China's Energy and Emission Scenario
&
IPCC New Emission Scenario Development

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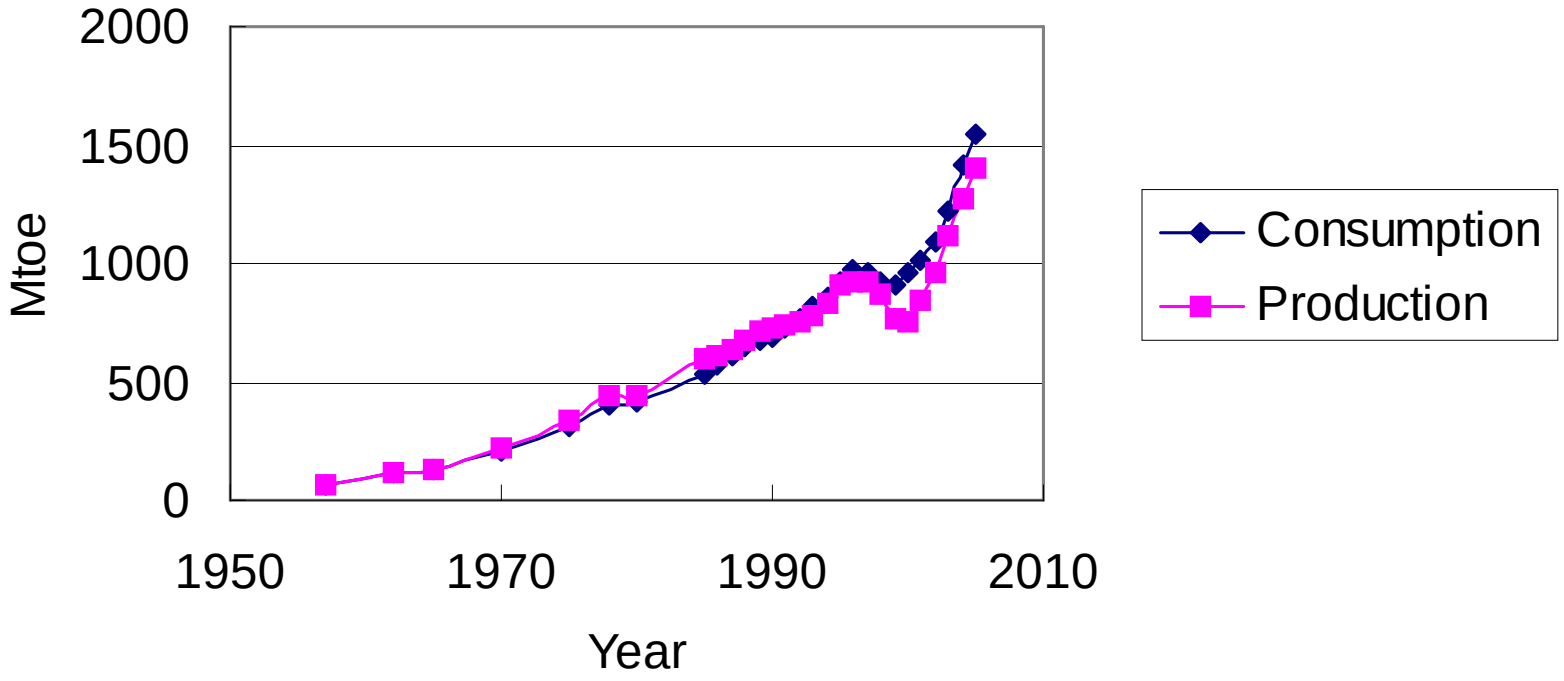
Content

- Energy Policies
- Energy and GHG Emission Scenarios in China
- Agenda of IPCC New Scenarios

Energy Production and Consumption in China, 1957-2005



Energy Policies: After 2003

Energy issue is becoming crucial concerning of government:

- Sustainable development is an important voice in recent years; circular economy is widely accepted
- Widely spread energy shortage: power shortage in 24 provinces in 2004; Gasoline shortage in Guang Dong province in 2005
- Environment target was not reached in 10th Five Yeay Plan, energy is key driving force
- Accident in coal mine is widely known by public, and major concerning of government on improving life and working standard of rural employees
- Energy price increase is getting much more attention on energy

Energy Policies: After 2003

National laws and plan

- Long- and Medium-term Energy Conservation Plan, with much more concrete content
- Renewable energy law: renewable energy target by 2020
- 11th Five Year Energy Plan: National energy intensity target: 20% energy intensity reduction from 2005 to 2010

Energy Policies: After 2003

Standard and regulation

- Vehicle fuel efficiency standard
- Strictly implementation of building energy standard in many provinces and cities
- Implementation of energy label of electric appliances
- Release control on coal price for all users
- Higher consumption tax for larger engine vehicles

Sustainable Development and Energy Policies

Renewable energy law: renewable energy target by 2020

Wind:	30GW
Solar Power PV:	1.8GW
Solar heater:	300million m2
Biomass Power:	30GW
Biomass Diesel:	2Mt
Biomass	10Mt
Biomass solid fuel:	50million ton
Small Hydro:	80GW

Energy Policies: After 2003

What's going on:

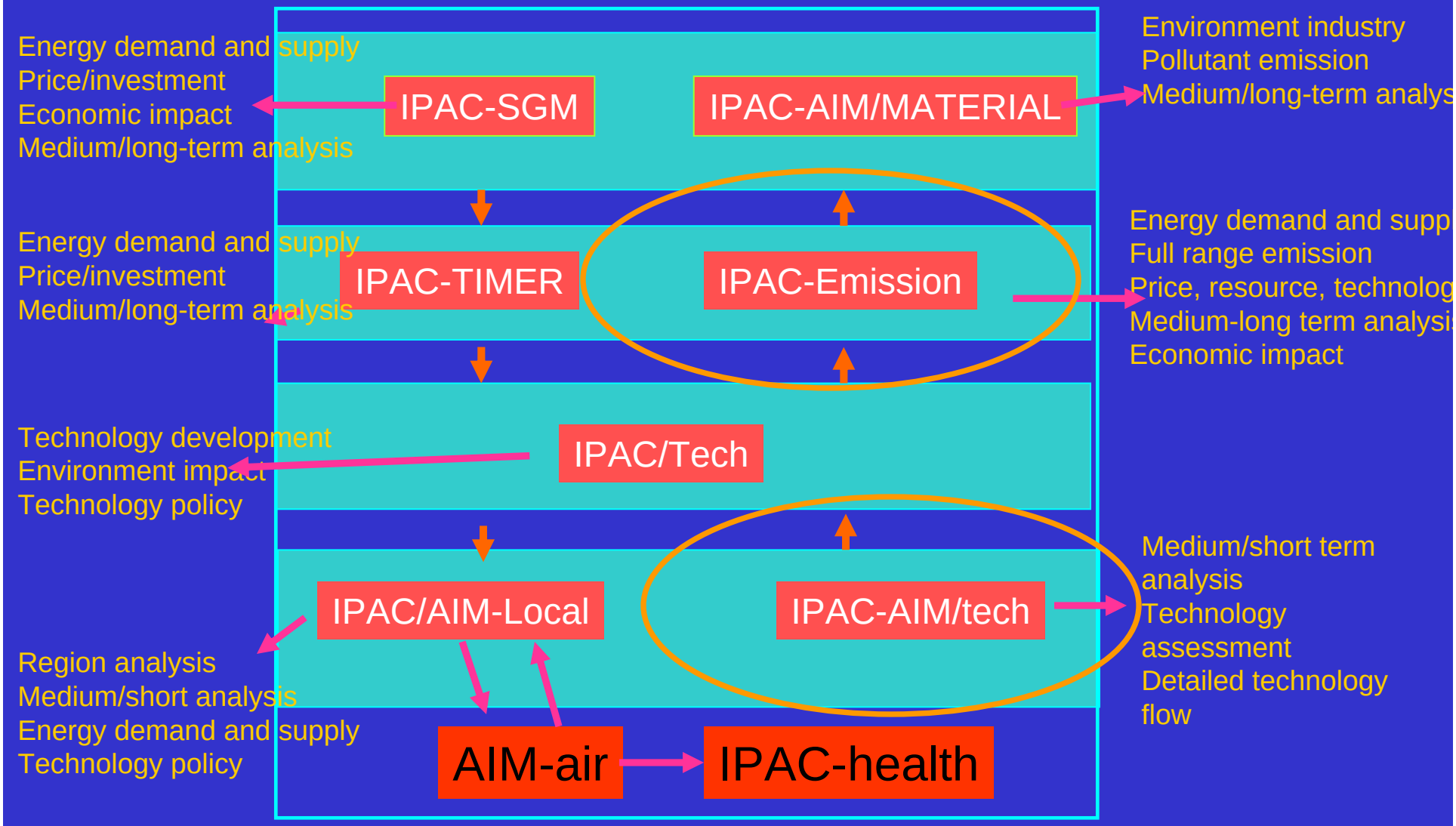
- Draft Energy Law
- Revise Energy Conservation Law
- Draft Oil and Natural Gas Law
- Renewable energy development plan up to 2020

- Implement fuel tax
- Second vehicle fuel efficiency standard
- Renewable energy policies (pricing, funding)

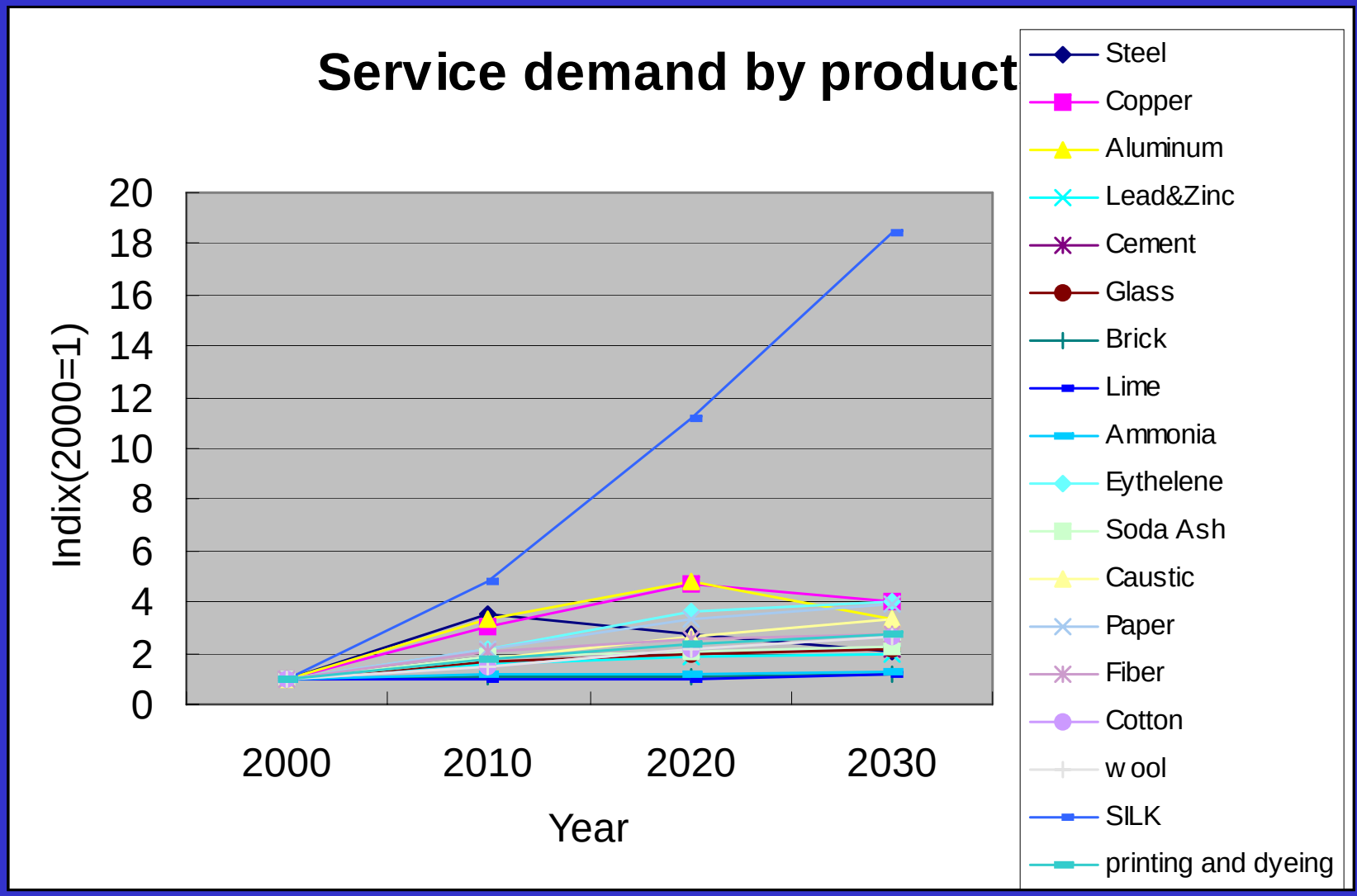
- Energy reporting by government officials
- Energy monitoring for 1000 large energy users

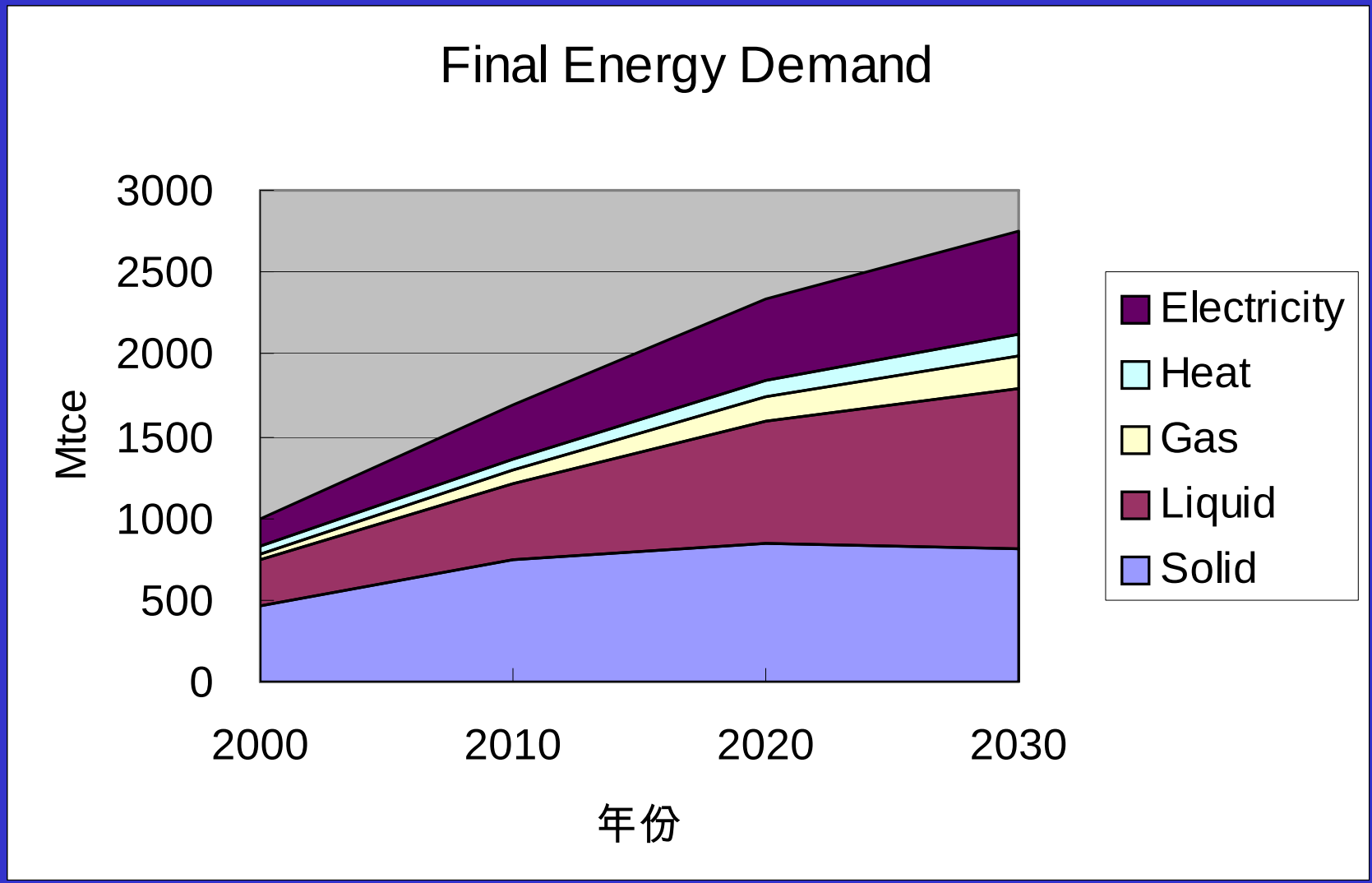
- More than 500 energy conservation projects, in 11th five year plan

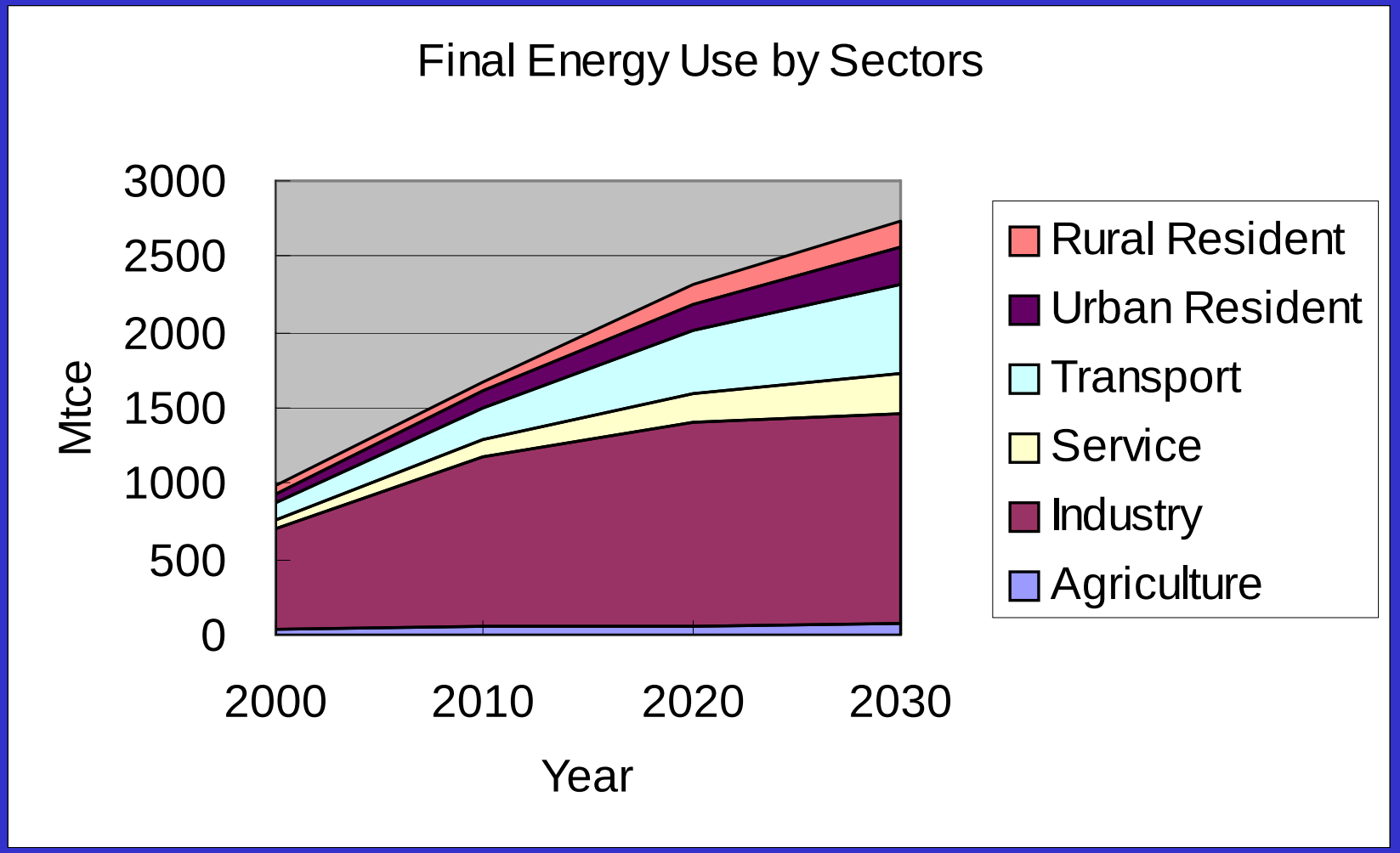
Framework of IPAC

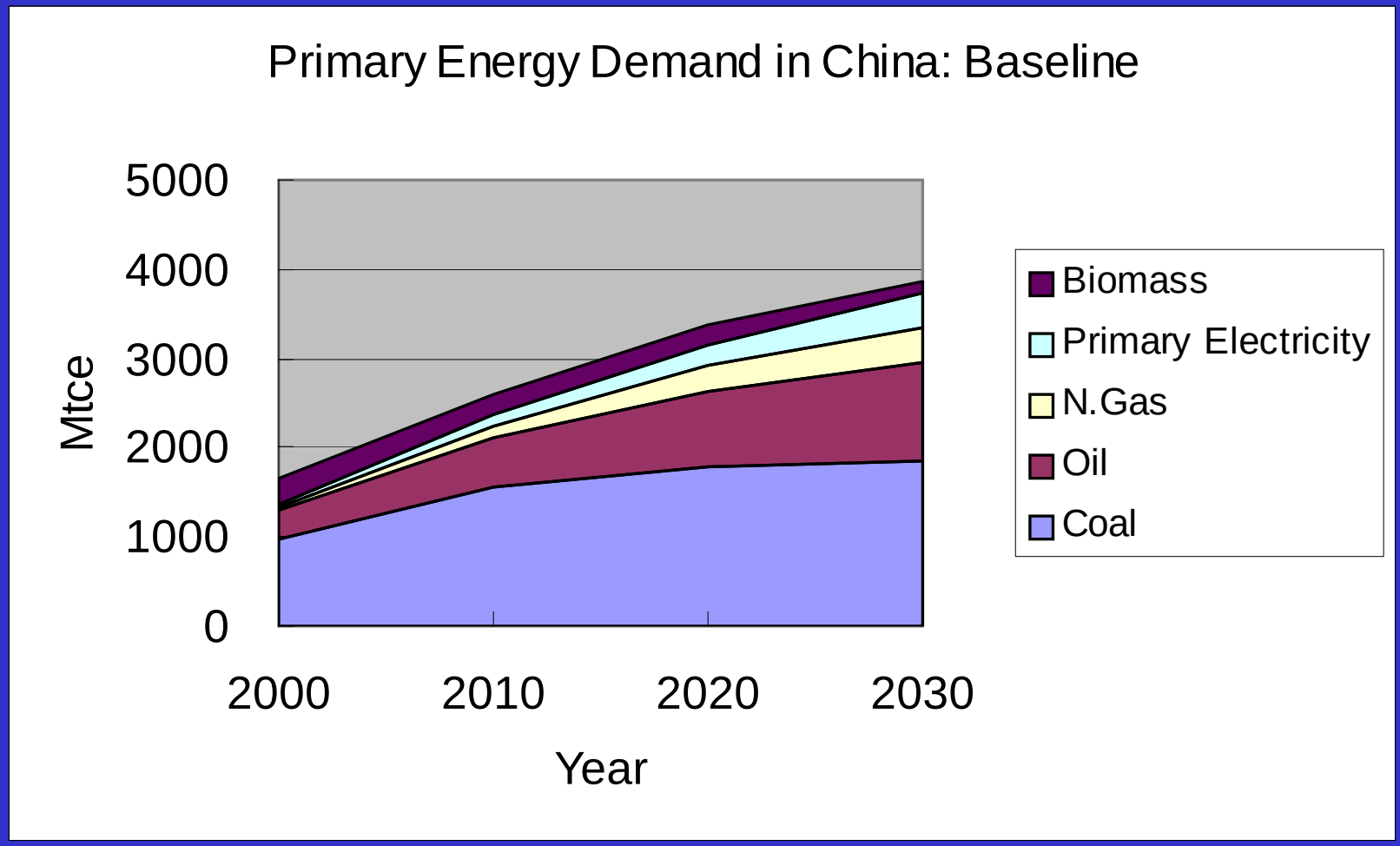


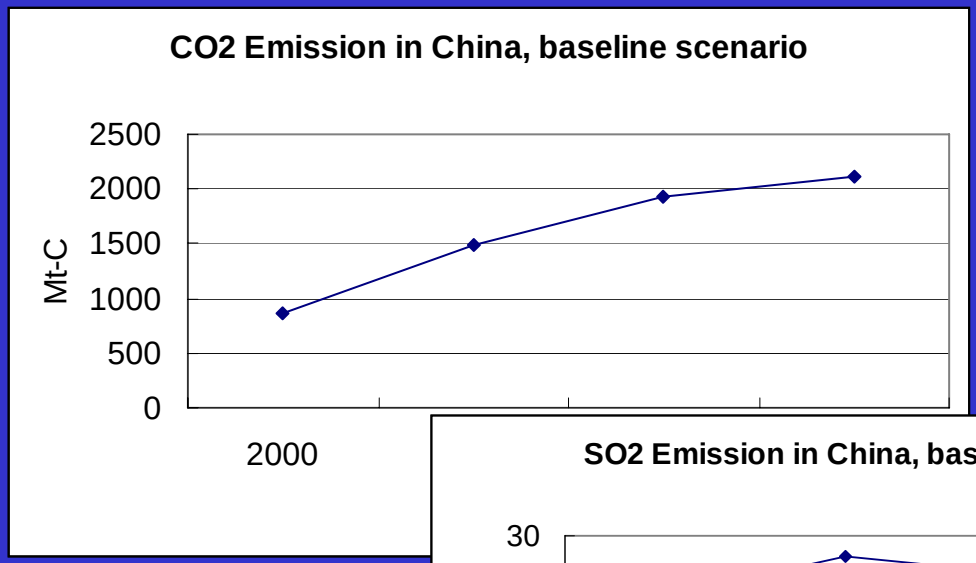
ERI, China

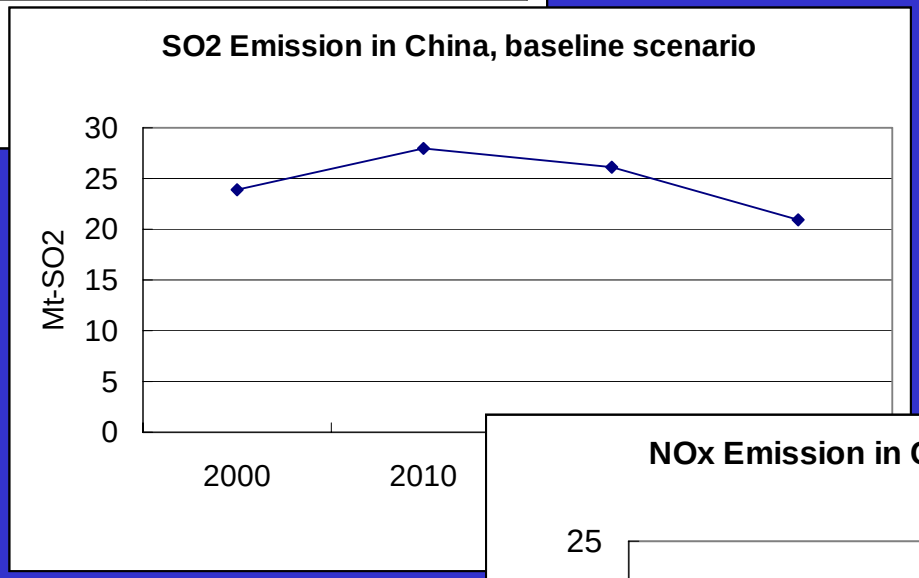

Service demand by product
Indix(2000=1)
20
18
16
14
12
10
8
6
4
2
0
2000
2010
2020
2030
Year
Steel
Copper
Aluminum
Lead&Zinc
Cement
Glass
Brick
Lime
Ammonia
Eythelene
Soda Ash
Caustic
Paper
Fiber
Cotton
w ool
SILK
printing and dyeing

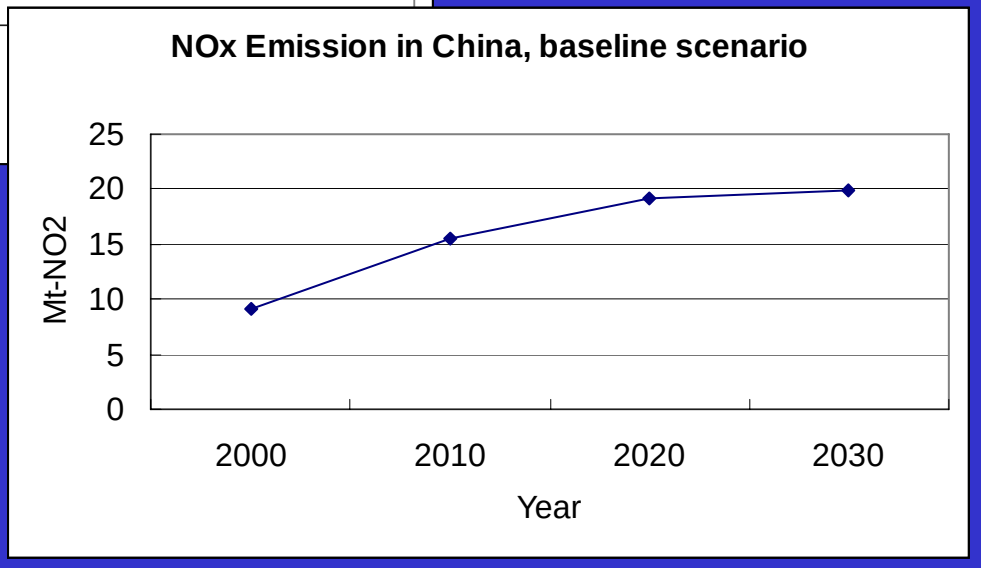

Final Energy Demand
3000
2500
2000
1500
1000
500
0
Mtce
2000
2010
2020
2030
年份
Electricity
Heat
Gas
Liquid
Solid


Final Energy Use by Sectors
3000
2500
2000
1500
1000
500
0
Mtce
2000
2010
2020
2030
Year
Rural Resident
Urban Resident
Transport
Service
Industry
Agriculture

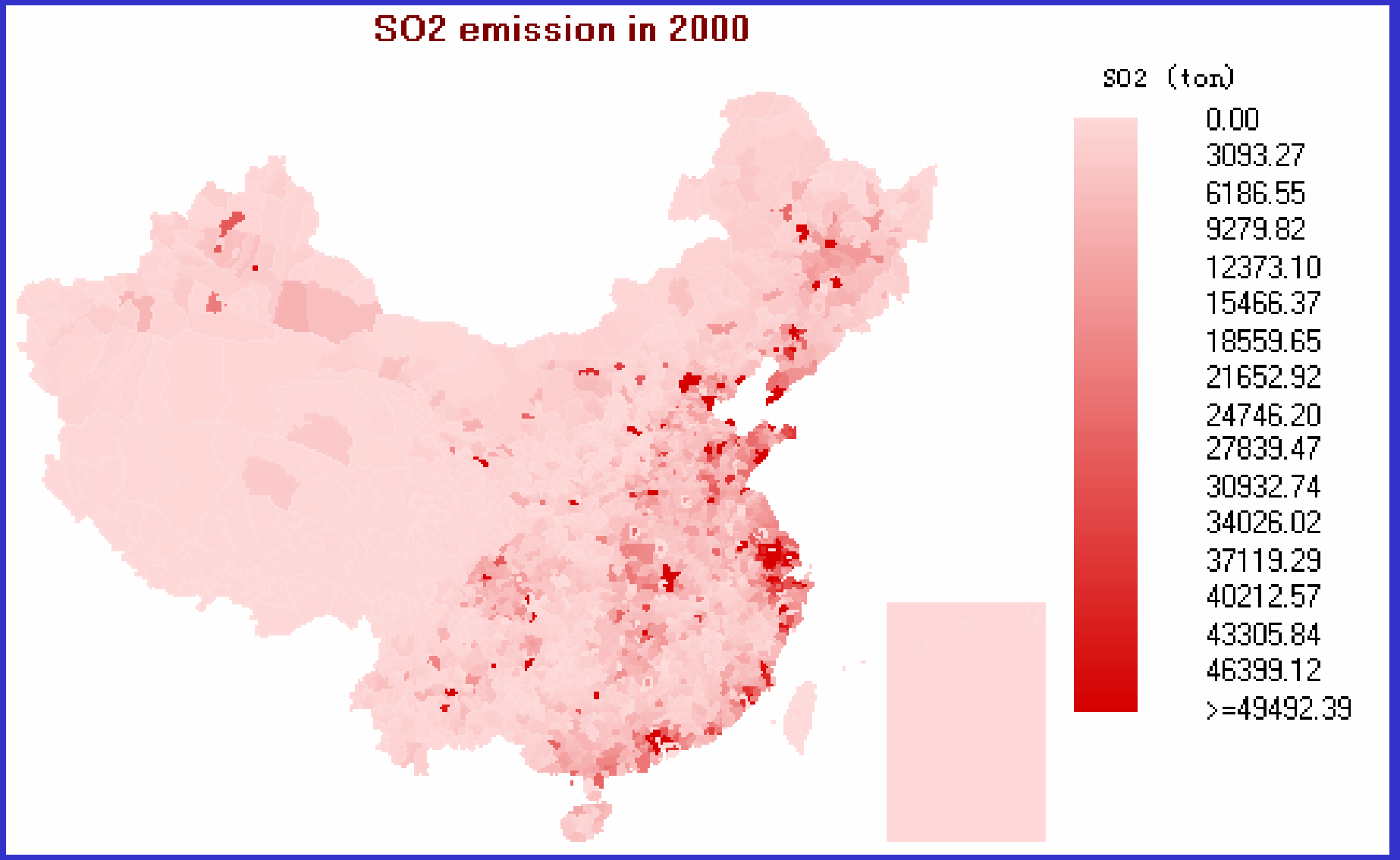

Primary Energy Demand in China: Baseline
5000
4000
3000
2000
1000
0
Mtce
2000
2010
2020
2030
Year
Biomass
Primary Electricity
N.Gas
Oil
Coal


CO2 Emission in China, baseline scenario
2500
2000
1500
1000
500
0
Mt-C
2000

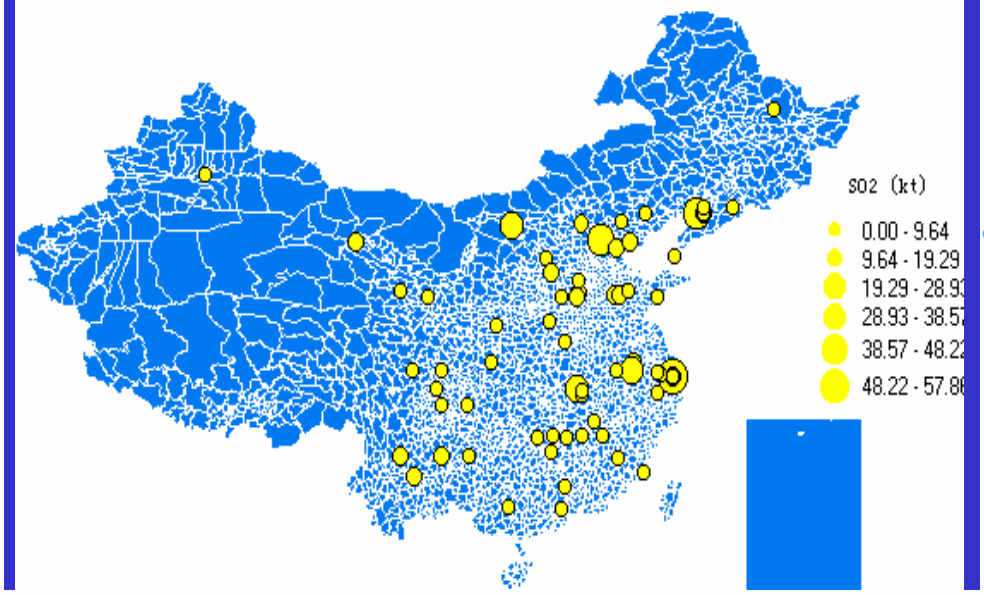

SO2 Emission in China, baseline scenario
30
25
20
15
10
5
0
Mt-SO2
2000
2010


NOx Emission in China, baseline scenario
25
20
15
10
5
0
Mt-NO2
2000
2010
2020
2030
Year

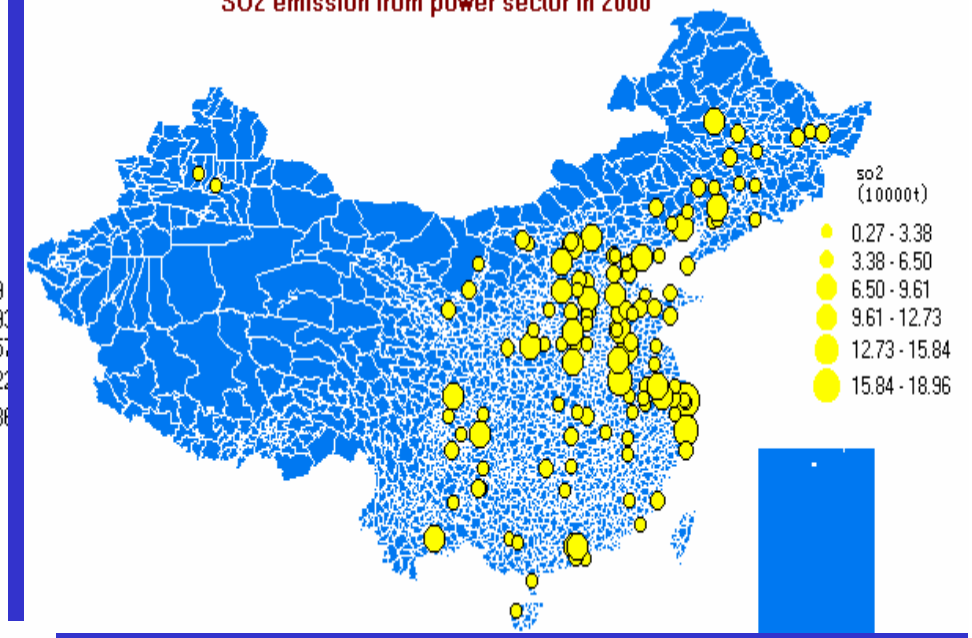
ERI:IPAC-AIM/Local Model



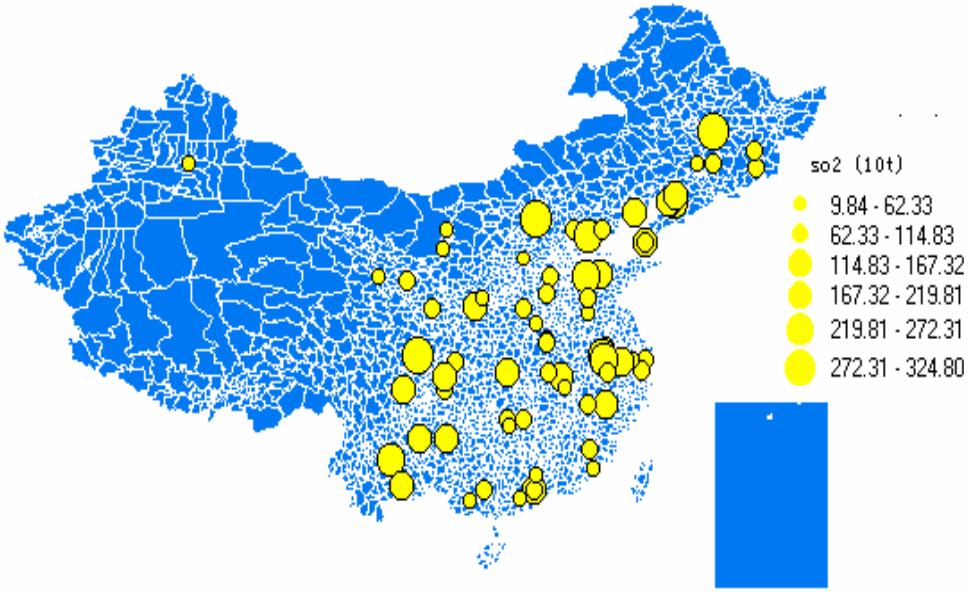
SO2 emission from steel sector in 2000



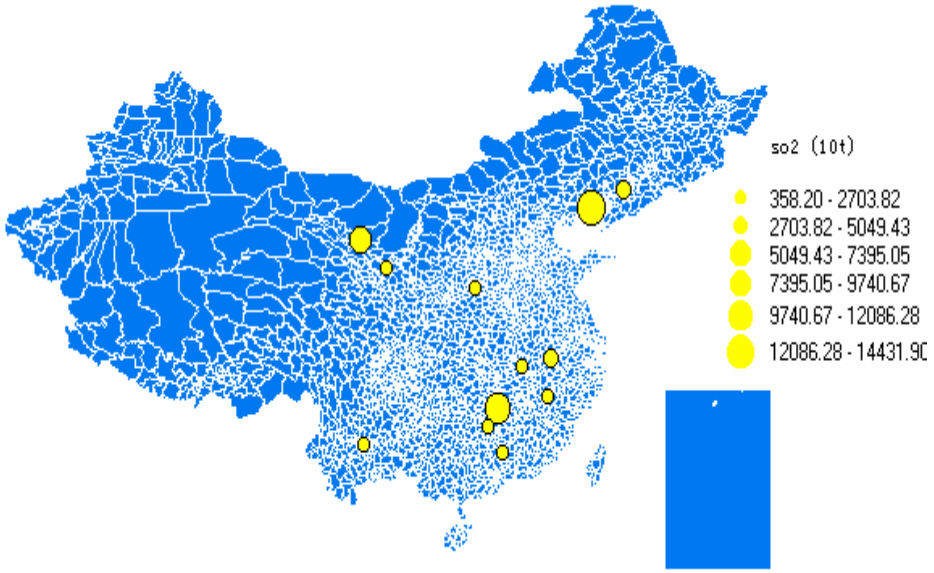
SO2 emission from power sector in 2000

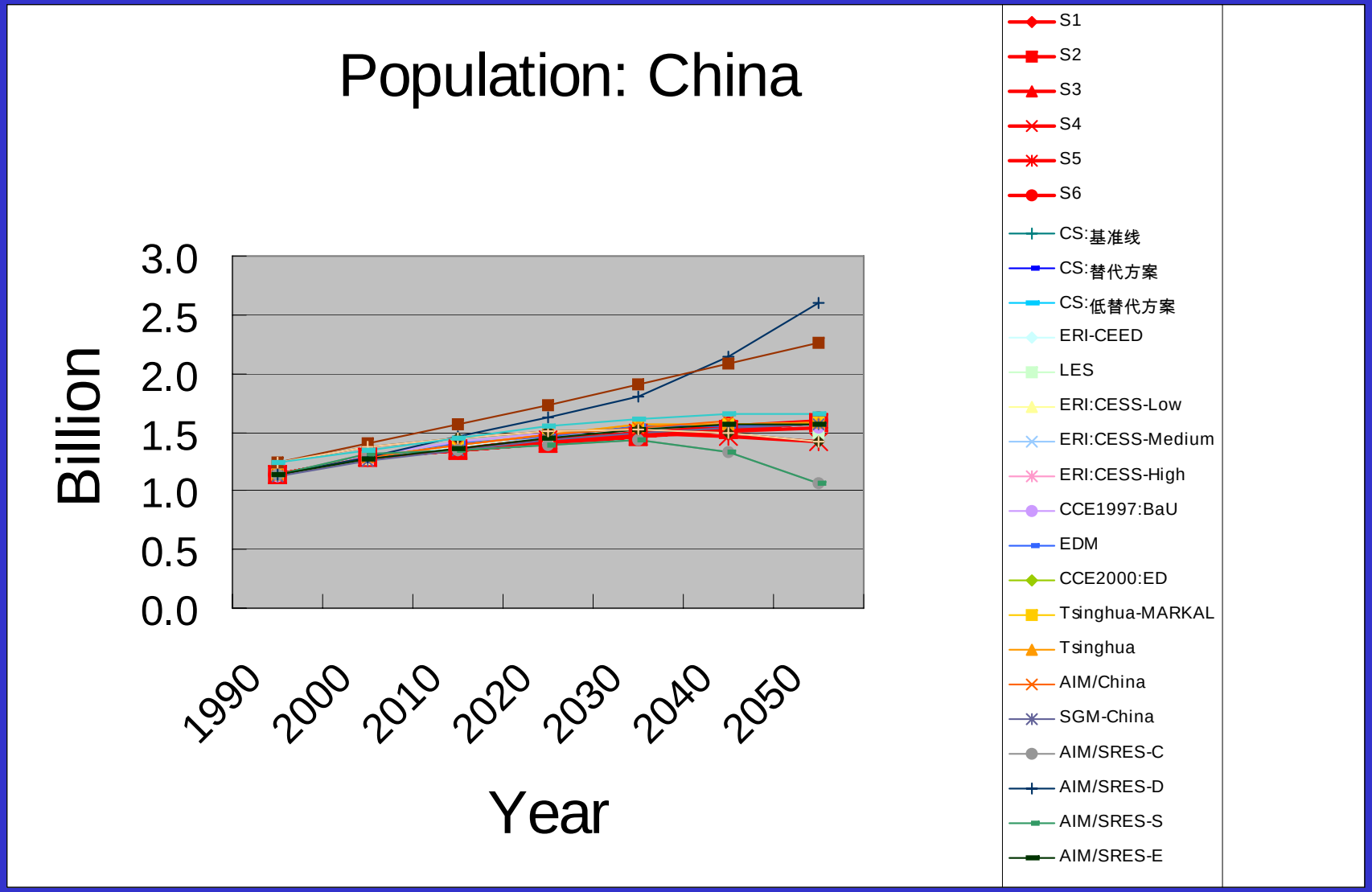


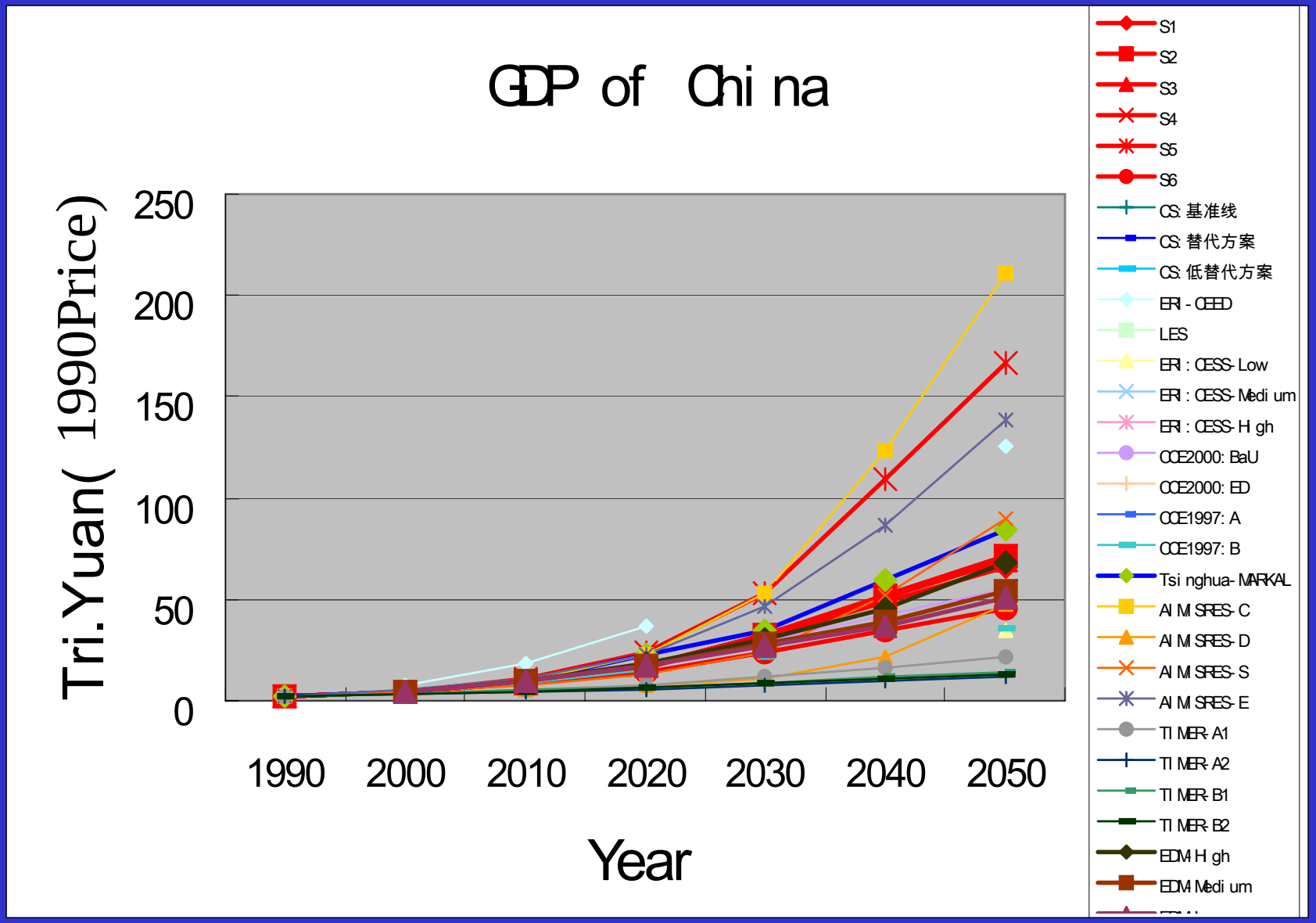
SO2 emission from cement factories in 2000



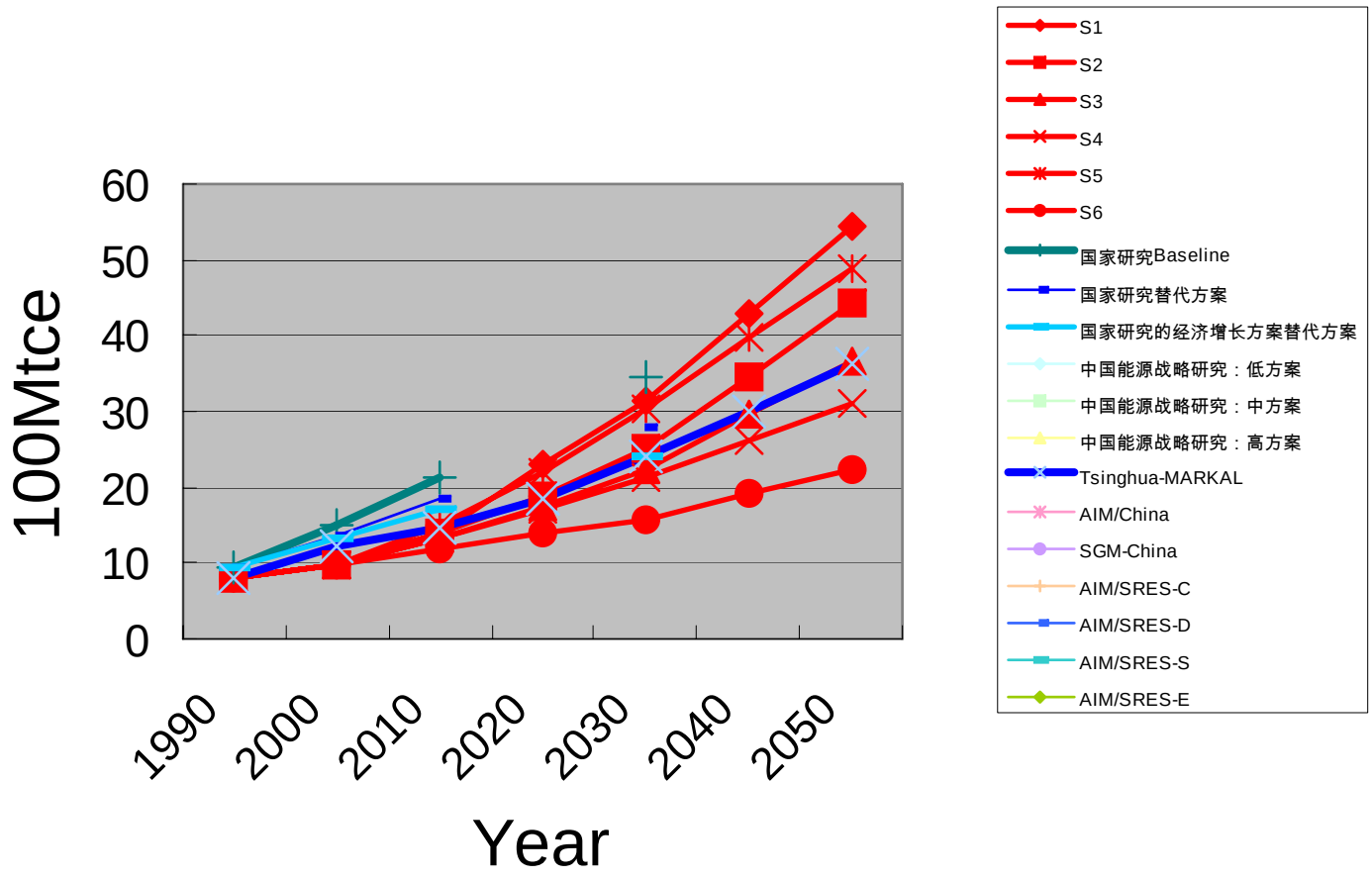
SO2 emission from nonferrous metallurgy in 2000

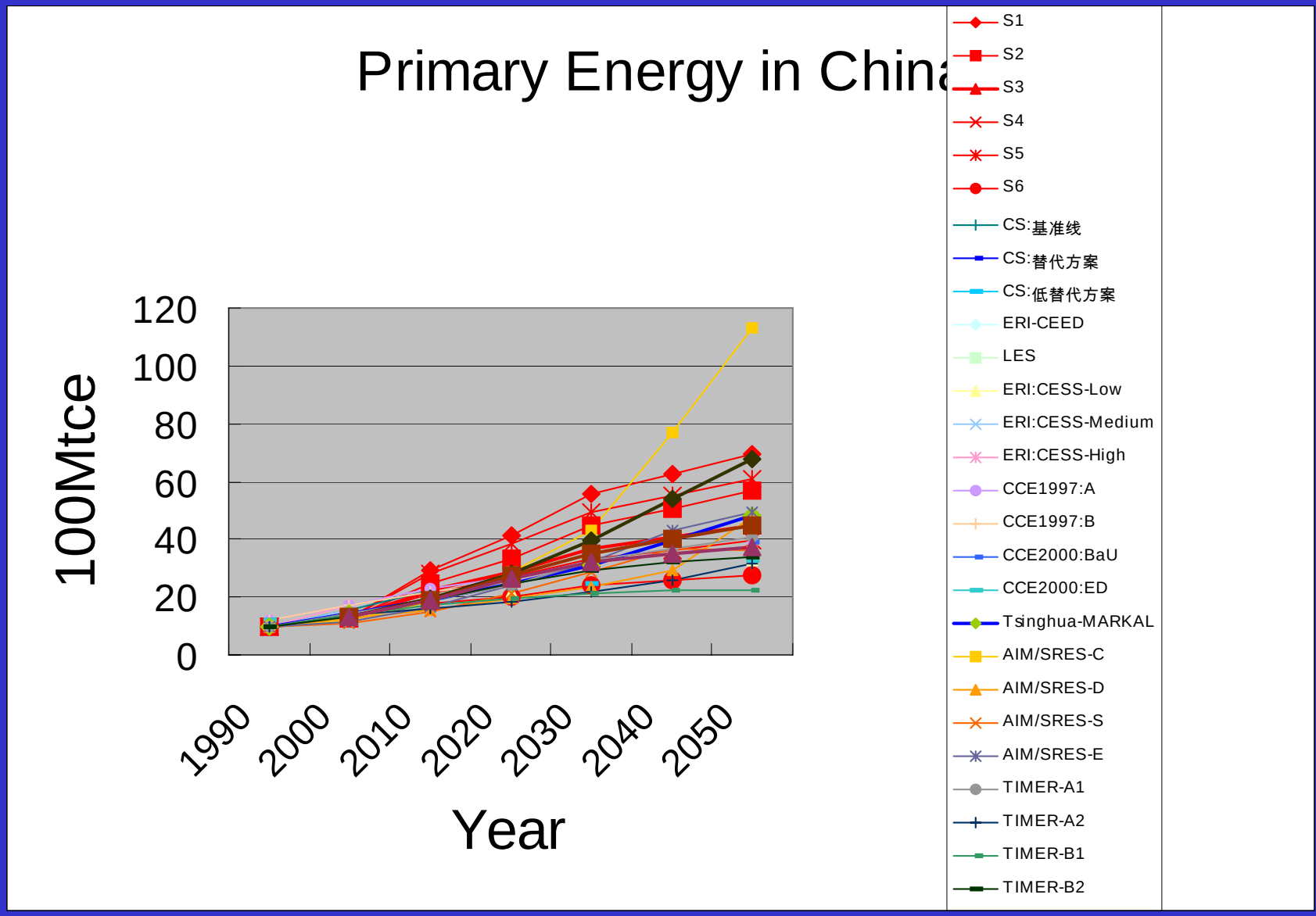


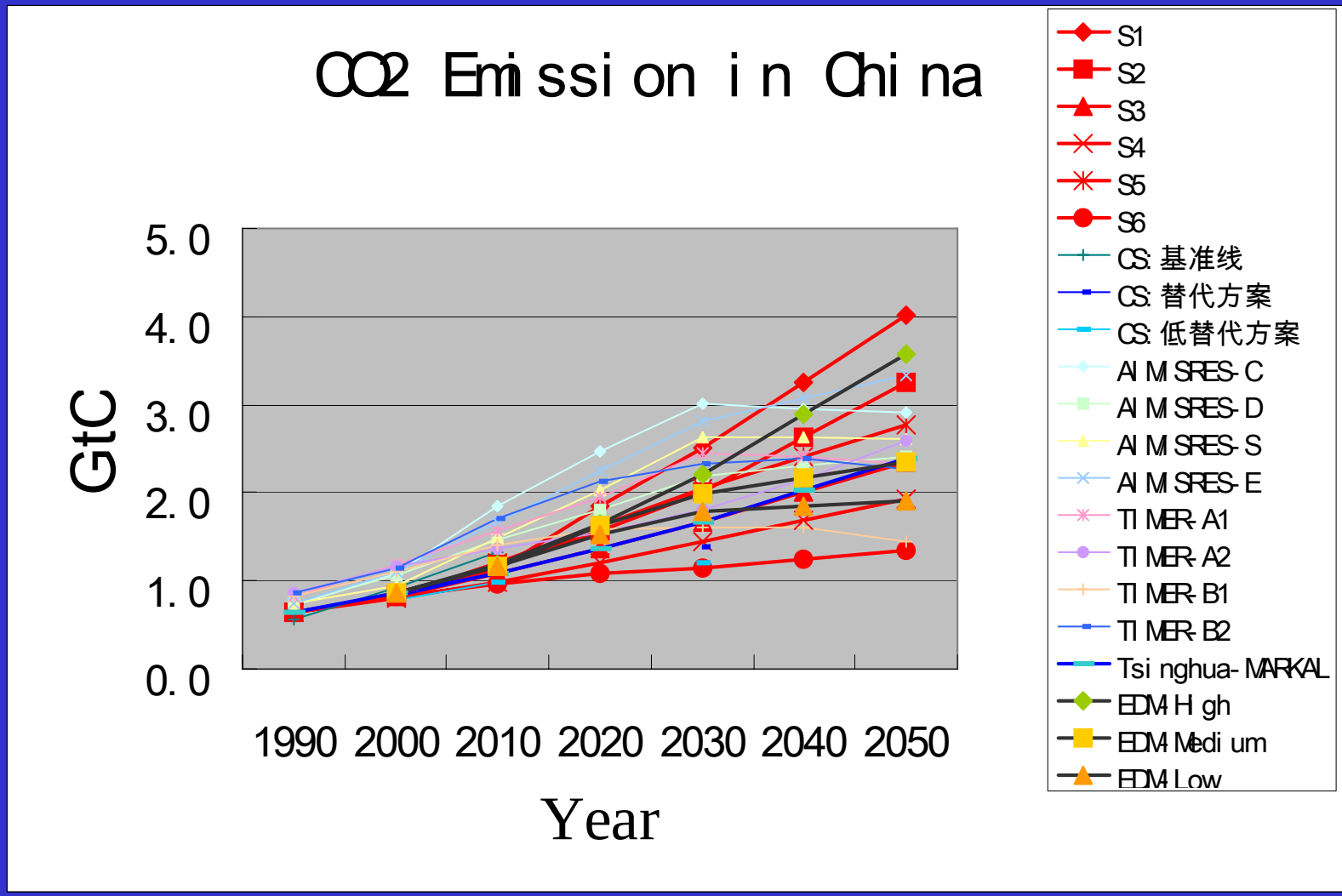

Population: China
Billion
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1990
2000
2010
2020
2030
2040
2050
Year
S1
S2
S3
S4
S5
S6
CS:基准线
CS:替代方案
CS:低替代方案
ERI-CEED
LES
ERI:CESS-Low
ERI:CESS-Medium
ERI:CESS-High
CCE1997:BaU
EDM
CCE2000:ED
Tsinghua-MARKAL
Tsinghua
AIM/China
SGM-China
AIM/SRES-C
AIM/SRES-D
AIM/SRES-S
AIM/SRES-E

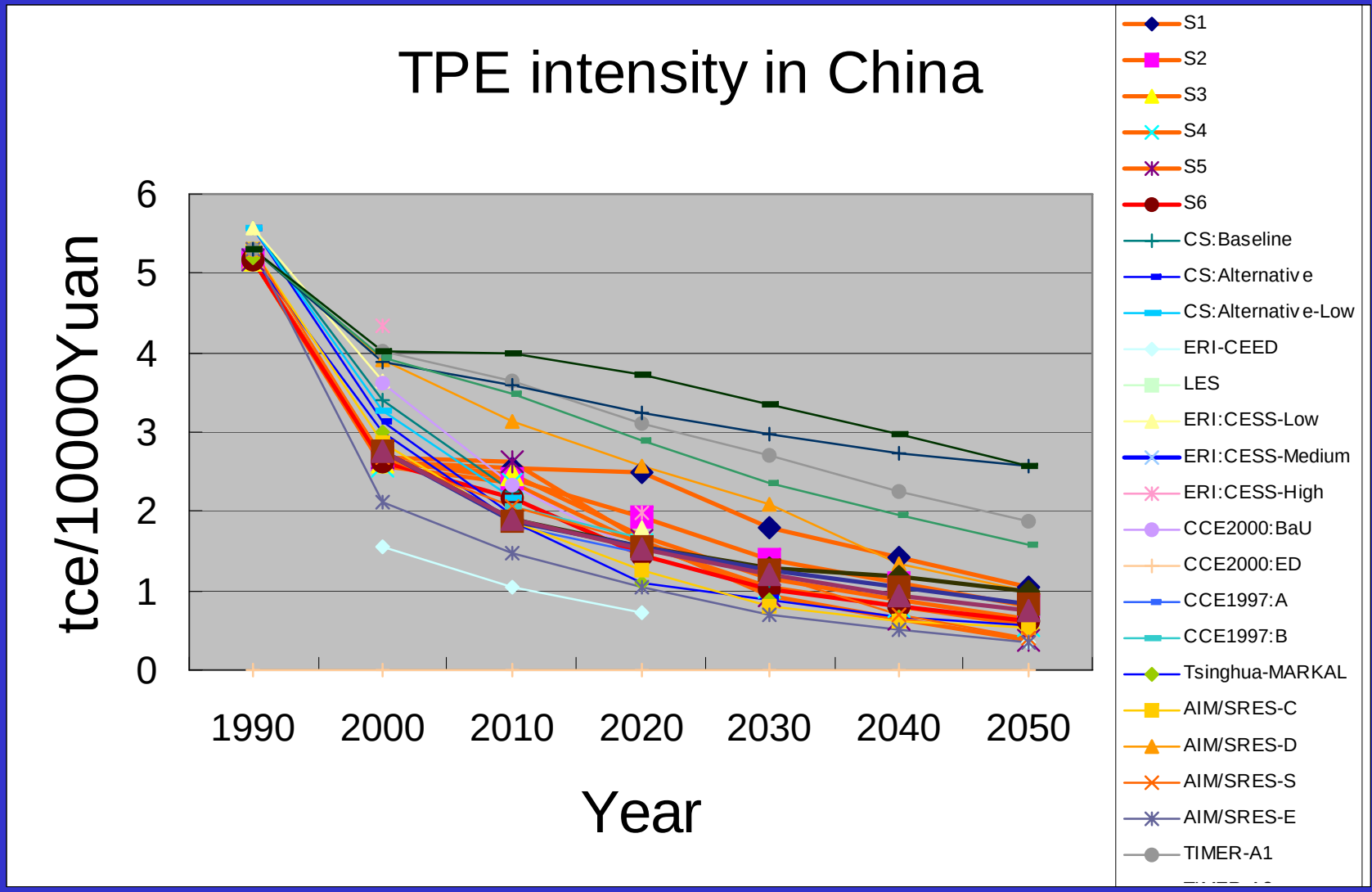

GDP of China
Tri.Yuan(1990Price)
250
200
150
100
50
0
1990
2000
2010
2020
2030
2040
2050
Year
S1
S2
S3
S4
S5
S6
CS: 基准线
CS: 替代方案
CS: 低替代方案
ERI - CEED
LES
ERI : CESS-Low
ERI : CESS-Medium
ERI : CESS-High
CCE2000: BaU
CCE2000: ED
CCE1997: A
CCE1997: B
Tsinghua-MARKAL
AIM SRES-C
AIM SRES-D
AIM SRES-S
AIM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

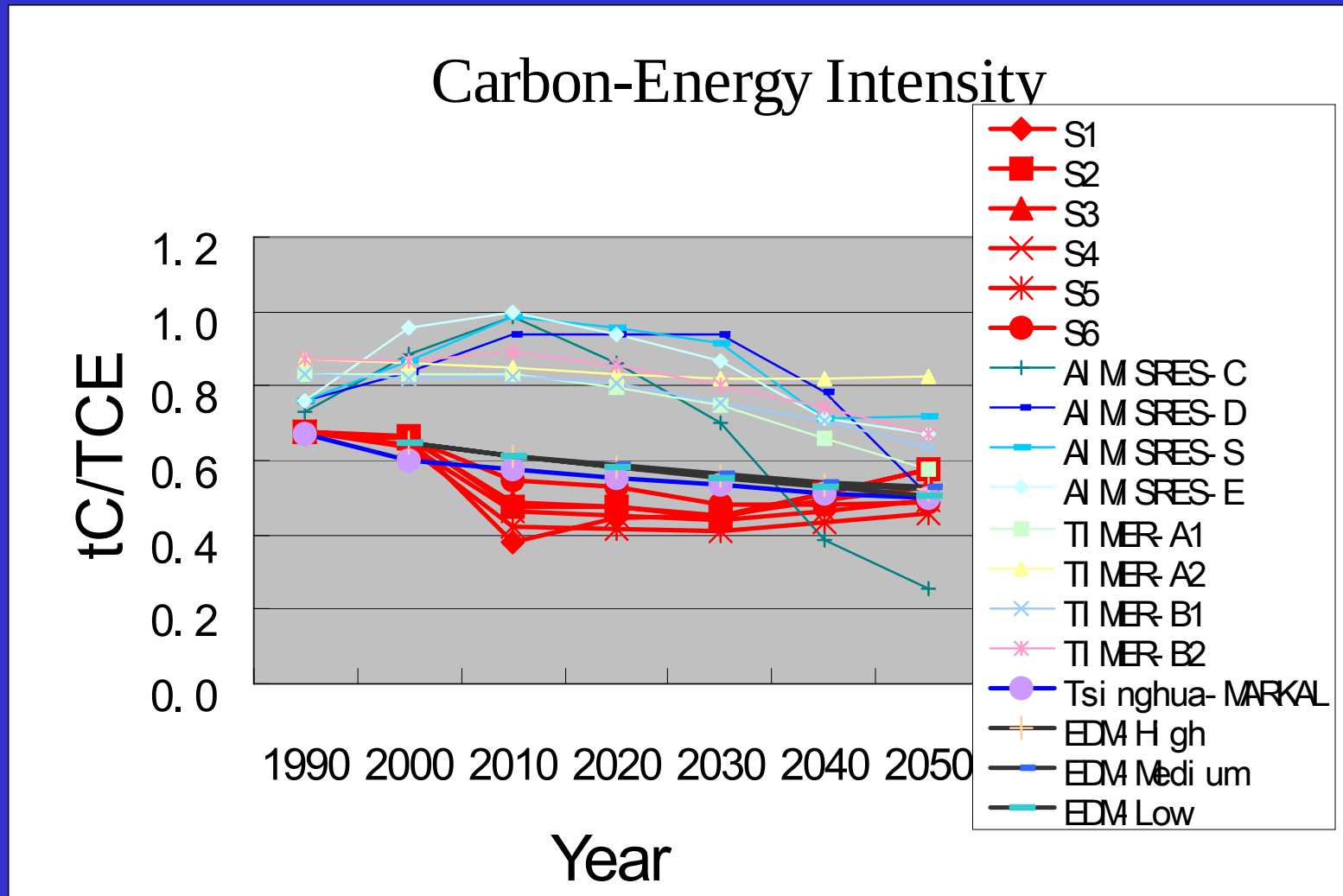
Final energy in China

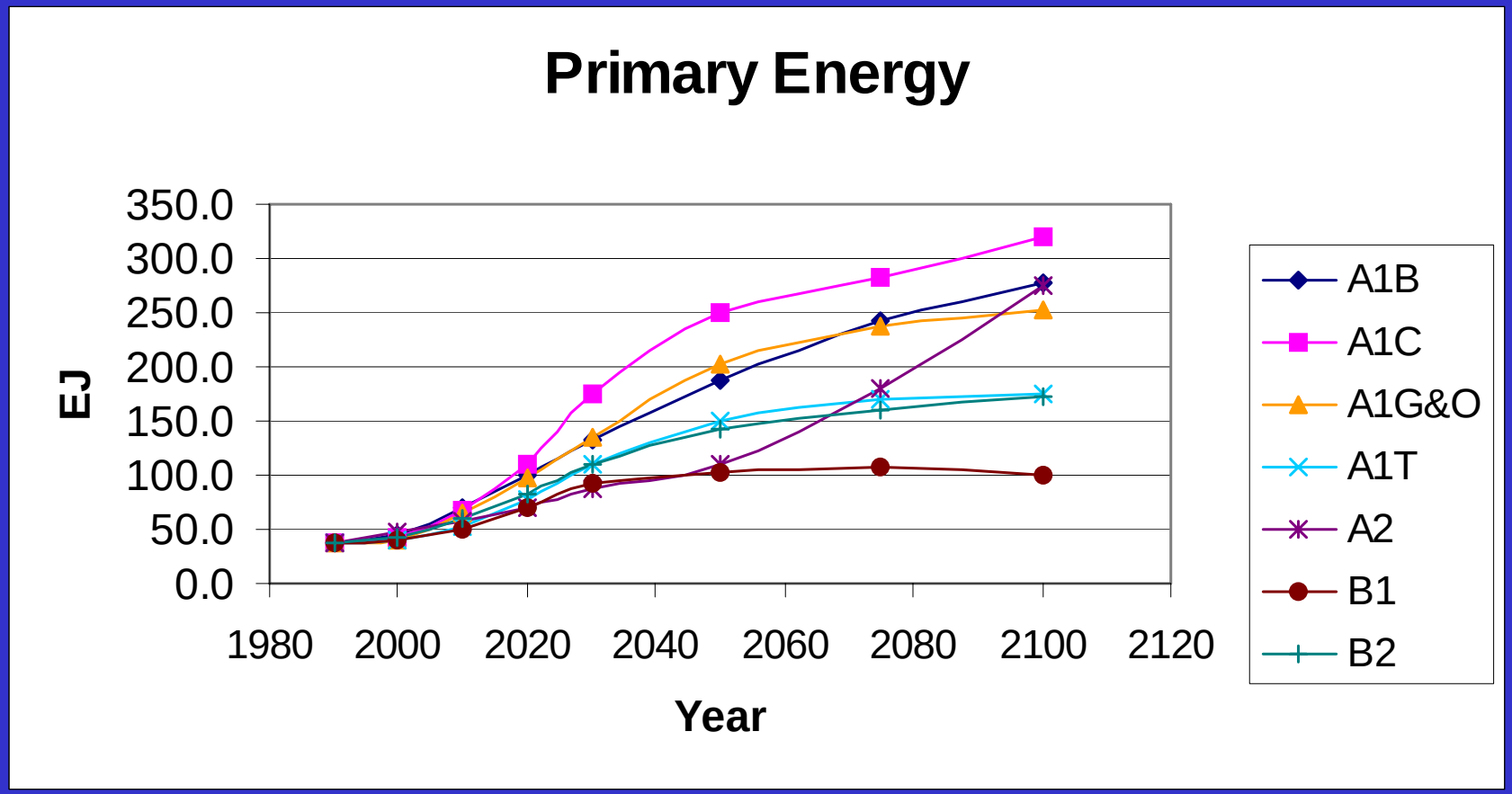


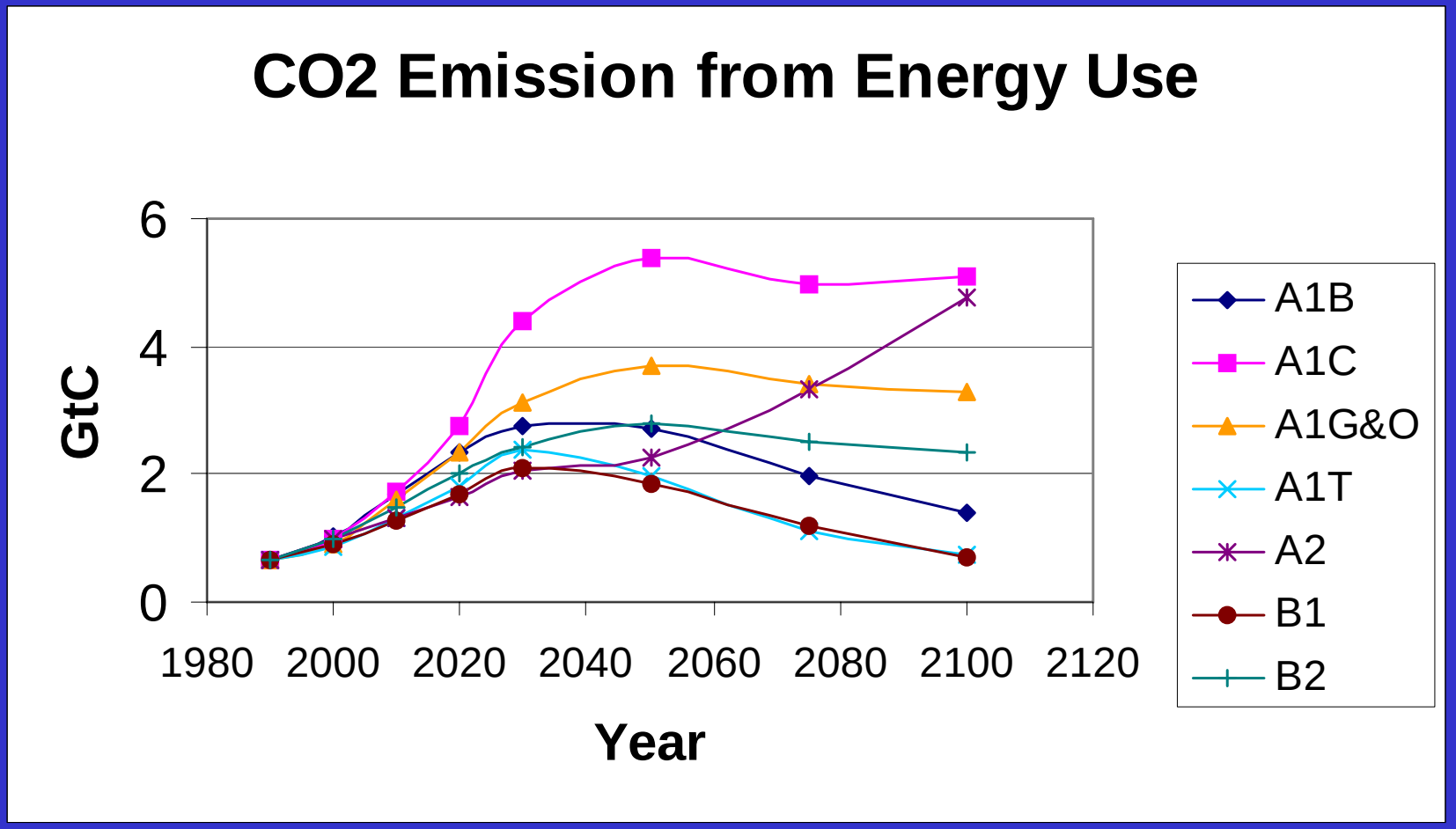

Primary Energy in China
100Mtce
120
100
80
60
40
20
0
1990
2000
2010
2020
2030
2040
2050
Year
S1
S2
S3
S4
S5
S6
CS:基准线
CS:替代方案
CS:低替代方案
ERI-CEED
LES
ERI:CESS-Low
ERI:CESS-Medium
ERI:CESS-High
CCE1997:A
CCE1997:B
CCE2000:BaU
CCE2000:ED
Tsinghua-MARKAL
AIM/SRES-C
AIM/SRES-D
AIM/SRES-S
AIM/SRES-E
TIMER-A1
TIMER-A2
TIMER-B1
TIMER-B2


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

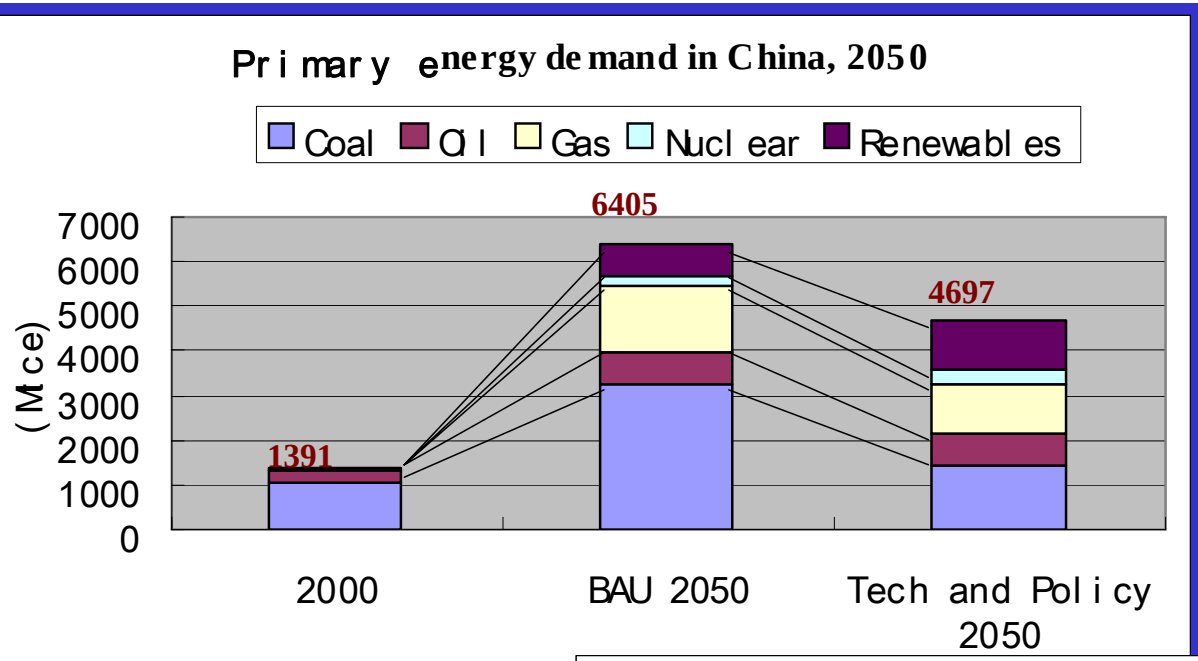

TPE intensity in China
tce/10000Yuan
0
1
2
3
4
5
6
1990
2000
2010
2020
2030
2040
2050
Year
S1
S2
S3
S4
S5
S6
CS:Baseline
CS:Alternative
CS:Alternative-Low
ERI-CEED
LES
ERI:CESS-Low
ERI:CESS-Medium
ERI:CESS-High
CCE2000:BaU
CCE2000:ED
CCE1997:A
CCE1997:B
Tsinghua-MARKAL
AIM/SRES-C
AIM/SRES-D
AIM/SRES-S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

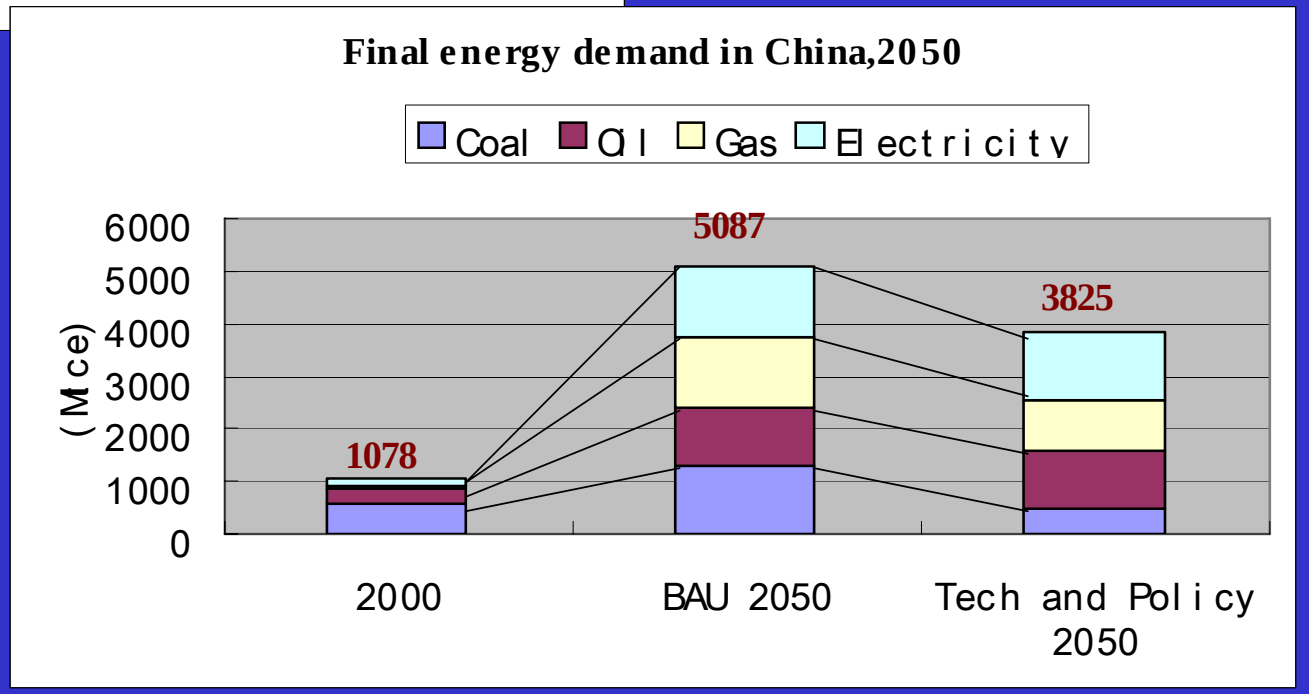

Carbon-Energy Intensity
tC/TCE
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1990 2000 2010 2020 2030 2040 2050
Year
S1
S2
S3
S4
S5
S6
AIM/SRES-C
AIM/SRES-D
AIM/SRES-S
AIM/SRES-E
TIMER-A1
TIMER-A2
TIMER-B1
TIMER-B2
Tsinghua-MARKAL
EDMA-High
EDMA-Medium
EDMA-Low


Primary Energy
EJ
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
1980
2000
2020
2040
2060
2080
2100
2120
Year
A1B
A1C
A1G&O
A1T
A2
B1
B2

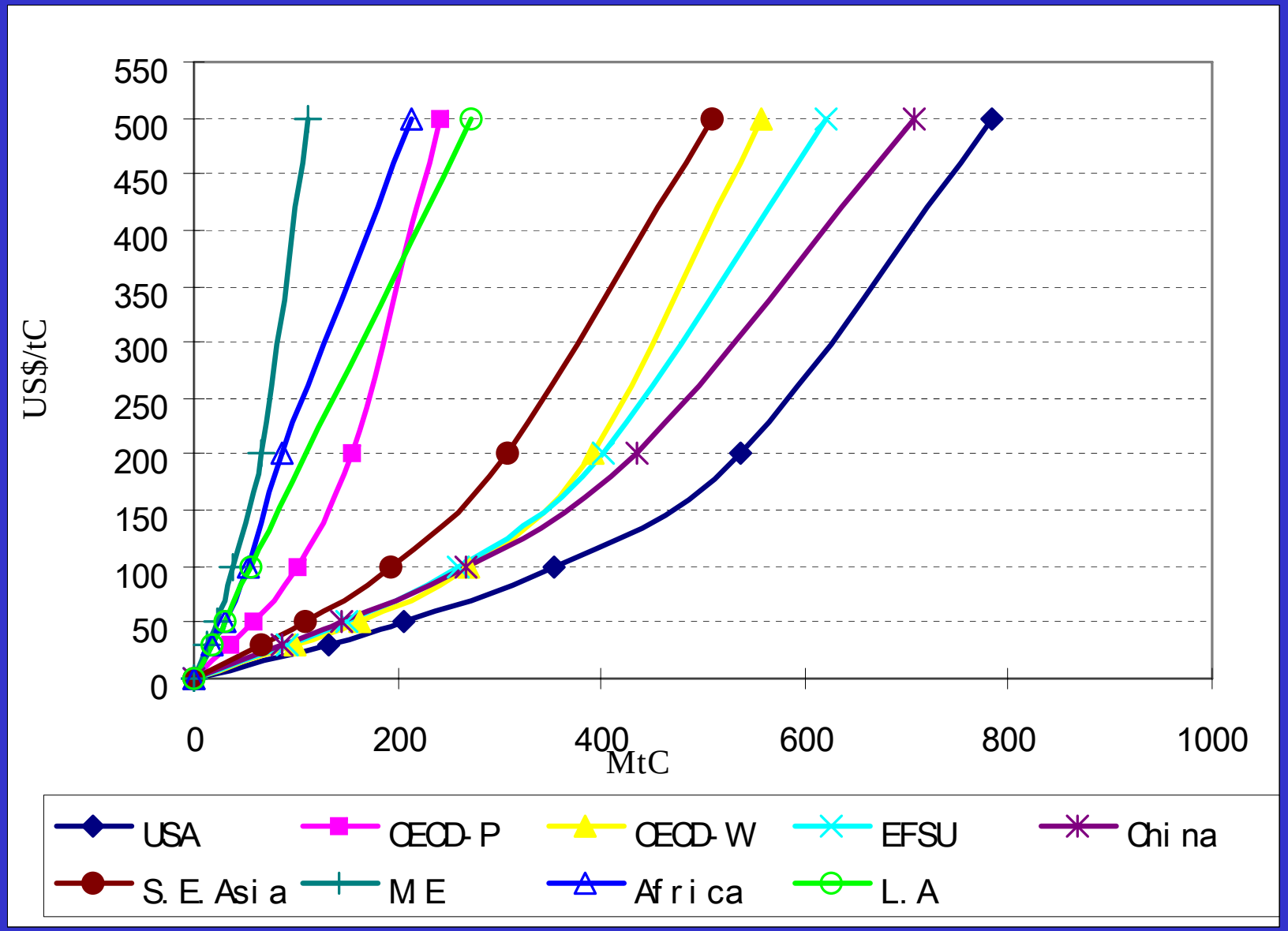

CO2 Emission from Energy Use
GtC
6
4
2
0
1980
2000
2020
2040
2060
2080
2100
2120
Year
A1B
A1C
A1G&O
A1T
A2
B1
B2

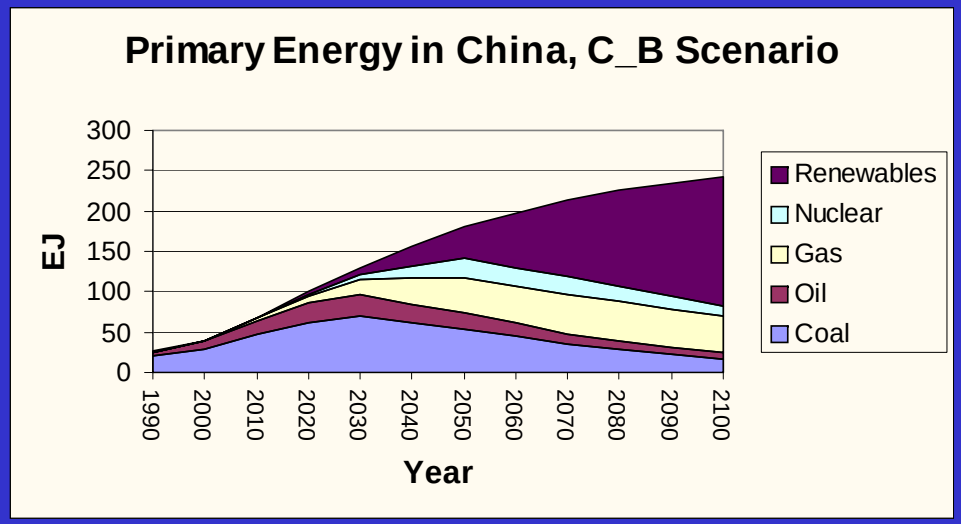
Low Carbon Society

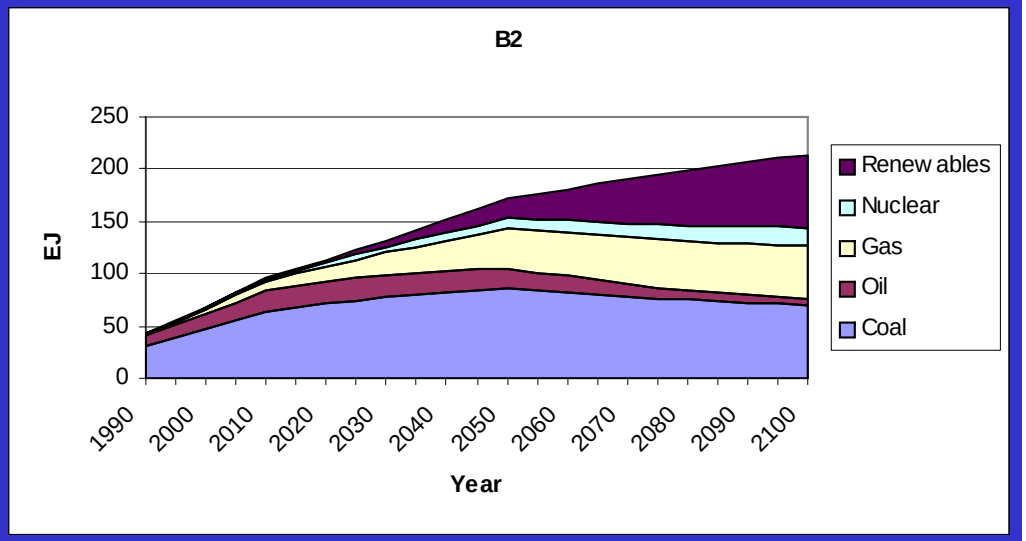




Marginal Abatement Cost: IPAC-Emission model




Primary Energy in China, C_B Scenario
300
250
200
150
100
50
0
EJ
1990
2000
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100
Year
Renewables
Nuclear
Gas
Oil
Coal


B2
250
200
150
100
50
0
EJ
1990
2000
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100
Year
Renew ables
Nuclear
Gas
Oil
Coal

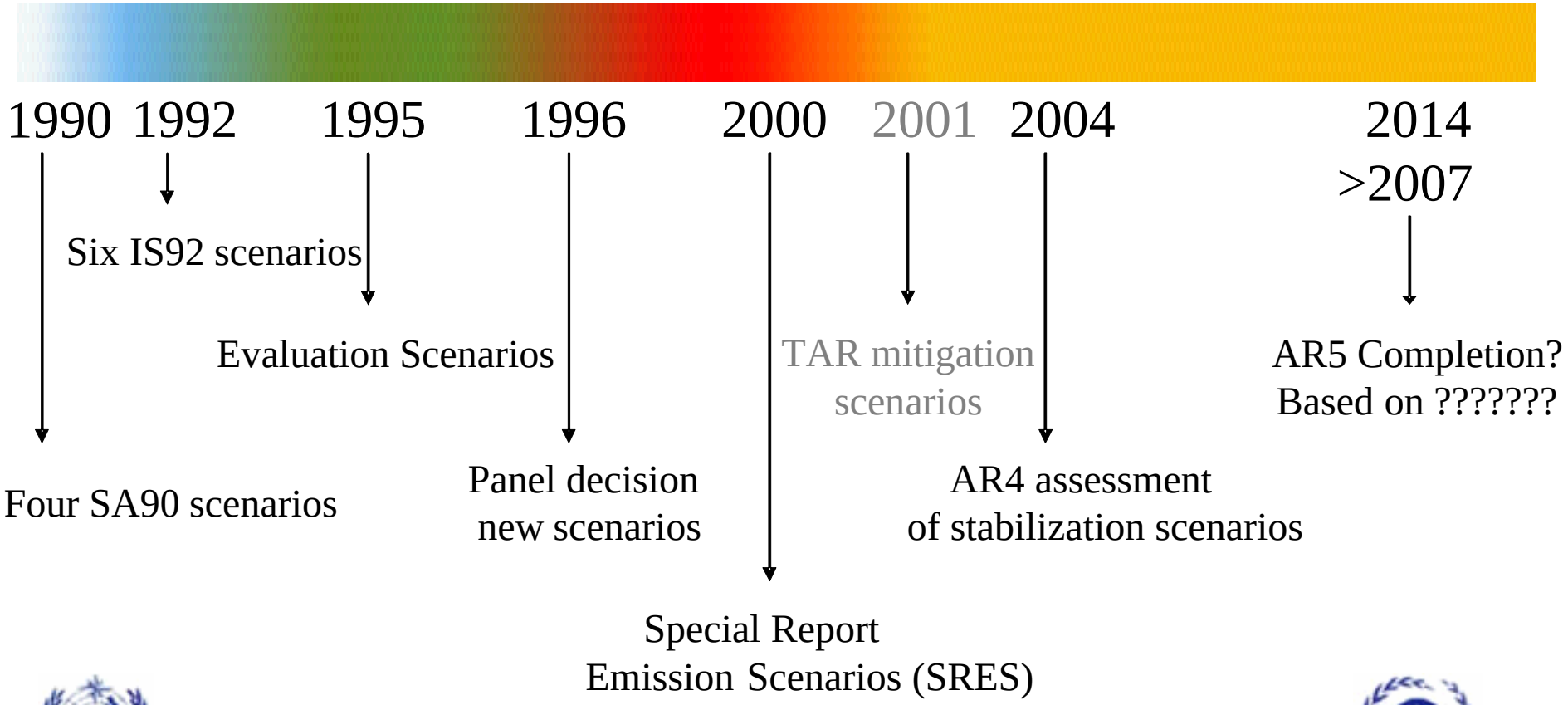
Related Studies

- Energy tax simulation and design
- Fuel tax assessment
- 20% energy intensity target assessment
- Transition scenario study: EMF-22
- Gains-Asia/China
- Urban Transport Strategy
- Post-Kyoto Pathway

Agenda

- New scenarios for AR5 – emerging plans of the climate modeling community
- How to organize the development of new integrated assessment scenarios for AR5
- A possible joint response to the request by IPCC Chair on new scenarios

Previous IPCC Scenarios and Future Outlook



- Assuming the IPCC AR5 publication date is 2014, modeling groups are making decisions this year (2006) on what form their next generation models will take (to be used in IA and for climate change projections).

- The IPCC TGNES and other groups have been discussing new emission scenarios (e.g. "mitigation/adaptation", or more generically "stabilization"). These scenarios will come to bear on climate change projections performed for assessment in the IPCC AR5 with the new emerging earth system models.

- Thus there has been a confluence of activities in model development and scenario development that must be communicated and coordinated across various groups and scientific communities this year.

Source: Jerry Meehl, 2006

For coordinated climate change projection experiments to be run by the international climate modeling community for assessment in the IPCC AR5, two classes of climate change experiments are proposed, each focused on defined scientific questions:

1. Near-Term (2005-2030)
2. Longer term (to 2100 and beyond)

Source: Jerry Meehl, 2006

Near-Term Experimental Design (2005-2030)

A prime goal of projections for the next 25 years is to provide better guidance on the likelihood of changes in regional extremes

- To produce such regional scale predictions will require finer-resolution models (about ½ degree to 1 degree horizontal resolution, and increased vertical resolution and domain) with inclusion of:
  - simple atmospheric chemistry
  - aerosols
  - dynamic vegetation
  - (no carbon cycle on this timescale)

- Both improved process representation and higher resolution are important, and compromises will be required to make the simulations computationally feasible.
- Such simulations will also require accurate ocean data for coupled initialization; this is currently problematic due to the lack of salinity data. Improved initialization datasets such as soil moisture and sea ice may also be required.

Source: Jerry Meehl, 2006

Near-Term Experimental Design (2005-2030) continued…

- Since there is little quantitative difference across scenarios for GHG concentrations on the short term, a single mid-range scenario would be run.

- Additionally, a number of scenarios for pollutants (aerosols and short-lived gases) could be provided (by IA models) for low, medium and high emission projections as perturbations around the standard scenario.

- To provide statistically significant regional assessments will require ensemble simulations of at least 10 members for each scenario

- To incorporate past climate forcings, for model evaluation, and for the coupled assimilation/initialization process, simulations should start some time during the latter half of the 20th century.

Source: Jerry Meehl, 2006

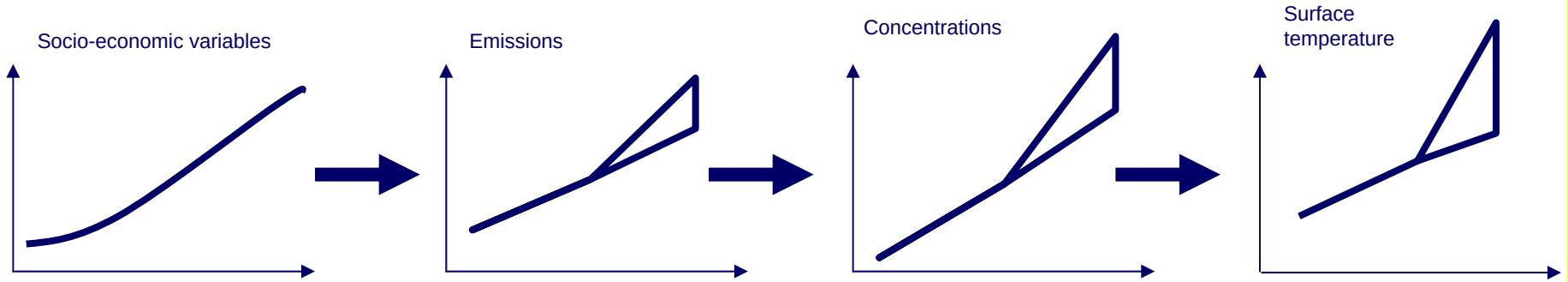
Long-Term Experimental Design (2100 and Beyond)

WHAT ARE CARBON CYCLE FEEDBACKS ON CLIMATE SYSTEM?

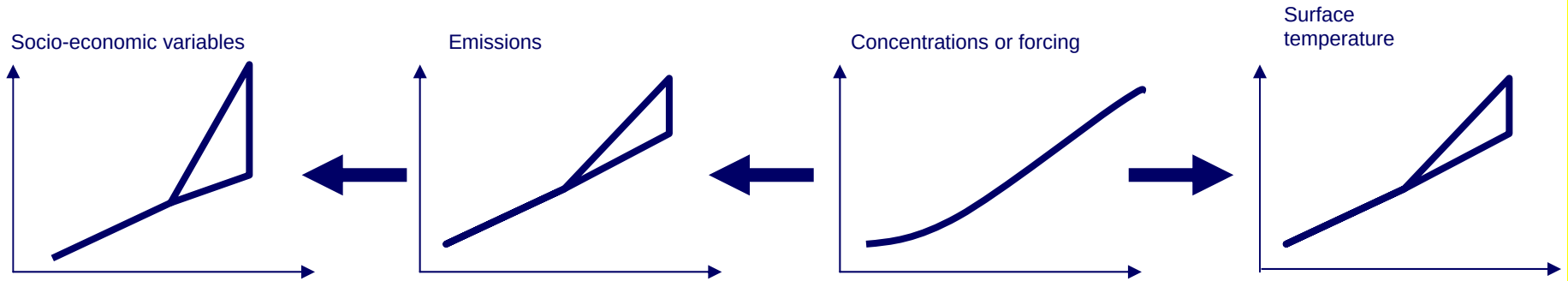
- Long-term runs provide an opportunity to contribute to a policy perspective on avoiding consequences of climate change (e.g. mitigation/stabilization)
- Lower resolution AOGCM and/or ESM (roughly 2^{o}) w/pre-industrial spinup including 20^{th} century experiments with natural and anthropogenic forcings (at least 10 ensemble members).
- IA models to provide CO2 concentration stabilization benchmark scenarios: (1) high case 6W/m2 ~700 ppm, (2) low case 3W/m2 ~400 ppm, and possibly (3) midrange 4.5W/m2 ~550 ppm. At least one ensemble per scenario; models to include terrestrial and ocean carbon cycle, dynamic vegetation as available, chemistry and aerosols prescribed to 2100, stabilized after 2100 to 2300; IA models would derive policy options to attain permissible emissions
- To address this problem, two experiments will be required with an additional optional experiment

Source: Jerry Meehl, 2006

Forward approach: start with socio-economic variables



Reverse approach: start with stabilization scenario concentrations



Source: Jerry Meehl, 2006