Emission Scenario in China: A Comparison

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Objectives

Work together among modeling teams in China and other countries

Understand well the key assumption and results

Provide basis information for further study

Recent modeling study in China for Climate change policies Assessment

Tsinghua-MARKAL

CDRC model

He Model

EDM Model

IPAC-e

IPAC-AIM/Country

IPAC-AIM/Local

IPAC-SGM

IPAC-TIMER

Model for emission scenarios

Tsinghua-MARKAL

CDRC model

EDM Model

IPAC-e

IPAC-AIM/Country

IPAC-SGM

IPAC-TIMER

Tsinghua-MARKAL

- MARKAL, a ”bottom-up” technology oriented model which represents the detailed energy and environmental systems based on the Reference Energy System Approach, and

- MACRO, a “top-down” macroeconomic framework formulated as a long-term neoclassical growth model.

IPAC-e model

- A linkage model by covering top-down, bottom-up approach
- Full range emission source: energy, land use and industrial process
- Global model: 9 regions in the world
- Partial equilibrium model

ERI: IPAC-AIM/Technology model

- Bottom-up model for China
- 26 sectors
- Least cost option model
- More than 500 technologies
- Medium-term scenario(2030)

CASS: HE model

- A CGE model
- Static model(dynamic model in future)
- 9 sectors
- Carbon tax as policy implication

DRC: CDRC model

- A CGE model
- dynamic model
- 29 sectors
- Economic activities and environment issues
- Serve as a base for other modeling team on economic development

CASS: EDM Model

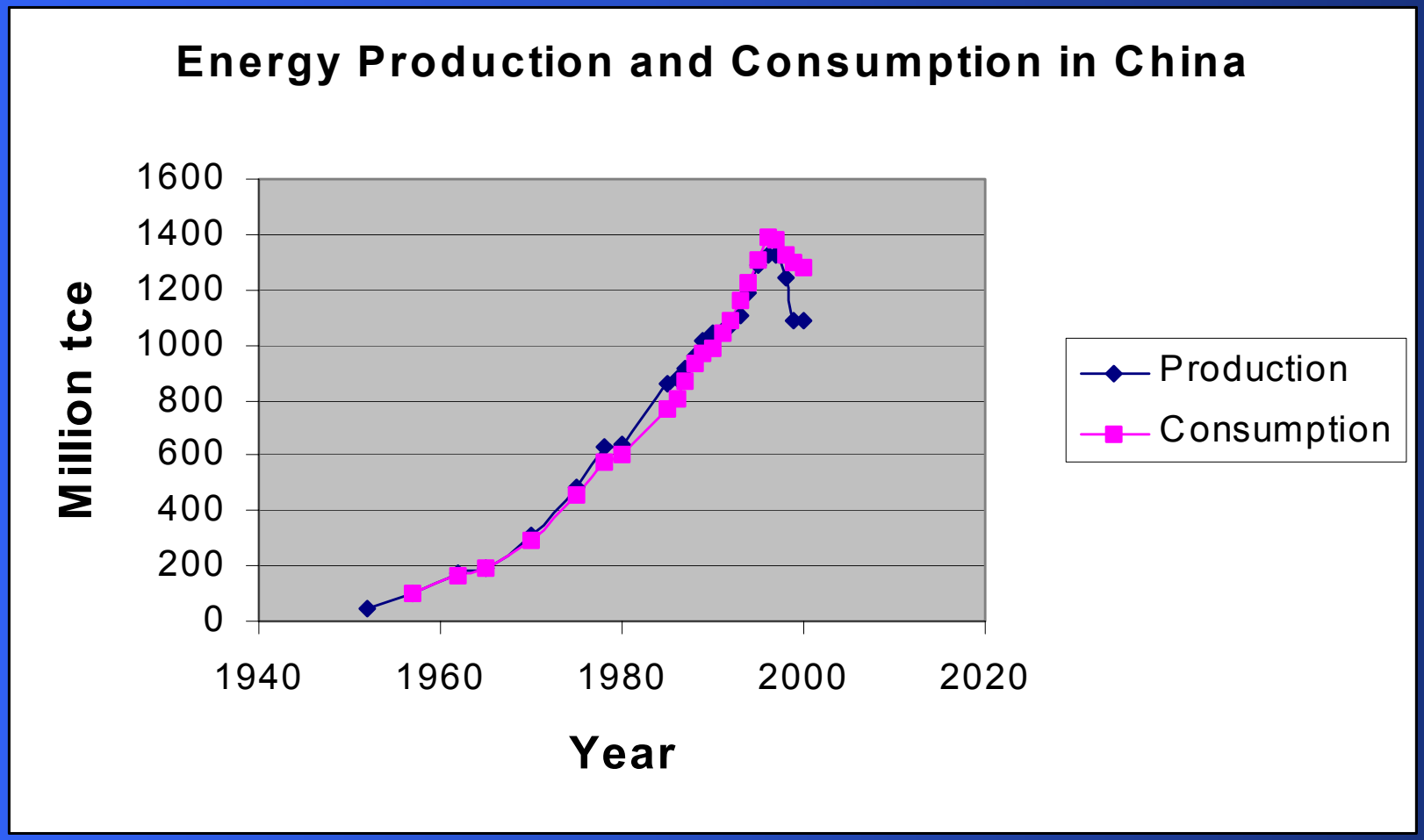
- A CGE model
- dynamic model
- 29 sectors
- Economic activities and environment issues

ERI: IPAC-SGM

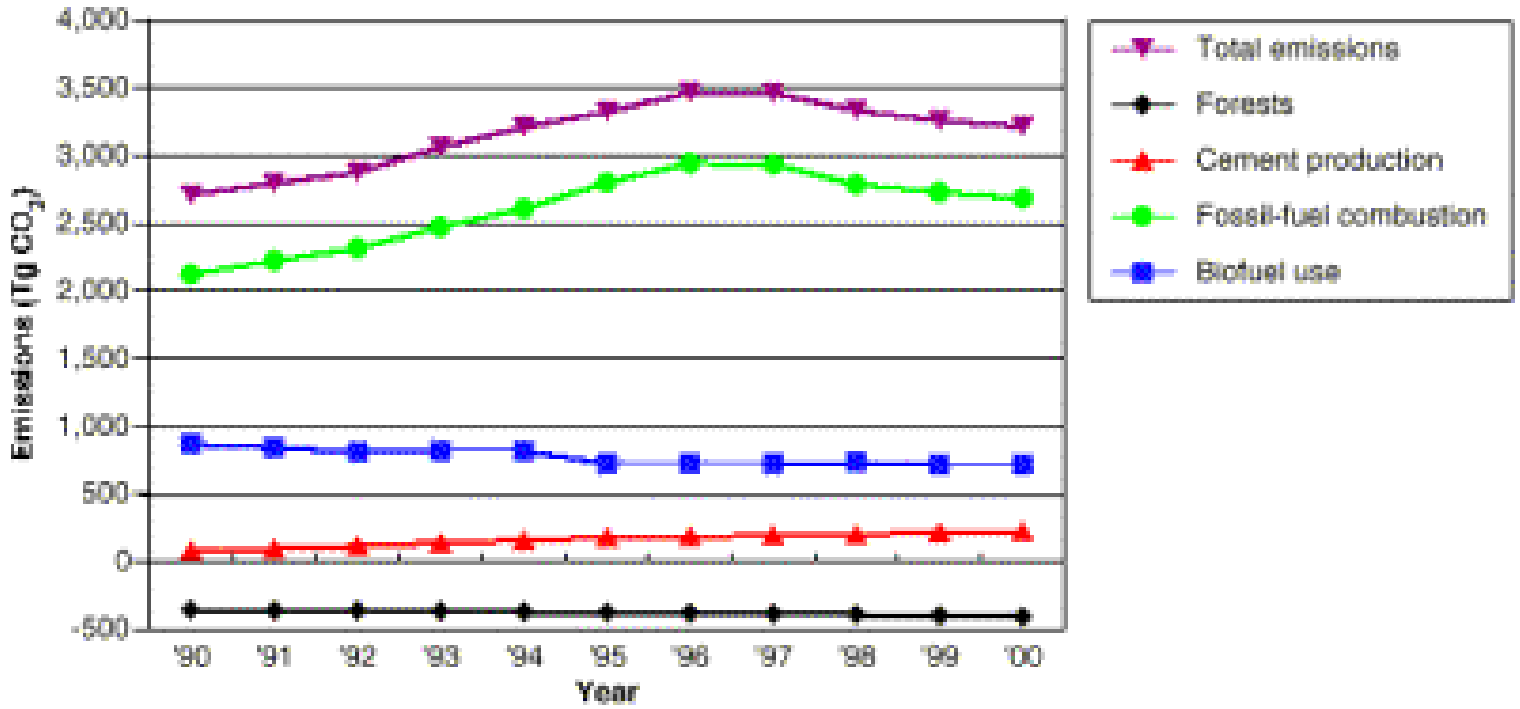
- A CGE model
- dynamic model
- 29 sectors
- Economic activities and environment issues

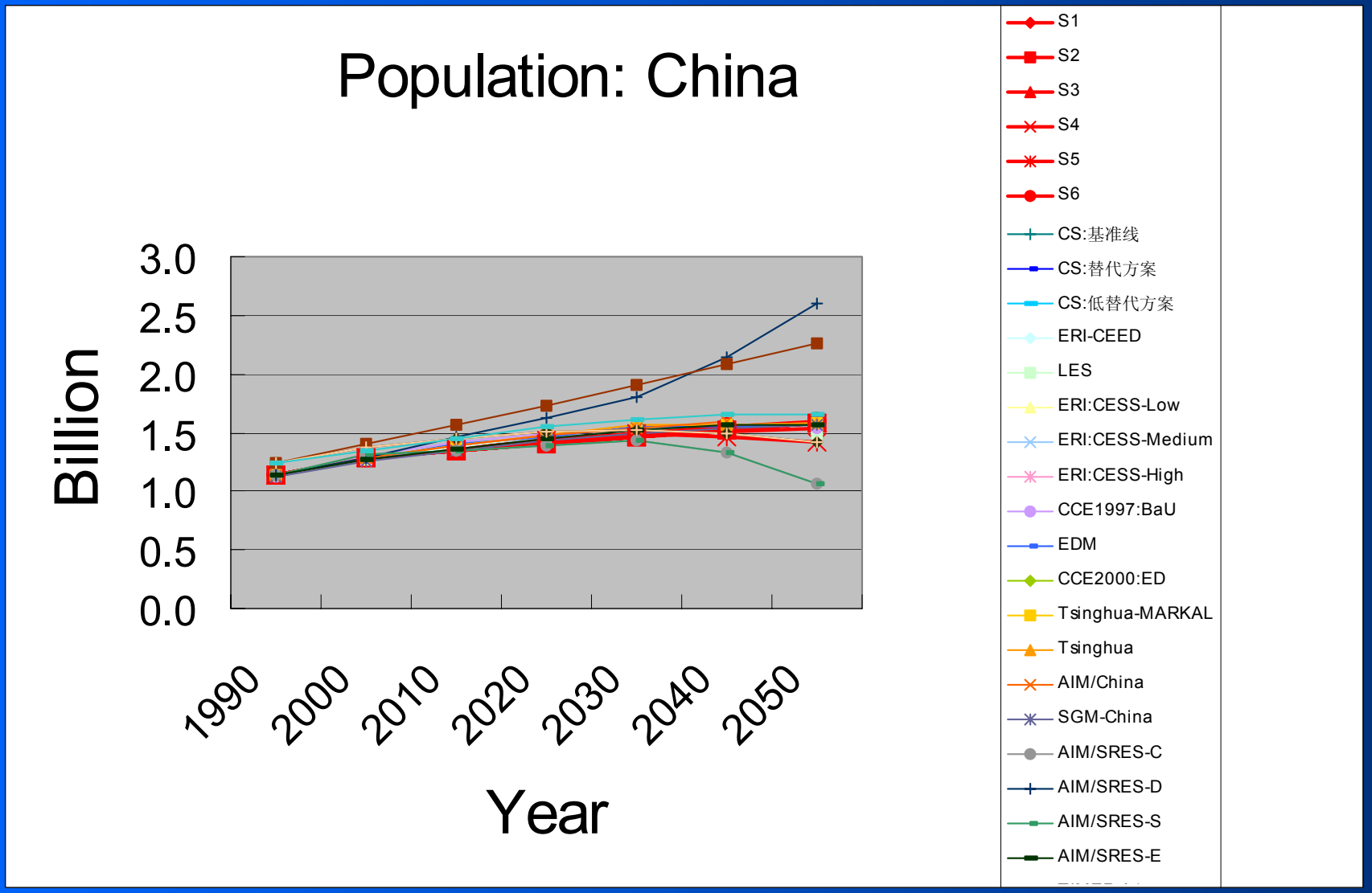
Scenario comparison: models

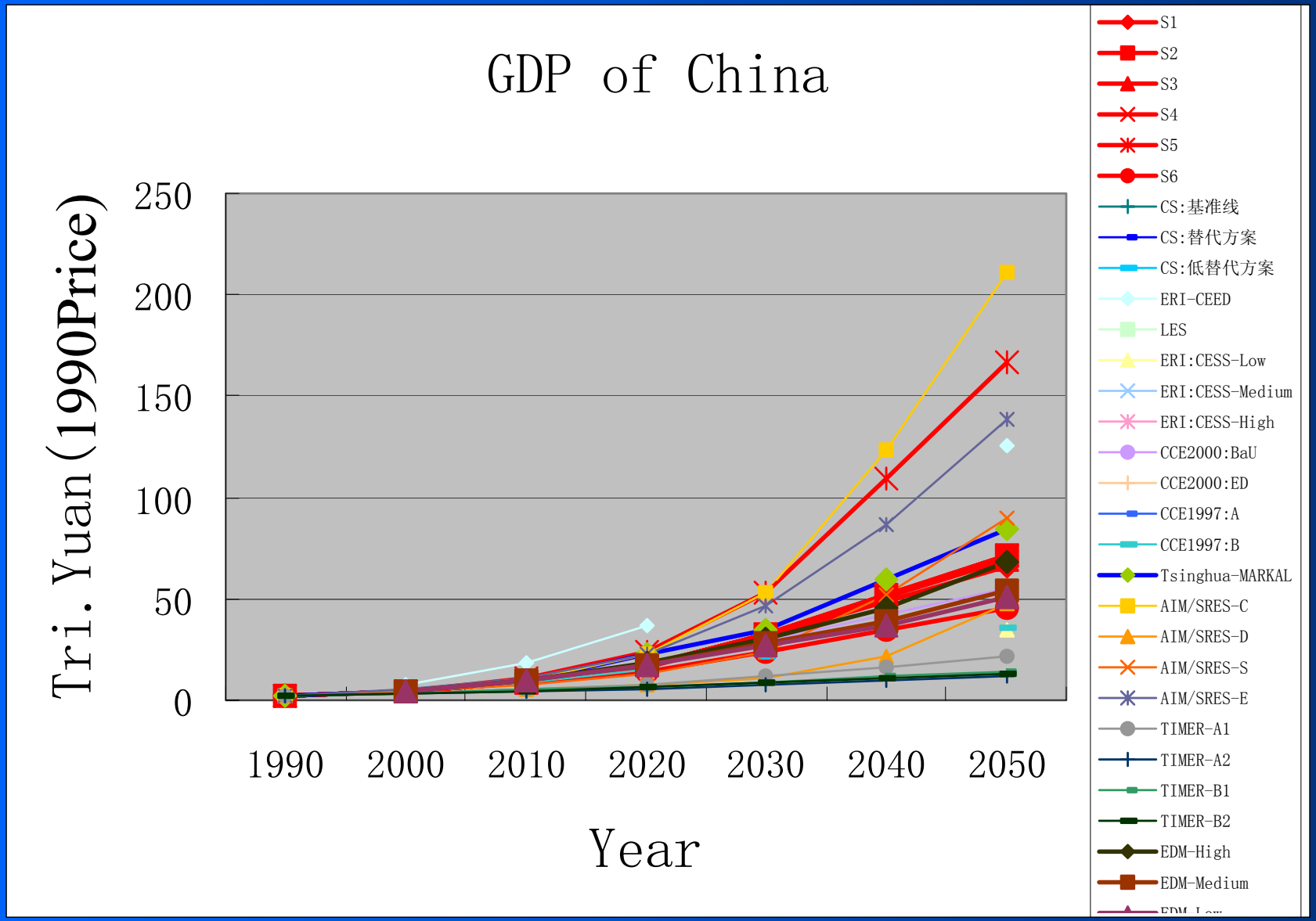
- Tsinghua-MARKAL
- CASS-EDM model
- DRC-CDRC model
- IPAC-emission
- IPAC-AIM/technology
- IPAC-TIMER
- IPAC-SGM
- Other studies in China: non-modeling research


Energy Production and Consumption in China
Million tce
1600
1400
1200
1000
800
600
400
200
0
1940
1960
1980
2000
2020
Year
Production
Consumption

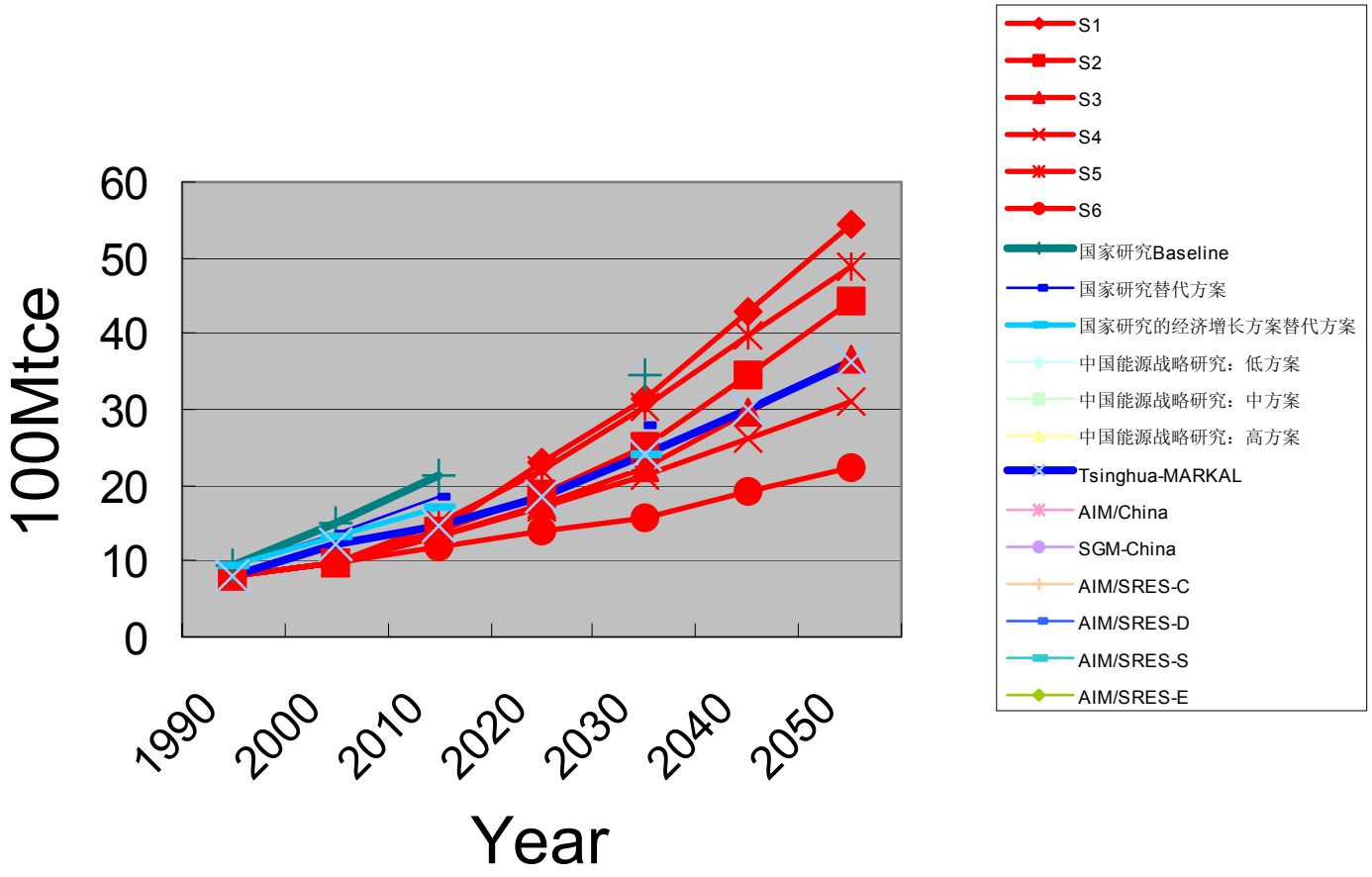
CO2 emission in China



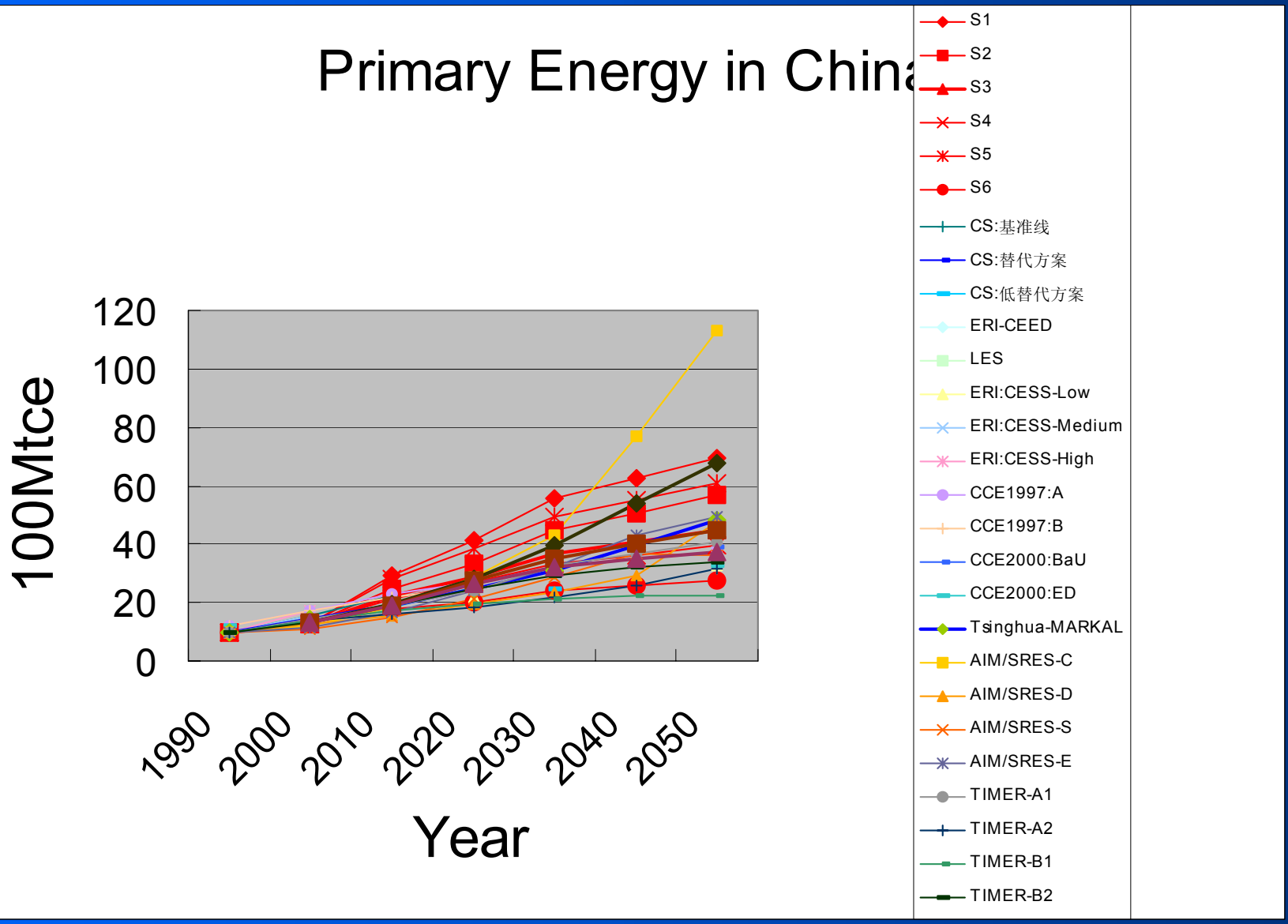

Population: China
Billion
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1990
2000
2010
2020
2030
2040
2050
Year
S1
S2
S3
S4
S5
S6
CS:基准线
CS:替代方案
CS:低替代方案
ERI-CEED
LES
ERI:CESS-Low
ERI:CESS-Medium
ERI:CESS-High
CCE1997:BaU
EDM
CCE2000:ED
Tsinghua-MARKAL
Tsinghua
AIM/China
SGM-China
AIM/SRES-C
AIM/SRES-D
AIM/SRES-S
AIM/SRES-E

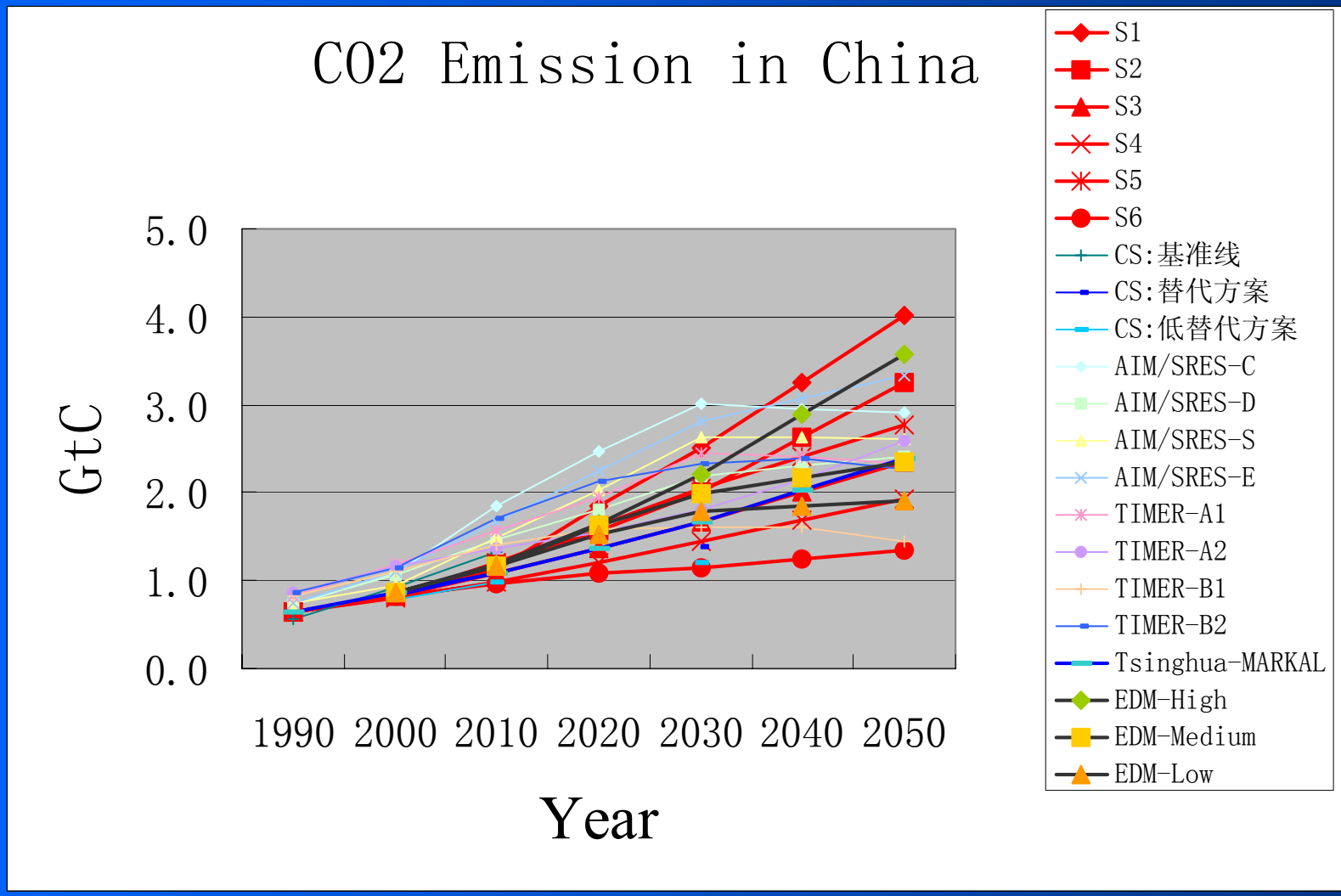

GDP of China
Tri. Yuan (1990Price)
250
200
150
100
50
0
1990
2000
2010
2020
2030
2040
2050
Year
S1
S2
S3
S4
S5
S6
CS:基准线
CS:替代方案
CS:低替代方案
ERI-CEED
LES
ERI:CESS-Low
ERI:CESS-Medium
ERI:CESS-High
CCE2000:BaU
CCE2000:ED
CCE1997:A
CCE1997:B
Tsinghua-MARKAL
AIM/SRES-C
AIM/SRES-D
AIM/SRES-S
AIM/SRES-E
TIMER-A1
TIMER-A2
TIMER-B1
TIMER-B2
EDM-High
EDM-Medium

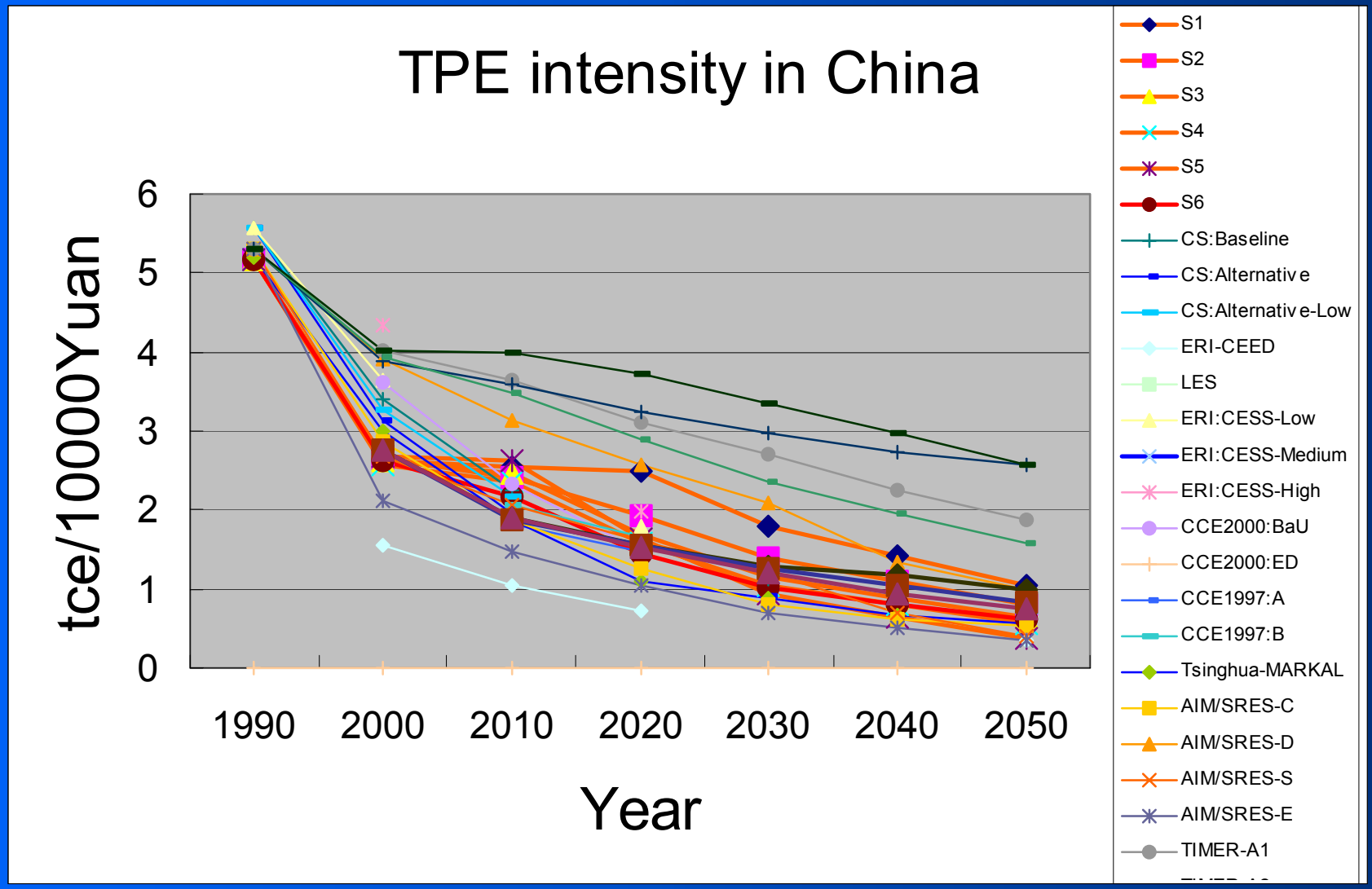
Final energy in China



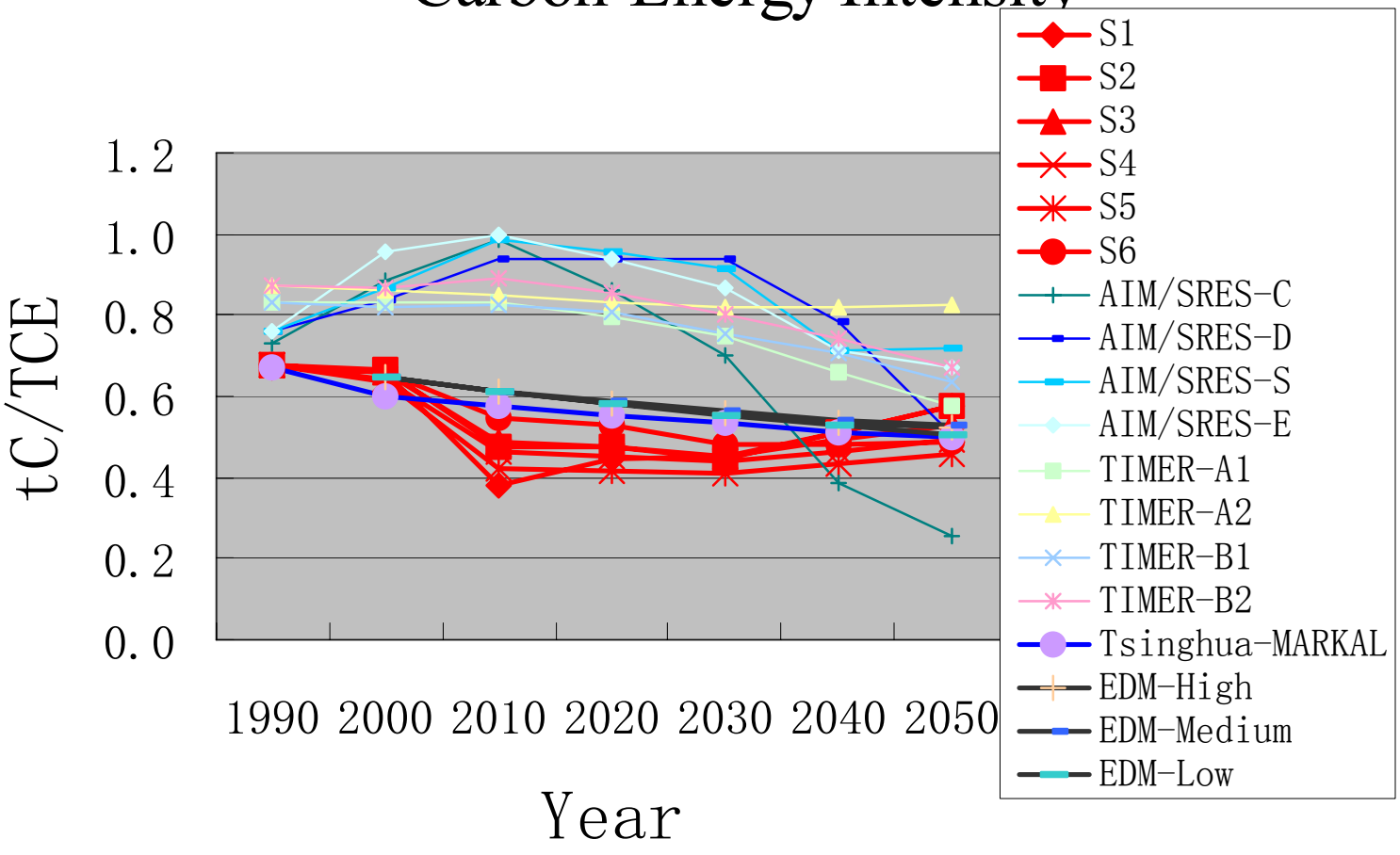
Primary Energy in China

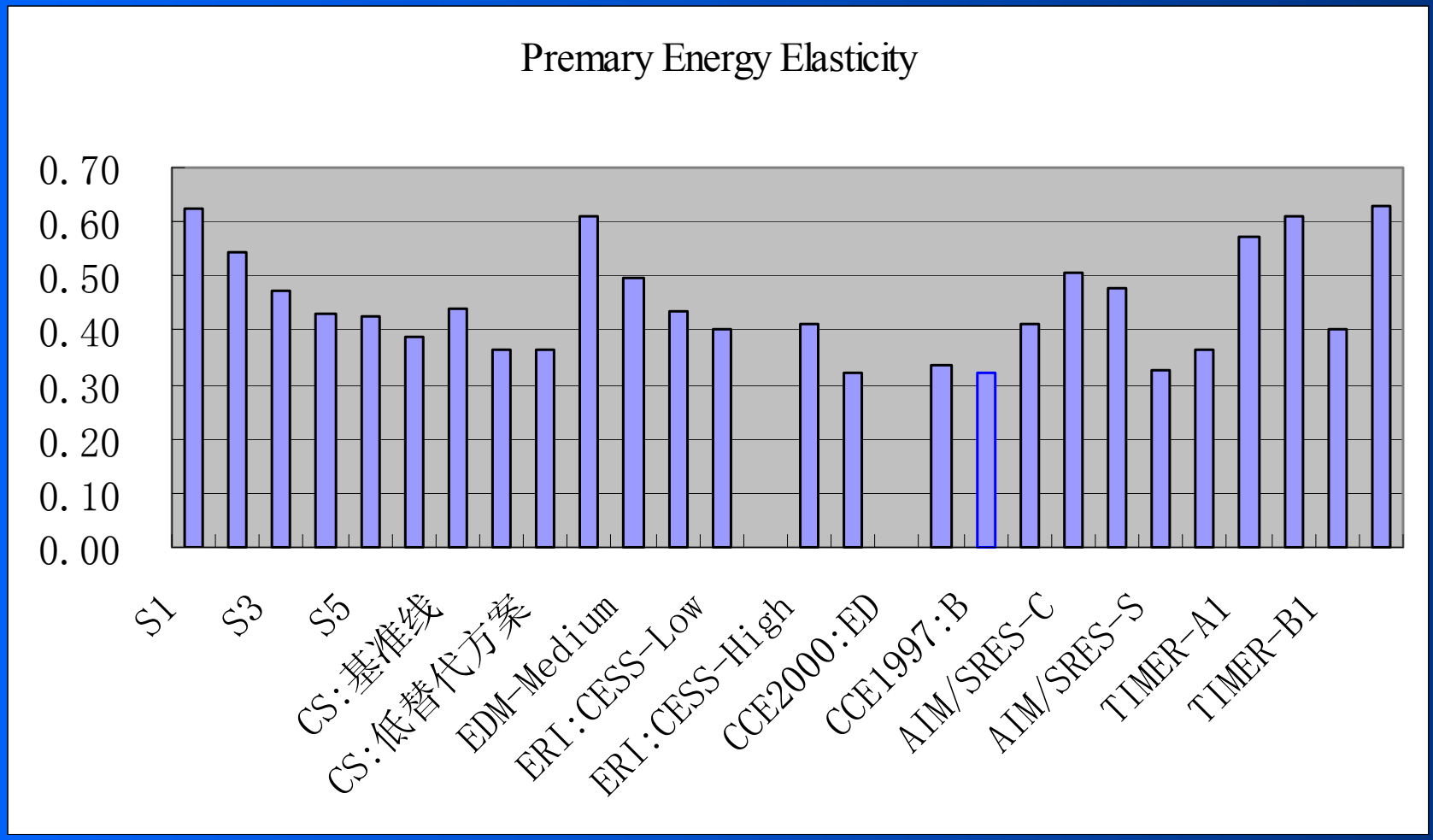


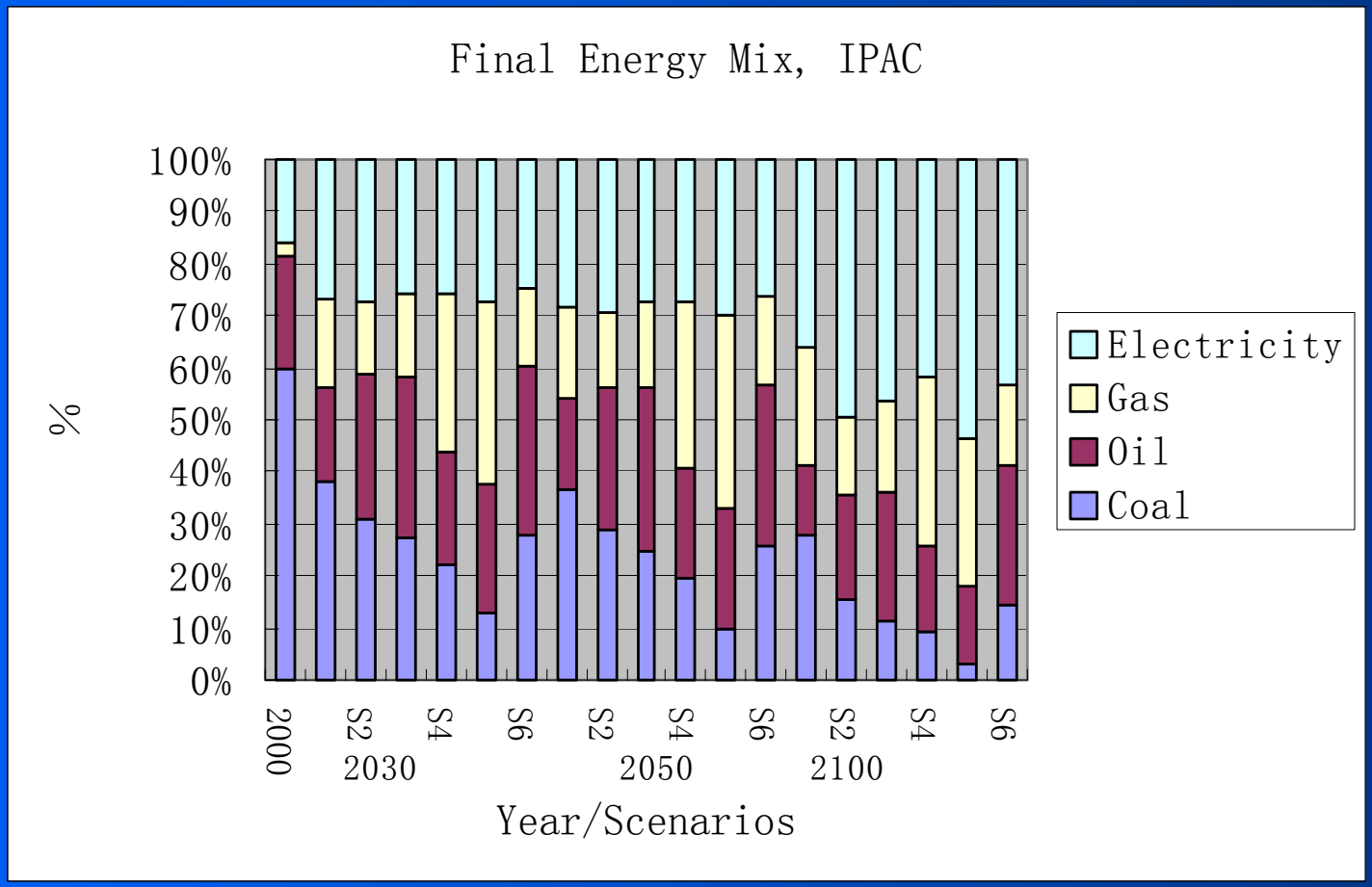

CO2 Emission in China
GtC
5.0
4.0
3.0
2.0
1.0
0.0
1990 2000 2010 2020 2030 2040 2050
Year
S1
S2
S3
S4
S5
S6
CS:基准线
CS:替代方案
CS:低替代方案
AIM/SRES-C
AIM/SRES-D
AIM/SRES-S
AIM/SRES-E
TIMER-A1
TIMER-A2
TIMER-B1
TIMER-B2
Tsinghua-MARKAL
EDM-High
EDM-Medium
EDM-Low


TPE intensity in China
tce/10000Yuan
0
1
2
3
4
5
6
1990
2000
2010
2020
2030
2040
2050
Year
S1
S2
S3
S4
S5
S6
CS:Baseline
CS:Alternative
CS:Alternative-Low
ERI-CEED
LES
ERI:CESS-Low
ERI:CESS-Medium
ERI:CESS-High
CCE2000:BaU
CCE2000:ED
CCE1997:A
CCE1997:B
Tsinghua-MARKAL
AIM/SRES-C
AIM/SRES-D
AIM/SRES-S
AIM/SRES-E
TIMER-A1

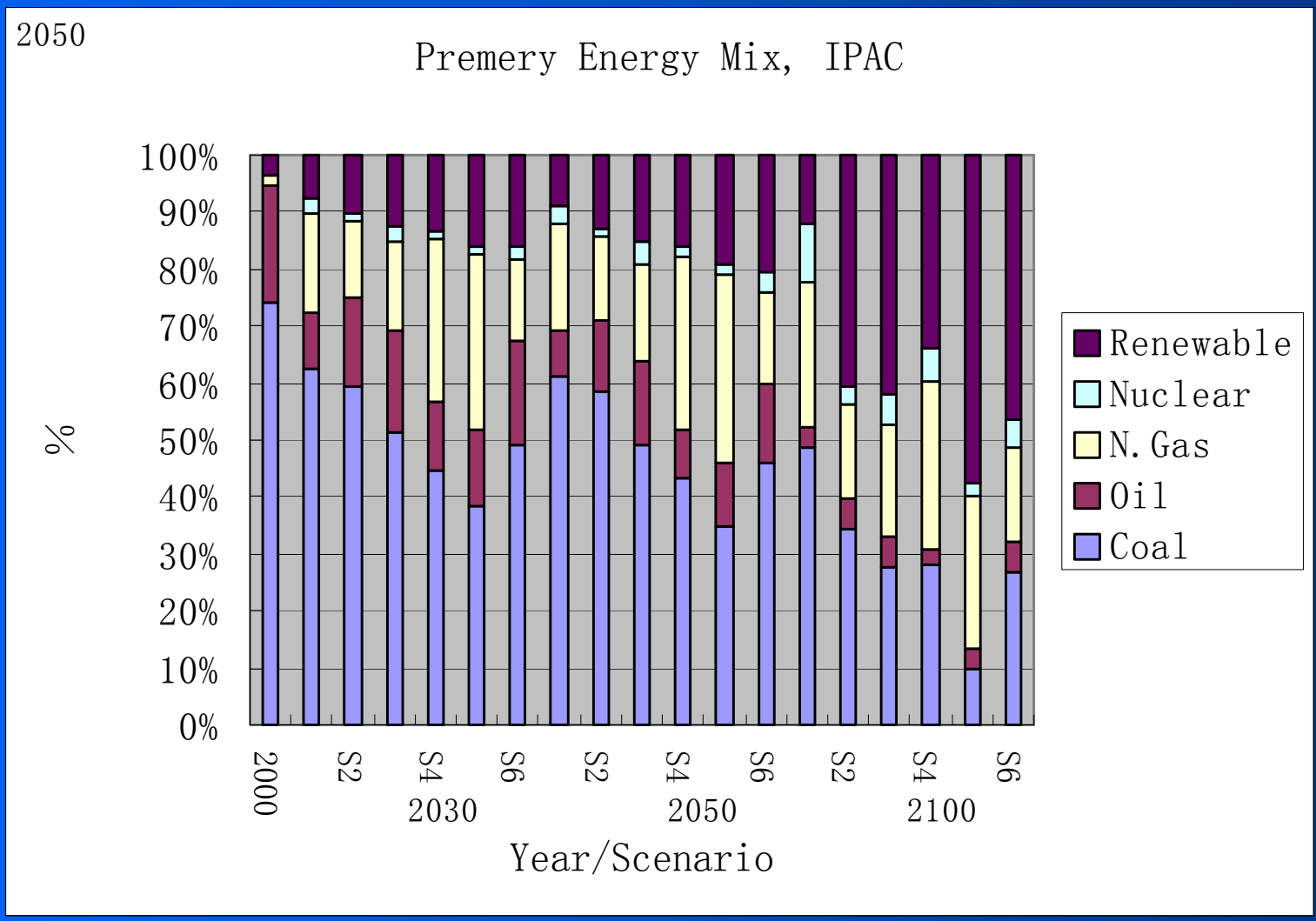
Carbon-Energy Intensity

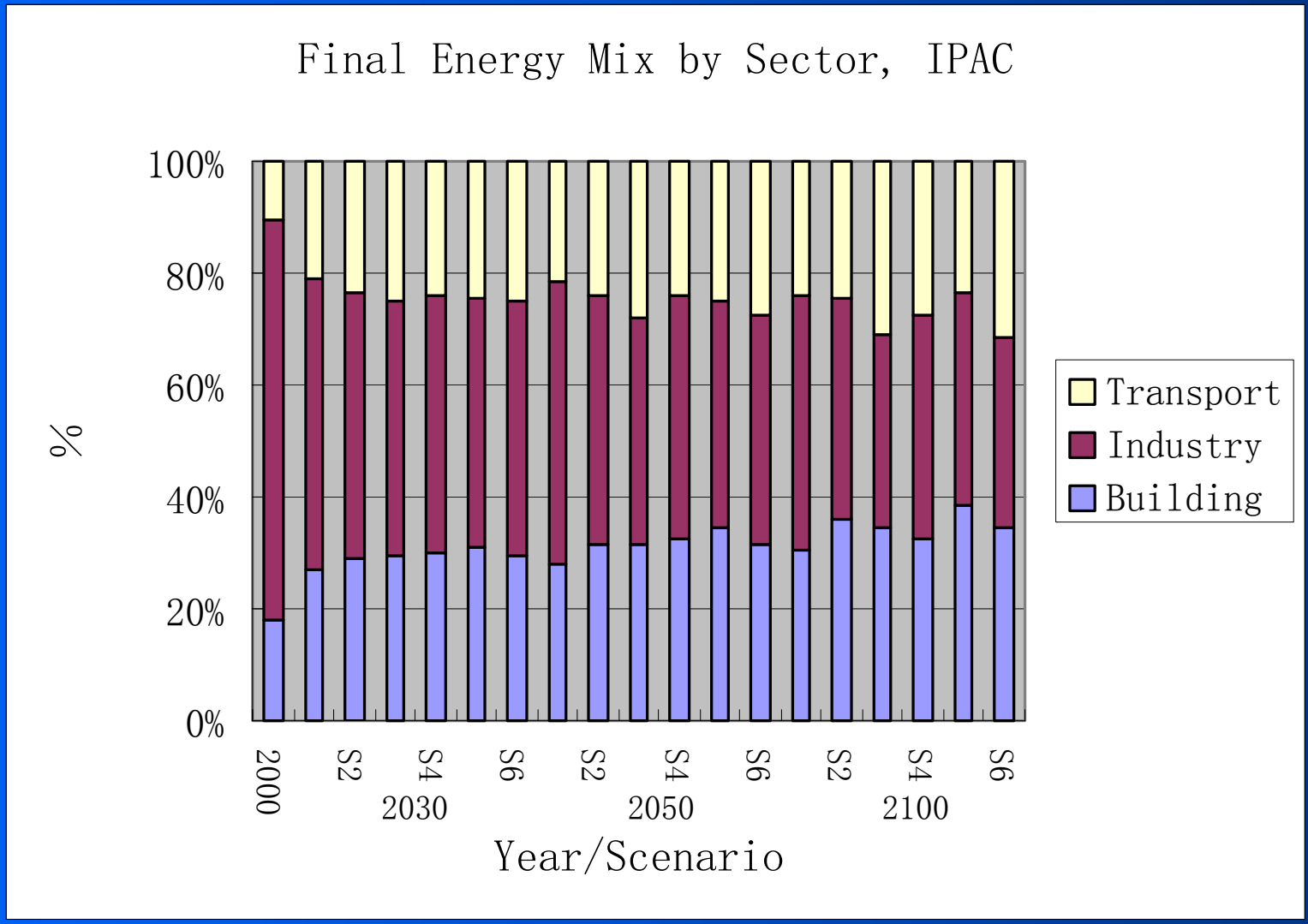



Premary Energy Elasticity
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
S1
S3
S5
CS:基准线
CS:低替代方案
EDM-Medium
ERI:CESS-Low
ERI:CESS-High
CCE2000:ED
CCE1997:B
AIM/SRES-C
AIM/SRES-S
TIMER-A1
TIMER-B1

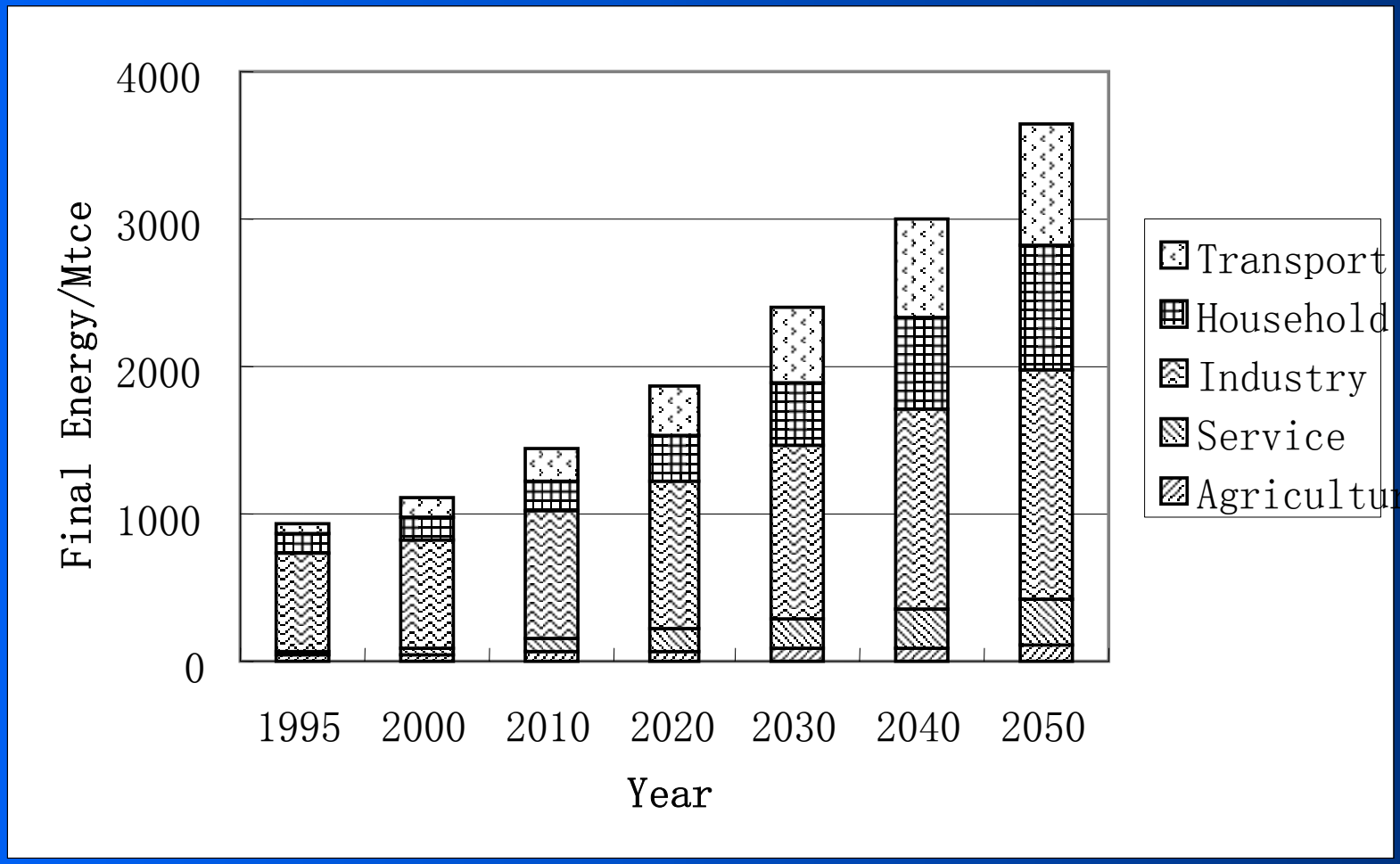

Final Energy Mix, IPAC
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
%
2000
S2
S4
S6
2030
S2
S4
S6
2050
S2
S4
S6
2100
Year/Scenarios
Electricity
Gas
Oil
Coal

2050

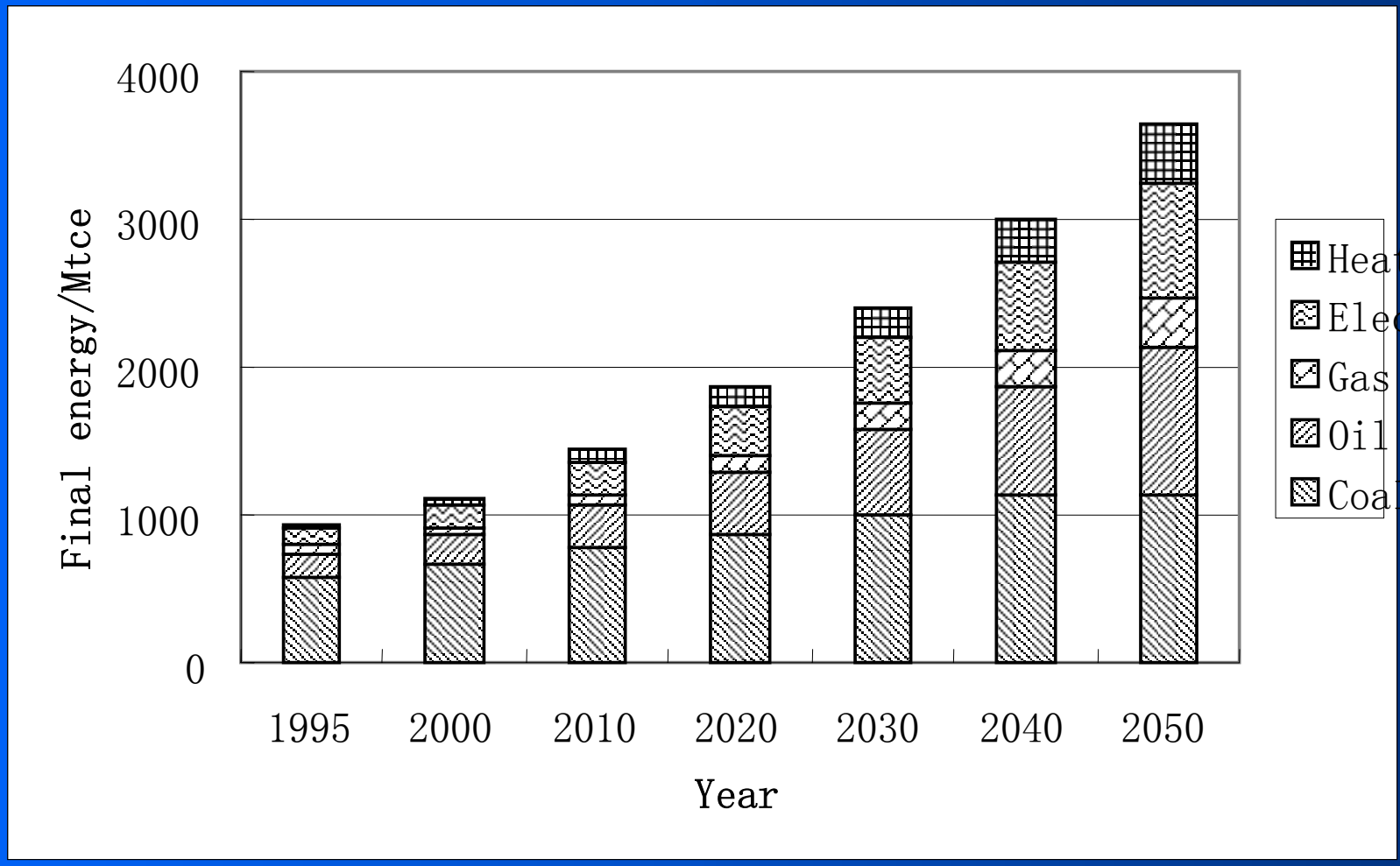

Premery Energy Mix, IPAC
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
%
2000
S2
S4
S6
S2
S4
S6
S2
S4
S6
2030
2050
2100
Year/Scenario
Renewable
Nuclear
N.Gas
Oil
Coal

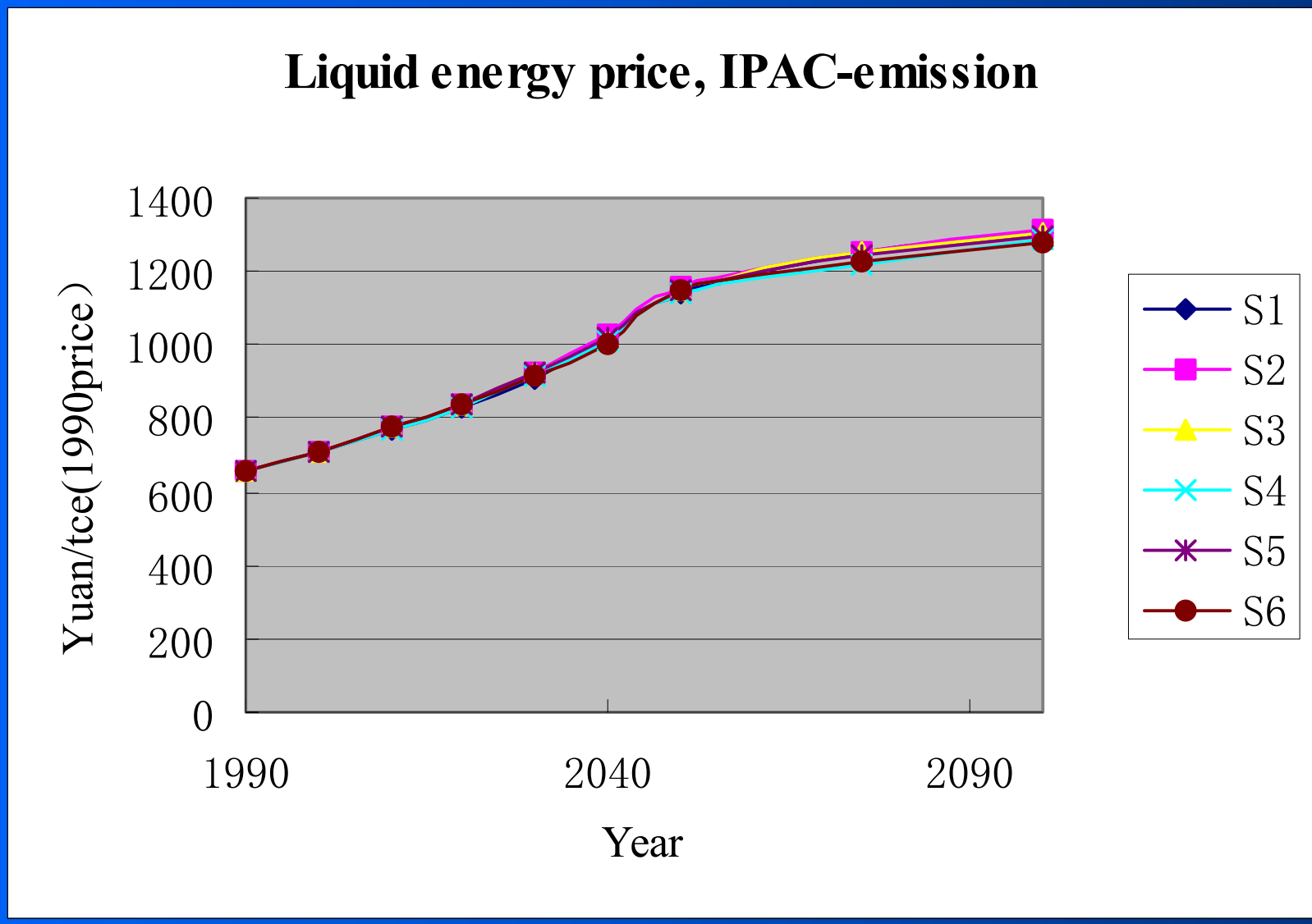

Final Energy Mix by Sector, IPAC
100%
80%
60%
40%
20%
0%
%
Transport
Industry
Building
2000
S2
S4
S6
S2
S4
S6
S2
S4
S6
2030
2050
2100
Year/Scenario

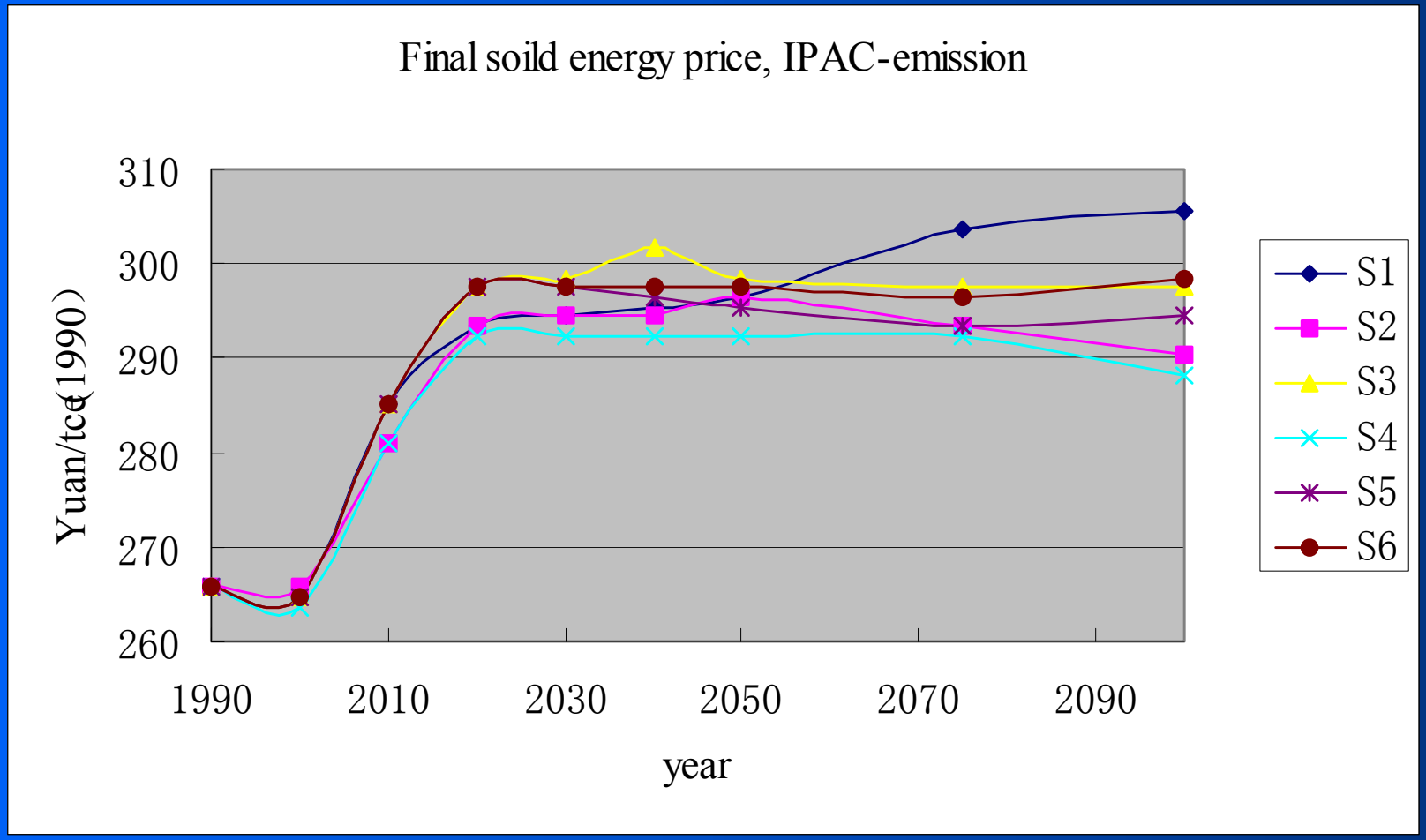
Final Energy Demand by Sector: Tsinghua-MARKAL

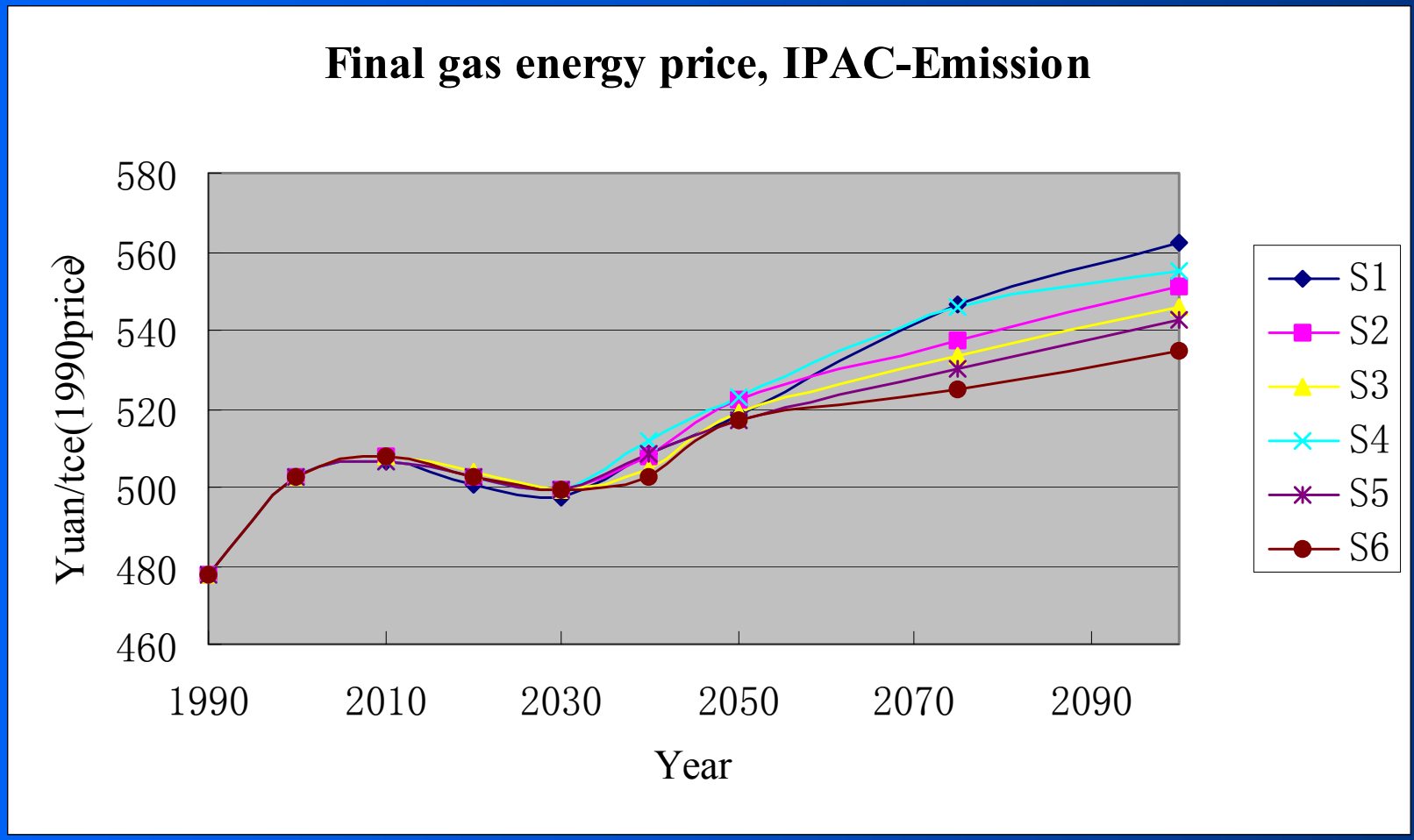


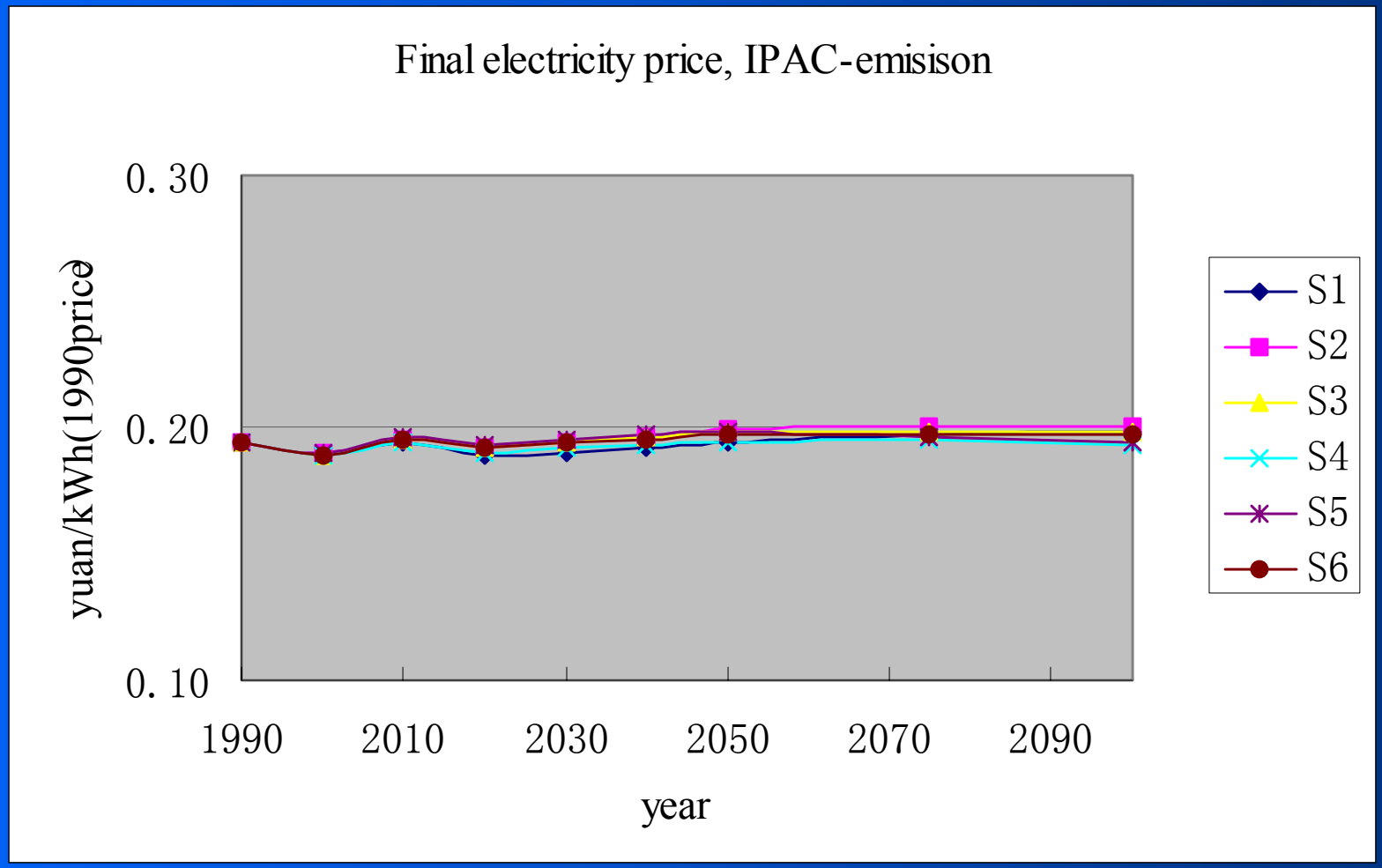
Final Energy Demand by Fuel: Tsinghua-MARKAL




Liquid energy price, IPAC-emission
1400
1200
1000
800
600
400
200
0
Yuan/tce(1990price)
1990
2040
2090
Year
S1
S2
S3
S4
S5
S6


Final soild energy price, IPAC-emission
Yuan/tce(1990)
310
300
290
280
270
260
1990
2010
2030
2050
2070
2090
year
S1
S2
S3
S4
S5
S6


Final gas energy price, IPAC-Emission
Yuan/tce(1990price)
580
560
540
520
500
480
460
1990
2010
2030
2050
2070
2090
Year
S1
S2
S3
S4
S5
S6


Final electricity price, IPAC-emisison
0. 30
0. 20
0. 10
yuan/kWh(1990price)
1990
2010
2030
2050
2070
2090
year
S1
S2
S3
S4
S5
S6

Brief Conclusion

- Scenario for population, GDP growth is relatively similar
- Most scenarios shows the primary energy demand in 2050 is between 4btce to 5.7btce, how ever there is difference among scenarios for energy mix,
- As result, CO2 emission has relative large scope
- More detailed parameters need to be discussed