The 21th AIM International Workshop
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Assessment of GHGs and SLCPs emissions projections in Asia based on SSP scenarios by using AIM/Enduse[Global]

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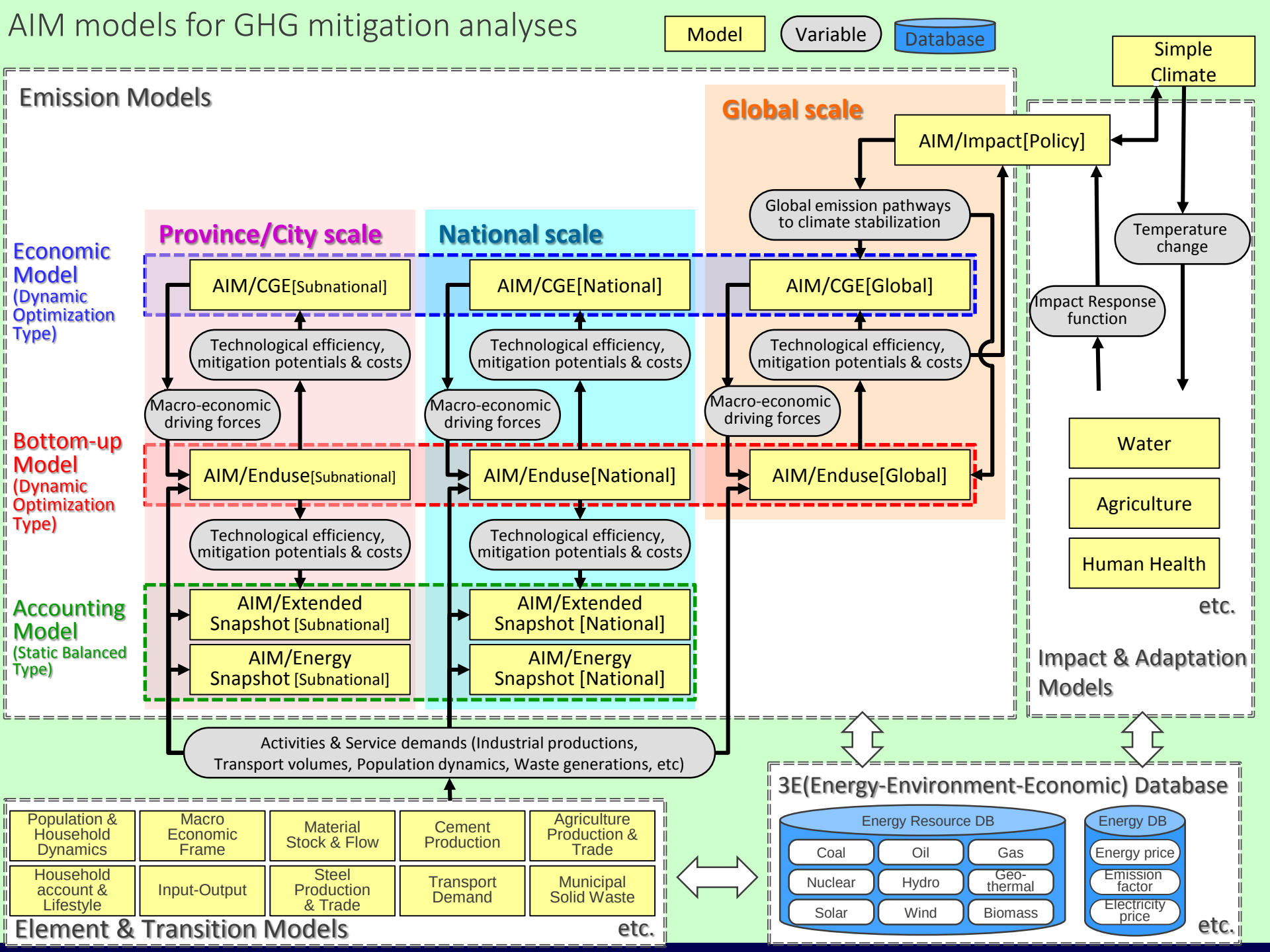
AIM ASIA-PACIFIC INTEGRATED MODEL

NIES JAPAN

AIM models for GHG mitigation analyses



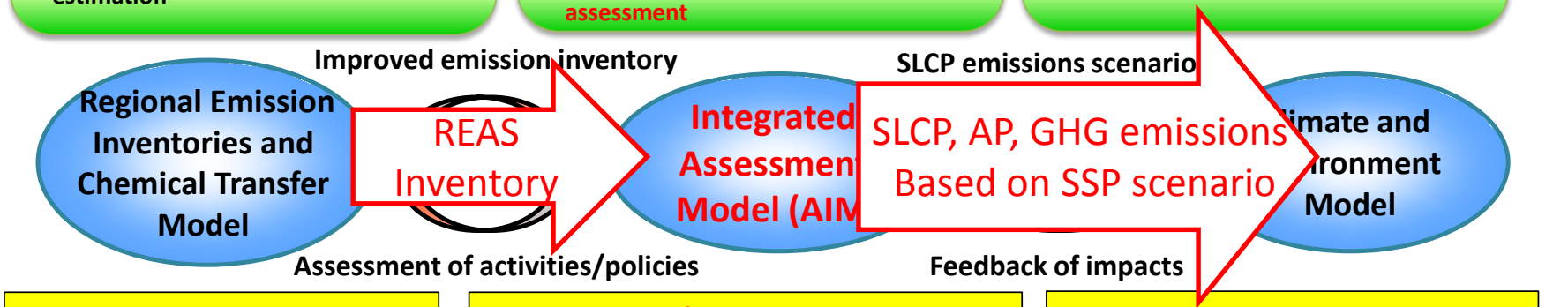
MOEJ-S12: Promotion of climate policies by assessing environmental impacts of SLCP and seeking LLGHG emissions pathways (FY2014-FY2018)

Goal: To develop an integrated evaluation system for LLGHG and SLCP mitigation policy, by interconnecting emission inventory, integrated assessment models, and climate models.

Theme 1: Air quality change event analysis
- Analysis on regional AQ change
- Development of emission inventory
- Inversion algorithms of emission estimation

Theme 2: Integrated model and future scenarios
- Global socio-economic scenarios
- National & regional emissions scenarios
- Urban & household emissions AQ assessment

Theme 3: SLCP impacts on climate & environment
- Impact assessment of aerosols & GHG
- Assessment of health, agriculture, water cycle, sea level rise



Chemical transfer model and emission inventory in Asia

AIM/Enduse model
Socio-economical & emissions scenario

Climate model, earth system model
Climate change impact & adaptation

Theme 4: Integrated operation system (Toolkits, data archive)

Science

Model improvement

Experiment setup
Database development
Metric definitions

Stakeholders
Policy makers

System utilization

CCAC, UNFCC, IPCC, EANET
Proposal and assessment of climate and air pollution policies

Society

Information transmission

MDG・SDG・Future Earth

Regional strategy
⇅
Global strategy

AIM
ASIA-PACIFIC INTEGRATED MODEL

AIM/Enduse[Global]
- Target Gases and Sectors -

	CO2	CH4	N2O	HFCs	PFCs	SF6	CFCs	HCFCs	SO2	NOx	BC	OC	PM10	PM2.5	CO	NH3	VOC	Hg
Fuel combustion	✔	✔	✔						✔	✔	✔	✔	✔	✔	✔	✔	✔	
Industrial process	✔	✔	✔	✔	✔	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔	✔	
Agriculture		✔	✔													✔		
Waste		✔	✔															
Fuel mining		✔																
Others	✔	✔	✔															

Note) Emission factors are set by energy, sector and region over time.

Mitigation measures listed in the following sectors are considered in the AIM/Enduse[Global] model

Sector	Sub sectors whose mitigation actions are considered in Enduse model (other subsectors are treated as scenario)
Power generation	Coal power plant, Oil power plant, Gas power plant, Renewable (Wind, Biomass, PV)
Industry	Iron and steel, Cement Other industries（Boiler, Motor etc）
Transportation	Passenger vehicle, Truck, Bus, Ship, Aircraft, Passenger train, Freight train (except for pipeline transport and international transport)
Residential & Commercial	Cooling, Heating, Hot-water, Cooking, Lighting, Refrigerator, TV
Agriculture	Livestock rumination, Manure management, Paddy field, Cropland
MSW	Municipal solid waste,
Fugitive	Fugitive emission from fuel
Fgas emissions	By-product of HCFC-22, Refrigerant, Aerosol, Foams, Solvent, Etching, Aluminum production, Insulation gas, others.

Base-Year Calibration and Regional Classification

[Base-Year] : 2010

- Base-Year emissions in Asia are calibrated close to **REAS(Regional Emissions Inventory in Asia)**
- Base-Year emissions in Annex I countries are calibrated close to **UNFCCC official national inventory**
- Base-Year emissions in all other countries are calibrated close to EDGER4.2

(note: EDGER4.2 provides only up to 2008)

[Regional Classification]

- AIM/Enduse[Global] aggregates 32 regions in the world and 12 regions in Asia.
- Correspondence of sectoral classification and regional classification between REAS and AIM/Enduse[Global] is carefully checked.

24 regions in Asia in REAS inventory

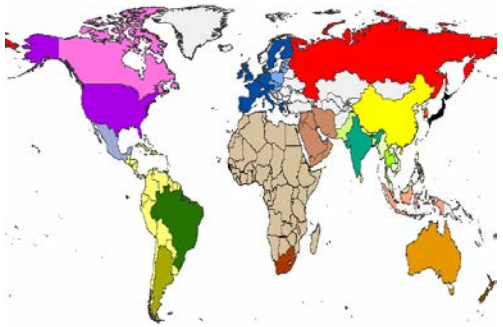
REAS	name	AIM/Enduse[Global]	name
CHN	China	CHN	China
TWN	Taiwan	XEA	Other East Asia
JPN	Japan	JPN	Japan
PRK	N.Korea	XEA	Other East Asia
KOR	S.Korea	KOR	Korea
MNG	Mongolia	XEA	Other East Asia
BRN	Brunei	XSE	Other South-east Asia
MMR	Myanmar	XSE	Other South-east Asia
KHM	Cambodia	XSE	Other South-east Asia
IDN	Indonesia	IDN	Indonesia
LAO	Laos	XSE	Other South-east Asia
MYS	Malaysia	MYS	Malaysia
PHL	Philippines	XSE	Other South-east Asia
SGP	Singapore	XSE	Other South-east Asia
VNM	Vietnam	VNM	Viet Nam
THA	Thailand	THA	Thailand
AFG	Afghanistan	XSA	Other South Asia
BGD	Bangladesh	XSA	Other South Asia
BTN	Bhutan	XSA	Other South Asia
LKA	Sri Lanka	XSA	Other South Asia
IND	India	IND	India
MDV	Maldives	XSA	Other South Asia
NPL	Nepal	XSA	Other South Asia
PAK	Pakistan	XSA	Other South Asia

Annex I (exact)

JPN (Japan)	USA (United States)	CAN (Canada)	KOR (Korea)
AUS (Australia)	XE15 (Western EU-15)	TUR (Turkey)	MEX (Mexico)
NZL (New Zealand)	XE10 (Eastern EU-10)	XEWI (Other Western EU in Annex I)	BRA (Brazil)
RUS (Russia)	XE2 (Other EU-2)	XEEI (Other Eastern EU in Annex I)	ARG (Argentine)
CHN (China)	XSA (Other South Asia)	XENI (Other EU)	XLM (Other Latin America)
IND (India)	XEA (Other East Asia)	XCS (Central Asia)	ZAF (South Africa)
IDN (Indonesia)	XSE (Other South-East Asia)	XOC (Other Oceania)	XAF (Other Africa)
THA (Thailand)	MYS (Malaysia)	VNM (Viet Nam)	XME (Middle East)

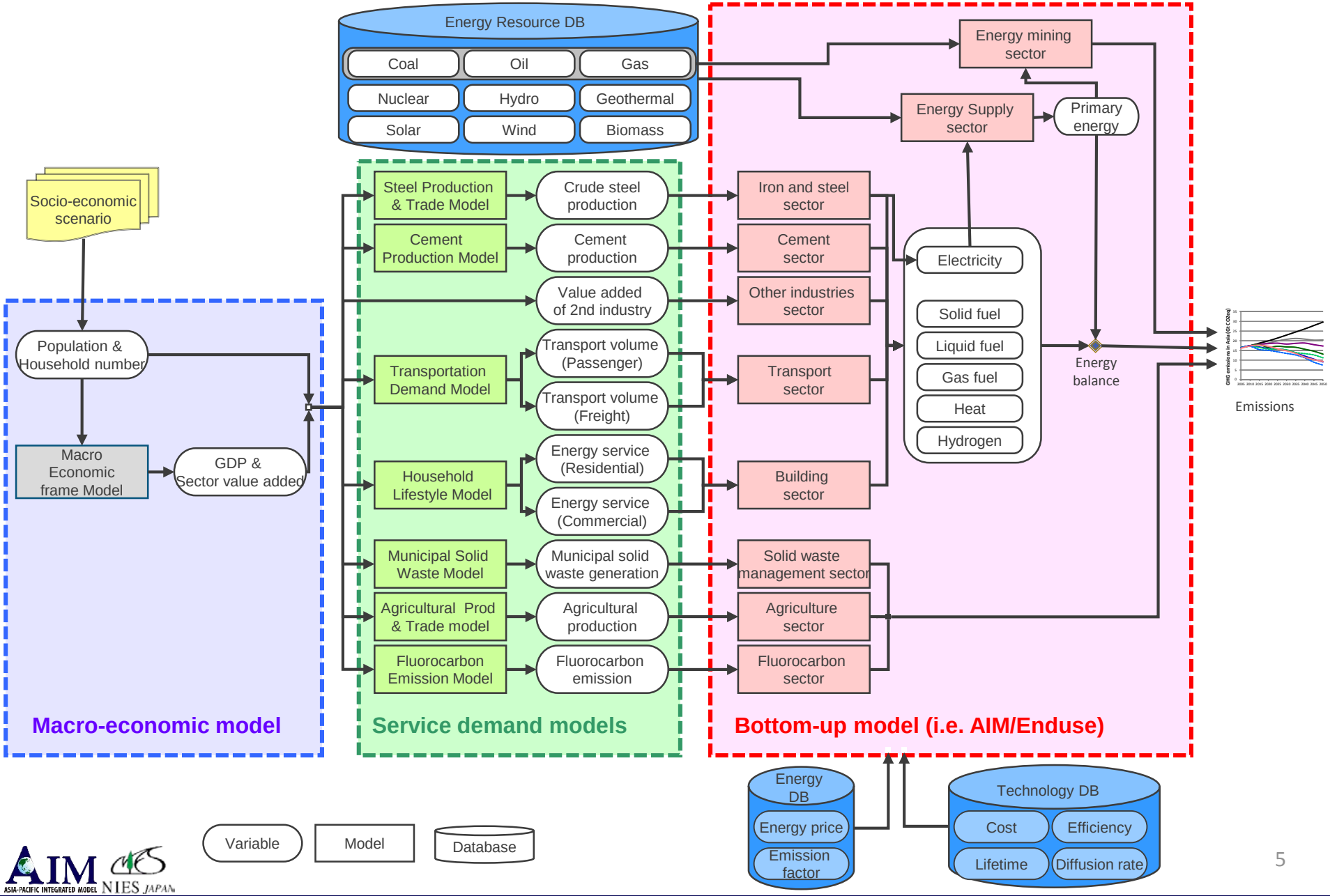
OECD (approx)

ASEAN (exact)

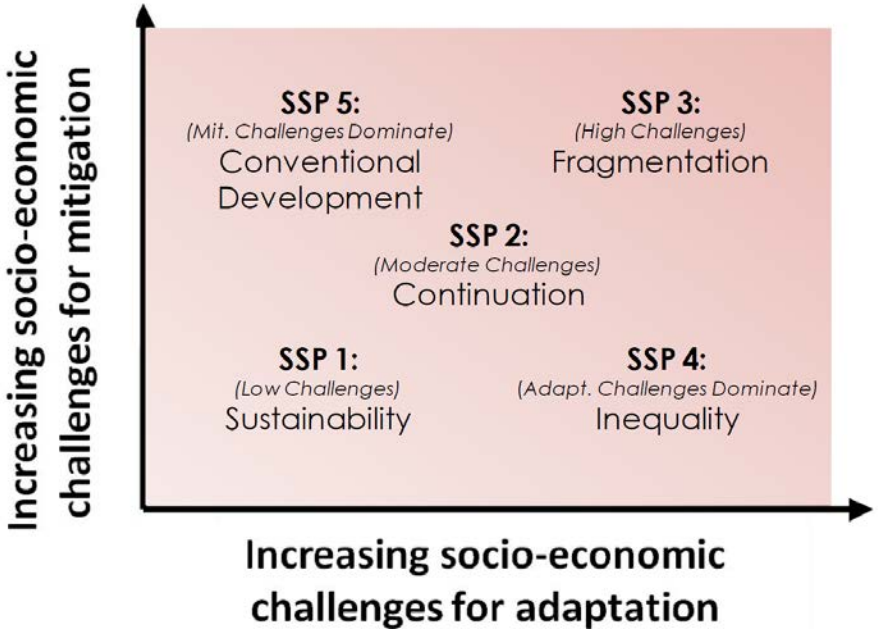


Global 32 regions

Overview of AIM/Enduse[Global] and element models



SSPs (Shared Socioeconomic Pathways)



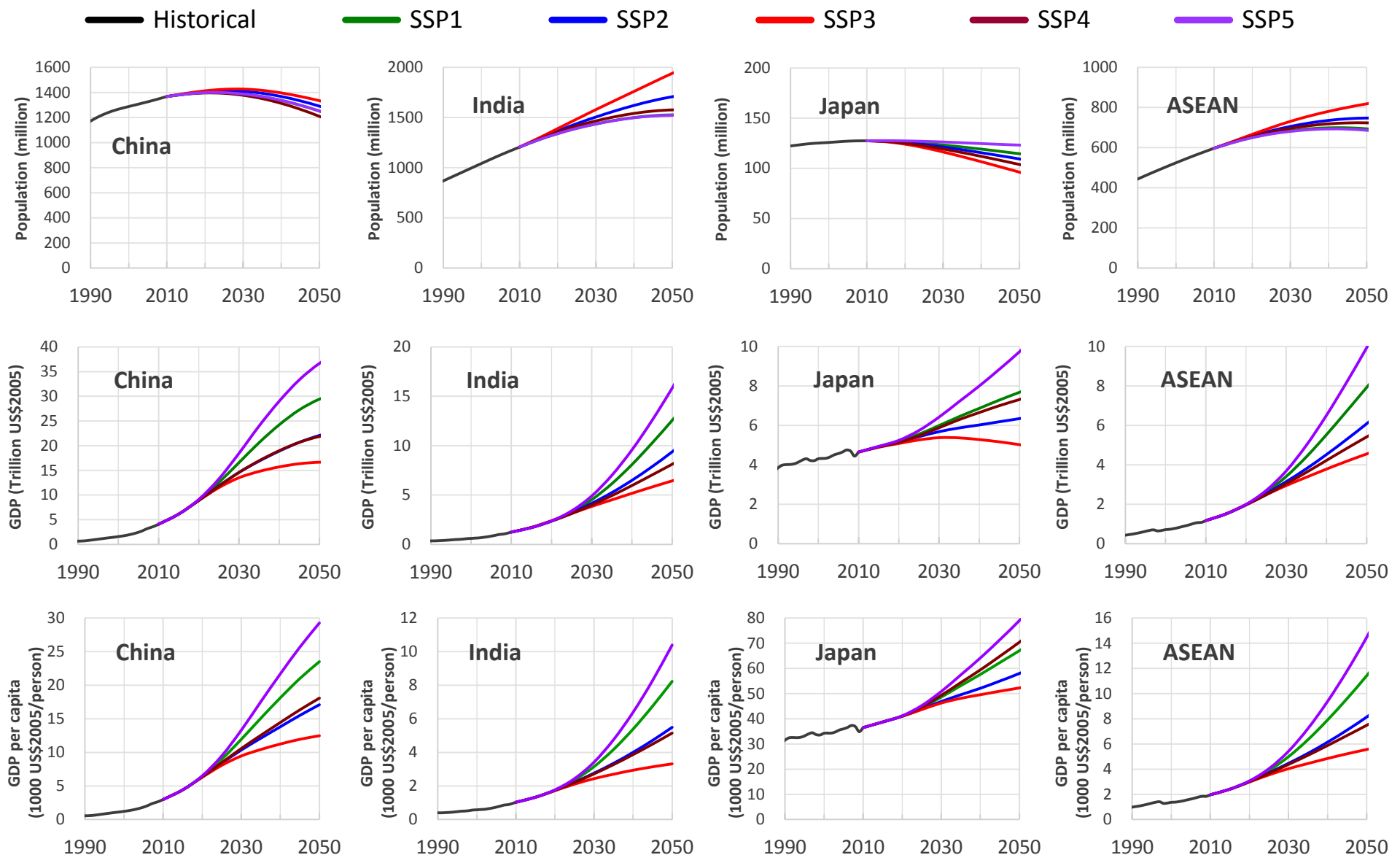
(O'Neill, 2012)

Source) https://secure.iiasa.ac.at/web-apps/ene/SspDb/dsd?Action=htmlpage&page=about

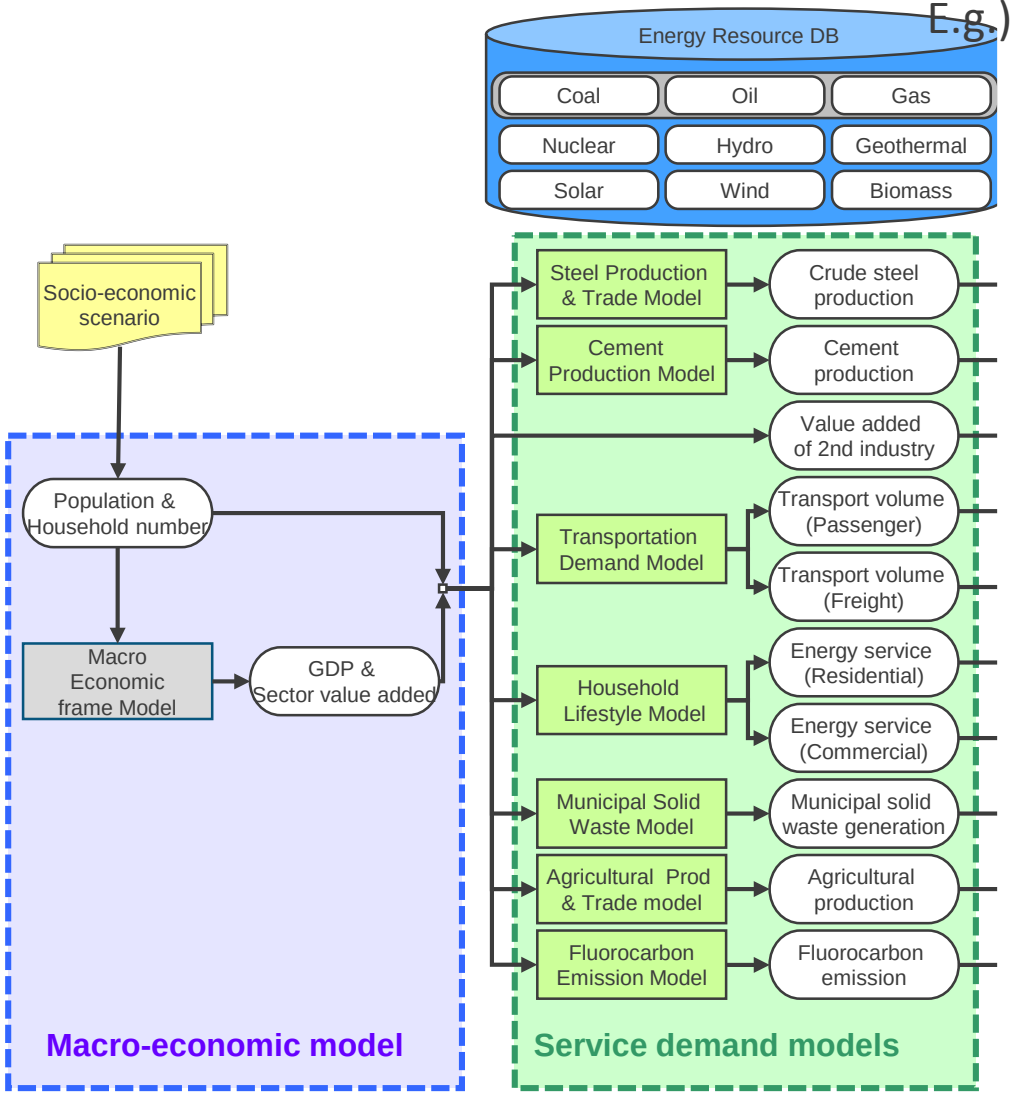
Example of how to translate narrative scenarios to quantitative scenarios in this study

- Using basic socio-economic data (GDP, POP, GDP per capita) provided by SSP
- Changing energy compositions constraints (e.g. Coal power plant remains more such as SSP3, SSP5 > SSP2 > SSP1, SSP4. Renewables can be introduced more such as SSP1, SSP4>SSP2> SSP3, SSP5)
- Changing level of GHG mitigation technology implementations (e.g. Payback period is longer such as SSP1 > SSP2,SSP4,SSP5 > SSP3 due to increasing environmental awareness.)
- Changing level of Air Pollutants mitigation technology implementations (e.g. Higher policy pushes and pollutions are more controlled such as SSP1 > SSP2,SSP4,SSP5 > SSP3.)

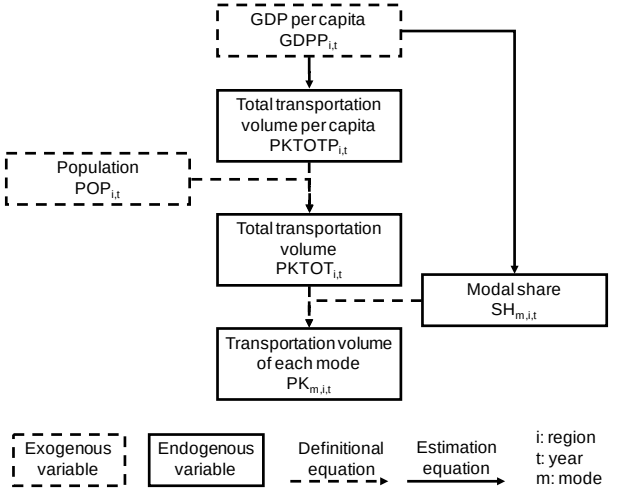
Socio-economic scenarios in Asia

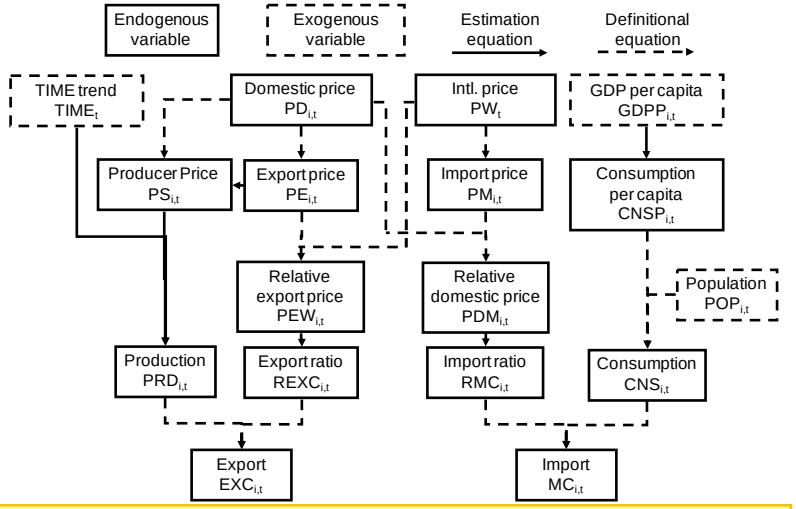


Overview of AIM/Enduse[Global] and element models



E.g.) Passenger transport volume estimation mode

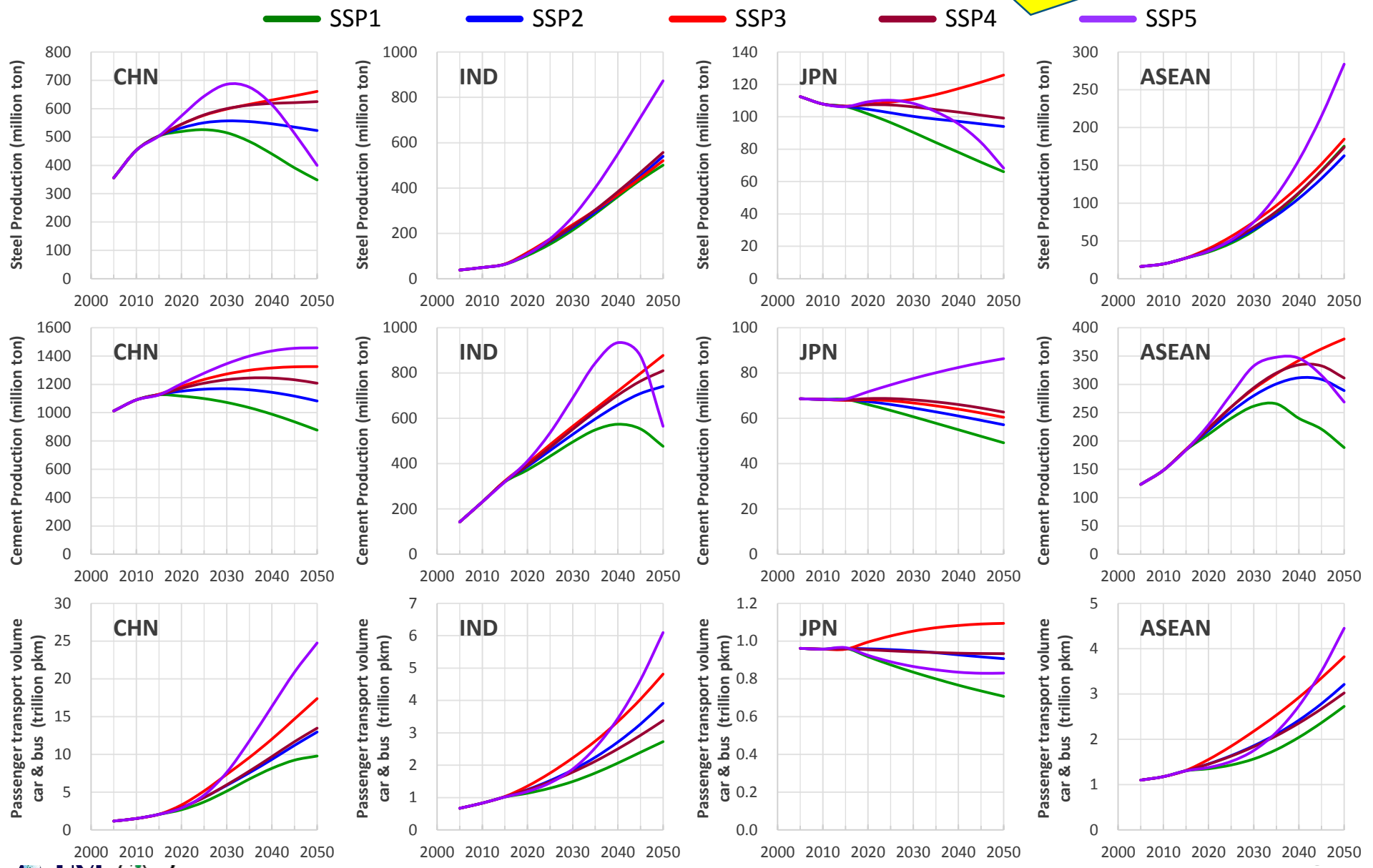




Consider socie-economic features to future service demand estimations in each sector and country (i.e. POP, GDP, are consistent across sectors and countries)

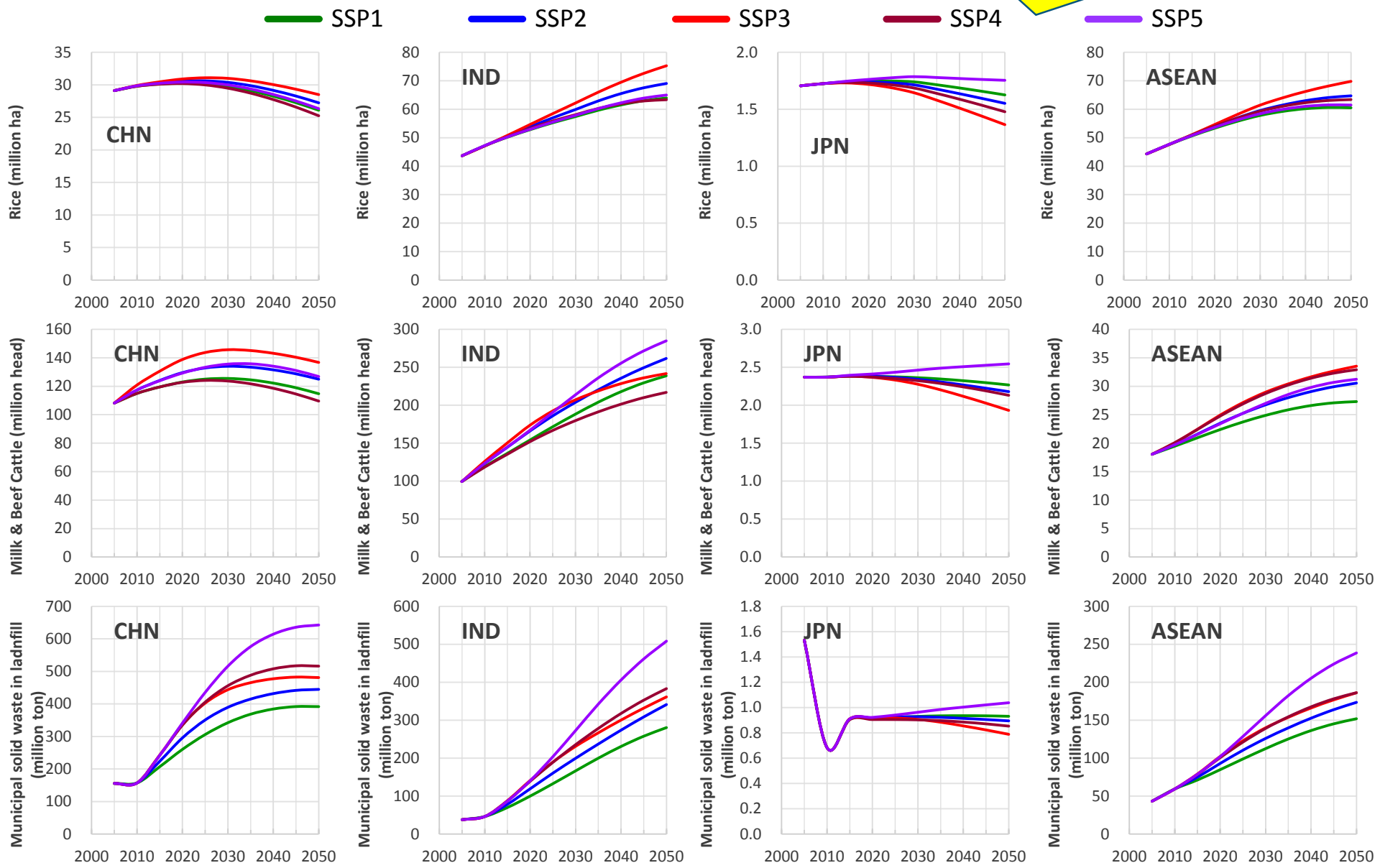
Service Demands estimations by SSP scenario - Sectors related to fossil fuel consumptions -

Need more modification, especially SSP4 & SSP5



Service Demands estimations by SSP scenario - Sectors related to non-fuel consumptions -

Need more modification, especially SSP4 & SSP5

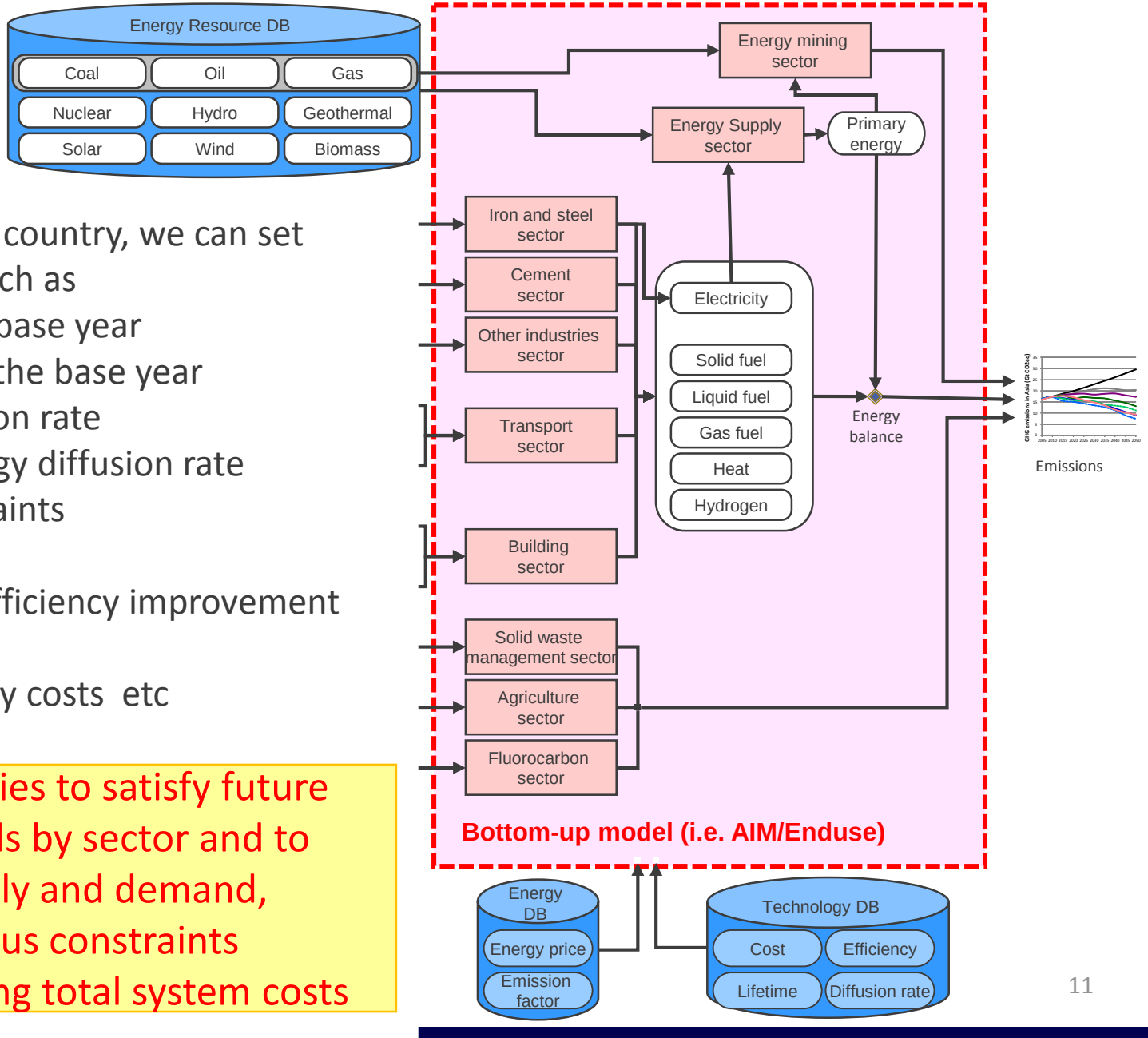


AIM/Enduse[Global] and element models

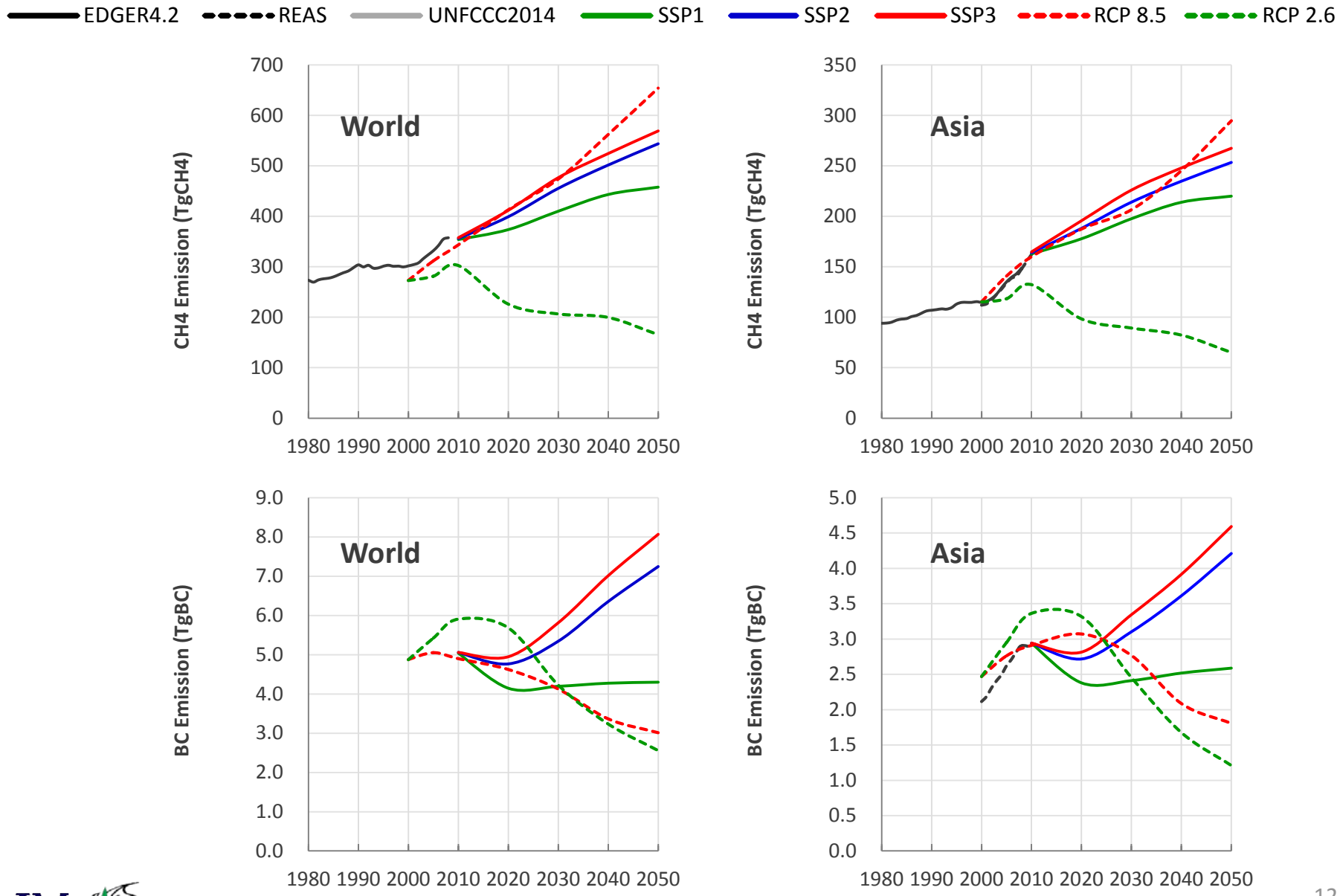
By energy, sector and country, we can set various constraints such as

- ✓ Technology in the base year
- ✓ Energy balance in the base year
- ✓ Technology diffusion rate
- ✓ Speed of technology diffusion rate
- ✓ Technology constraints
- ✓ Energy constraints
- ✓ Speed of energy efficiency improvement
- ✓ Technology cost
- ✓ Induced technology costs etc

Select technologies to satisfy future service demands by sector and to balance supply and demand, under various constraints & under minimizing total system costs



Short-Lived Climate Pollutants: CH_4 and BC Emissions - Global and Asia -



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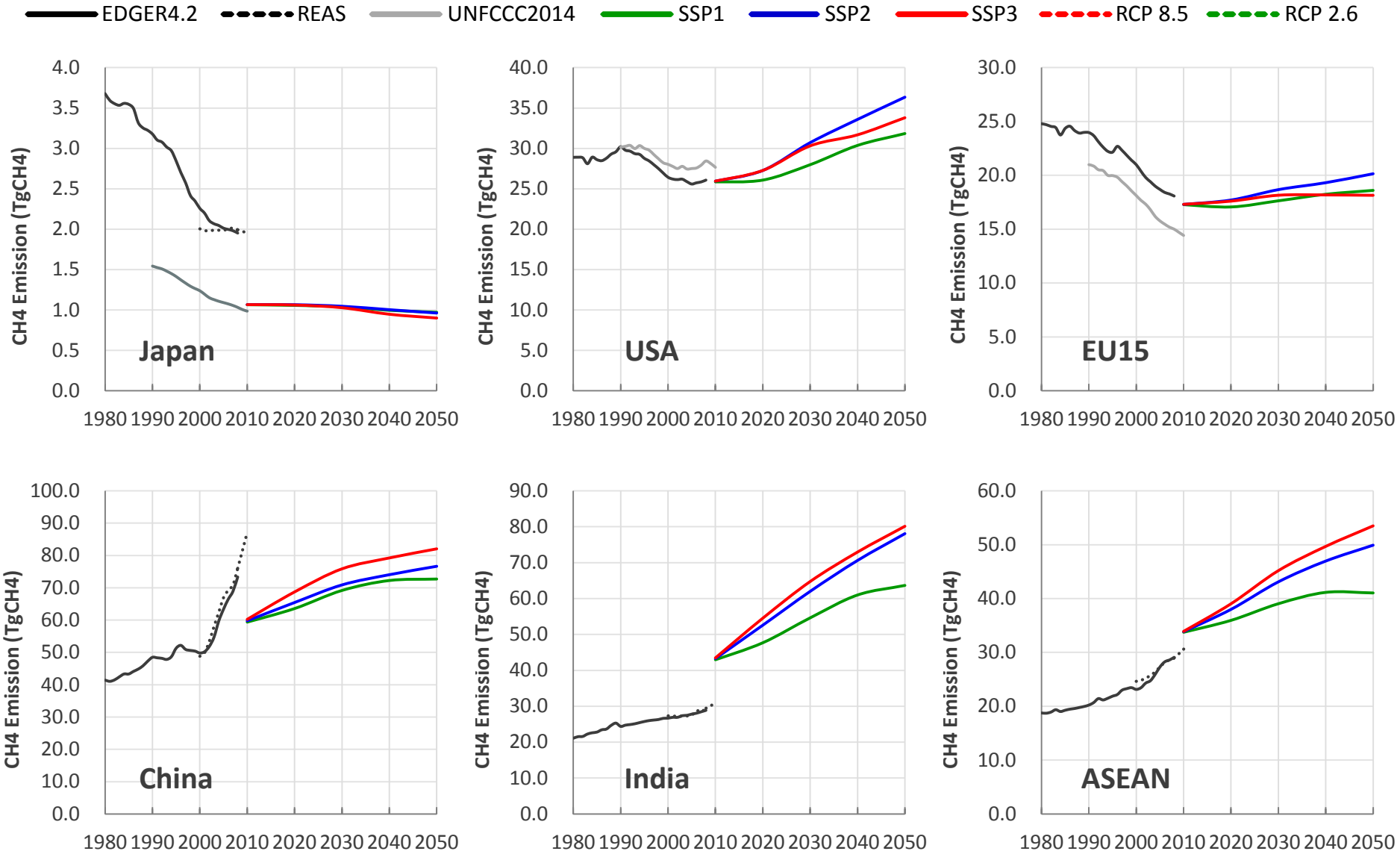
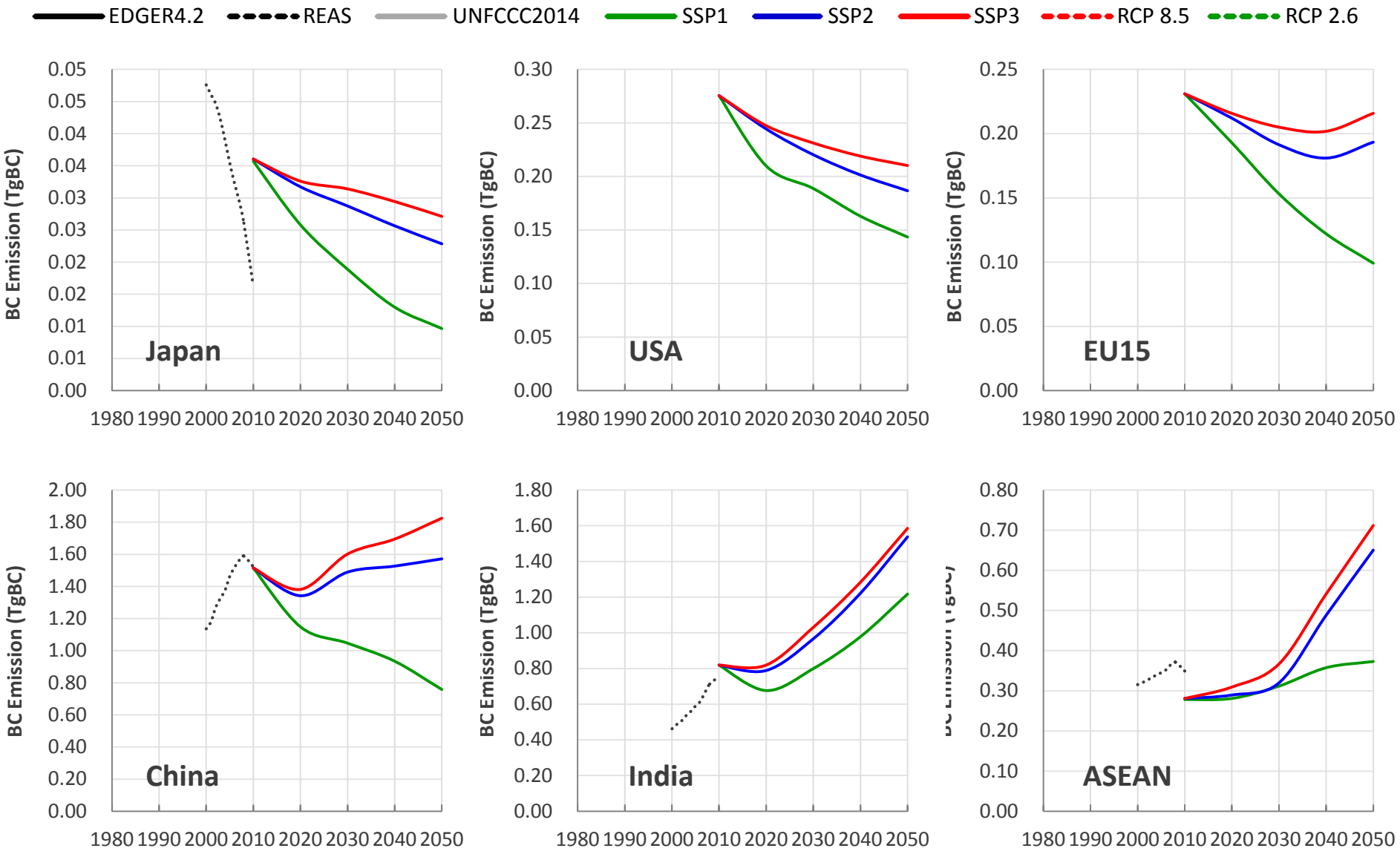
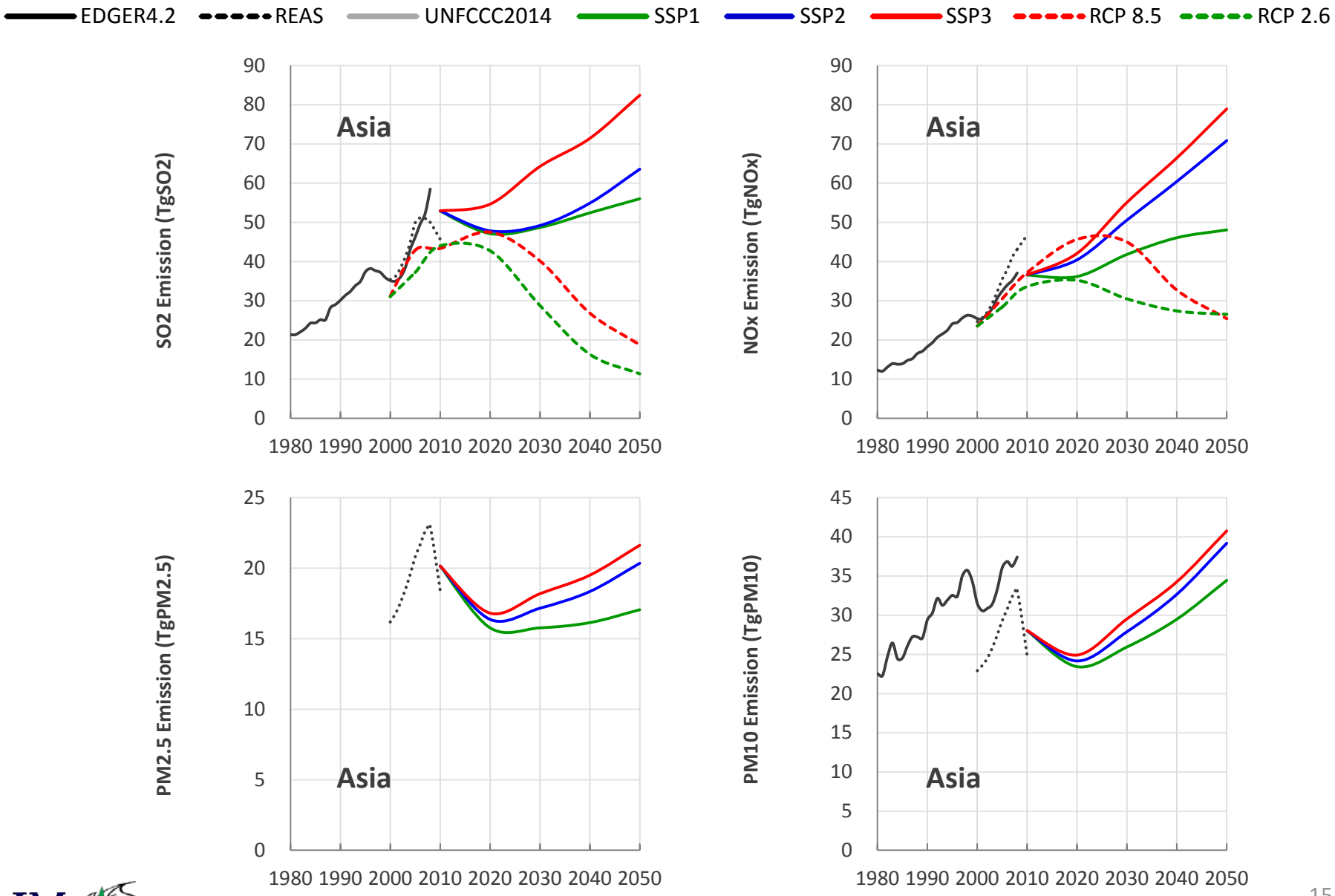
Short-Lived Climate Pollutants: CH_4 Emissions - Major countries in Annex I and Asia -



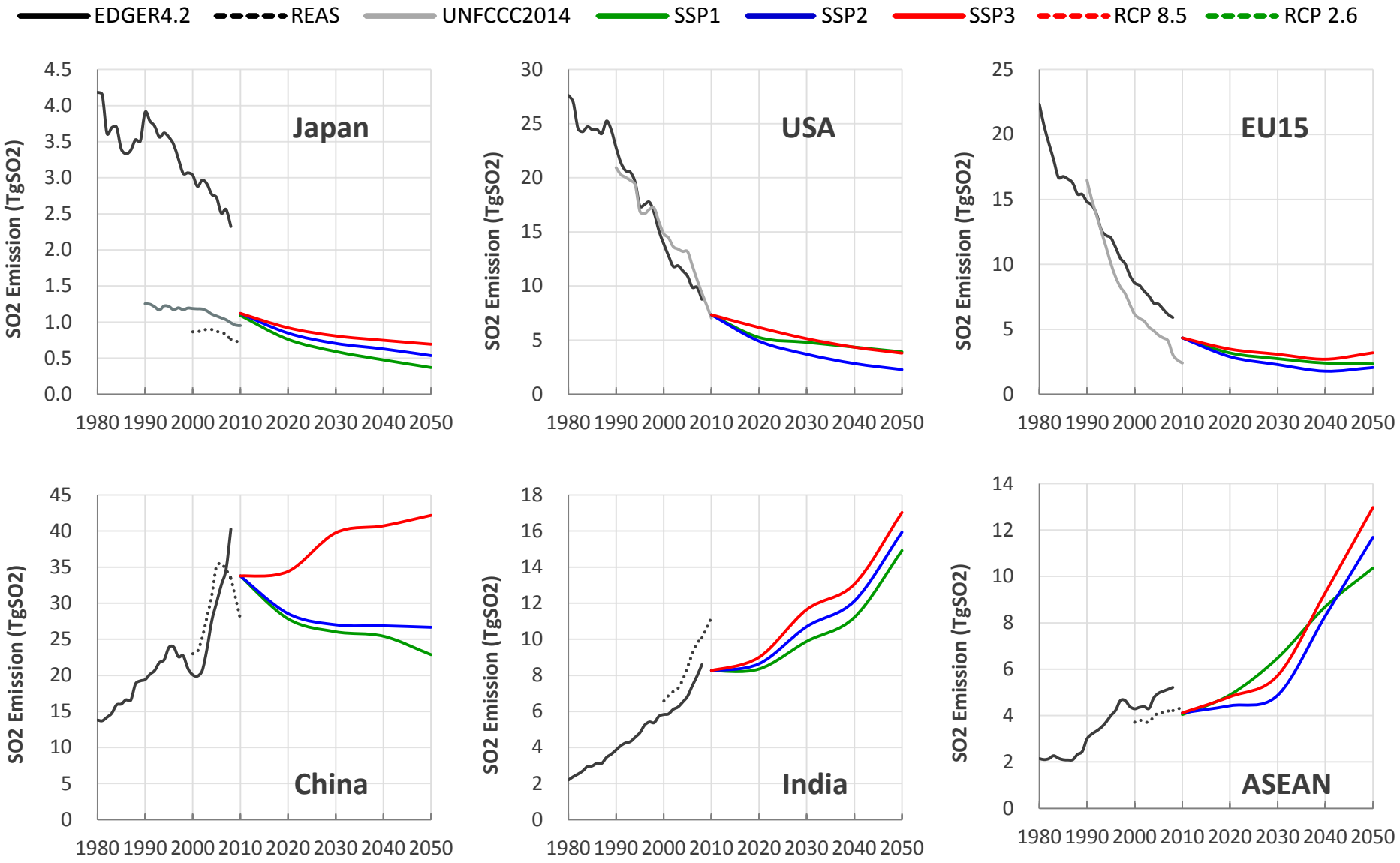
Short-Lived Climate Pollutants: BC Emissions
- Major countries in Annex I and Asia -



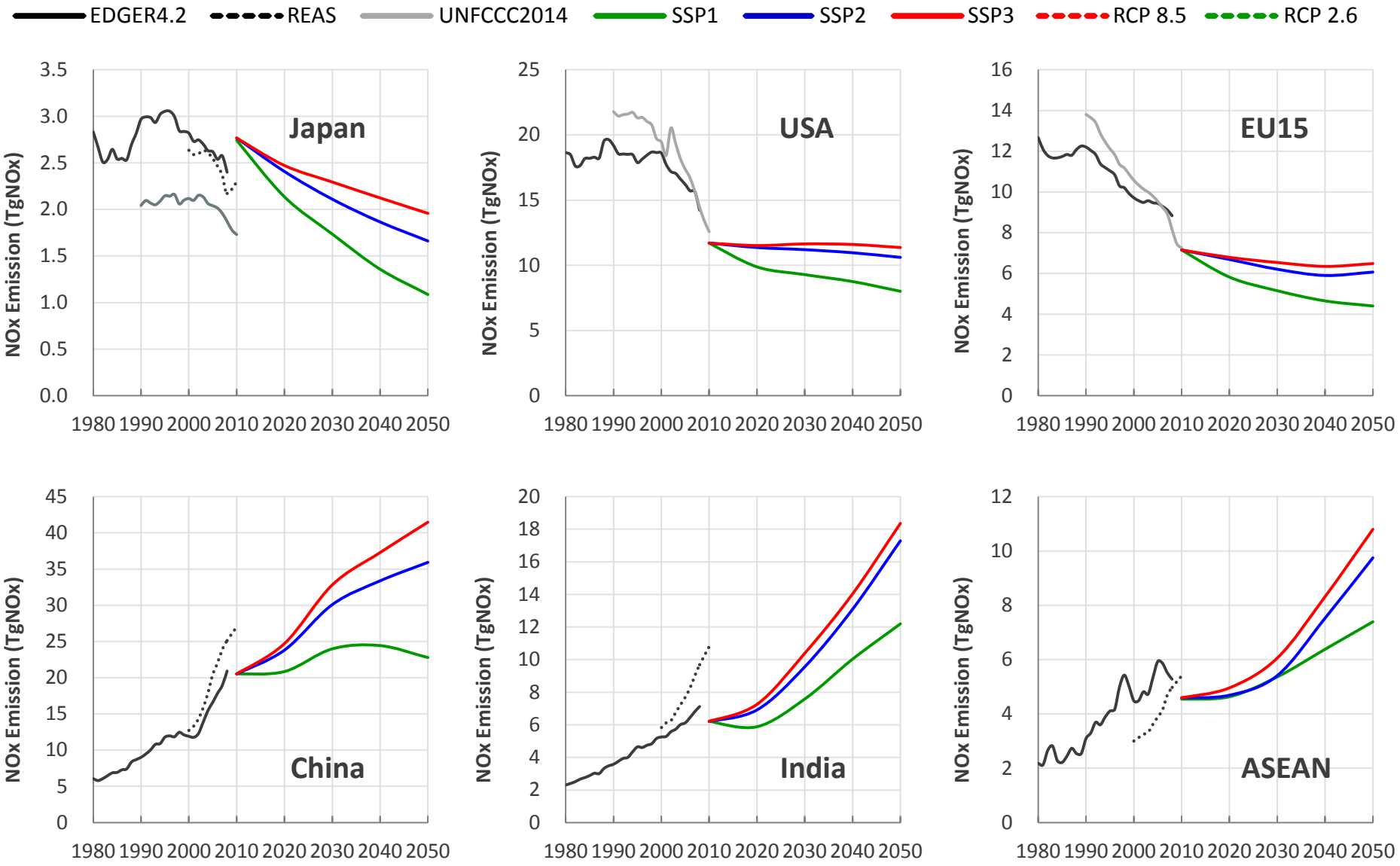
Air Pollutants: SO_2 , NOx, PM2.5, and PM10 Emissions - Asia -



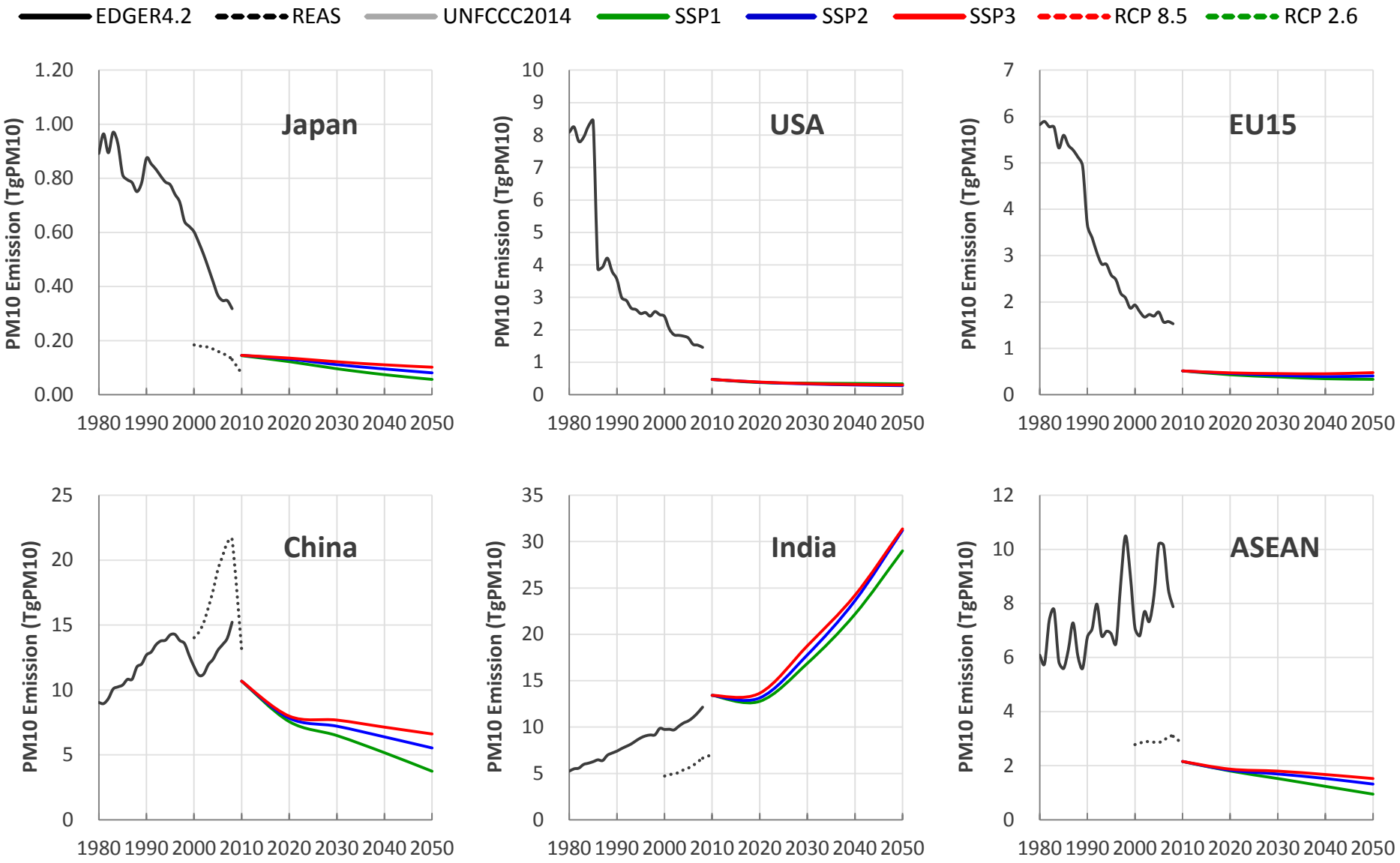
Air Pollutants: SO_2 Emissions
- Major countries in Annex I and Asia -



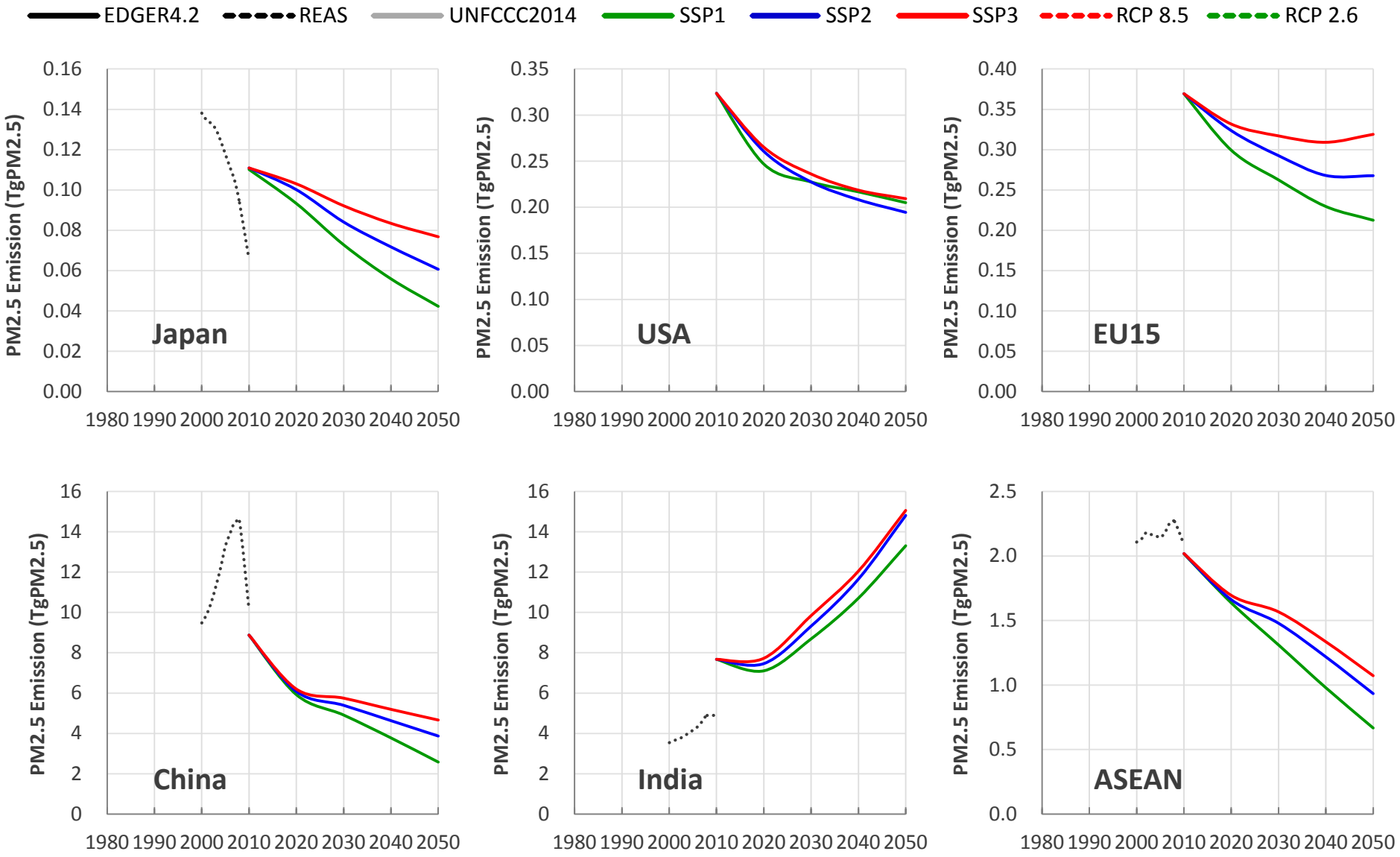
Air Pollutants: NOx Emissions
- Major countries in Annex I and Asia -



Air Pollutants: PM10 Emissions
- Major countries in Annex I and Asia -



Air Pollutants: PM2.5 Emissions
- Major countries in Annex I and Asia -



ご清聴ありがとうございました

Thank you for your attention