

GHG Emission Reduction Policy Assessment for China

-Collaborated Project on AIM/Emission-China Between NIES and ERI-

AIM/Emission China Project Team

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Sectors in AIM/End use of China

Sector	Sub-Sector	Simulation for 2010	Simulation for 2030
Agriculture		v	000
Industry	Iron and Steel	v	v
	Copper	v	v
	Aluminum	v	v
	Zinc&Lead	v	v
	Cement	v	v
	Glass	v	v
	Brick	v	v
	Lime	v	v
	Ammonia	v	v
	Ethylene	v	v
	Soda Ash	v	v
	Caustic Soda	v	v
	Fertilizer	v	000
	Calcium	v	000
	Paper Making	v	v
	Textile	v	000
	Casting	v	000
	Heat Treatment	v	000
	Forging	v	000
	Cutting	v	000
Other Industry	v	000	
Energy Conversion	Power Generation	v	000
	Refinery	v	000
Transport		v	v
Commercial Sector		v	v
Residential Sector	Urban Resident	v	v
	Rural Resident	v	v

Technology List

Classification	Technologies (equipment)
Steel	Coke oven, Sintering machine, Blast furnace, Open hearth furnace (OH), Basic oxygen furnace (BOF), AC-electric arc furnace, DC-electric arc furnace, Ingot casting machine, Continuous casting machine, Continuous casting machine with rolling machine, steel rolling machine, Continuous steel rolling machine, Equipment of coke dry quenching, Equipment of coke wet quenching, Electric power generated with residue pressure on top of blast furnace (TRT), Equipment of coke oven gas, OH gas and BOF gas recovery, Equipment of co-generation.
ferrous metal	Aluminum production with sintering process, Aluminum production with combination process, Aluminum with Bayer, Electrolytic aluminum with upper-insert cell, Electrolytic aluminum with side-insert cell, crude copper production with flash furnace, crude copper production with electric furnace, Blast furnace, Reverberator furnace, Lead smelting-sintering in blast furnace, Lead smelting with closed blast furnace, Zinc smelting with wet method, Zinc smelting with vertical pot method.
ing materials	Cement: Mechanized shaft kiln, Ordinary shaft kiln, Wet process kiln, Lepol kiln, Ling dry kiln, Rotary kiln with pro-heater, dry process rotary kiln with pre-calciner, Self-owned electric power generator, Electric power generator with residue heat; Brick & Tile: Hoffman kiln, Tunnel kiln; Lime: Ordinary shaft kiln, Mechanized shaft kiln; Glass: Floating process, Vertical process, Colburn process, Smelter.
ical industry	Equipment of synthetic ammonia production: Converter, Gasification furnace, Gas-making furnace, Synthetic column, Shifting equipment of sulphur removing; Equipment of caustic soda production: Electronic cell with graphite process, Two-stage effects evaporator, Multi-stage effects evaporator, Equipment of rectification, Ion membrane method; Calcium Carbide production: Limestone calciner, Closed carbide furnace, Open carbide furnace, Equipment of residue heat recovery; Soda ash production: Ammonia & salt water preparation, limestone calcining, distillation column, filter; Fertilizer production: Equipment of organic products production, Equipment of residue heat utilization
hemical Industry	Facilities of atmospheric & vacuum distillation, Facilities of rectification, Facilities of catalyzing & cracking, Facilities of cracking with hydrogen adding, Facilities of delayed coking, Facilities of light carbon cracking, Sequential separator, Naphtha cracker, de-ethane separator, diesel cracker, de-propane cracker, facilities of residue heat utilization from ethylene.
making	Cooker, facilities of distillation, facilities of washing, facilities of bleaching, evaporator, crusher, facilities of de-water, facilities of finishing, facilities of residue heat utilization, facilities of black liquor recovery, Co-generator, Back pressure electric power generator, condensing electric power generator.
e	Cotton weaving process, Chemical fiber process, Wool weaving & textile process, Silk process, Printing & dyeing process, Garment making, Air conditioner, Lighting, Facilities of space heating.
inery	Ingot process: Cupola, Electric arc furnace, fan; Forging process: coal-fired pre-heater, Gas-fired pre-heater, Oil-fired pre-heater, Steam hammer, Electric-hydraulic hammer, Pressing machine; Facilities of heat processing: Coal-fired heat processing furnace, Oil-fired heat processing furnace, Gas-fired heat processing furnace, Electric processing furnace; Cutting process: Ordinary cutting, high speed cutting.
ion	Diesel engine, Electric induct motor
ng works	Tractor, Other agricultural machine
ultural products process	Diesel engine, Electric induct motor, processing machine, coal-fired facilities.
y	Diesel engine, Electric induct motor.
al husbandry	Diesel engine, Electric induct motor, Other machines.
heating in resident	Heat supplying boiler in thermal power plant, Boiler of district heating, Dispersed boiler, Small coal-fired stove, Electric heater, Brick bed linked with stove (Chinese KANG).
ng in resident	Air conditioner, Electric fan.
ng in resident	Incandescent lamp, Fluorescent lamp, Kerosene lamp.
ng & Hot water in nt	Gas burner, bulk coal-fired stove, briquette-fired stove, Kerosene stove, Electric cooker, cow dung-fired stove, firewood-fired stove, methane-fired stove.
ic Appliance	Television, Cloth washing machine, Refrigerator, others.
heating in service sector	Heat supplying boiler in the thermal power plant, Boiler of district heating, dispersed boiler, Electric heater.
ng	System of central air conditioner, Air conditioner, Electric fan.
ng	Incandescent lamp, fluorescent lamp.
ng & Hot water	Gas burner, Electric cooker, Hot water pipeline, Coal-fired stove.
ic Appliance	Duplicating machine, computer, Elevator, others.
nger & freight transport	Railway (passenger & freight): Steam locomotive, Internal combustion engine locomotive, Electric locomotive.; Highway (passenger & freight): Public diesel vehicle, Public gasoline vehicle, Private vehicle, Large diesel freight truck, Large gasoline vehicle, small freight truck. Waterway (passenger & freight): Ocean-going ship, Coastal ship, Inland ship. Aviation (passenger & freight): Freight airplane, passenger airplane.

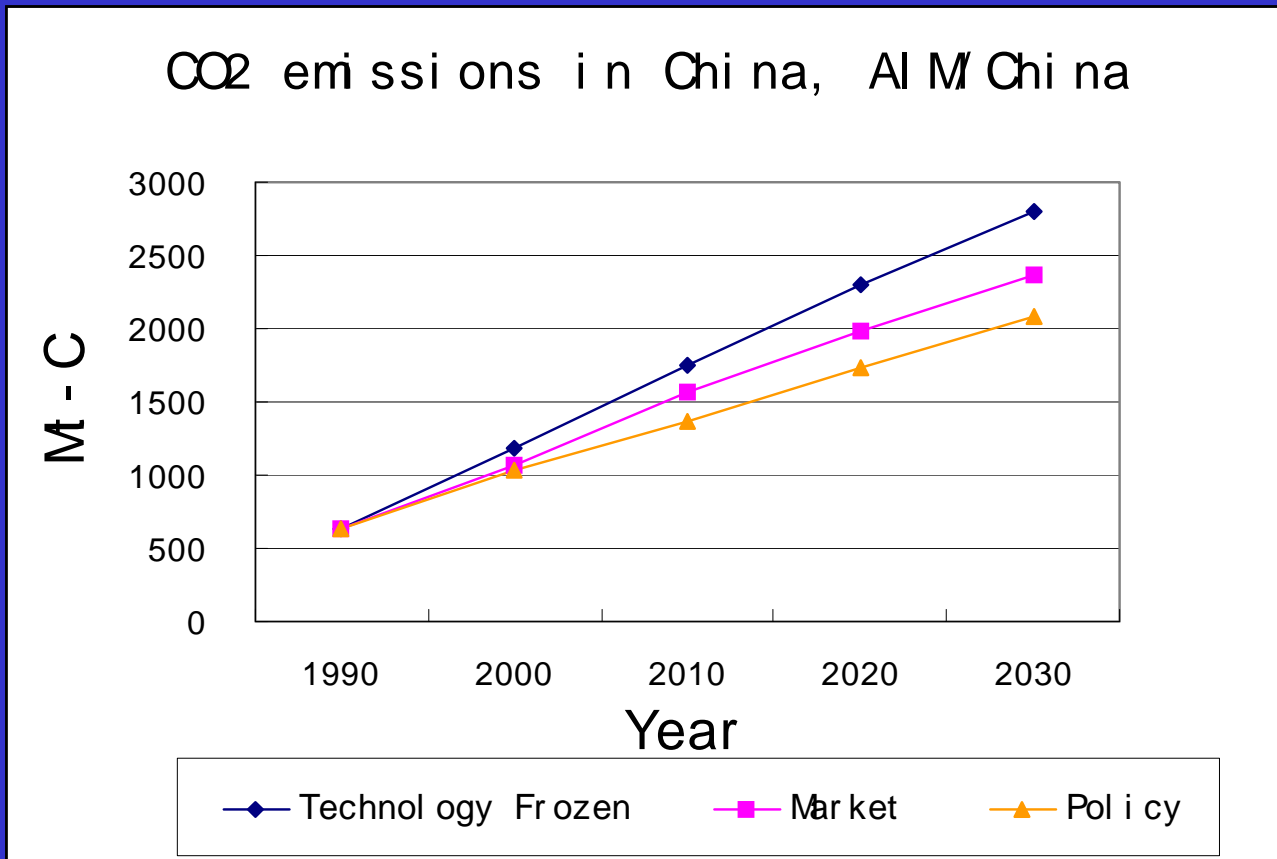
Energy Services in China

Energy Service	1990	2000	2010
Steel Output	1	1.8	2.1
Copper output	1	1.5	1.7
Aluminum output	1	2.5	3.5
Synthetic ammonia Output	1	1.3	1.8
Fertilizer Output	1	1.2	1.4
Cement Output	1	2.4	2.9
Brick & Tile Output	1	1.3	1.8
Flat glass Output	1	1.9	3.5
Paper and Pulp Output	1	2.1	2.6
Irrigated Land area	1	1.0	1.1
Cultivated land area	1	1.0	1.0
Residential households in the urban	1	1.5	2.0
Urban housing area of each household	1	1.3	1.6
Changes in cooling intensity in Urban Household	1	1.2	1.4
Changes in space heating intensity in Urban Household	1	1.3	1.3
Changes in cooking and hot water intensity in Urban Household	1	1.4	1.6
Changes in illumination of lighting in Urban Household	1	1.1	1.2
Possessing rate of refrigerator in Urban Household	1	1.5	1.9
Possessing rate of clothes washing machine in Urban Household	1	1.1	1.1
Possessing rate of color TV in Urban Household	1	1.4	1.5
Residential household in the rural	1	1.2	1.2
Rural Resident housing area	1	1.0	0.9
Changes in cooling intensity in Rural Household	1	1.3	1.5
Changes in space heating intensity in Rural Household	1	1.2	1.2
Changes in cooking intensity in Rural Household	1	1.2	1.3
Changes in illumination of lighting in Rural Household	1	1.1	1.2
Possessing rate of refrigerator in Rural Household	1	1.4	4.3
Possessing rate of clothes washing machine in Rural Household	1	1.3	1.5
Possessing rate of TV in Rural Household	1	1.2	1.4
Changes in intensity of space heating in service sector	1	1.2	1.36
Changes in intensity of space cooling in service sector	1	1.25	1.35
Changes in illumination requirement	1	1.10	1.20
Changes in electric power consumed by duplicating machine	1	1.10	1.15
Changes in electric power consumed by computer	1	1.20	1.25
Changes in electric power consumed by elevator	1	1.05	1.10
Changes in electric power consumed by other electric appliance	1	1.10	1.20
Traffic volume of Railway Freight Transport	1	1.5	1.9
Traffic volume of Railway Passenger Transport	1	1.8	2.4
Traffic volume of Aviation(freight transport)	1	11.0	53.1
Traffic volume of Aviation(passenger transport)	1	11.0	52.6
Traffic volume of private car	1	19.8	272.4
Traffic volume of Small truck	1	5.1	9.2
Traffic volume of Large truck	1	1.7	2.9

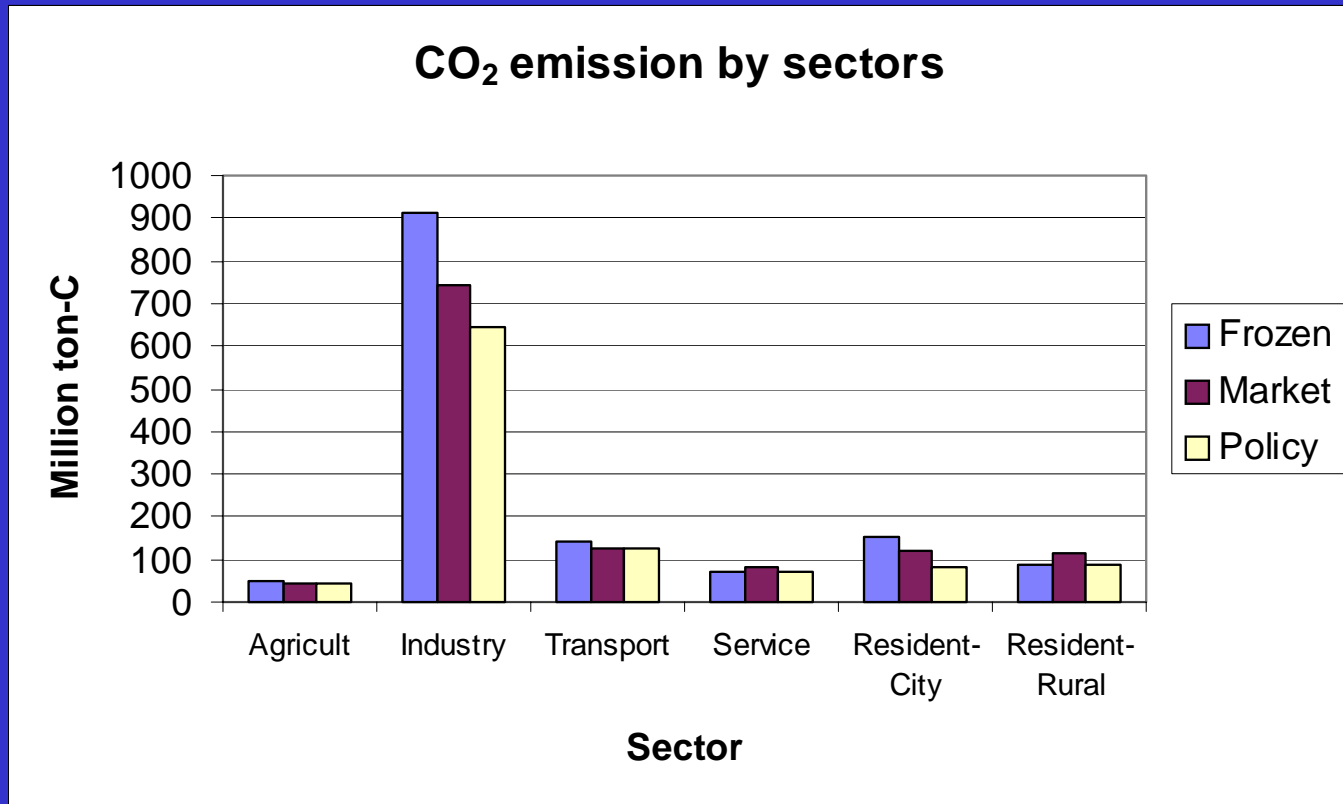
Case definition

<i>Case</i>	<i>Technology Selection</i>	<i>Countermeasures</i>
Frozen Efficiency (Frozen)	No	No
Baseline (MARKET)	Yes	No
Economic Instrument (Policy)	Yes	Carbon Tax and Subsidy

Medium-term emission scenarios: Results

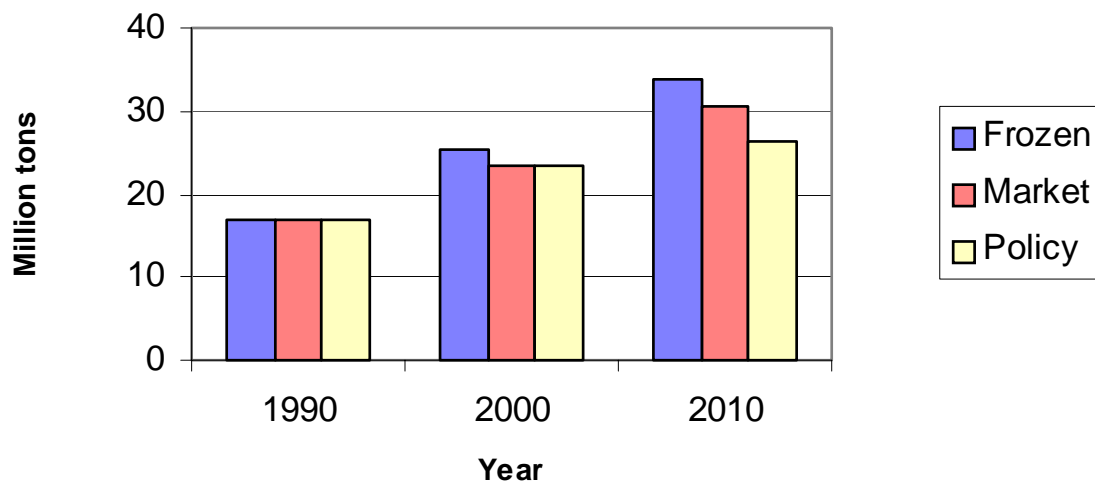


CO₂ Emission by sectors

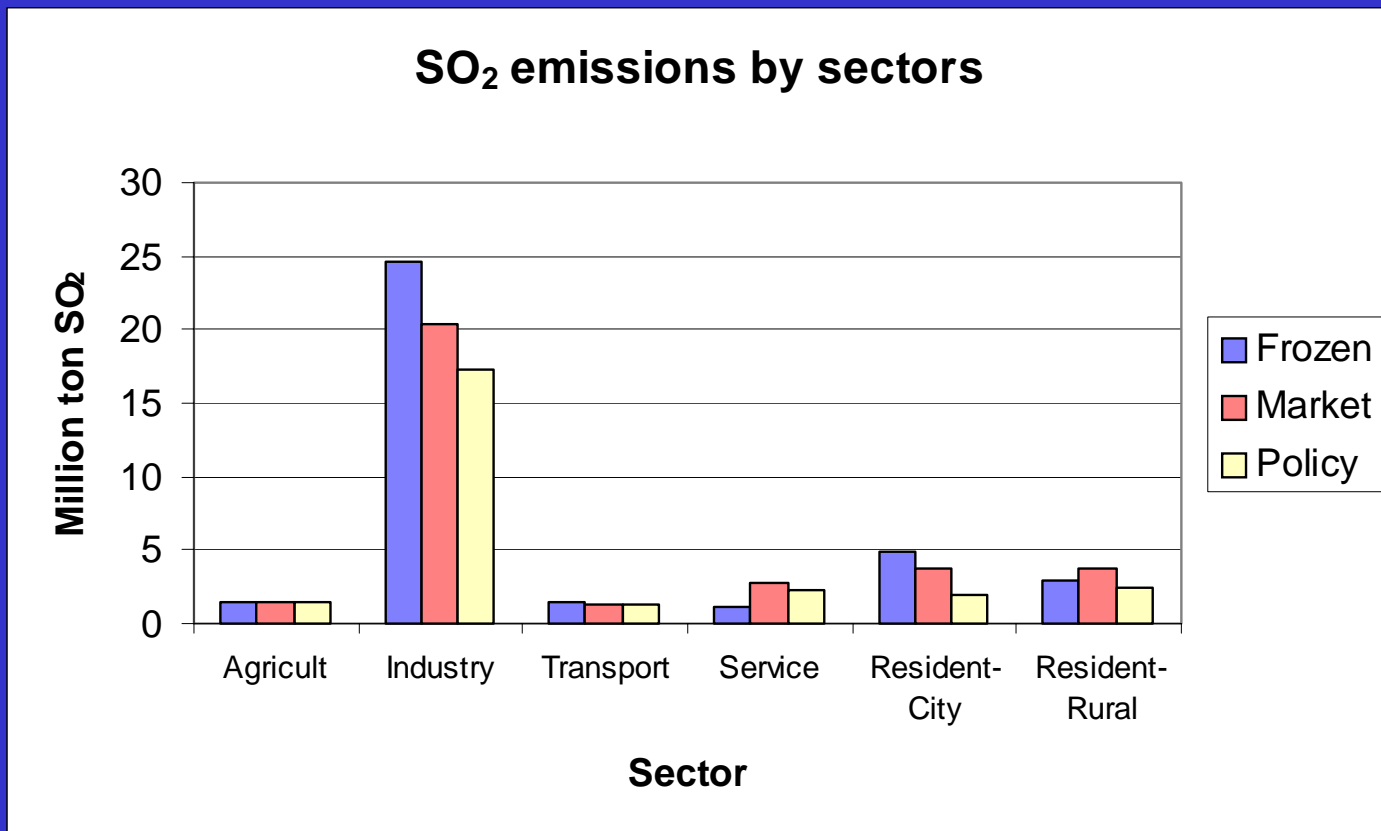


Integrated Environment Policy Assessment: Local air pollution

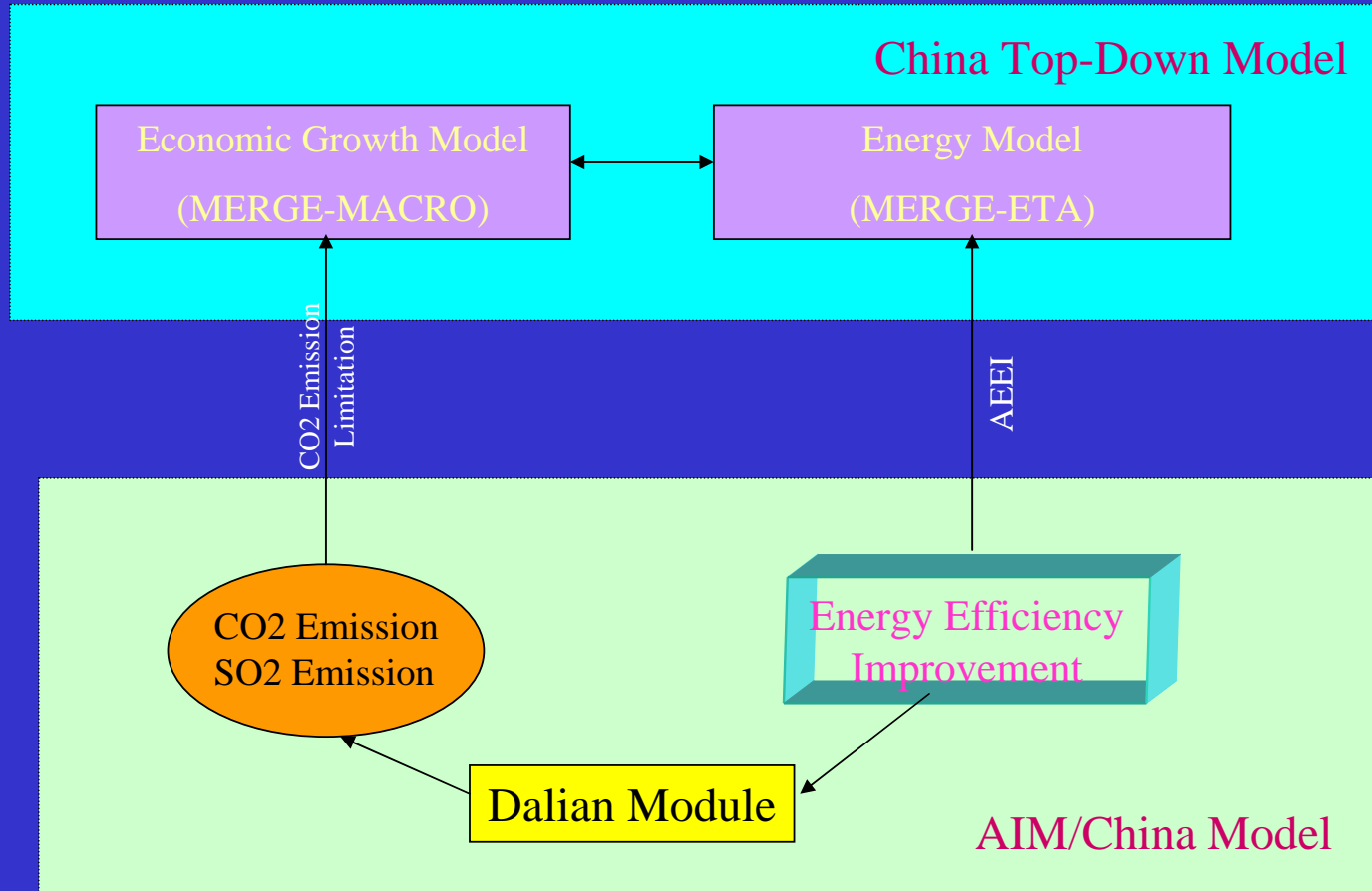
SO₂ emission Forecast in China



SO₂ emission by sectors

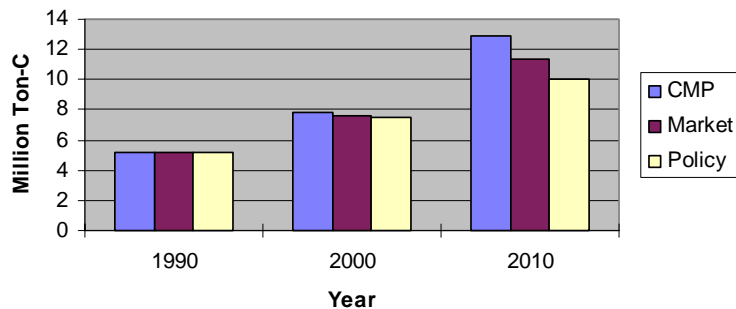


Regional Environment Policy Assessment: Dalian

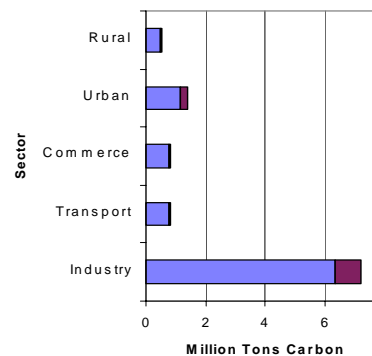


Regional Environment Policy Assessment: Dalian

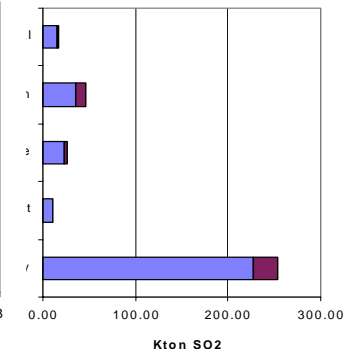
CO2 Emission in Dalian by AIM



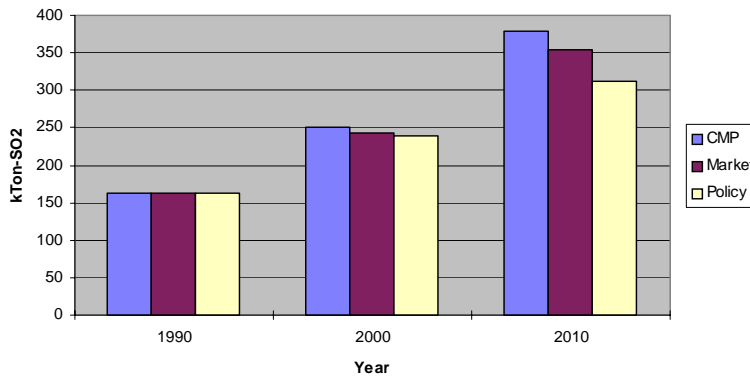
CO₂ Emission by Sectors



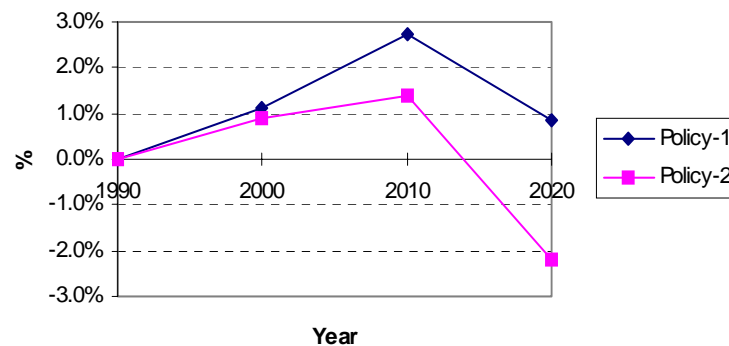
SO₂ Emission Reduction by Sectors



SO₂ Emission in Dalian by AIM



GDP Loss in Dalian



Model Linkage

AIM/Emission China: Bottom-up

SGM-China: Top-down, collaborated from 1992

Sectors in SGM-CHINA

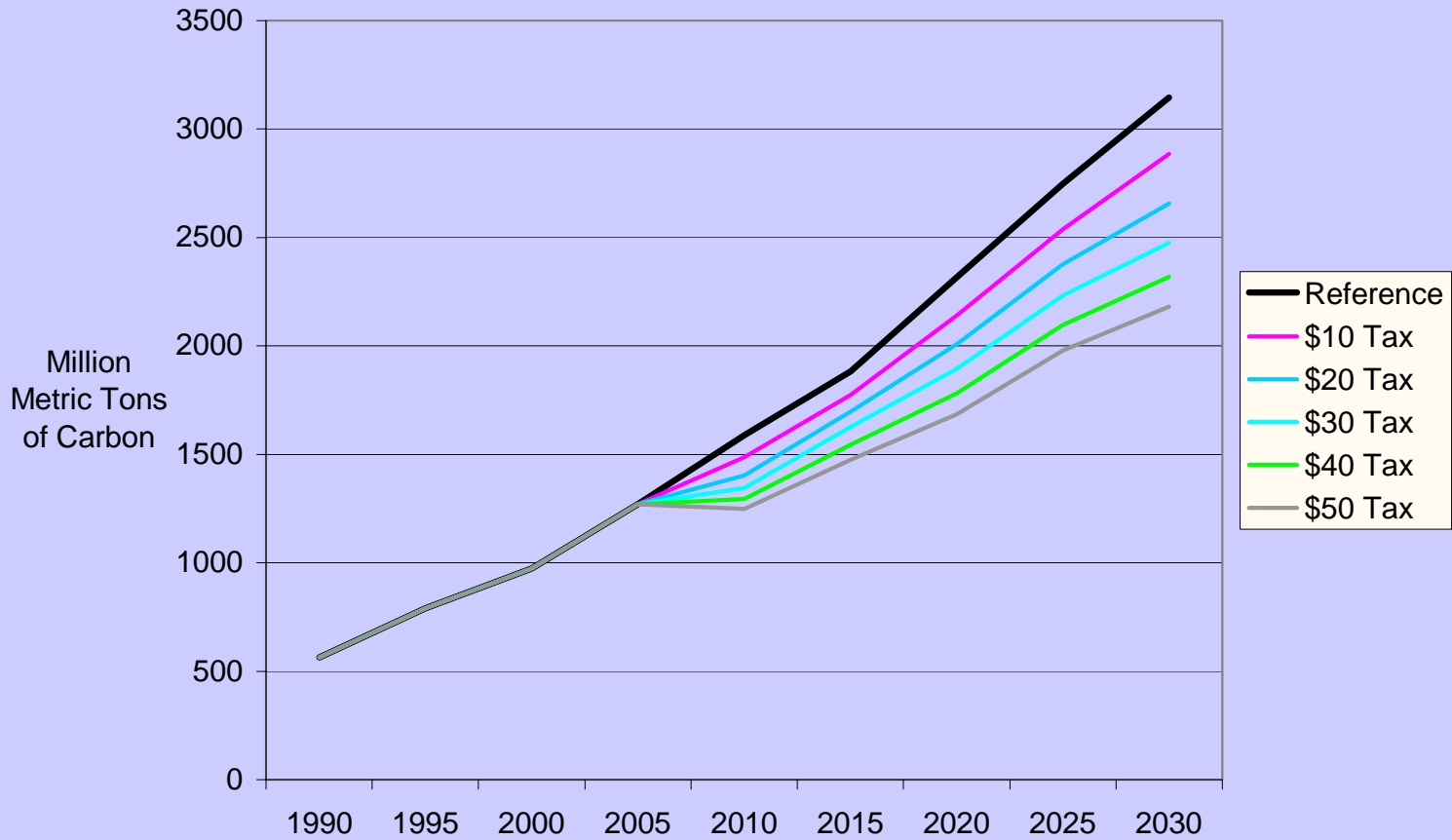
SGM 97

- 1 Agriculture
- 2 Everything Else
- 3 Oil Production
- 4 Gas Production
- 5 Coal Production
- 6 Biomass
- 7 Nuclear Fuel
- 8 Electricity Production
 - Oil-Fired
 - Gas-Fired
 - Coal-Fired
 - Nuclear
 - Hydro
- 9 Oil Refining
- 10 Gas Distribution

SGM 2000

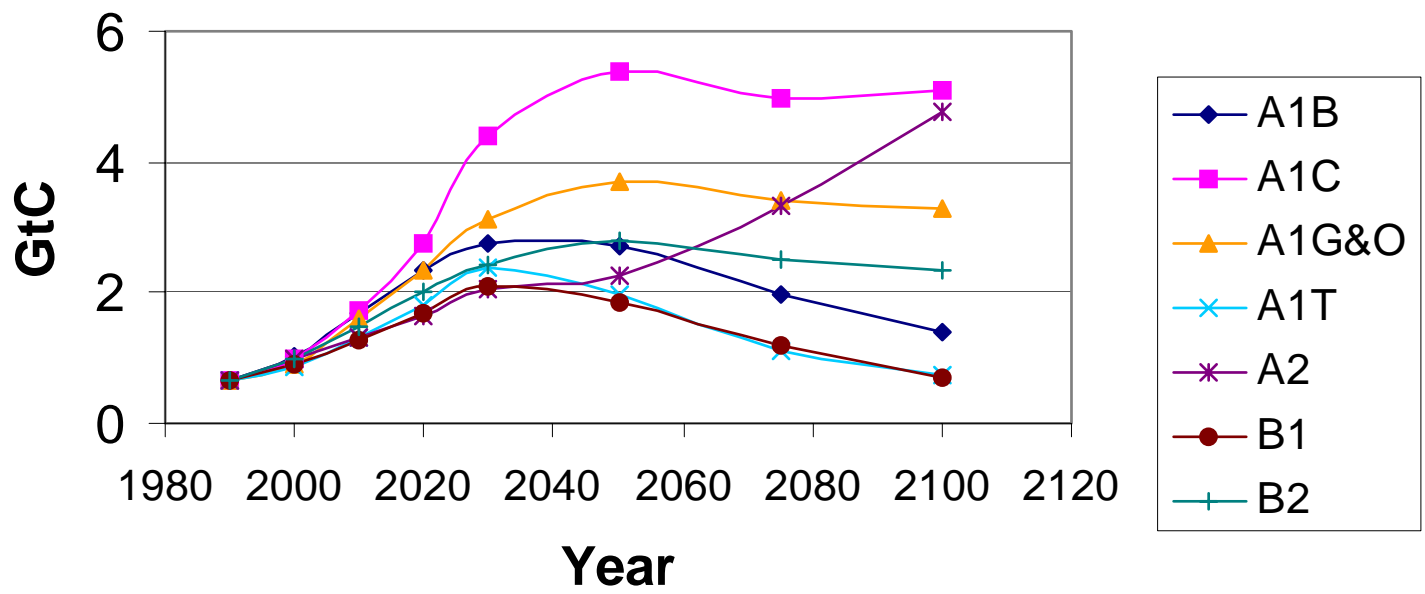
- 1 Other Agriculture
- 2 Everything Else
- 3 Oil Production
- 4 Gas Production
- 5 Coal Production
- 6 Coal Products
- 7 Biomass
- 8 Electricity Production
 - Oil-Fired
 - Gas-Fired
 - Coal-Fired
 - Nuclear
 - Hydro
- 9 Oil Refining
- 10 Gas Distribution
- 11 Paper and Pulp
- 12 Chemicals
- 13 Cement
- 14 Primary Metals
- 15 Food Processing
- 16 Other Industry
- 17 Passenger Transport
 - Automobile
 - Railway
 - Sea
 - Air
- 18 Freight Transport
 - Truck
 - Railway
 - Sea
 - Air
- 19 Residential Building Energy Services
- 20 Commercial Building Energy Services
- 21 Grains and Oil Crops
- 22 Animal Products
- 23 Forestry

China Carbon Emissions



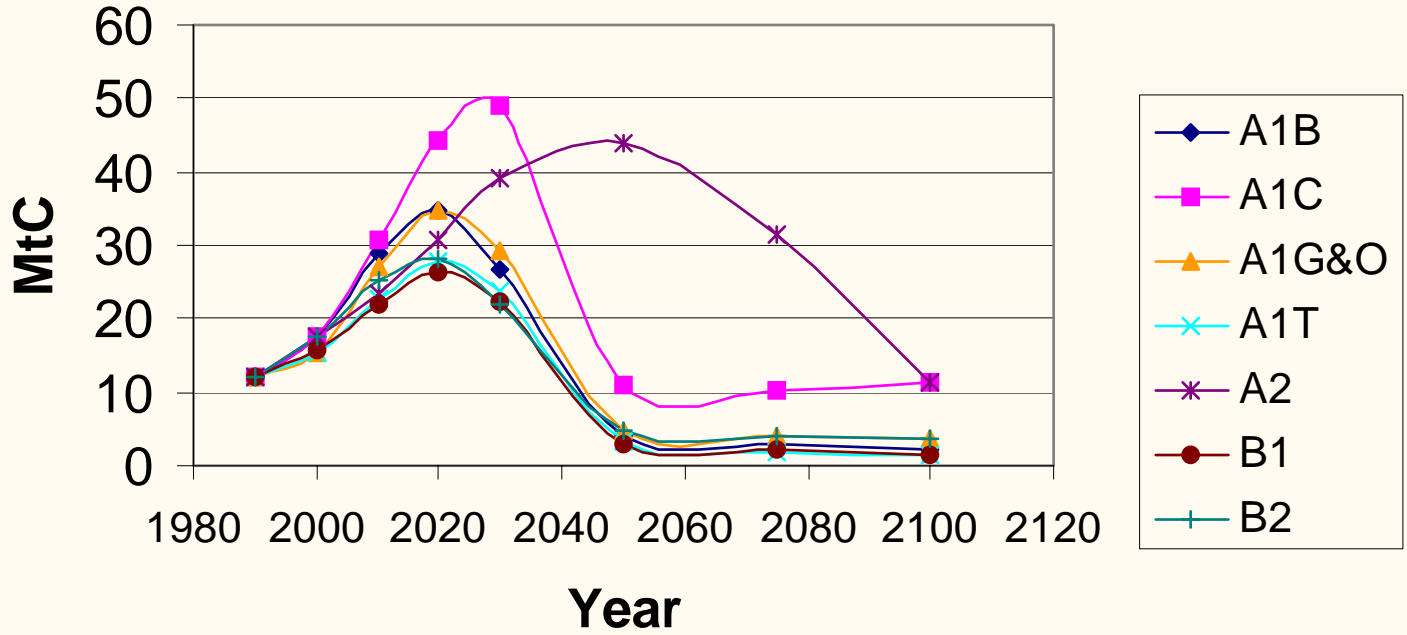
IPCC Special Report on Emission Scenarios (SRES)

CO2 Emission from Energy Use



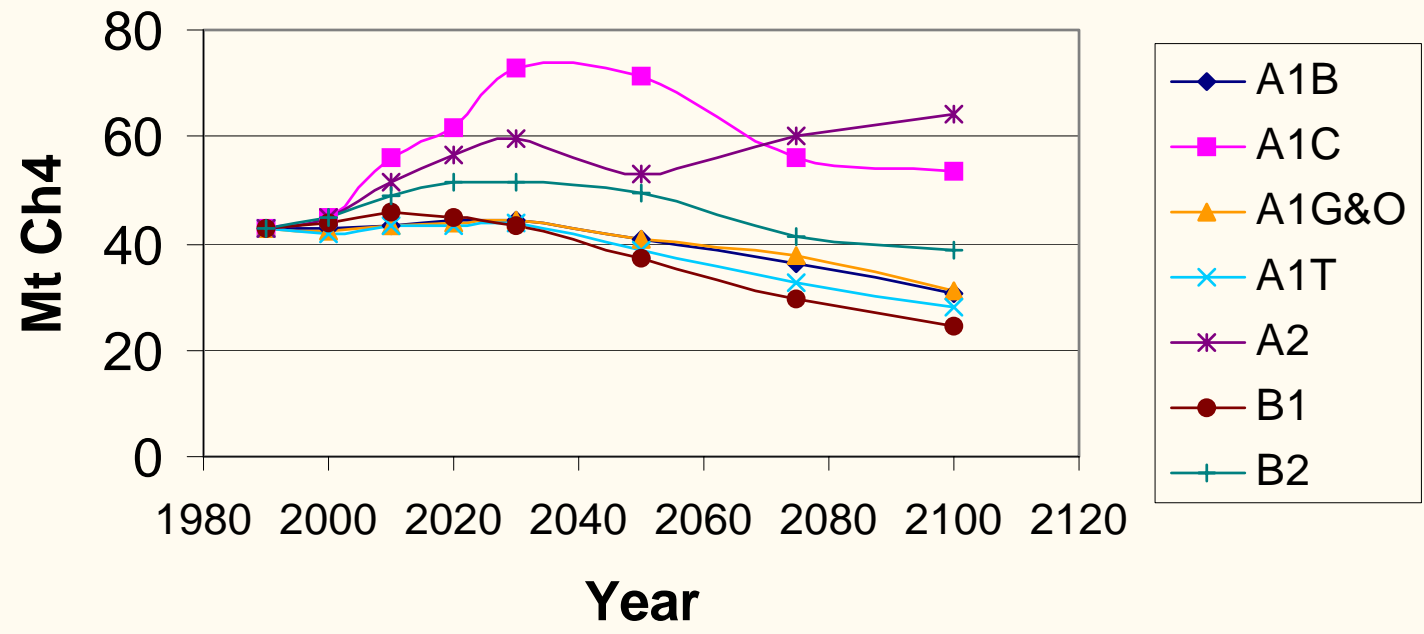
IPCC Special Report on Emission Scenarios (SRES)

SO2 Emission from Energy Use, China



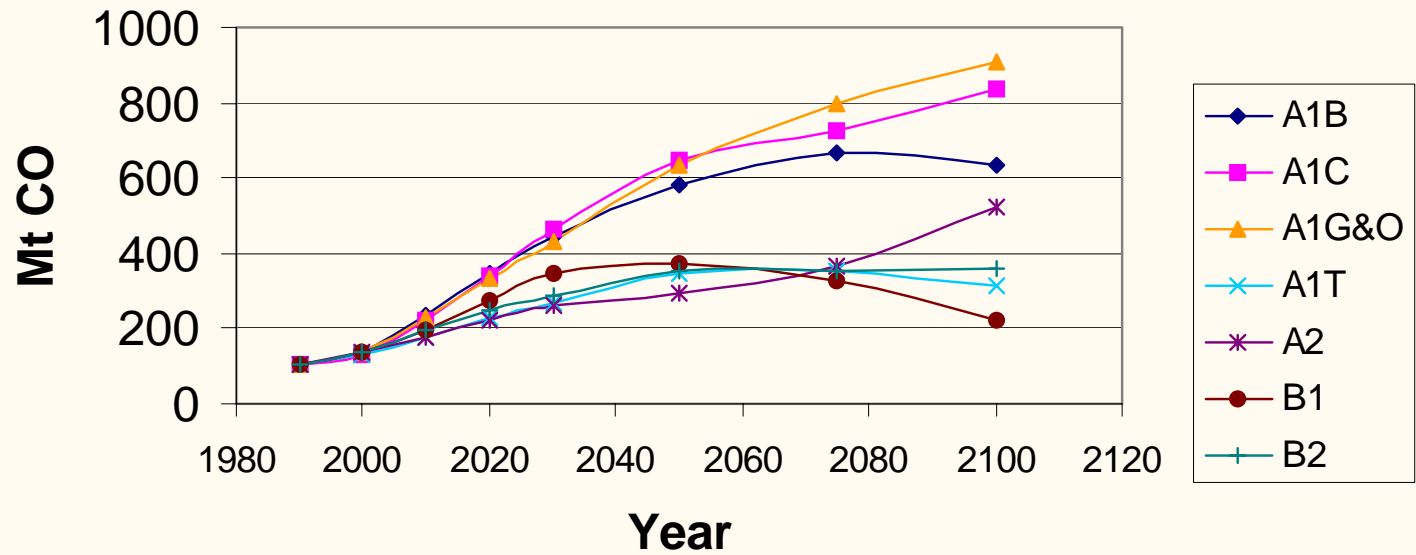
IPCC Special Report on Emission Scenarios (SRES)

CH₄ Emission of China



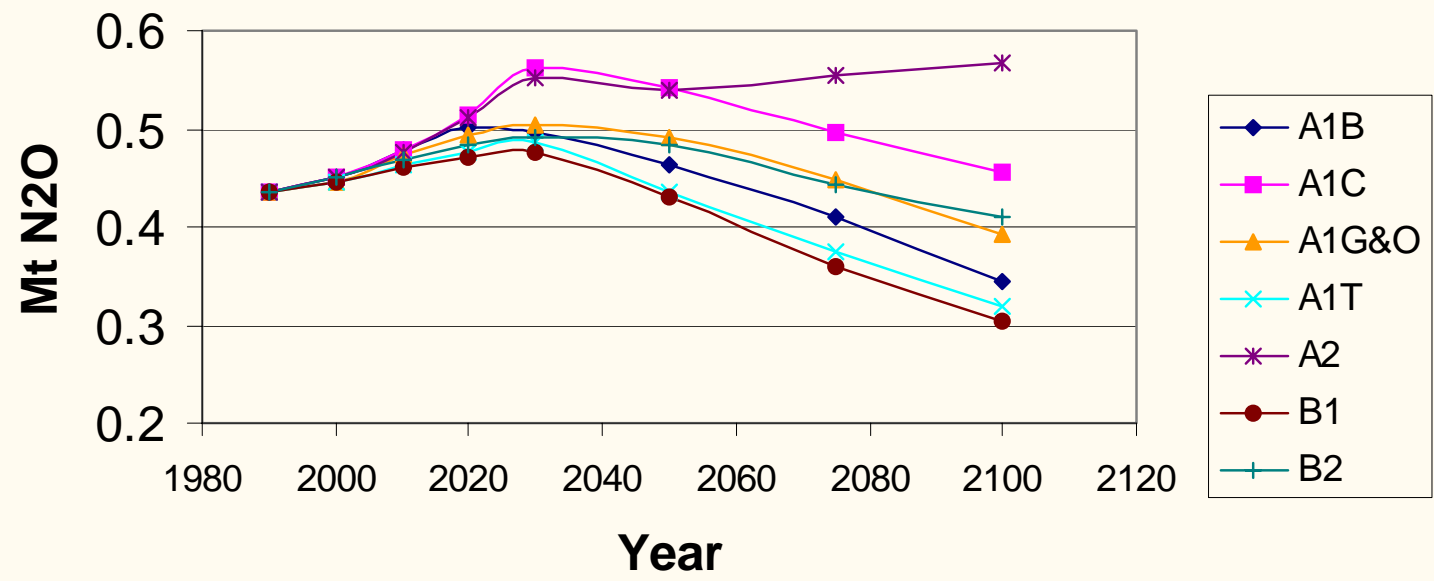
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CO Emission of China



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N2O Emission of China



IPCC Special Report on Emission Scenarios (SRES)

NOx Emission of China

