AIM/Country-China Model
&
AIM/Local-China Model Development in 2002 in China

ERI AIM Project team

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AIM/Country-China: Progress in 2002-2003

- First time running of AIM/Country model
- Revise technology and service data for AIM/Country model.
- Change base year from 1990 to 2000(service data, technology share data, energy price data)
- Extension of technologies(power generation sector)
- Include removal process technology(for So2)
- Design countermeasures, but not yet simulate by model.
- Emission factor for CH4, PM, but not yet input to model.
- Case simulation for several carbon taxes
- Preliminary analysis of results

Countermeasure in sectors for energy saving and emission reduction

Sector	Service	Countermeasures
Transport	Private car	Reduce private car use from 12000km per year to 10000km per year, shift to public transport use
	Freight truck	Reduce empty load truck travel, 15% reduction of traffic valume
Residential sector	Lighting	Reducing using time of light from 5.5 hour per day to 4.5 hour per day
	Space heating	Using heat meter per household, 15% reduction of demand
All sector	Carbon tax	Carbin tax rate: 50 yuan/t-C, 100, 200, 500, 1000Yuan/t-C.
	Subsidy for wind turbine	
Power generation	Extension of PBP for Hydro and Nuclear power plants.	10 year
	Natural gas supply constraint	2010, 100billion CM, 2030 400billion CM

Removal technology

Device_Name	SO2/ NO2	Fixed_s_Value	Operation_Value	Energy_Value	Removal_Value
Simple Wet FGD	SO2	0.23	0.02	0.0048	0.7
Advanced Wet FGD	SO2	0.34	0.03	0.0048	0.95
Dry Process	SO2	0.44	0.04	0.0048	0.99

Technology Share: power generation

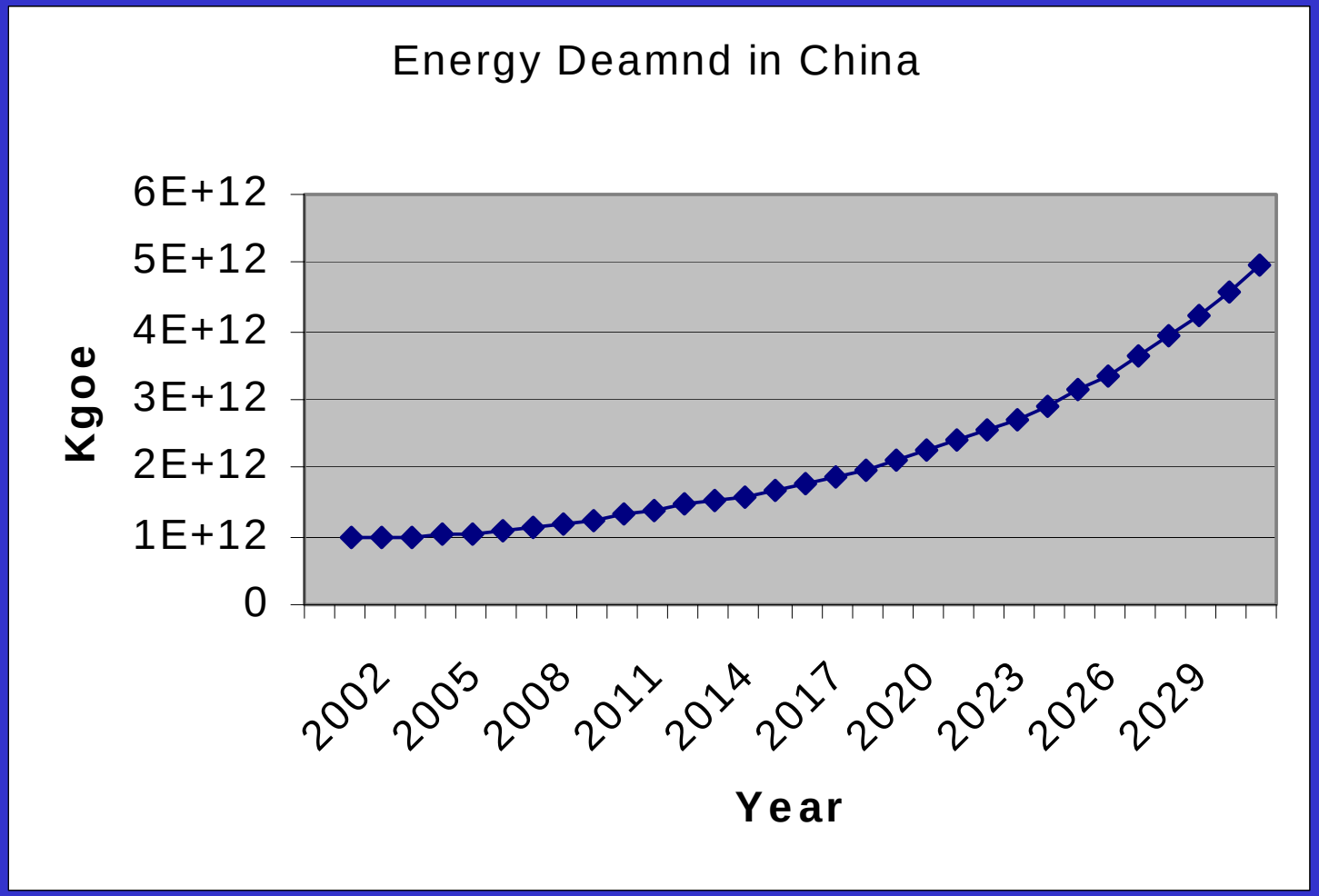
Technology	Year 1	SHARE	Year2	Share
Natural gas generator	2000	0.008	2030	0.3
Nuclear	2000	0.012	2030	0.1
Hydro	2000	0.165	2030	0.178
Low parameter coal power	2000	0.766	2030	0.758
Critical Coal power	2000	0	2030	1.001
Super critical Coal	2000	0	2030	1.001
Oil Power	2000	0.05	2030	0.1
Biomass Power	2000	0	2010	0.002
IGCC	2000	0	2030	1.001
NGCC	2000	0	2030	1.001
Wind Power	2000	0	2030	1.001

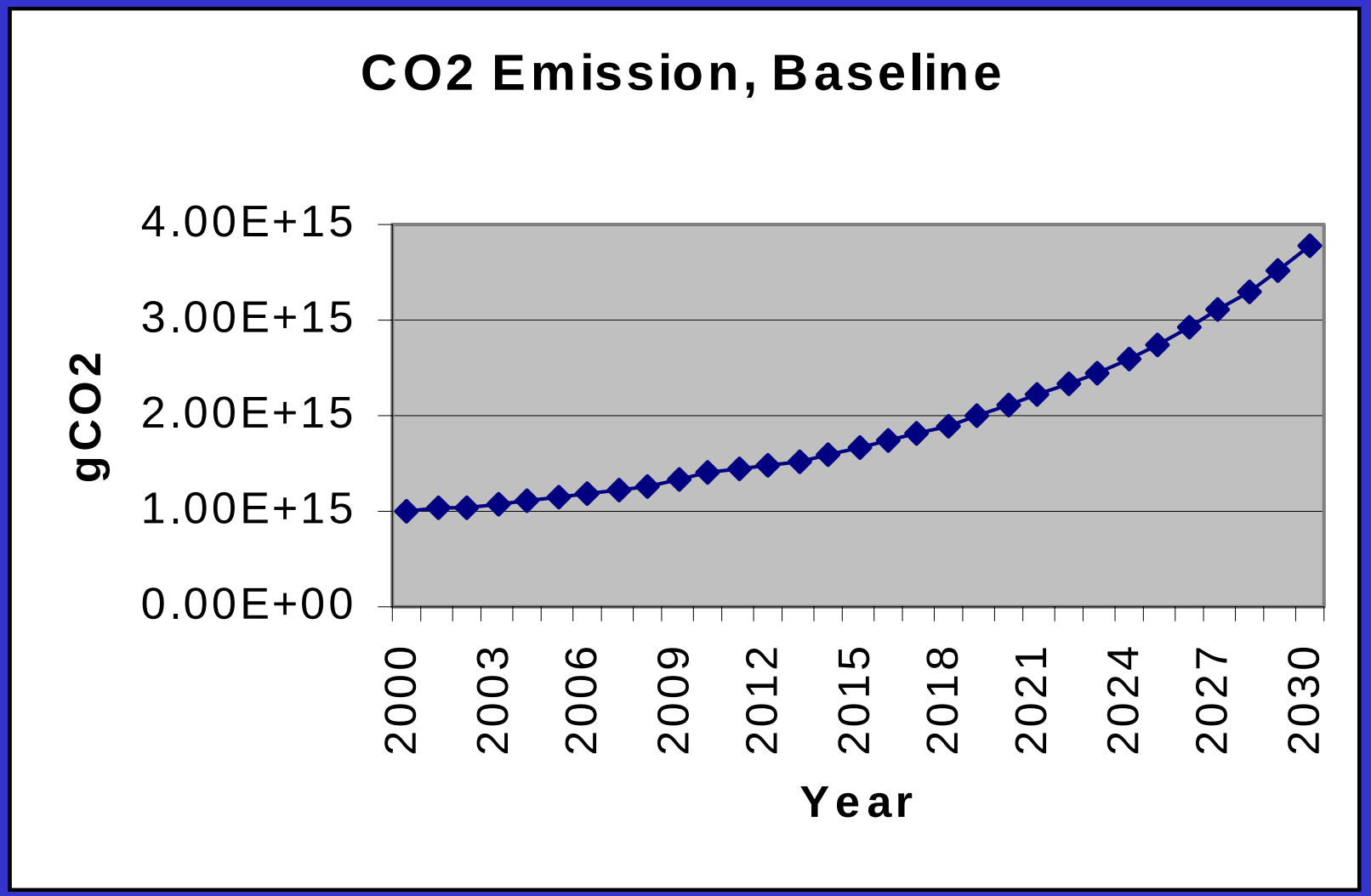
Service

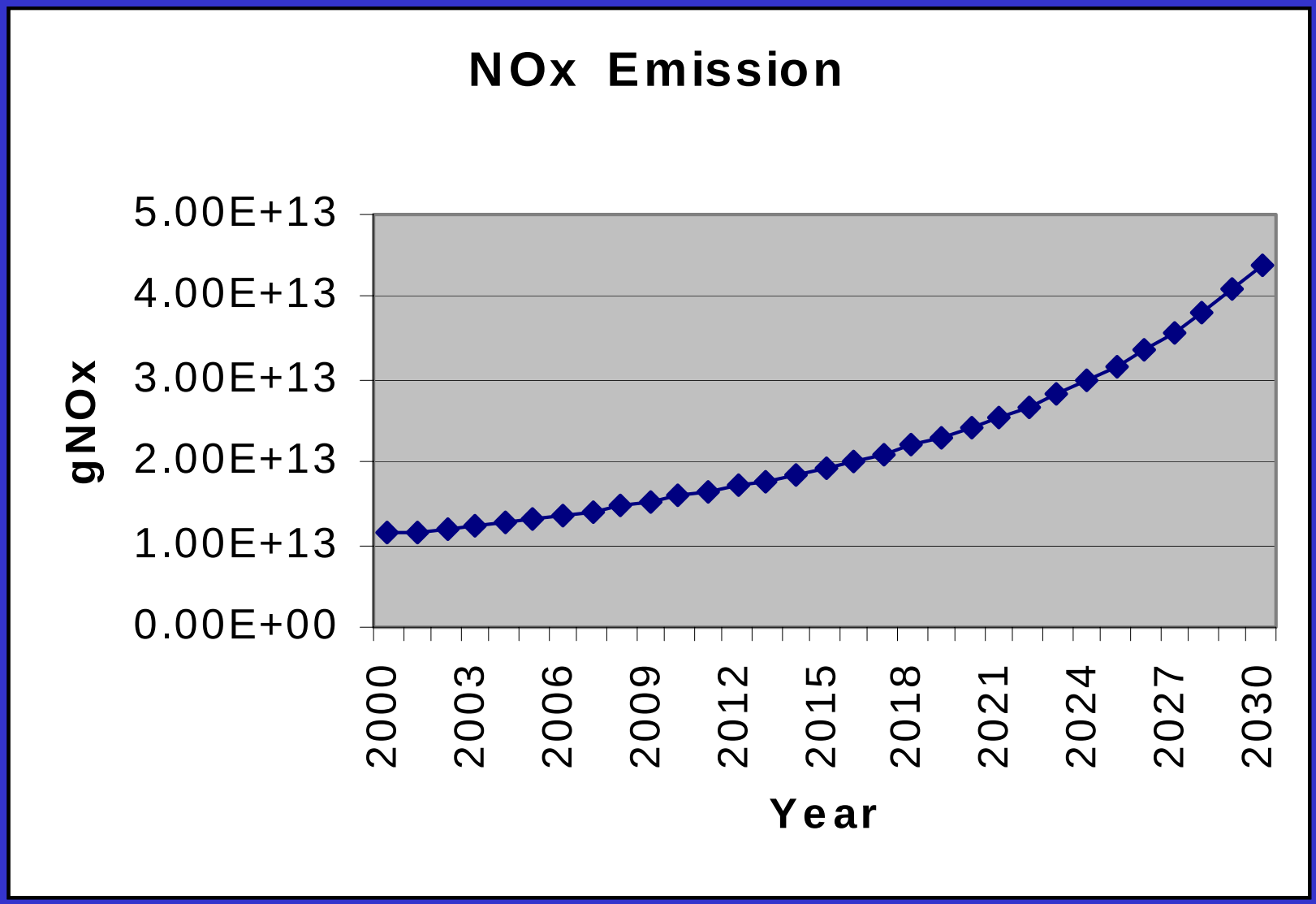
Service_Code	Unit	Year1	Value1	Year2	Value2	Year3	Value3
Blast furnace gas	1	2000	7.36E+09	2030	1		
Coke Gas	1	2000	3.58E+09	2030	1		
COKE	1	2000	4.66E+10	2030	1		
Power Generation	1	2000	7.18E+10	2030	1		
Oil Product	1	2000	1.09E+11	2030	1		
Husbandry	100ha	2000	1860000	2020	2560000	2030	2900000
Farmland work	100ha	2000	87650000	2020	1.75E+08	2030	2.2E+08
Fishery	100ha	2000	108700	2020	1465000	2030	1600000
Irrigation	100ha	2000	5002000	2020	5002000	2030	5002000
Farmland	100ha	2000	21000000	2020	38675000	2030	46000000
Agriculture products	100ha	2000	21000000	2020	38675000	2030	46000000
Space cooling	Service	2000	4.49E+08	2020	1.12E+09	2030	1.55E+09
Duplicator	Service	2000	1.32E+08	2020	4.61E+08	2030	7.04E+08
Other electric appl.	Service	2000	7.6E+08	2020	1.69E+09	2030	2.29E+09

Technology

Technology Code	Technology Name	Life Span	Fixed Cost	Intro. Year	Expri. Year	Energy Used	Energy use Kgoe/kgoe
PWRATM	Nuclear Power Plant	30	8	1950	9999	Atomic energy	3.03
PWRBIO	Biomass Power Plant	30	39	1950	9999	Bio Energy	4
PWRCLH	Super Critical Unit	30	11.8	1950	9999	Coal & Coal products	2.44
PWRCLM		30	12	1950	9999	Coal & Coal products	2.68
PWRCOL	Coal Power Plant	30	6.6	1950	9999	Coal & Coal products -1	3.3
PWRGAS	Gas Power Plant	30	6.2	1950	9999	Natural gas	2.86
PWRIGC	IGCC	30	24.9	1950	9999	Coal & Coal products	2.36
PWRNGC	NGCC	30	9.97	1950	9999	Natural gas	2.27
PWROIL	Oil Power Plant	30	5.9	1950	9999	Oil Products	2.94
PWRWAT	Water Power Plant	30	1	1950	9999	Water energy	1
PWRWND	Wind Power	30	41	1950	9999	Wind	1

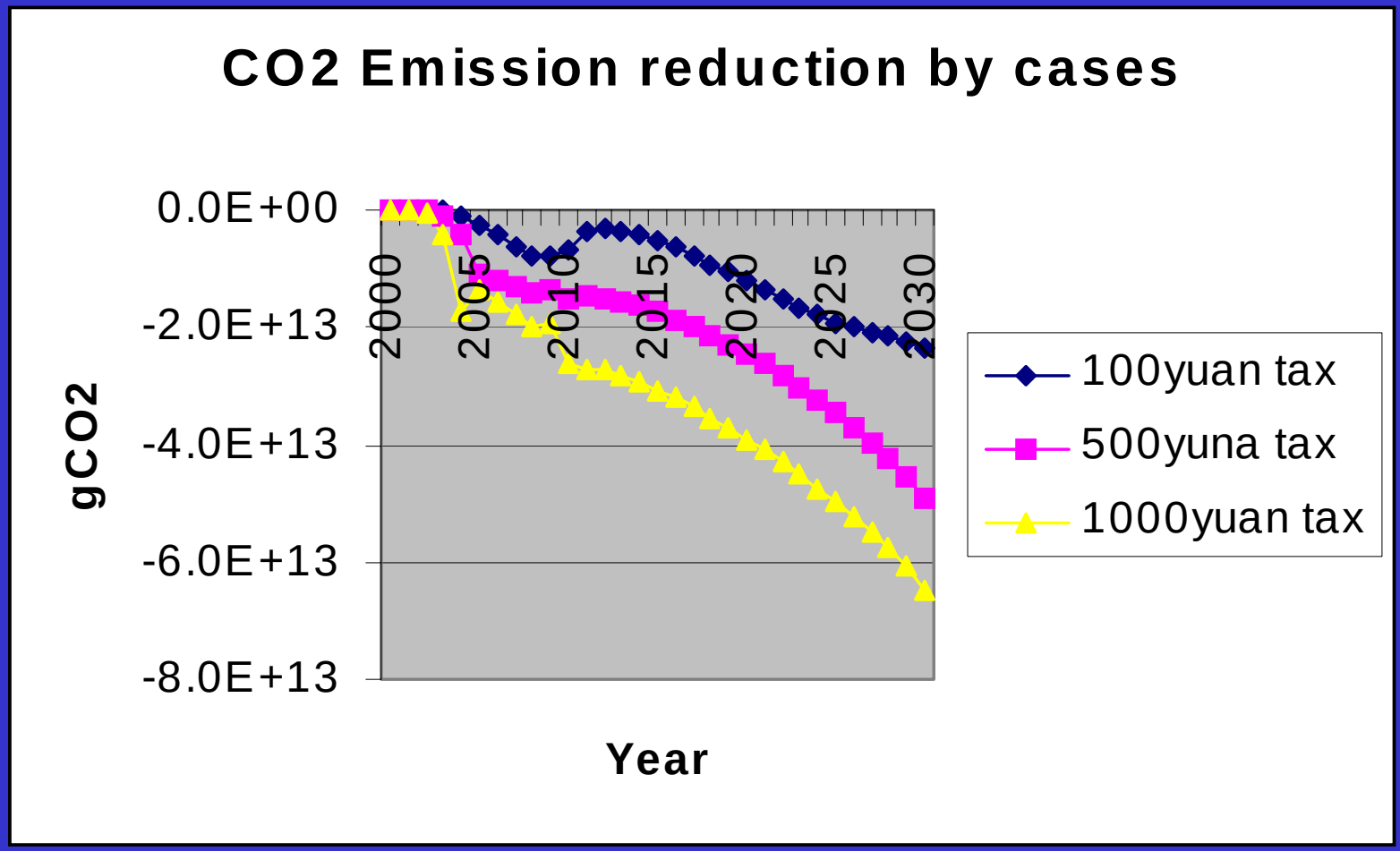

Energy Deamnd in China
6E+12
5E+12
4E+12
3E+12
2E+12
1E+12
0
Kgoe
2002
2005
2008
2011
2014
2017
2020
2023
2026
2029
Year

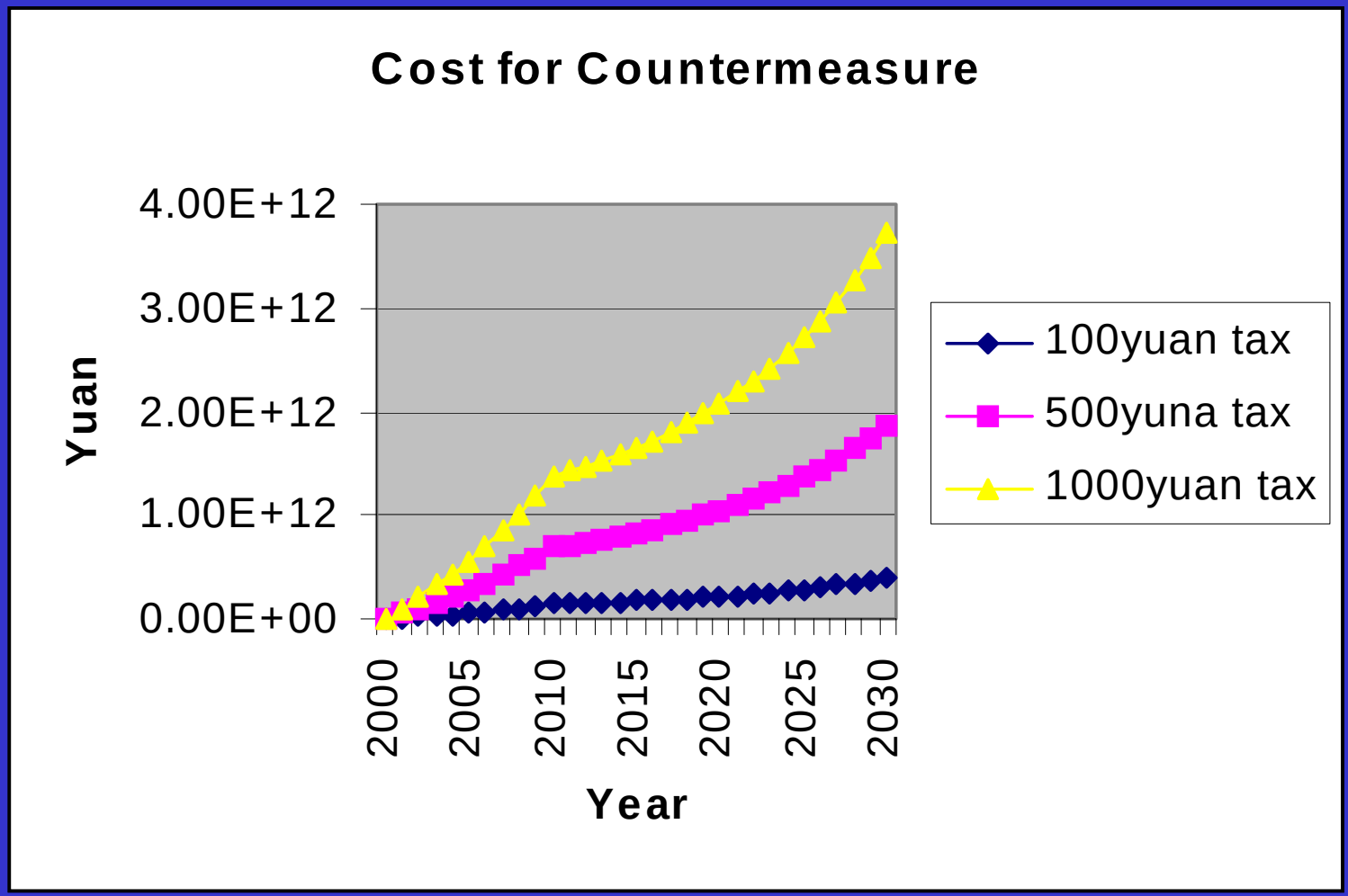

CO2 Emission, Baseline
4.00E+15
3.00E+15
2.00E+15
1.00E+15
0.00E+00
gCO2
2000
2003
2006
2009
2012
2015
2018
2021
2024
2027
2030
Year

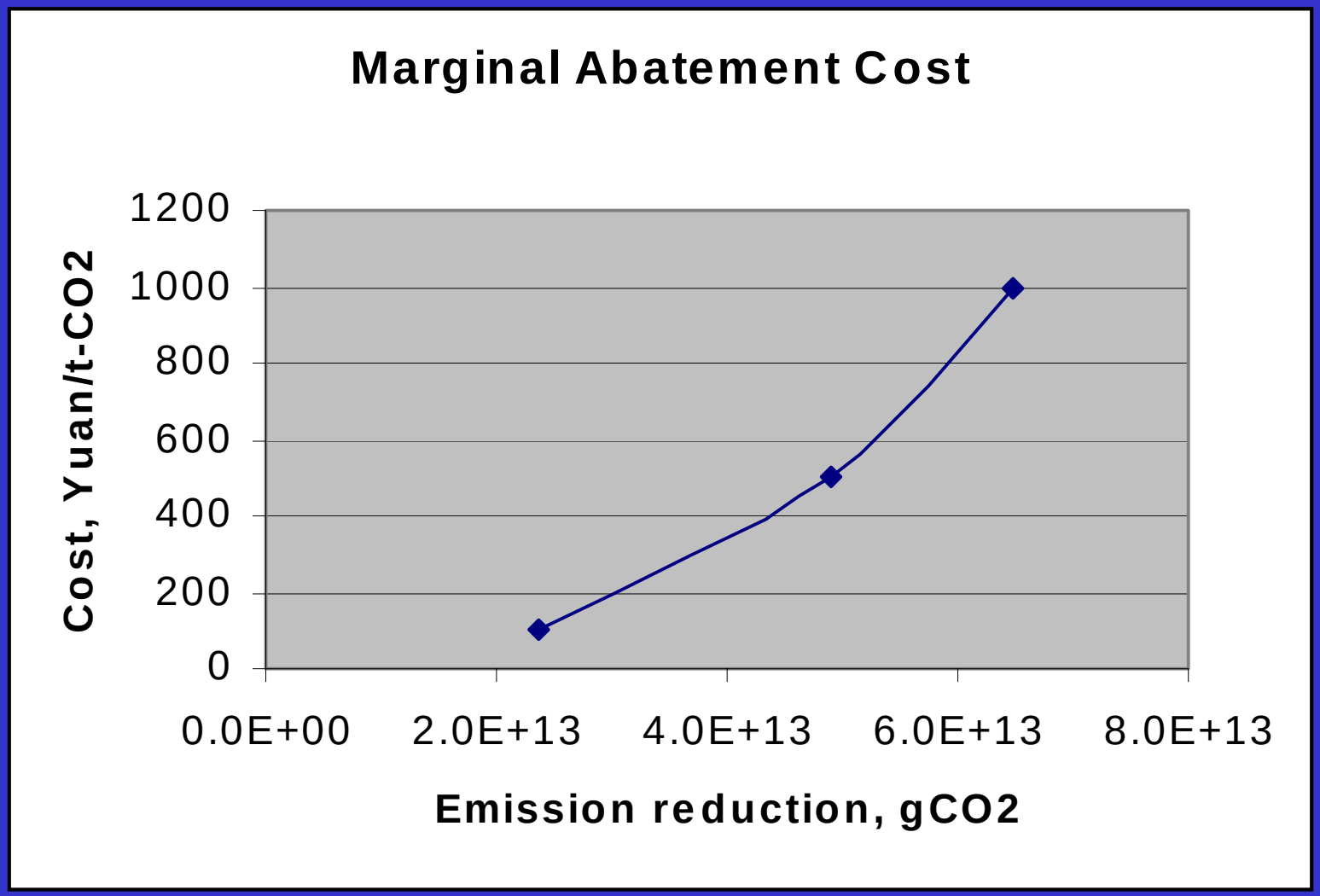

NOx Emission
5.00E+13
4.00E+13
3.00E+13
2.00E+13
1.00E+13
0.00E+00
gNOx
2000
2003
2006
2009
2012
2015
2018
2021
2024
2027
2030
Year

Technology selection for power generation sector(1000yuan/t-C tax case)

	2000	2010	2020	2030
Nuclear Power Plant	9.89E+08	4.19E+09	9.83E+09	1.91E+10
Biomass Power Plant	0	2.03E+08	9.74E+08	2.29E+09
Coal Power Plant	0	0	0	0
Coal Power Plant	6.29E+10	7.58E+10	1.01E+11	1.36E+11
Gas Power Plant	0	0	0	0
Oil Power Plant	0	0	0	0
Water Power Plant	1.86E+10	2.12E+10	2.70E+10	3.40E+10


CO2 Emission reduction by cases
0.0E+00
-2.0E+13
-4.0E+13
-6.0E+13
-8.0E+13
gCO2
2000
2005
2010
2015
2020
2025
2030
Year
100yuan tax
500yuna tax
1000yuan tax


Cost for Countermeasure
4.00E+12
3.00E+12
2.00E+12
1.00E+12
0.00E+00
Yuan
2000
2005
2010
2015
2020
2025
2030
Year
100yuan tax
500yuna tax
1000yuan tax


Marginal Abatement Cost
Cost, Yuan/t-CO2
1200
1000
800
600
400
200
0
0.0E+00
2.0E+13
4.0E+13
6.0E+13
8.0E+13
Emission reduction, gCO2

AIM/Local-China: Progress in 2002-2003

- checked, supplemented and improved the information about energy type and prices, as well as emission factors of CO2、SO2、NOX by category of energy variety and utilization
- collected the emission factors of major equipments in main energy-intensive industry sectors
- Data collection for removal processes.
- Detail countermeasure study for steel making and cement industry
- Use standard unit for energy in database
- Including hydropower, nuclear power and wind power plant into LPS in power model. Large point source extended from 252 to 364.
- Data revising for power sector on stock and service. Stock data use MW and service use GWh as unit.
- Part work for GIS information for LPS

Emission Factor

Energy Code	Energy _Name	Price Value yuan/Gcal	CO_2 Value kgCO_2/Gcal	SO_2 Value kgSO_2/Gcal	NOx Value kgNOx/Gcal
COL1	Coal1(S content less than 1.0)	54	100.62	2.88	0.86
COL2	Coal2(S content 1.0 to 2.0)	45	131	2.38	1.64
COL3	Coal3(S content more than 2.0)	50	150	6.83	1.47
TOG	Town Gas	311	58.35	1.2	0.2
COLB	riquettes	54	125	1.7	0.5
OCP	Other Coal Products	50	176	4	0.5
COLR	Raw Coal	45.6	140	3.46	1.64
COK	Coke	78.5	123	1.41	2.63
OKP	Other Coking Products	62.5	87.8	1	2.63
COG	Coke Oven Gas	302	66	1.25	1.05
OIL	Crude Oil	160	78.11	1.8	0.83
OPR	Oil Products	250	78.11	1.8	0.83
OPI	Oil Products (Industrial)	128.5	78.11	1.8	0.83
OPH	Oil Products (Residential)	313.6	76.58	1.4	0.83
OPC	Oil Products (Commerce)	323.3	76.58	1.4	0.83
OPT	Oil Products (Transportation)	295	76.58	1.4	0.83
OPA	Oil Products (Agriculture)	283.3	78.39	1.86	0.83

Emission factor for technologies

Sector	Technologies	Pollutants	Unit	Produced factor	Emissior factor
Nonferrous	Flashing Funace	SO2	kg/ton copper	2916	35
	Electricity furnace	SO2	kg/ton copper	1175	209
	Catoptric furnace	SO2	kg/ton copper	826	264
	Silver furnave	SO2	kg/ton copper	1480	282
	Bkast furnace	SO2	kg/ton copper	2447	1156
	Bkast furnace	SO2	kg/ton lead	952	199
	Staring tin furnace	SO2	kg/ton zinc	1681	84
Power	Low pressure unit	SO2	kg/10000kWh	147	132
	High pressure unit	SO2	kg/10000kWh	115	108
	Critical pressure unit	SO2	kg/10000kWh	97	92
	Super Critical pressure unit	SO2	kg/10000kWh	75	74

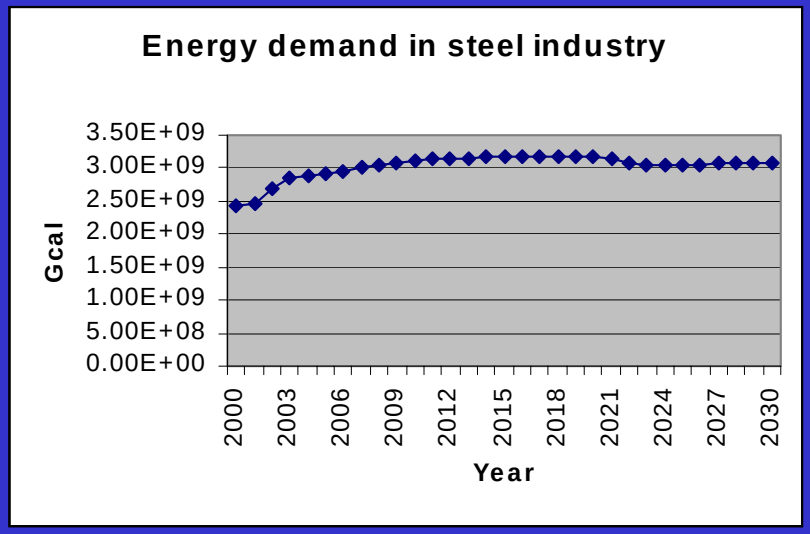
Removal Technologies

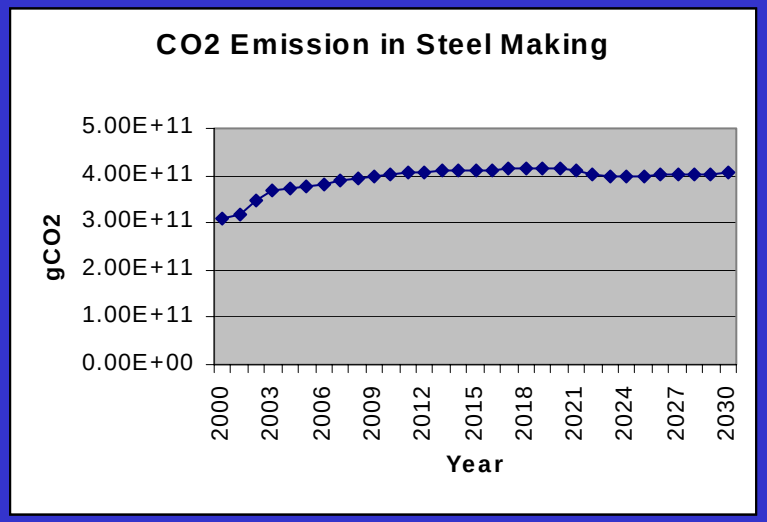
Cement

CDC	Cyclone dust catcher		INCDC	
SDC	Sacking dust catcher		INSDC	
EDC	Electrostatic dust catcher		INEDC	
COW	Coal washing	PRCOW		
DDF	Dry Desufurization			PODDF
WDF	Wet Desufurization			POWDF
NSPK	New Suspension Preheater Kiln			PONSP

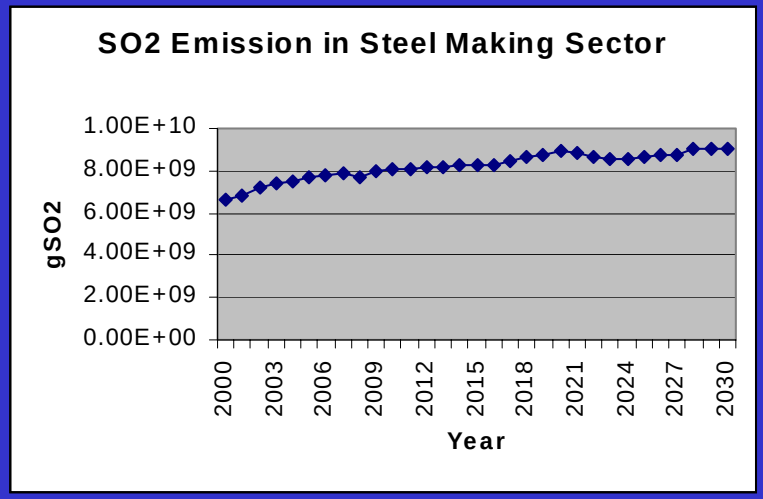
Countermeasures

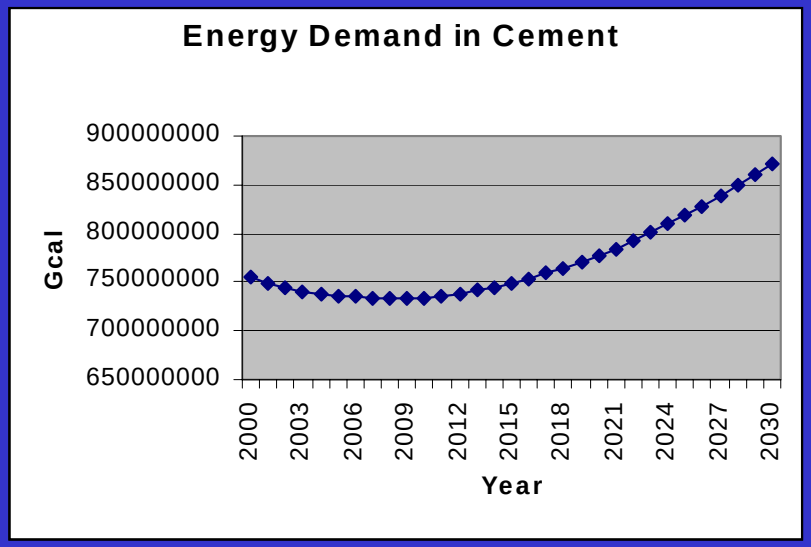
Cement CM_Code	CM_Name	Reduction_Rate
EEI	Energy Efficiency Improvement of MSK	0.3
DPS	Development of Policies and Standards of LBK	0.05
PIT	Promotion of Innovative Technologies of WTK	0.54
EM	Enhancing management of SSK	0.05
RCU	Resource Cycle Used of PDTK	0.1
EEI	Energy Efficiency Improvement of LBK	0.2
DPS	Development of Policies and Standards of PDTK	0.05
PIT	Promotion of Innovative Technologies of PTK	0.4
EM	Enhancing management of PTK	0.1
RCU	Resource Cycle Used of PTK	0.1
EEI	Energy Efficiency Improvement of SSK	0.3
DPS	Development of Policies and Standards of LBK	0.05
PIT	Promotion of Innovative Technologies of PDTK	0.4
EM	Enhancing management of WTK	0.05
RCU	Resource Cycle Used of LBK	0.1
EEI	Energy Efficiency Improvement of PDK	0.2
DPS	Development of Policies and Standards of SSK	0.1
PIT	Promotion of Innovative Technologies of LBK	0.5
EM	Enhancing management of NTLK	0.05
RCU	Resource Cycle Used of MSK	0.1

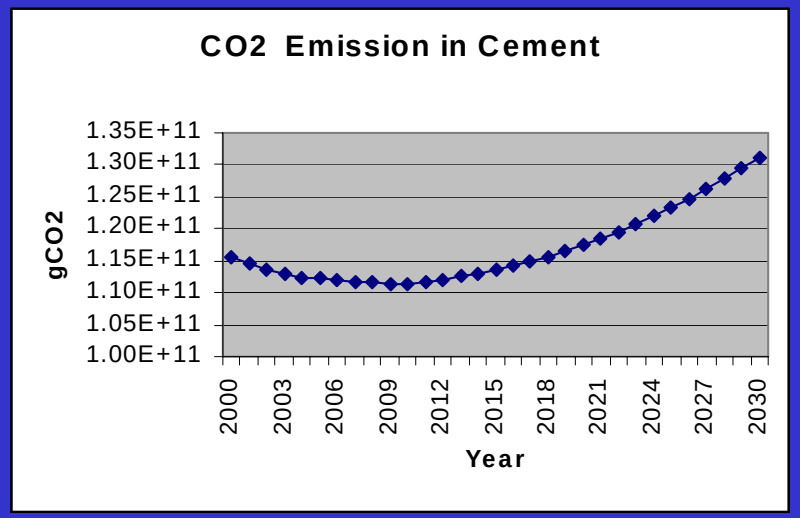

Energy demand in steel industry
Gcal
3.50E+09
3.00E+09
2.50E+09
2.00E+09
1.50E+09
1.00E+09
5.00E+08
0.00E+00
2000
2003
2006
2009
2012
2015
2018
2021
2024
2027
2030
Year

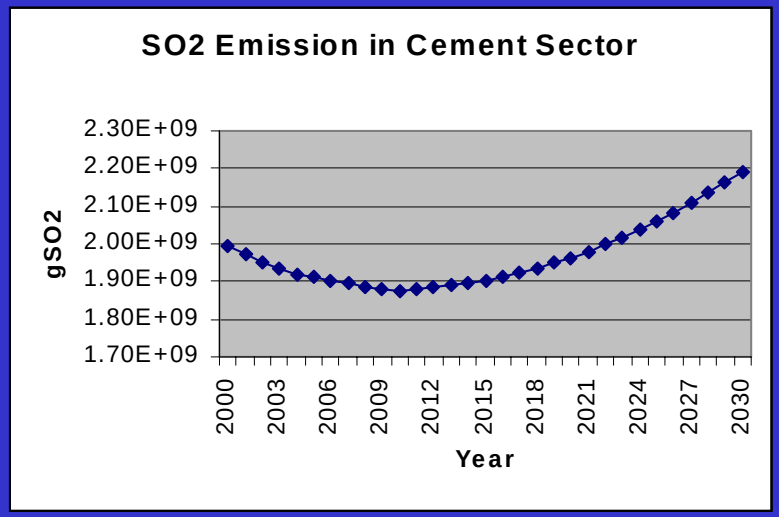

CO2 Emission in Steel Making
gCO2
5.00E+11
4.00E+11
3.00E+11
2.00E+11
1.00E+11
0.00E+00
2000
2003
2006
2009
2012
2015
2018
2021
2024
2027
2030
Year

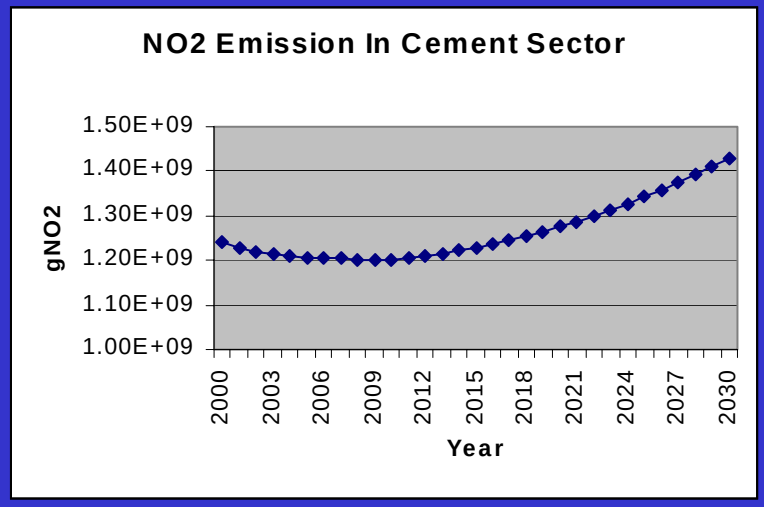

NO2 Emission in Steel Making Sector
gNO2
3.50E+09
3.00E+09
2.50E+09
2.00E+09
1.50E+09
1.00E+09
5.00E+08
0.00E+00
2000
2003
2006
2009
2012
2015
2018
2021
2024
2027
2030
Year

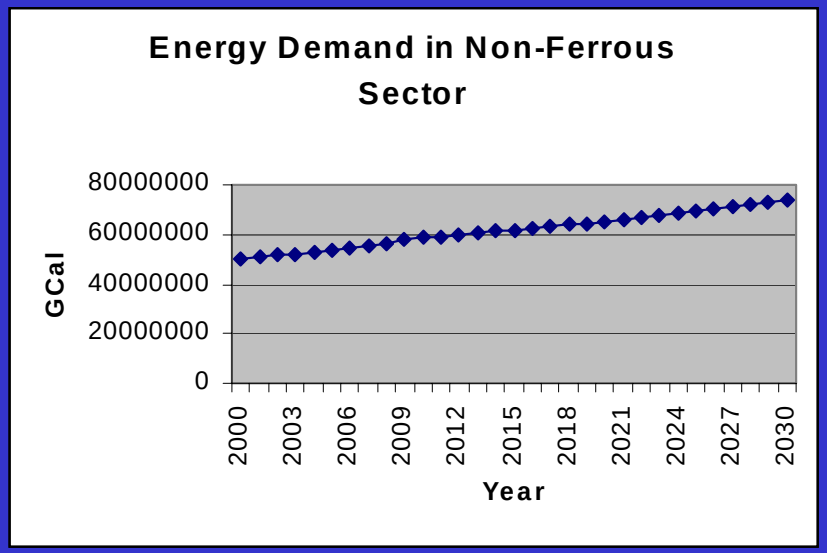

SO2 Emission in Steel Making Sector
gSO2
1.00E+10
8.00E+09
6.00E+09
4.00E+09
2.00E+09
0.00E+00
2000
2003
2006
2009
2012
2015
2018
2021
2024
2027
2030
Year

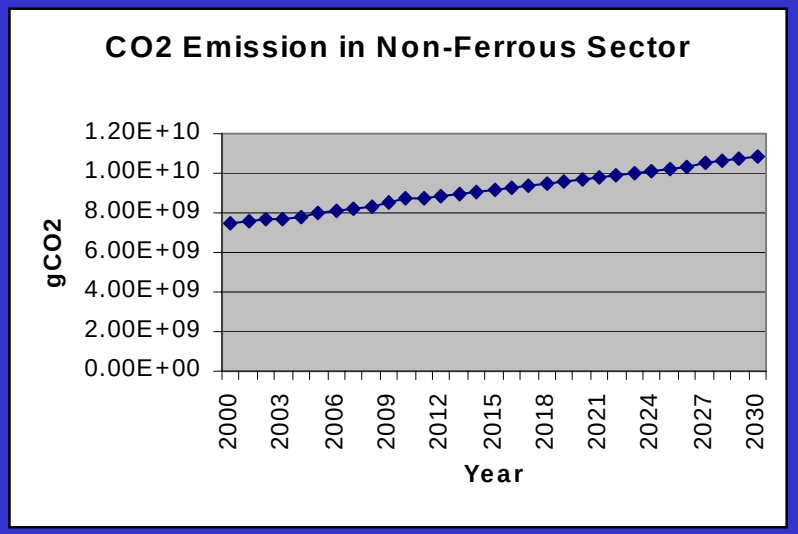

Energy Demand in Cement
900000000
850000000
800000000
750000000
700000000
650000000
Gcal
2000
2003
2006
2009
2012
2015
2018
2021
2024
2027
2030
Year

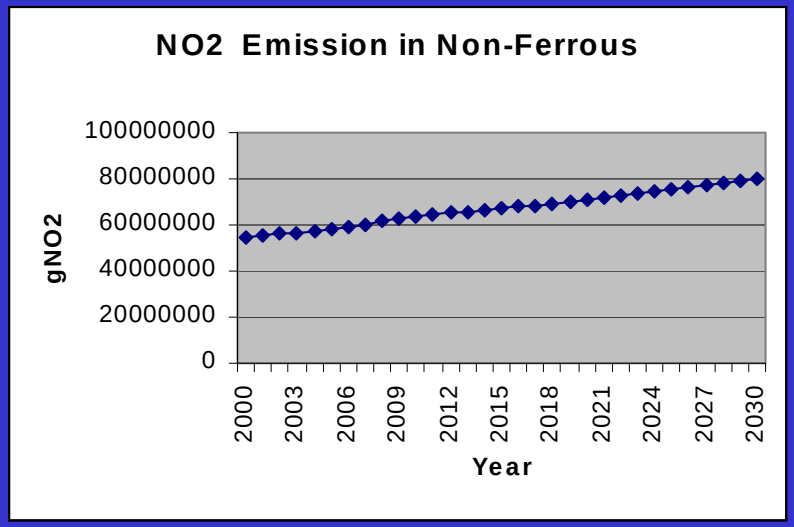

CO2 Emission in Cement
1.35E+11
1.30E+11
1.25E+11
1.20E+11
1.15E+11
1.10E+11
1.05E+11
1.00E+11
gCO2
2000
2003
2006
2009
2012
2015
2018
2021
2024
2027
2030
Year

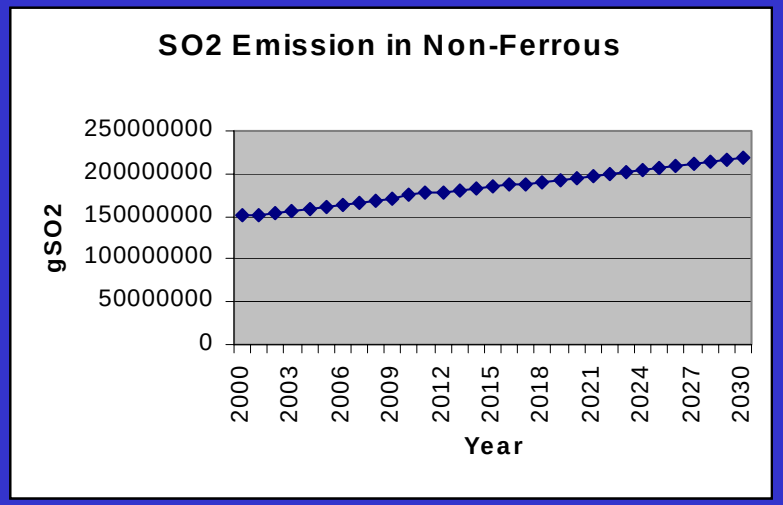

SO2 Emission in Cement Sector
2.30E+09
2.20E+09
2.10E+09
2.00E+09
1.90E+09
1.80E+09
1.70E+09
gSO2
2000
2003
2006
2009
2012
2015
2018
2021
2024
2027
2030
Year


NO2 Emission In Cement Sector
1.50E+09
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
gNO2
2000
2003
2006
2009
2012
2015
2018
2021
2024
2027
2030
Year


Energy Demand in Non-Ferrous Sector
GCal
80000000
60000000
40000000
20000000
0
2000
2003
2006
2009
2012
2015
2018
2021
2024
2027
2030
Year


CO2 Emission in Non-Ferrous Sector
gCO2
1.20E+10
1.00E+10
8.00E+09
6.00E+09
4.00E+09
2.00E+09
0.00E+00
2000
2003
2006
2009
2012
2015
2018
2021
2024
2027
2030
Year


NO2 Emission in Non-Ferrous
gNO2
100000000
80000000
60000000
40000000
20000000
0
2000
2003
2006
2009
2012
2015
2018
2021
2024
2027
2030
Year


SO2 Emission in Non-Ferrous
gSO2
250000000
200000000
150000000
100000000
50000000
0
2000
2003
2006
2009
2012
2015
2018
2021
2024
2027
2030
Year

No Results from Power Sector !

Next Step

Improve AIM/Country-China: technology selection, service
Final results from AIM/Country-China
Non-CO2 emission: CH4, Nox, PM
Removal process
Countermeasures

AIM/Local-China: all sector model
Power sector
Other sector
GIS information
Final results