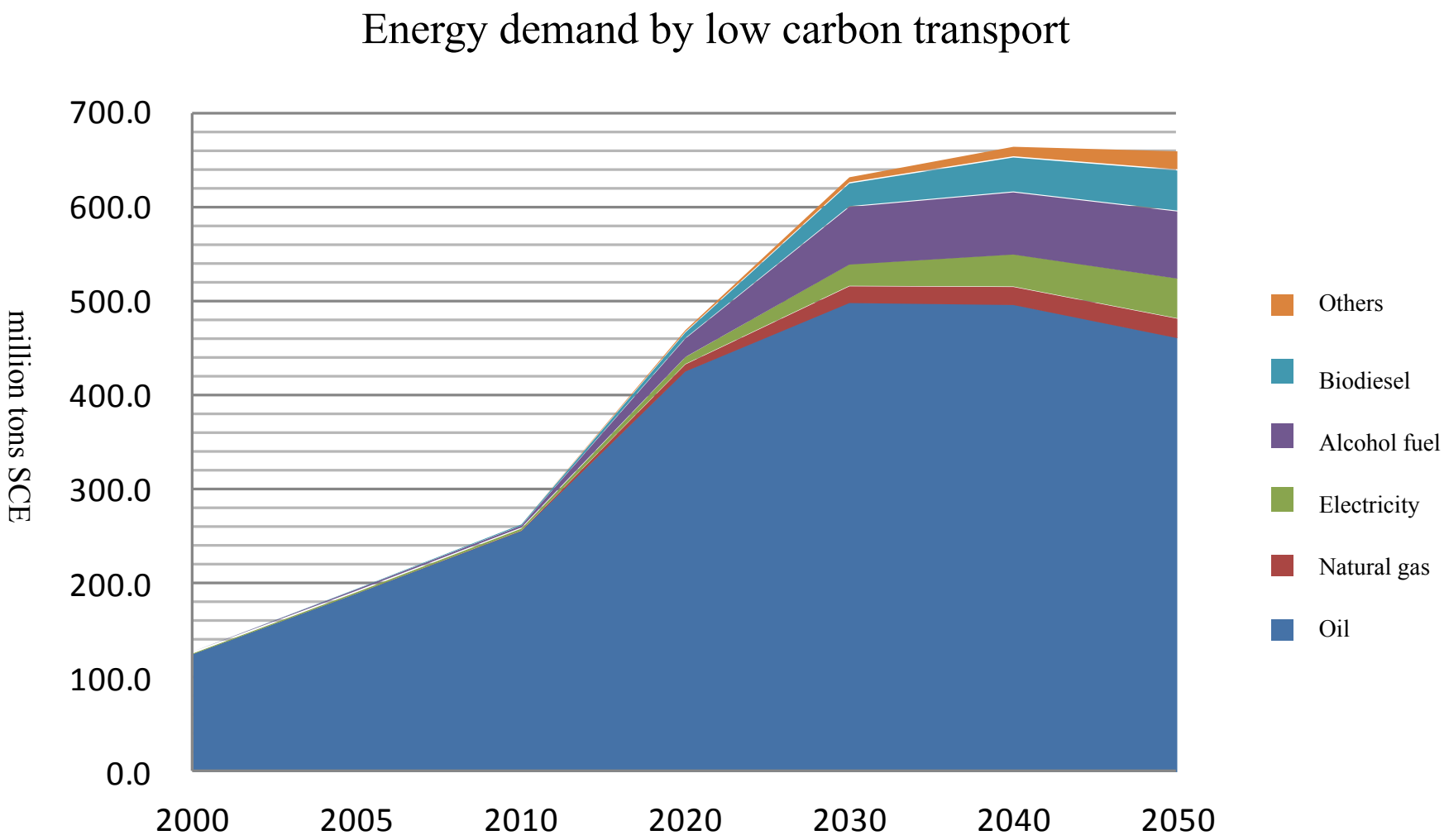
Primary energy demand: Enhanced Low Carbon Scenario

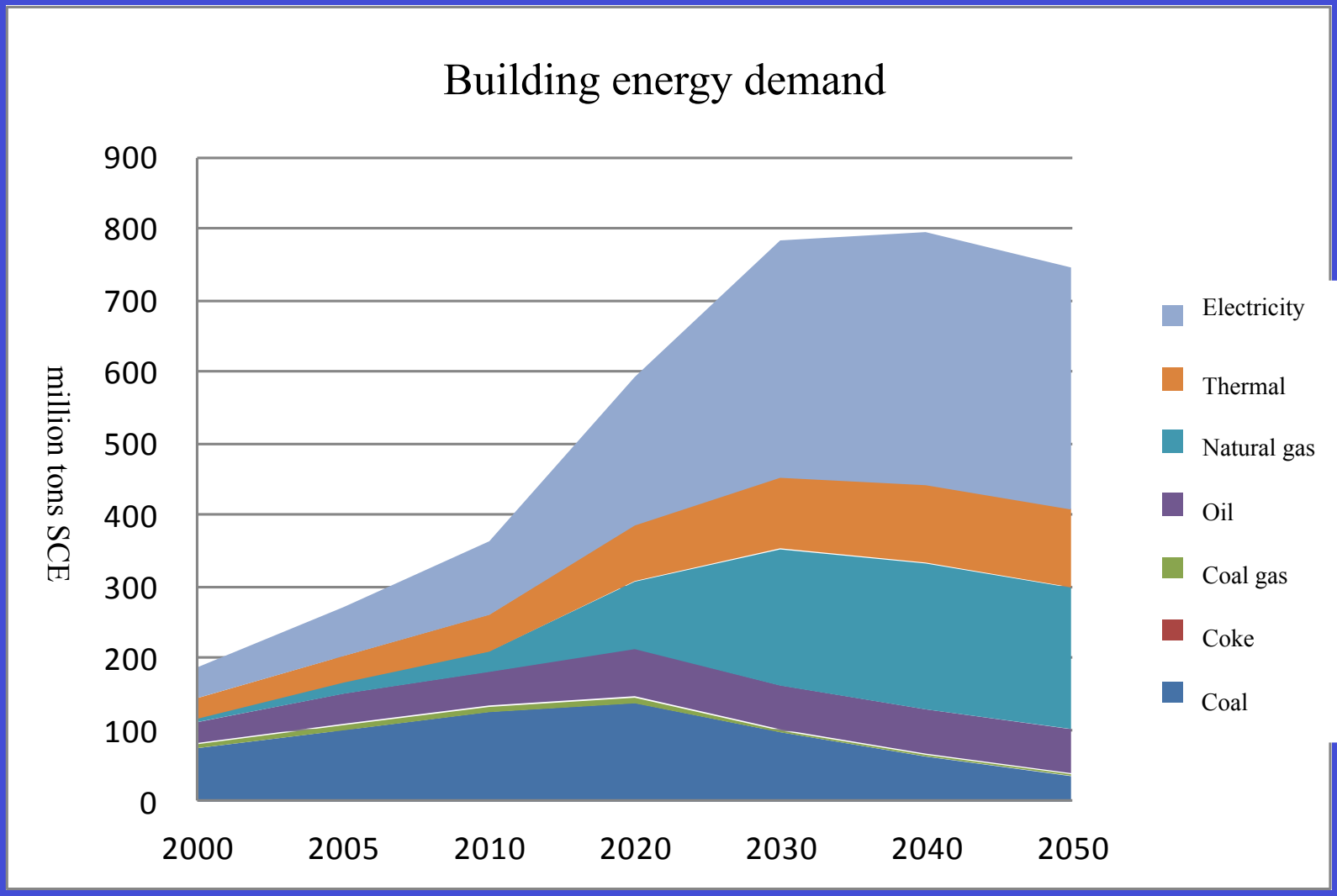


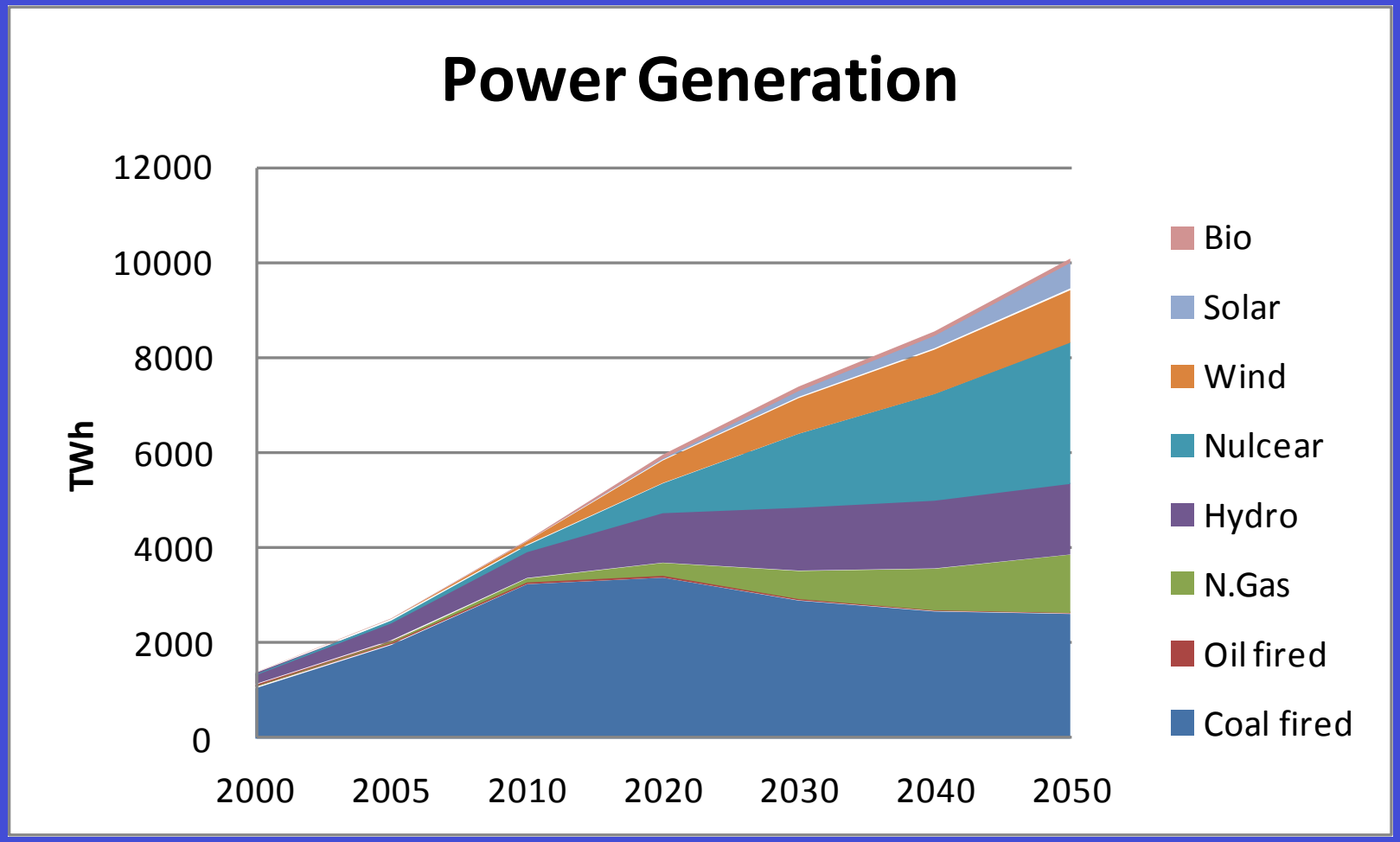

Primary energy demand: 2º Celsius Scenario
million tons SCE
8000
7000
6000
5000
4000
3000
2000
1000
0
2000
2005
2010
2020
2025
2030
2040
2050
Year
Bio-Diesel
Ethonal
Biomass Power
Solar
Wind
Nuclear
Hydro
N.Gas
Oil
Coal

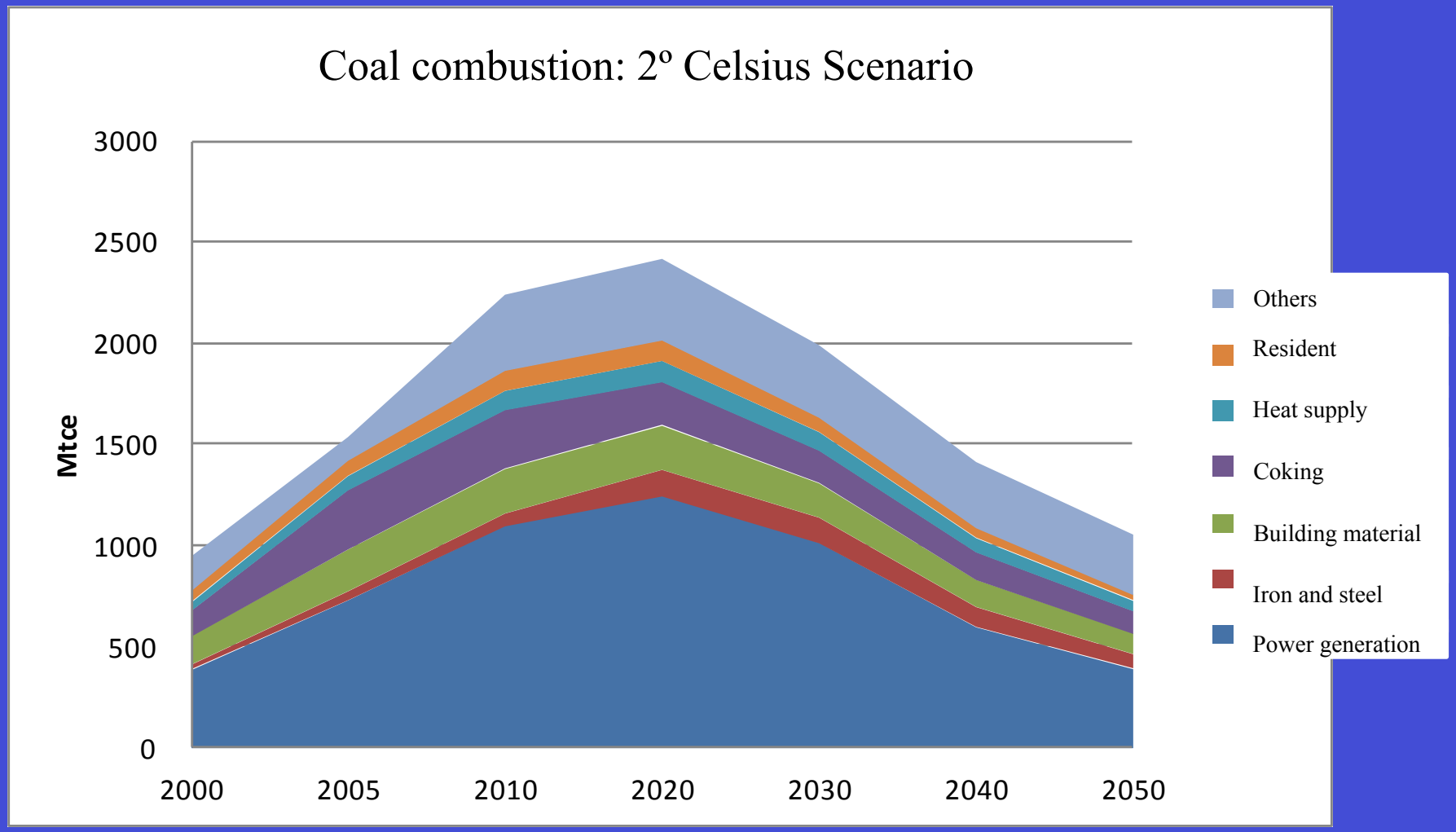

Energy demand by sector, equivalent method
3500
3000
2500
2000
1500
1000
500
0
million tons SCE
2005
2010
2020
2030
2040
2050
Year
Building
Transport
Industry
Agriculture

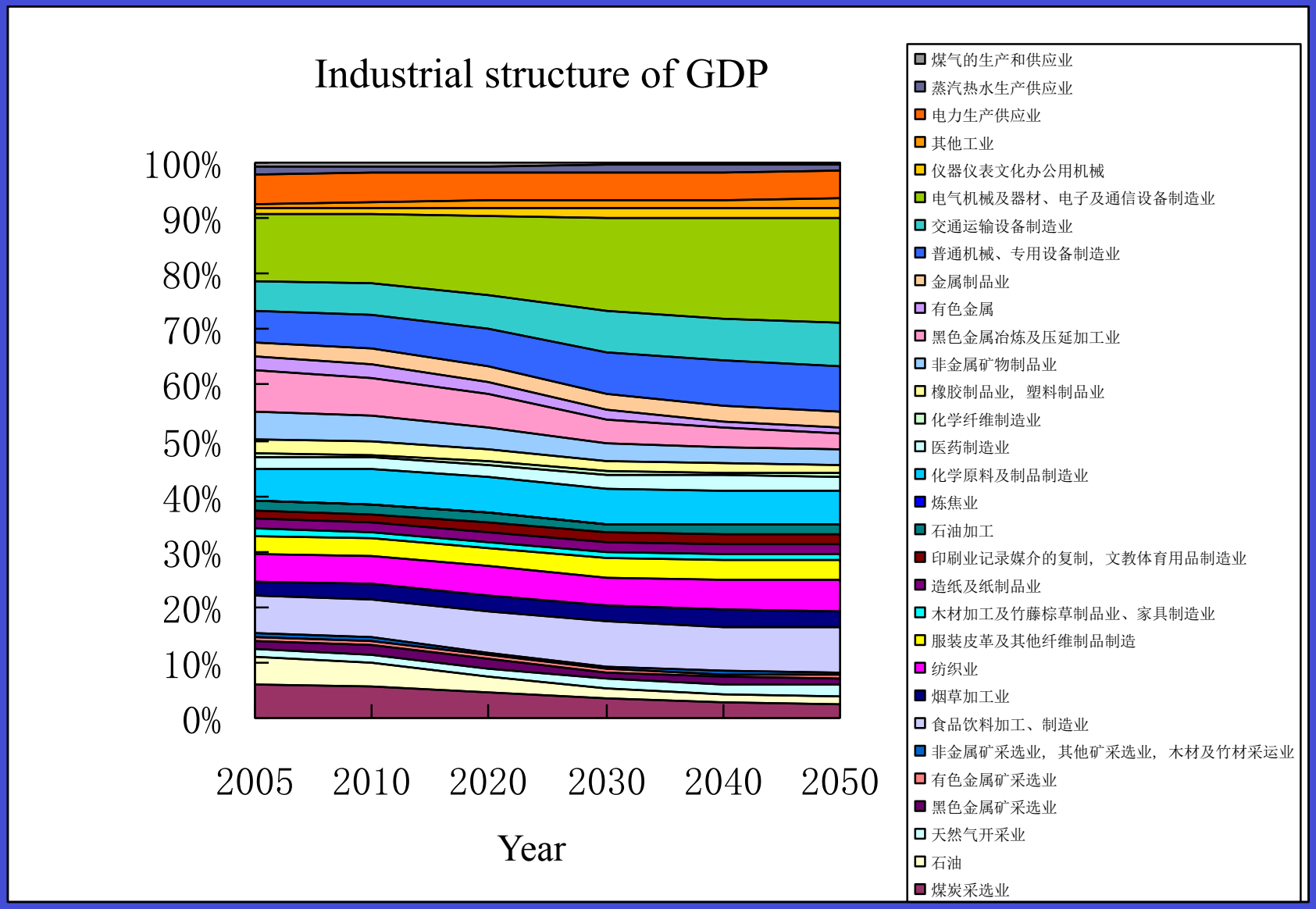

Energy demand by sector, power generation coal consumption method
6000
5000
4000
3000
2000
1000
0
million tons SCE
2005
2010
2020
2030
2040
2050
Year
Building
Transport
Industry
Agriculture


Energy demand by low carbon transport
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
million tons SCE
2000
2005
2010
2020
2030
2040
2050
Others
Biodiesel
Alcohol fuel
Electricity
Natural gas
Oil


Building energy demand
million tons SCE
900
800
700
600
500
400
300
200
100
0
2000
2005
2010
2020
2030
2040
2050
Electricity
Thermal
Natural gas
Oil
Coal gas
Coke
Coal


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


Coal combustion: 2º Celsius Scenario
Mtce
3000
2500
2000
1500
1000
500
0
2000
2005
2010
2020
2030
2040
2050
Others
Resident
Heat supply
Coking
Building material
Iron and steel
Power generation

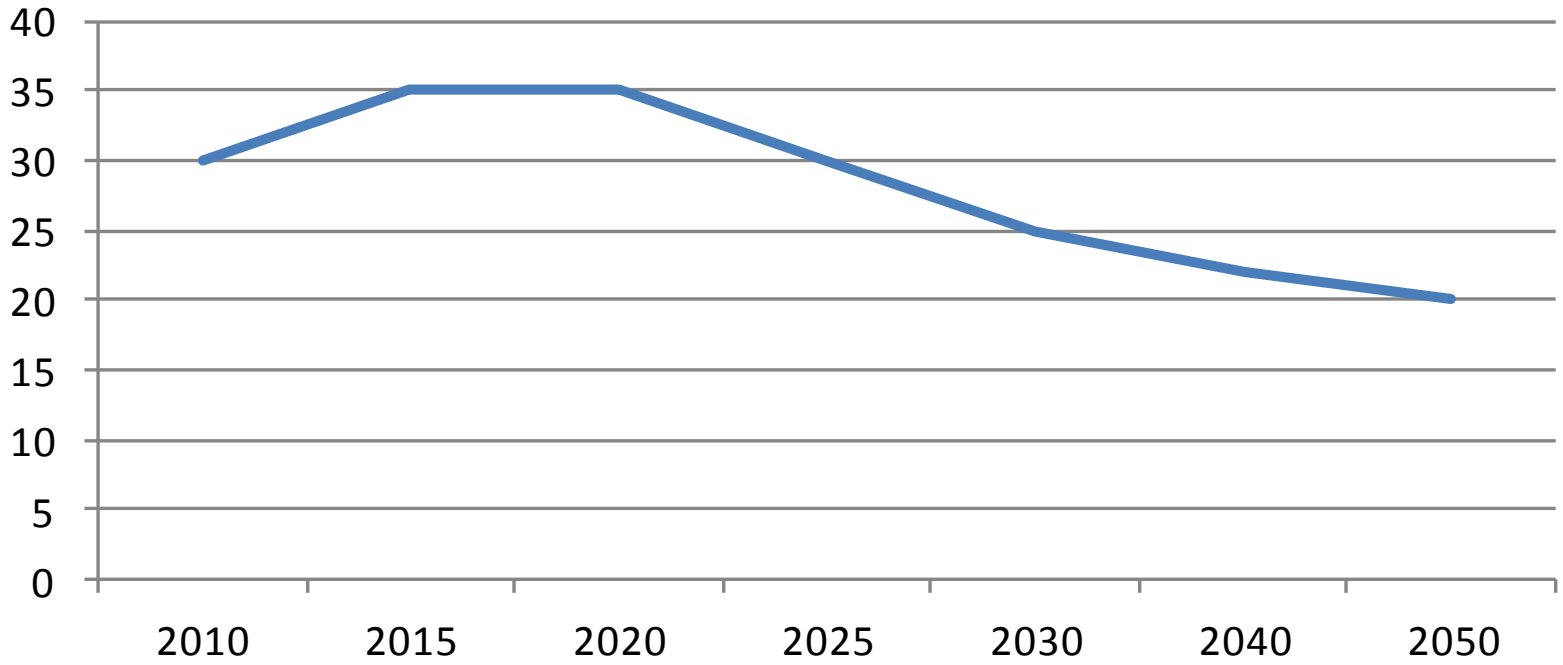

Industrial structure of GDP
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2005
2010
2020
2030
2040
2050
Year
煤气的生产和供应业
蒸汽热水生产供应业
电力生产供应业
其他工业
仪器仪表文化办公用机械
电气机械及器材、电子及通信设备制造业
交通运输设备制造业
普通机械、专用设备制造业
金属制品业
有色金属
黑色金属冶炼及压延加工业
非金属矿物制品业
橡胶制品业，塑料制品业
化学纤维制造业
医药制造业
化学原料及制品制造业
炼焦业
石油加工
印刷业记录媒介的复制，文教体育用品制造业
造纸及纸制品业
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
煤炭采选业

Development of main high energy-consuming industry: Turn appears by 2020

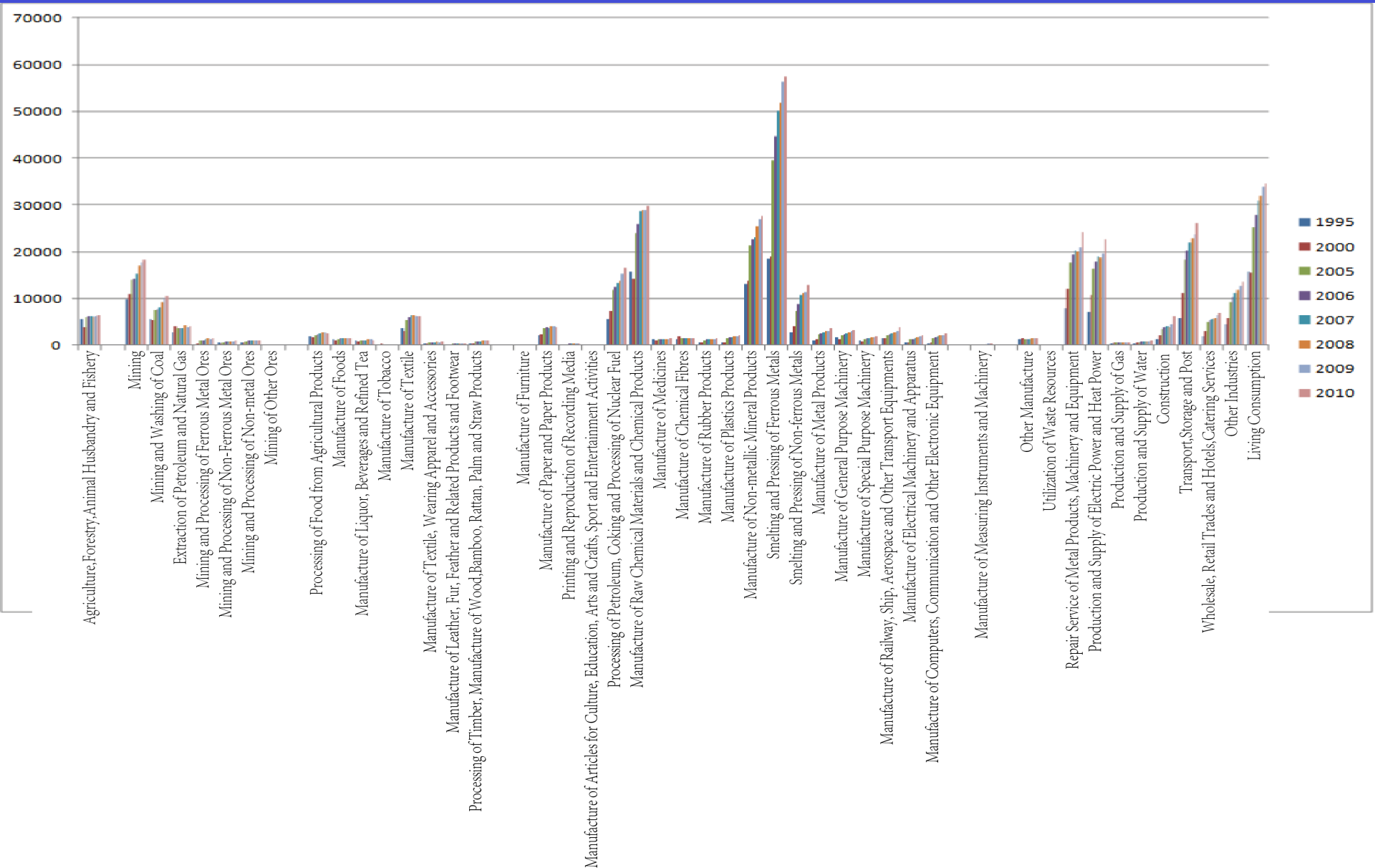
	单位	2005年	2010	2011	2012	2020年	2030年	2040年	2050年
粗钢	亿吨	3.55	6.27	6.83	7.17	6.1	5.7	4.4	3.6
水泥	亿吨	10.6	18.68	20.63	22	16	16	12	9
玻璃	亿重量箱	3.99	5.8	7.38	7.14	6.5	6.9	6.7	5.8
铜	万吨	260	479	518	560	700	700	650	460
电解铝	万吨	851	1695	1806	1966	1600	1600	1500	1200
铅锌	万吨	510		521	969	720	700	650	550
纯碱	万吨	1467		2303	2382.545	2300	2450	2350	2200
烧碱	万吨	1264		2466	2698	2400	2500	2500	2400
纸和纸板	万吨	6205	9270	9930	10500	11000	11500	12000	12000
化肥	万吨	5220		6027		6100	6100	6100	6100
乙烯	万吨	756		1527	1487	3400	3600	3600	3300
合成氨	万吨	4630		5069	5423.83	5000	5000	5000	4500
电石	万吨	850		1737		1000	800	700	400

According to the fast development before 2011, the peak may come by 2012-2015; Data of 2012 has presented this trend.

New buildings (hundred million square meter)
The total construction area are 135 billion by 2050



Energy demand by sector:
Industry consumes 70% of the new energy consumption of 2000-2010, while the five high energy-consuming sectors consume 49%.



Natural gas plan

- 2015: 260 billion m^3
- 2030: 450 billion m^3, by forecasting
- It is equivalent to new energy of 0.16 billion SCE in 2015 (0.22 billion SCE, considering the efficiency), and new energy of 0.48 billion in 2020.
- New scenario
  2015： 300 billion m^3
  2020： 450 billion m^3

Renewable energy have huge potential development

The development of renewable energy and nuclear power provide plenty of opportunities to further reduction of GHGs.

According to present forecasting, by 2050 the wind power capacity will reach 0.4-0.5 billion kw; the nuclear power capacity will reach 0.4-0.5 billion kw; the water power capacity will reach 0.4-0.5kw; the solar power capacity will reach 0.3-0.5 billion kw. The renewable and nuclear power capacity may occupy more than 55% of the total power capacity.

Compared to the basic scenario, the reduction of 2030 is 0.2-0.3 billion tons carbon, while the reduction of 2050 is 0.3-0.8 billion tons carbon.

The renewable can develop faster. Wind power capacity could reach 0.2-0.3 billion kw, and solar power capacity could reach 20-80 million kw.

If peak level is reached, the renewable power will supply 1.8 trillion kwh, and the nuclear power could supply 580 billion kwh. They occupy about 32-35% of the total power generation.

January 24, 2013: PV capacity target is increased from 20 million kw to 35 million kw by 2015, announced by National Energy Board.

December 2012: 43 million kw pv

2013 Energy Conference: New wind power capacity 18 million kw

Prospect in 2020

- Total energy consumption are 4.5-4.7 billion tons SCE in 2020.
- Natural gas: 360-460 billion m^3 (equivalent to 0.7-0.9 billion tons coal, 0.9-1.2 billion tons coal by considering the efficiency) Compared to 2013, increase of 0.4-0.6 billion tons coal (0.6-0.9 billion tons)
- Wind power: 0.25-0.3 billion kw; Solar power: 0.1 billion kw; Water power: 0.33 kw; Nuclear power: 60-80 million kw. (Equivalent to 0.5 billion tons coal)
- This can basically meet the new energy demand.
- Compared to 2013, the coal consumption may decrease about 0.1-0.4 billion tons in 2020.

It is a wise choice that natural gas replaces the coal

- Coal combustion is high pollution source.
- The current discussion between the clean coal generation and gas generation has a great number of misleading data: it is supposed to compare the coal-fired power plant emission standards to the gas-fired power plant, rather than the NGCC gas-fired power plant; it is supposed to compare the smoke volume concentration rather than the unit power generation.
- Super clean coal costs too much, and supervision difficulty is also large.
- In the long term target for air quality, if we target the WHO secondary standards by 2020 and primary standards by 2013, we need to control the coal consumption in power generation and other relevant industries, and coal consumption should decrease obviously after 2020.
- In the populous place, the coal consumption per unit area in China is over ten times more than the U.S. (Power plants in China have the most rigorous standards is often cited.)