

Preliminary IAM scenarios based on the RCP/SSP framework

Keywan Riahi

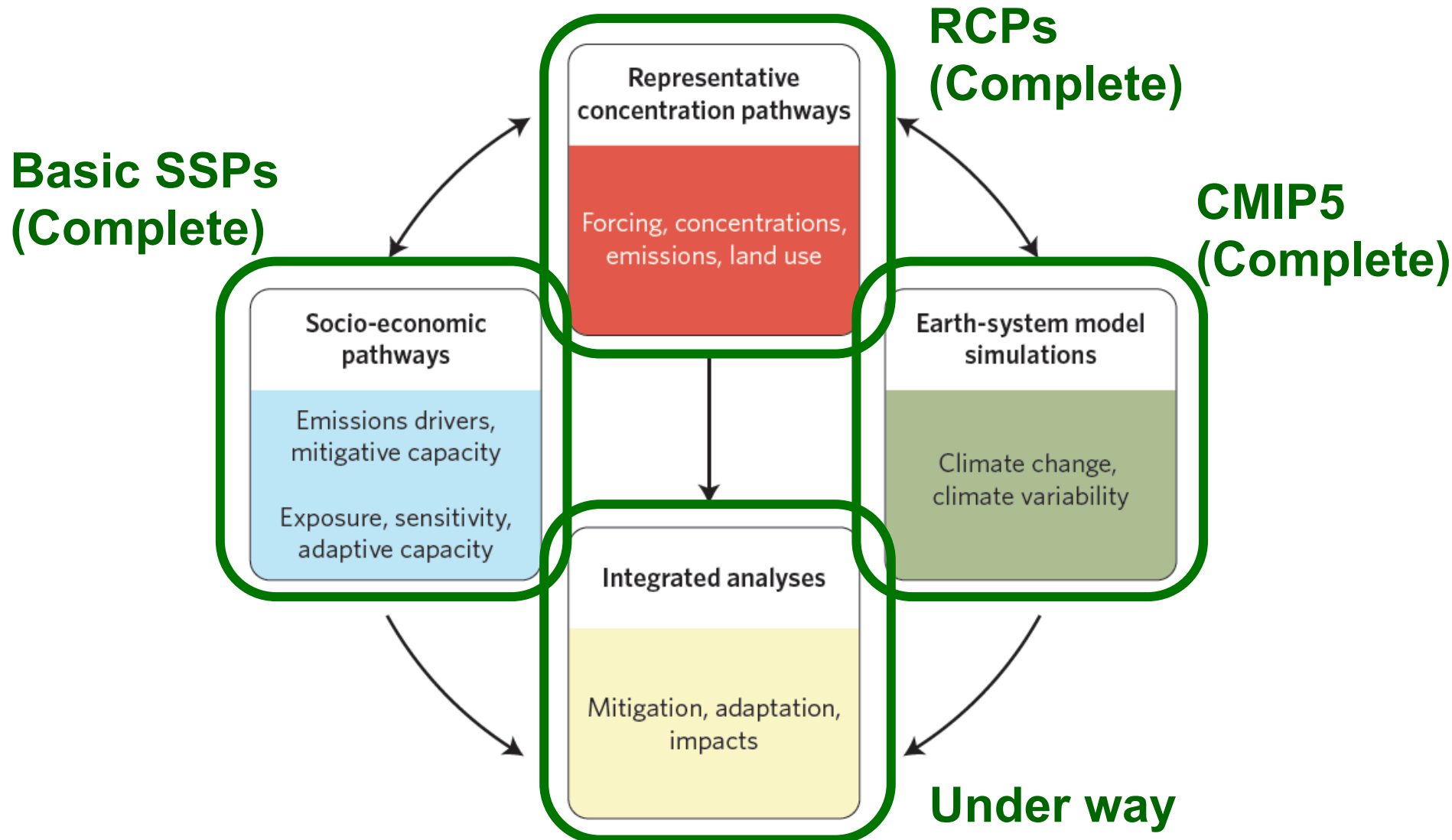
International Institute for Applied Systems Analysis

CCI/IA Workshop

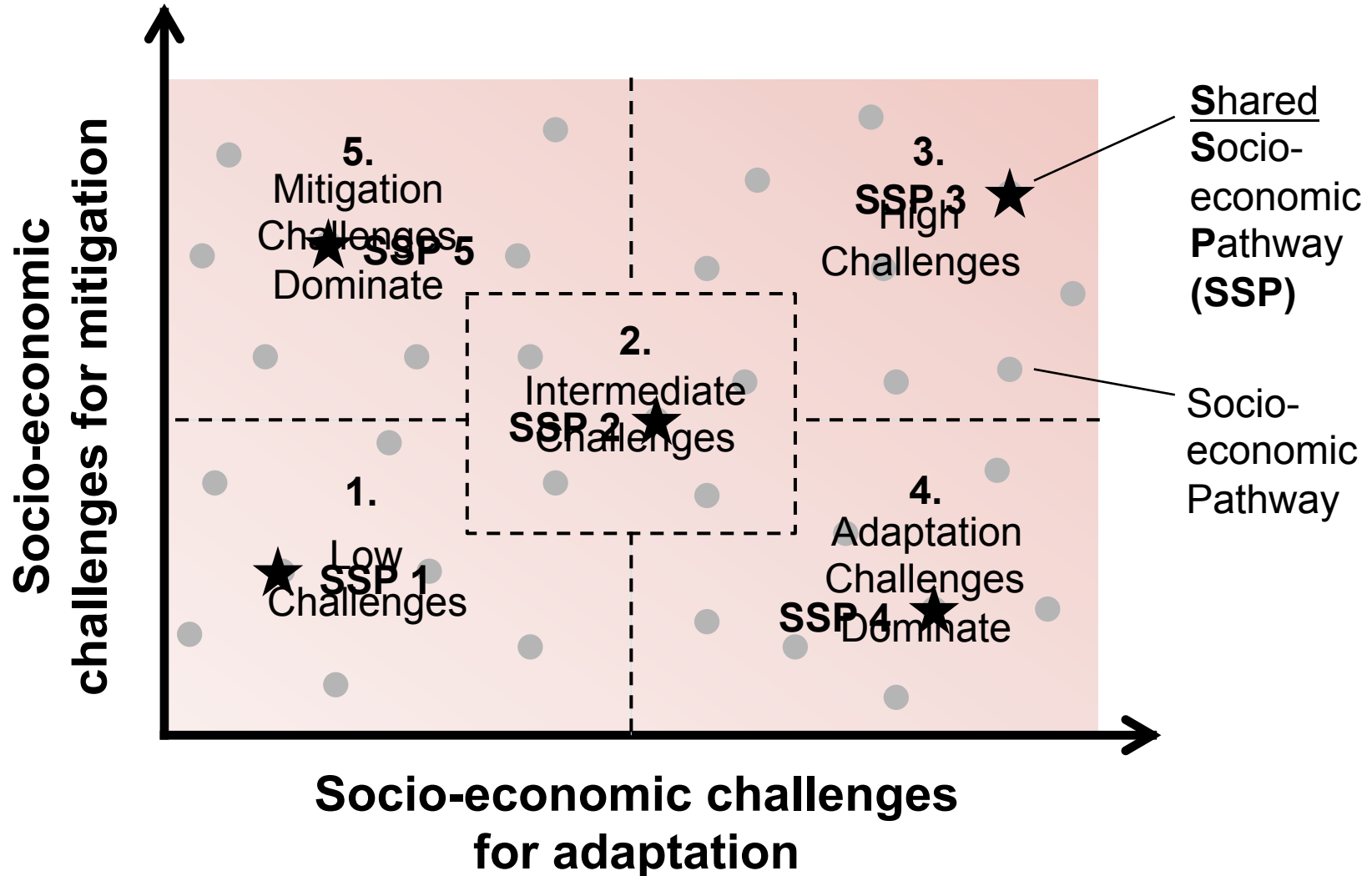
31 July 2013

Snowmass, Colorado

The Parallel Process

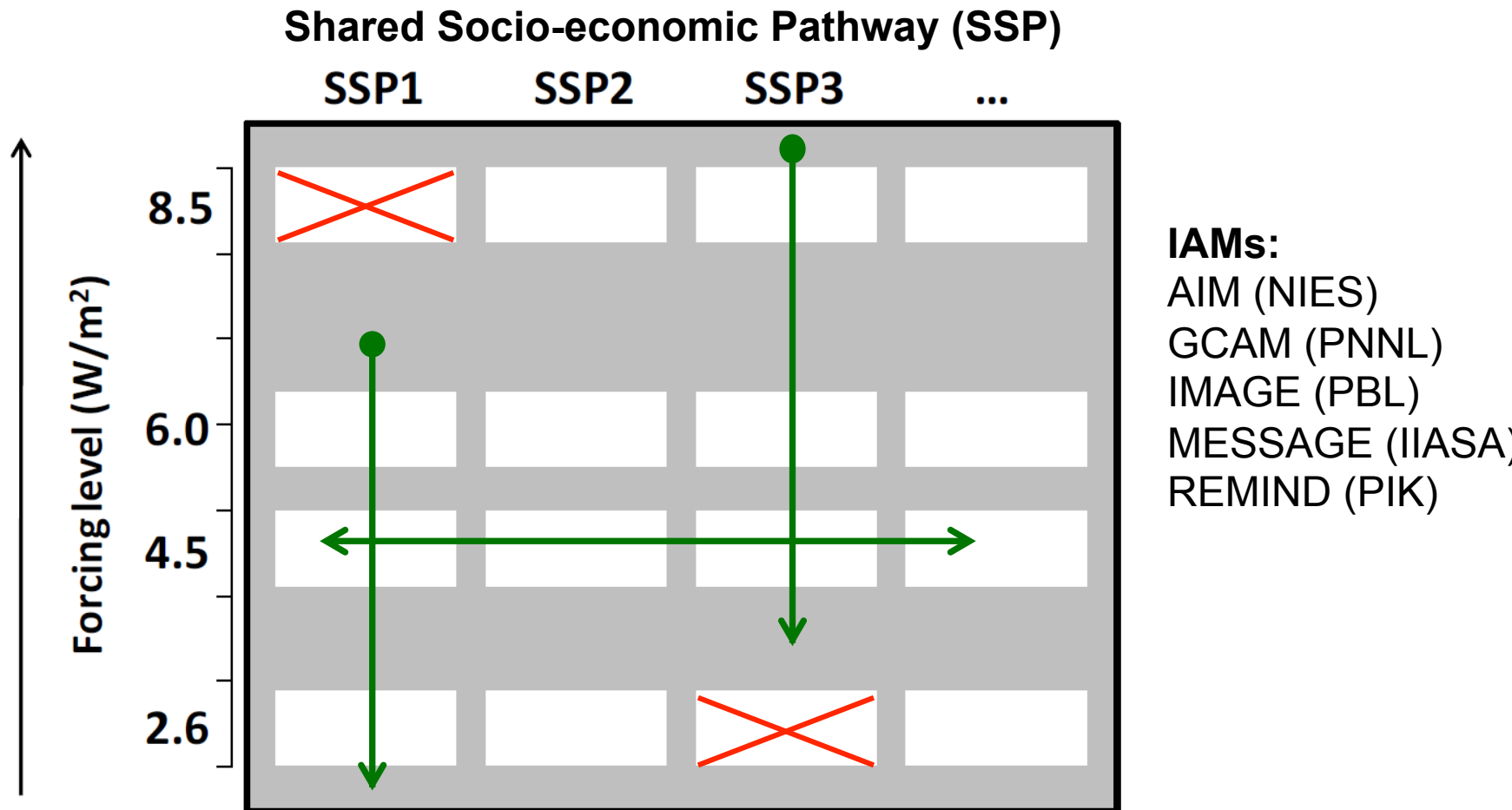


Purpose two: New shared pathways

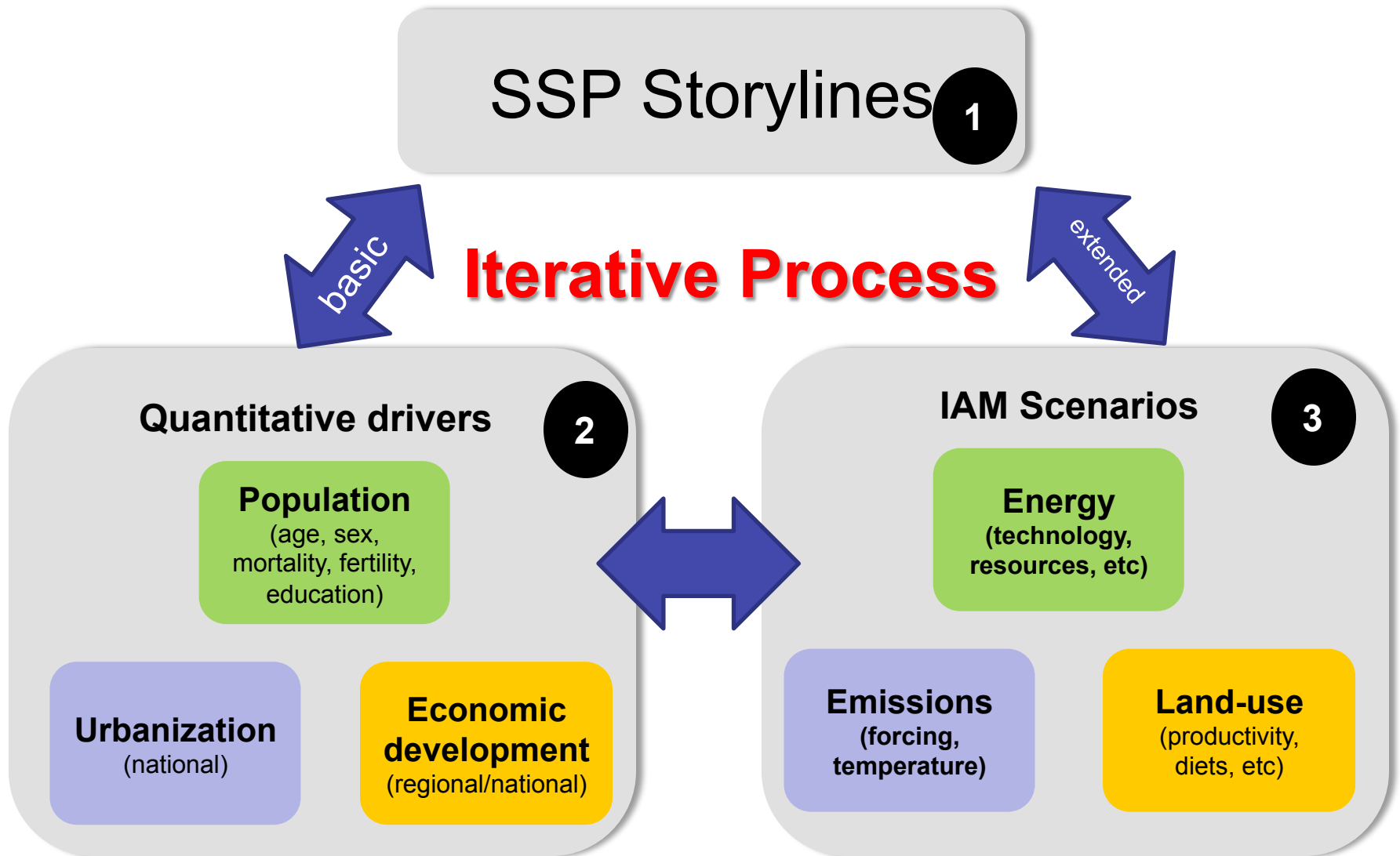




Exploration of climate policy dimension Matrix architecture



Key SSP elements (three main products + IAV variables)



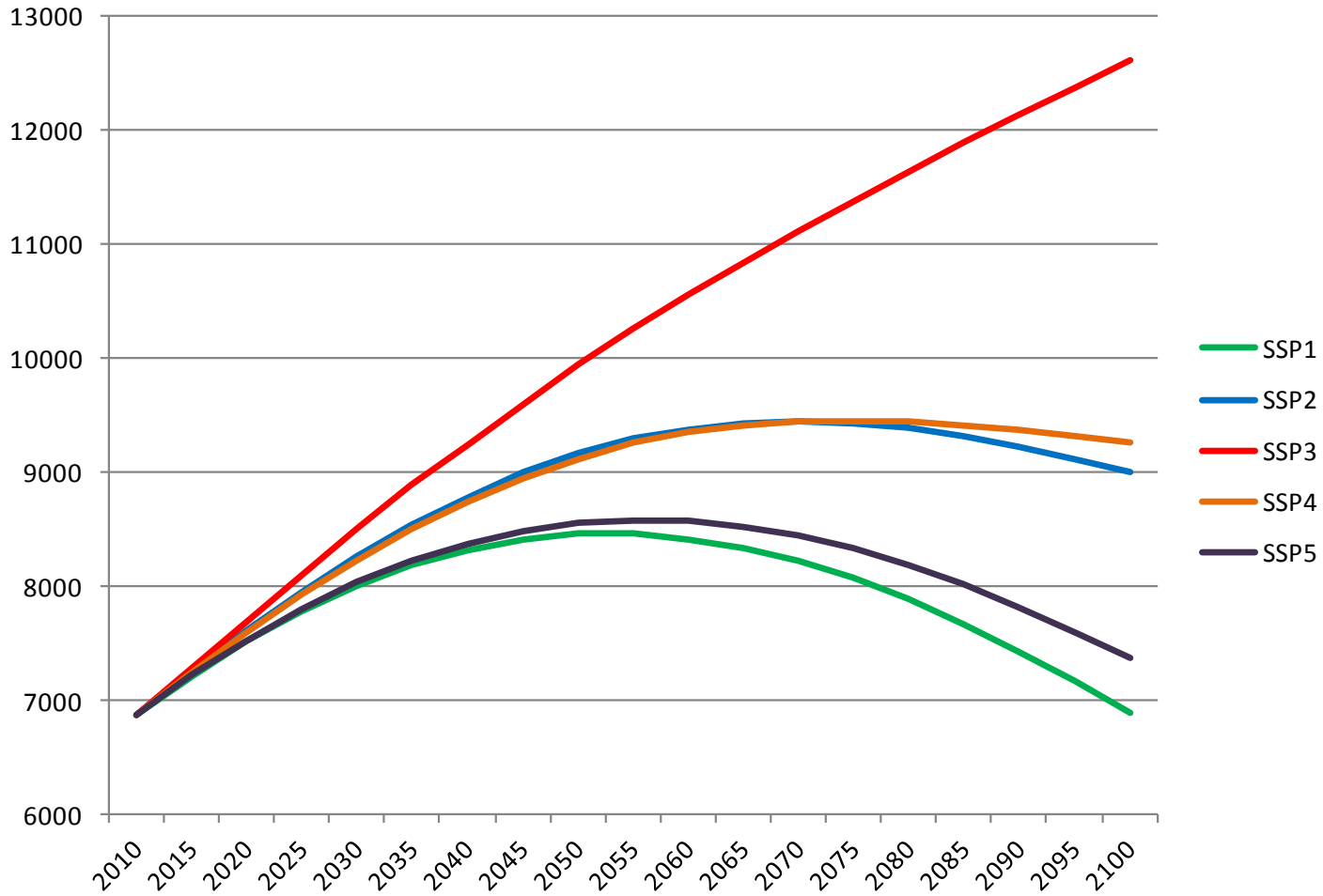
SSP Process

- Conceptual framework and nature of basic SSPs established
- Quantification of key elements of basic SSPs has been completed
- Narratives were refined based on community review (paper needs still to be submitted)
- Preliminary IAM scenarios ready for cross-model comparison and revisions
- Fast-track IAV analyses based on SSPs coming out (ISI-MIP, AgMIP, etc)
- Work in progress:
 - Continue vetting and development of SSP IAM scenarios
 - Define SPAs for refined stabilization analyses
 - Continue IAV analyses based on SSPs (multi year process)

SSP Driver Quantifications

- Country level projections:
 - Population
 - IIASA
 - Urbanization
 - NCAR
 - Economy
 - OECD
 - IIASA
 - PIK
- Status: Available and in use by various IAM and IAV comparison projects

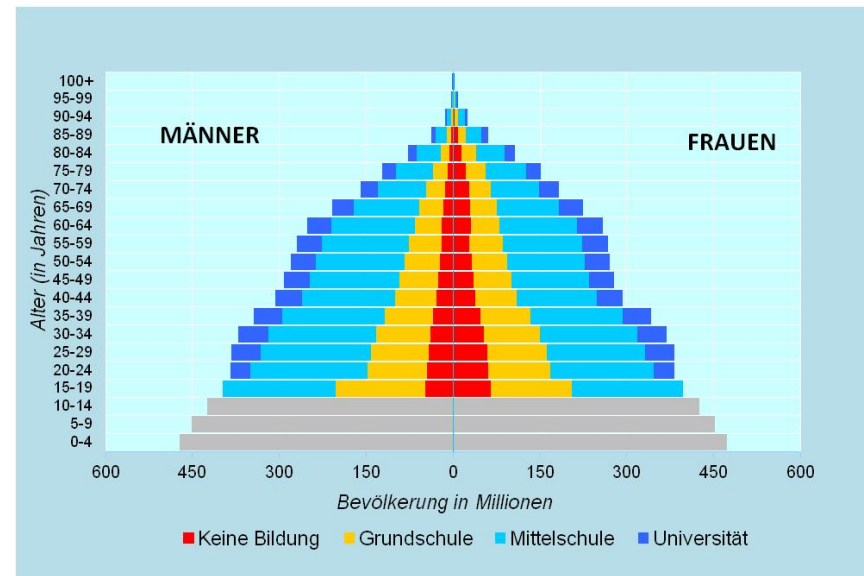
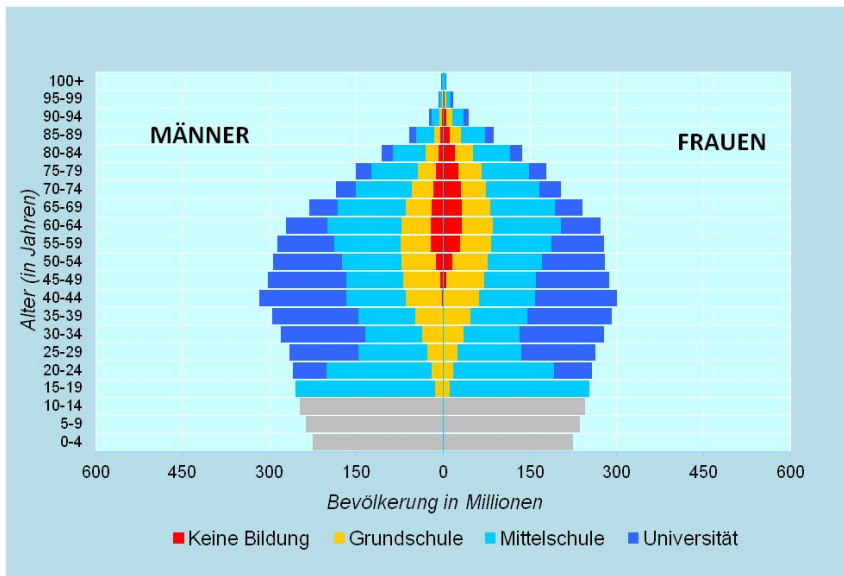
Global population for five SSPs



World 2050

SSP1 Pop=8673 Mio

SSP3 Pop=10603 Mio



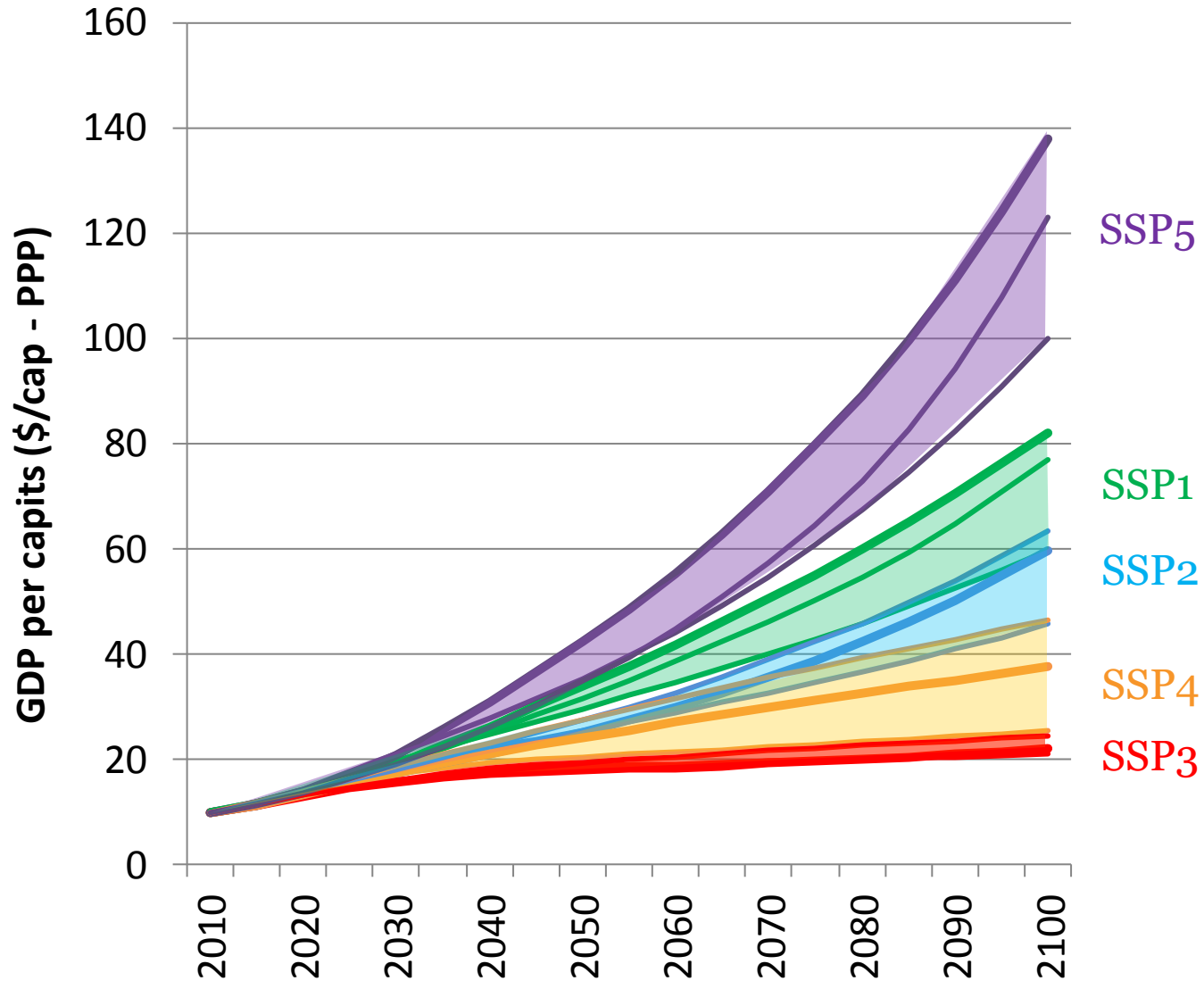
Common interpretation of the SSPs

OECD – IIASA - PIK

	Frontier TFP growth	Speed of convergence
SSP1: Sustainability	Medium high	High
SSP2: Middle of the road	Medium	Medium
SSP3: Fragmentation	Low	Low
SSP4: Inequality	Medium	Low Income: Low Middle Income: Medium High Income: Medium
SSP5: Conventional development	High	High

N.B. Quantitative interpretations and methodology differ between models, illustrating the uncertainties in making economic projections

Common interpretation of the SSPs OECD – IIASA - PIK



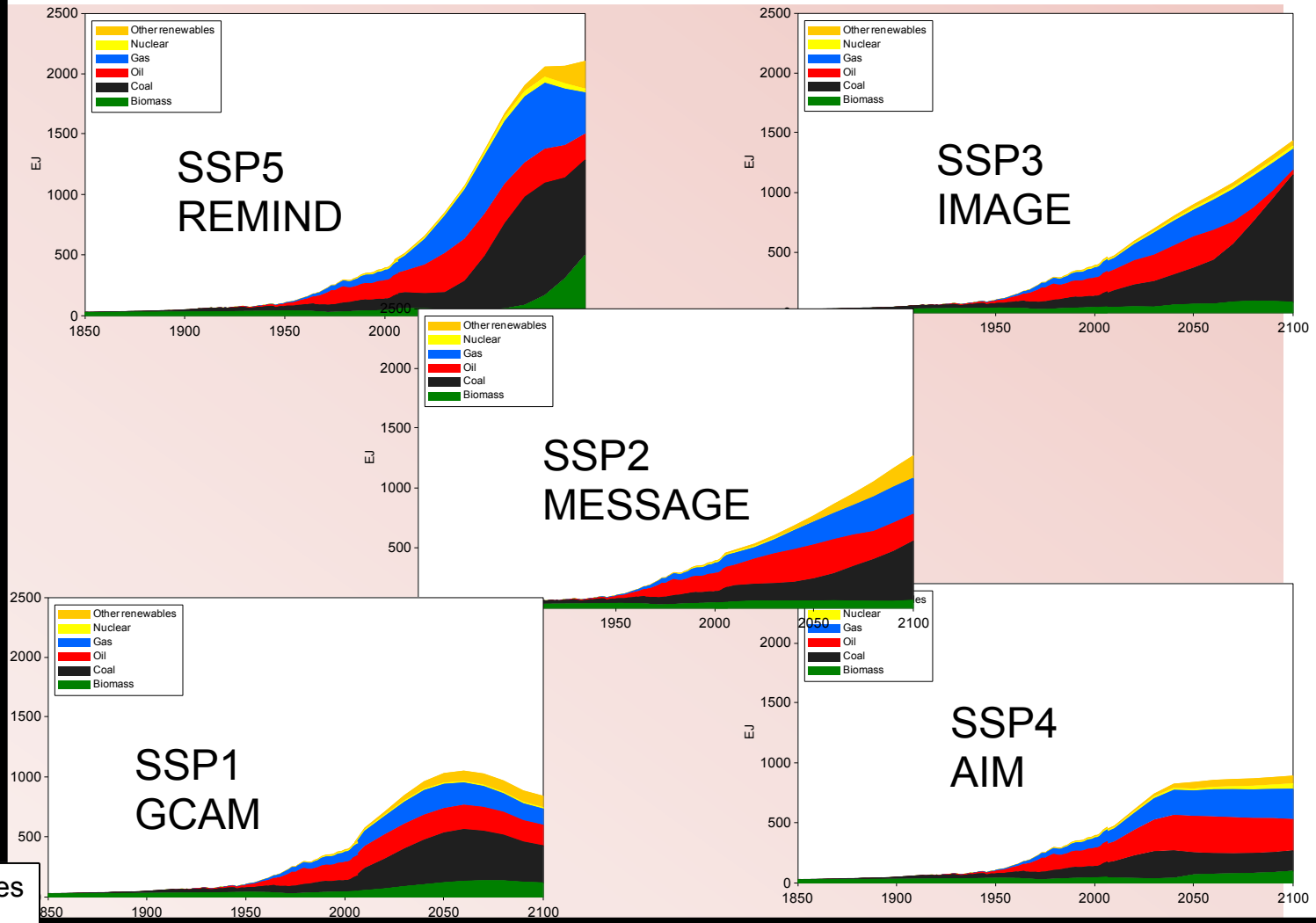
Extension of Storylines for IAM modeling (eg assumptions for energy demand)

SSP Element	SSP 1			SSP 2			SSP 3			SSP 4			SSP 5								
	<i>Country Income Groupings</i>																				
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High						
Non-climate Policies																					
Traditional Fuel Use	fast phase-out, driven by policies and economic development			intermediate phase-out, regionally diverse speed			continued reliance on traditional fuels			continued traditional fuel use among low income households			fast phase-out, driven by development priority								
Energy Demand Side																					
Lifestyles	modest service demands (less material intensive)			medium service demands (generally material intensive)			medium service demands (material intensive)			low service demands			modest service demands			high service demands (very material intensive)					
Environmental Awareness	high			medium			low			low			high			medium (low for global)					
Energy Intensity of Services																					
Industry	low			medium			high			high			low			medium					
Buildings	low			medium			high			medium			low/medium			medium					
Transportation	low			medium			medium			high			low/medium			low			high		
General Comments				some regional diversity																	

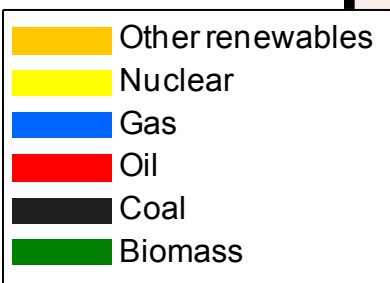
- Similar tables for tech change of supply, resource availability, and land-use change

Primary Energy

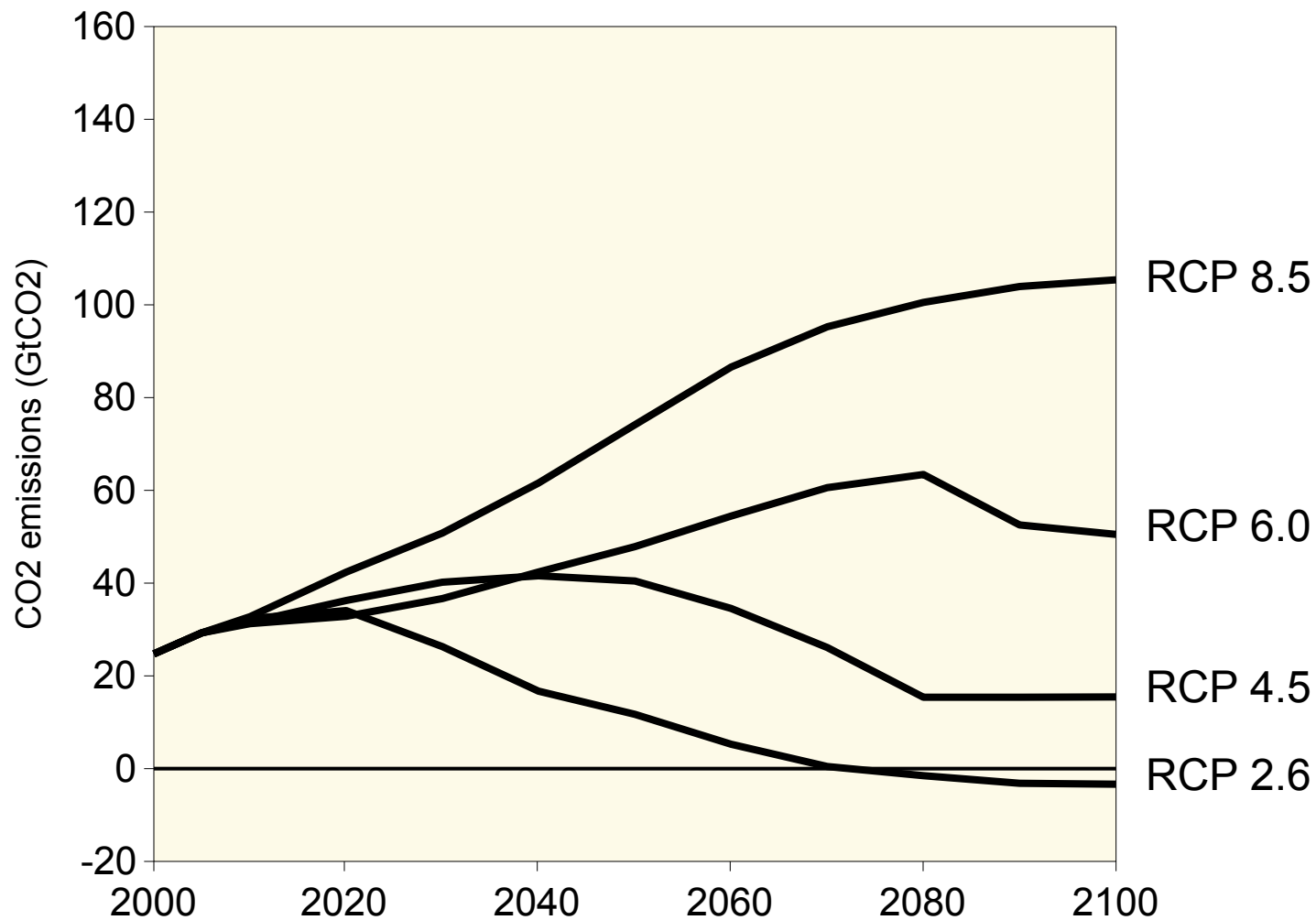
Socio-economic challenges for mitigation



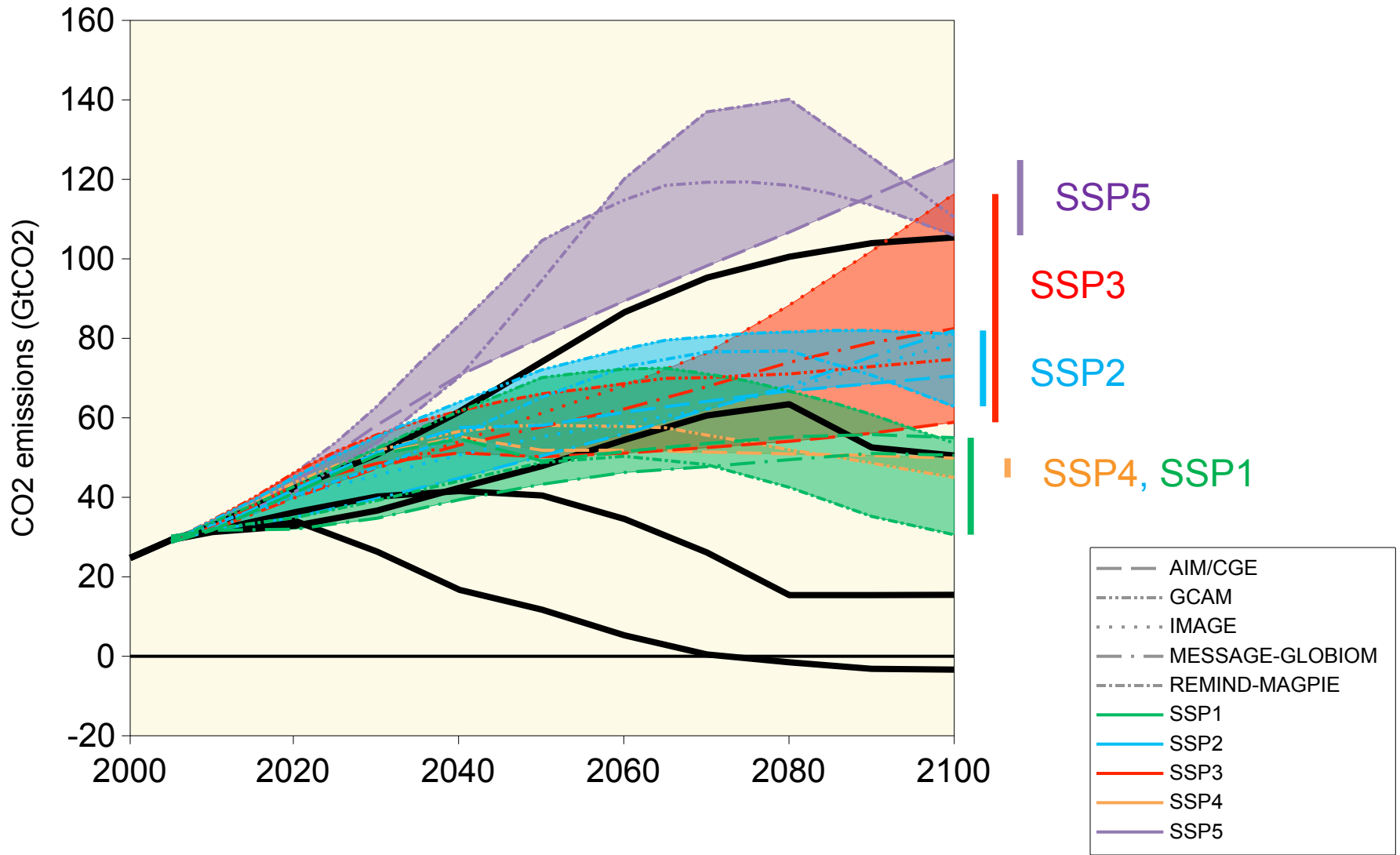
Socio-economic challenges for adaptation



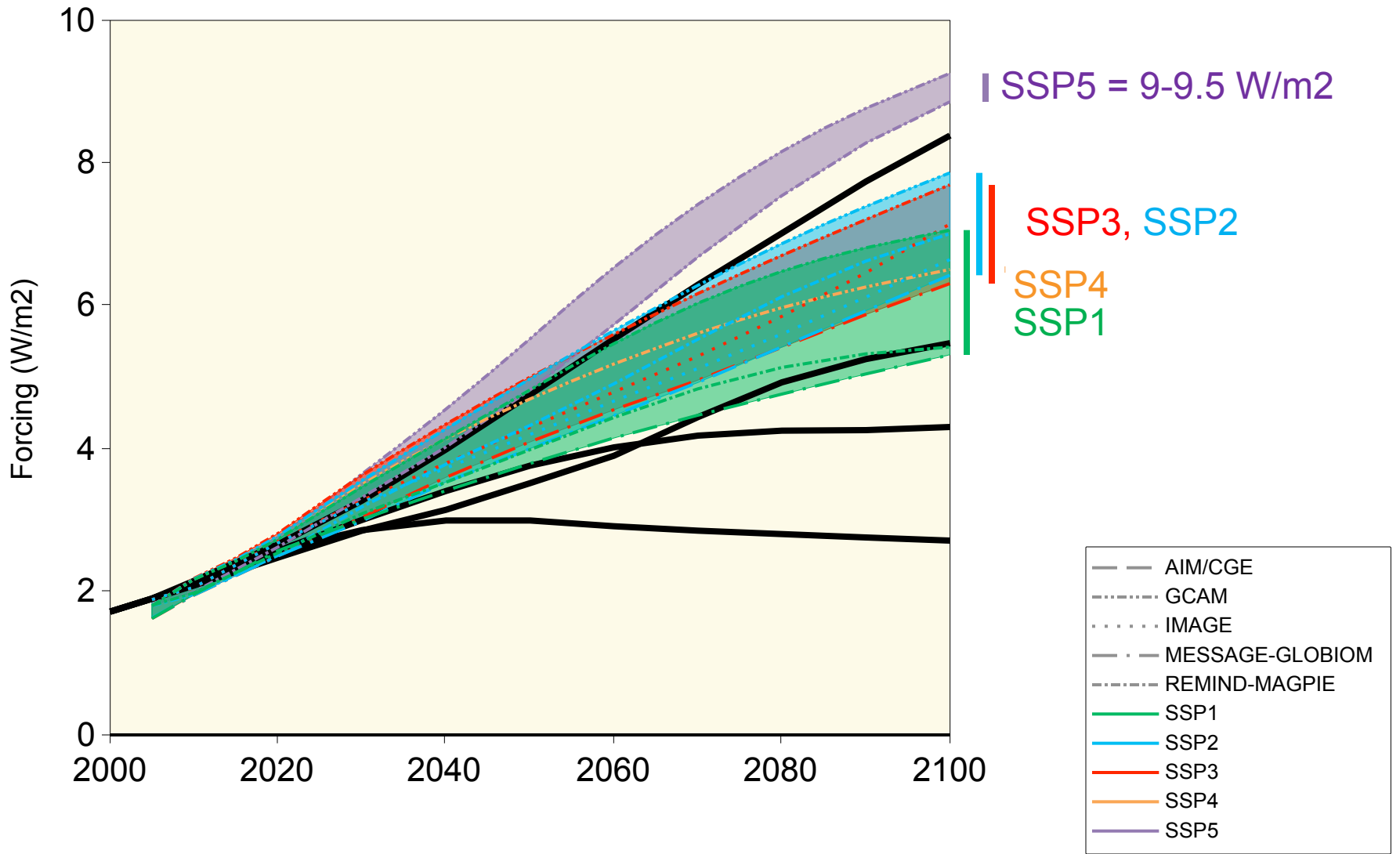
RCP CO2 Emissions, World (Fossil fuels and Industry)



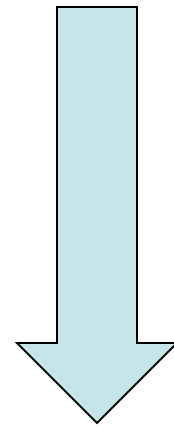
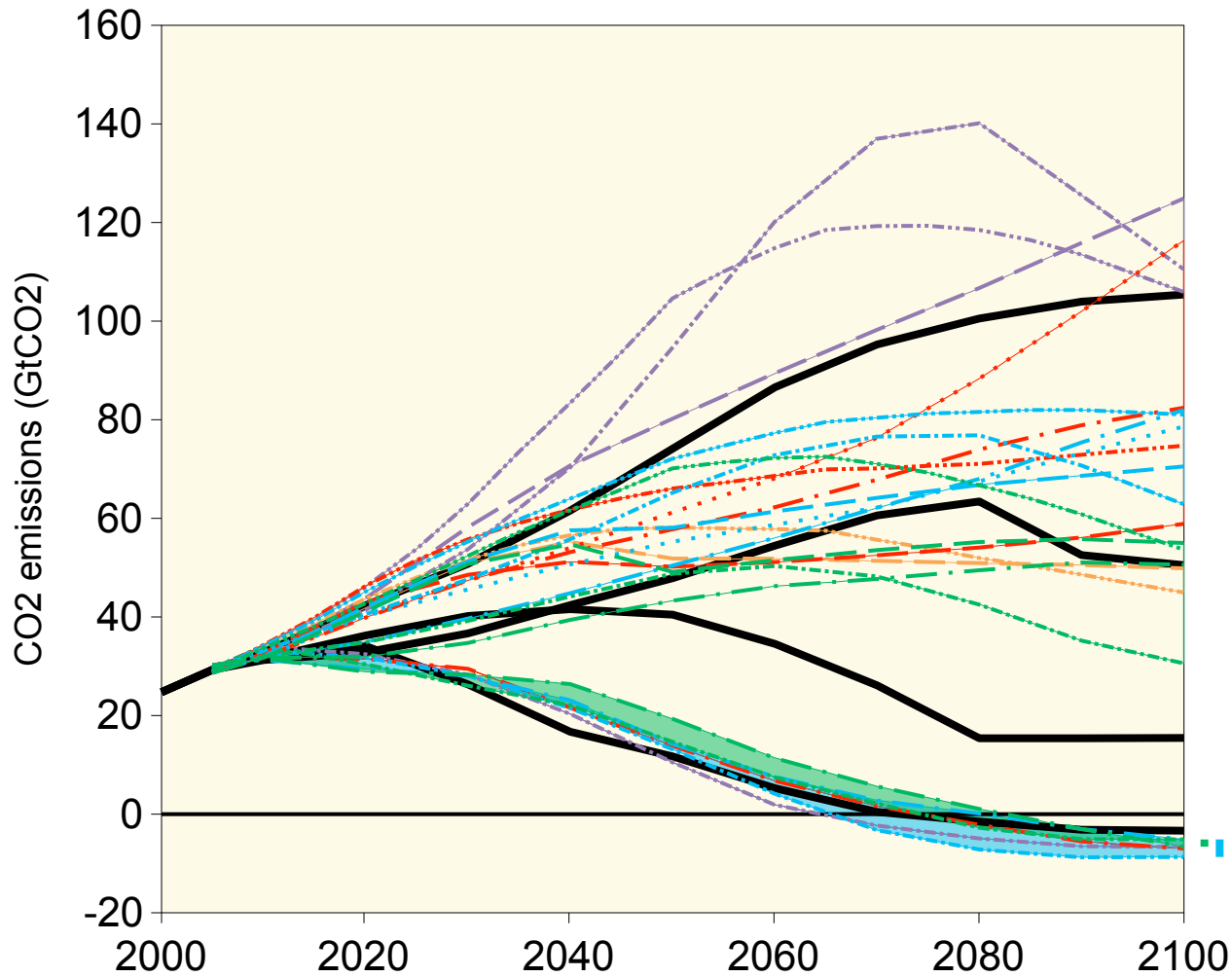
CO2 Emissions, World (Fossil fuels and Industry)



Total Radiative Forcing



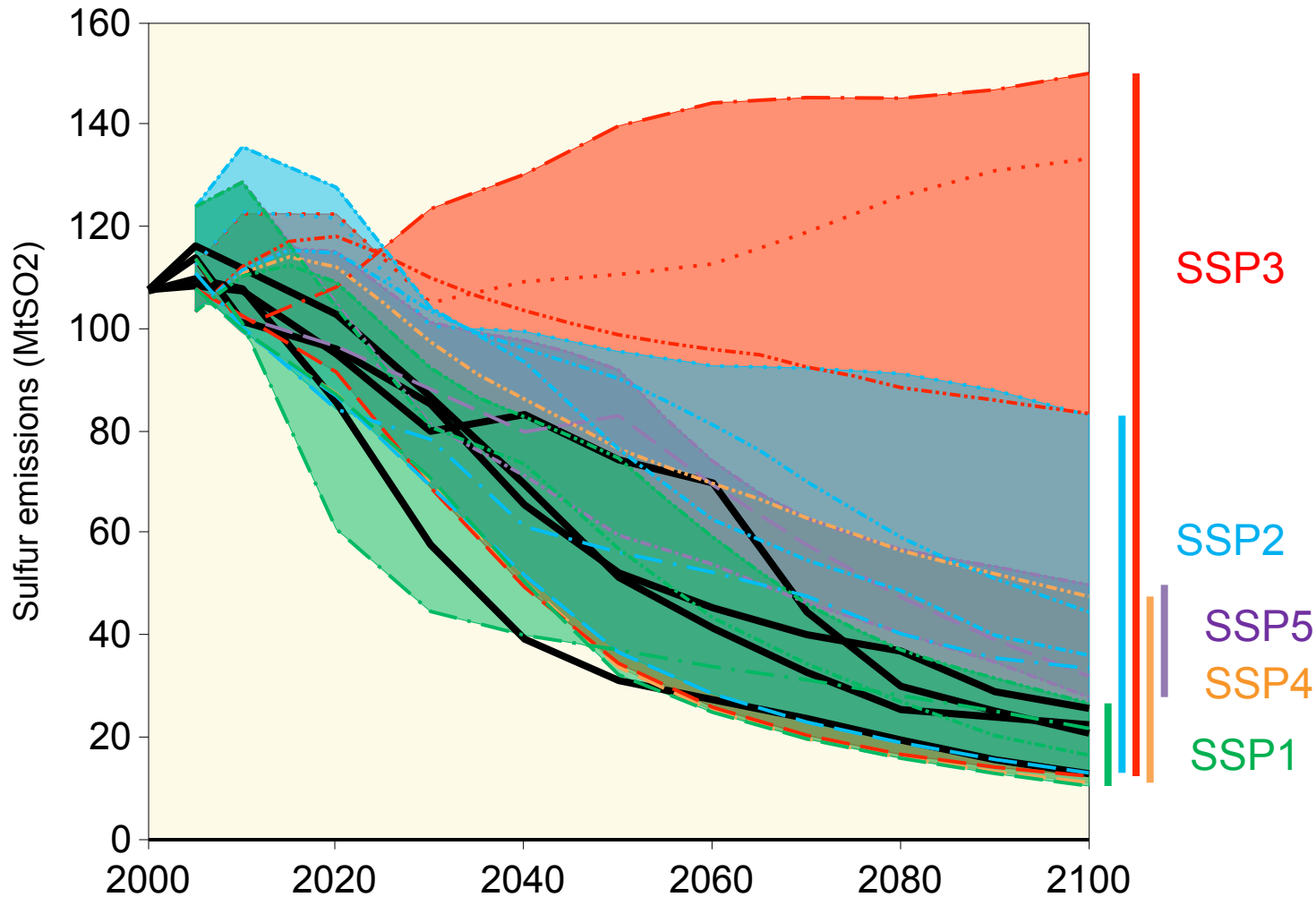
CO2 Emissions, World (Fossil fuels and Industry)



2.6 W/m²

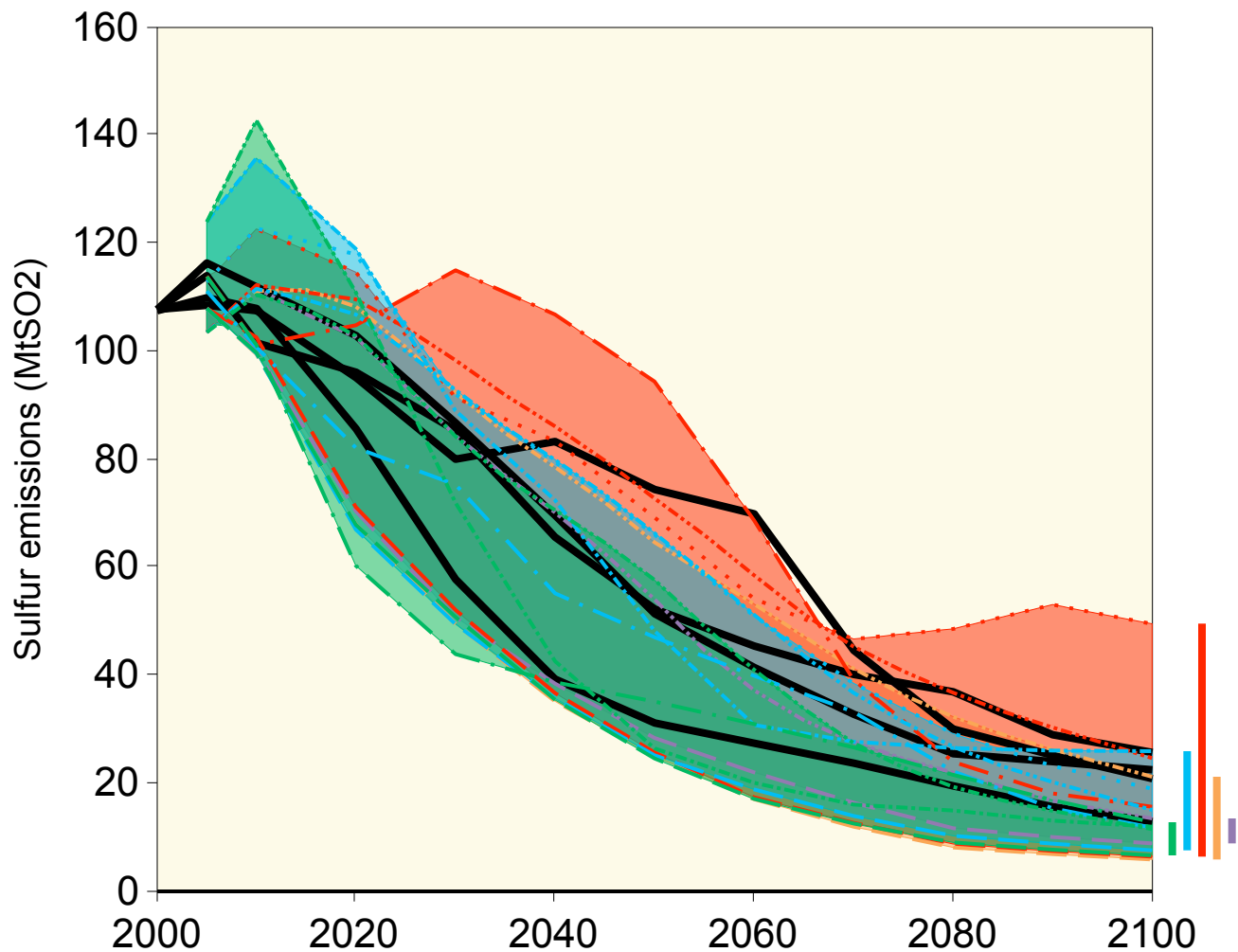
SSP range for short-lived forces wider than RCPs

Example: SO₂ emissions



Climate mitigation co-benefits across all SSPs

Example: SO₂ emissions



4.5 W/m²

SSP IAM scenarios – next steps

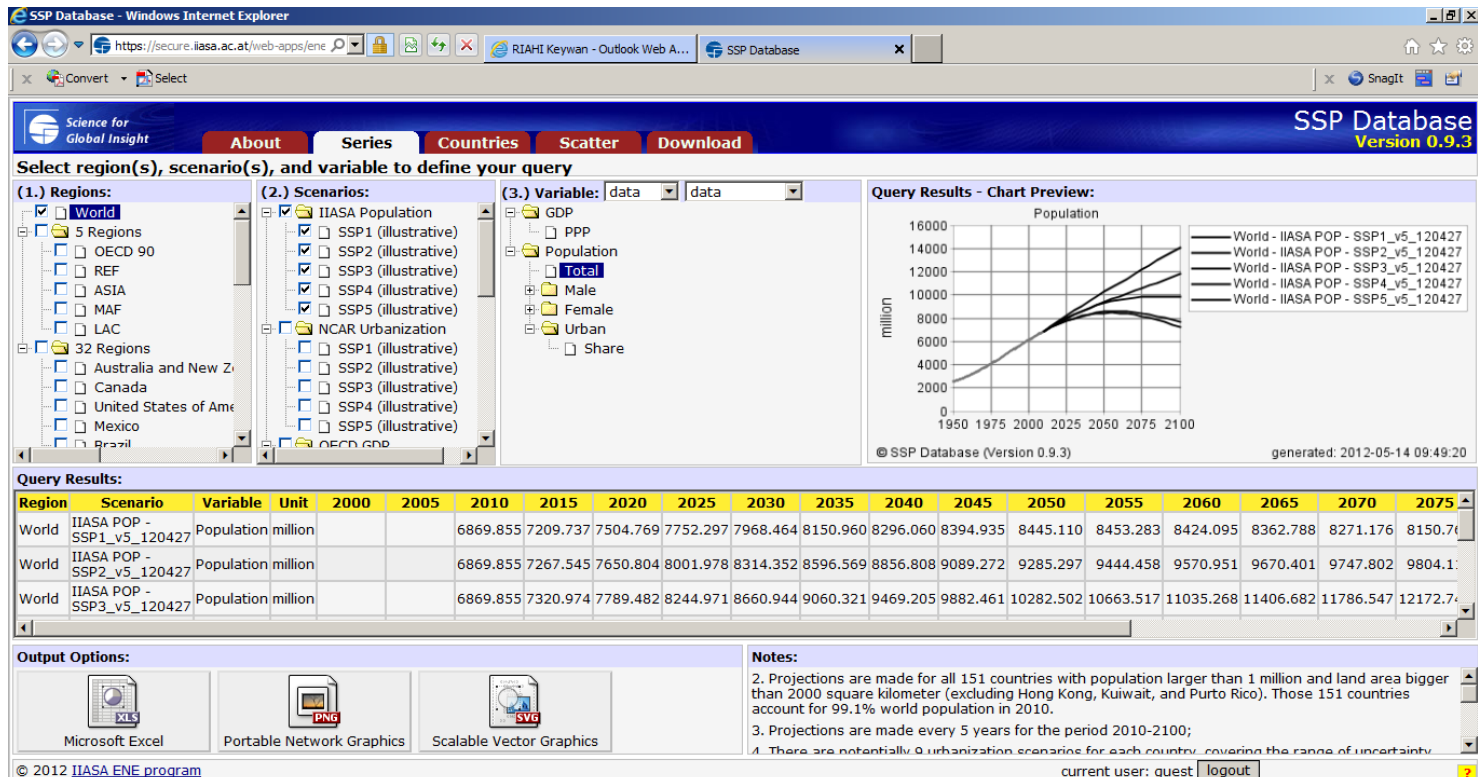
- Improve consistency with storylines
- Harmonization across major variables (develop clear-cut definitions)
- Define SPAs (climate policy dimension)
- Identify marker scenarios
- Organize hand-off to different communities and develop guidelines for SSP users (eg, plausible RCP/SSP combinations)
- Publication: Special Issue of Global Environmental Change

International Committee On New Integrated Climate change assessment Scenarios (ICONICS)

<http://www.isp.ucar.edu/iconics>

SSP database:

<https://secure.iiasa.ac.at/web-apps/ene/SspDb>



The screenshot shows the SSP Database web application interface. The top navigation bar includes 'About', 'Series', 'Countries', 'Scatter', and 'Download'. The main content area is titled 'Select region(s), scenario(s), and variable to define your query'. It features three selection panels: (1.) Regions, (2.) Scenarios, and (3.) Variable. The 'Query Results - Chart Preview' section displays a line graph of Population (million) from 1950 to 2100 for five different scenarios. Below the chart is a table of query results.

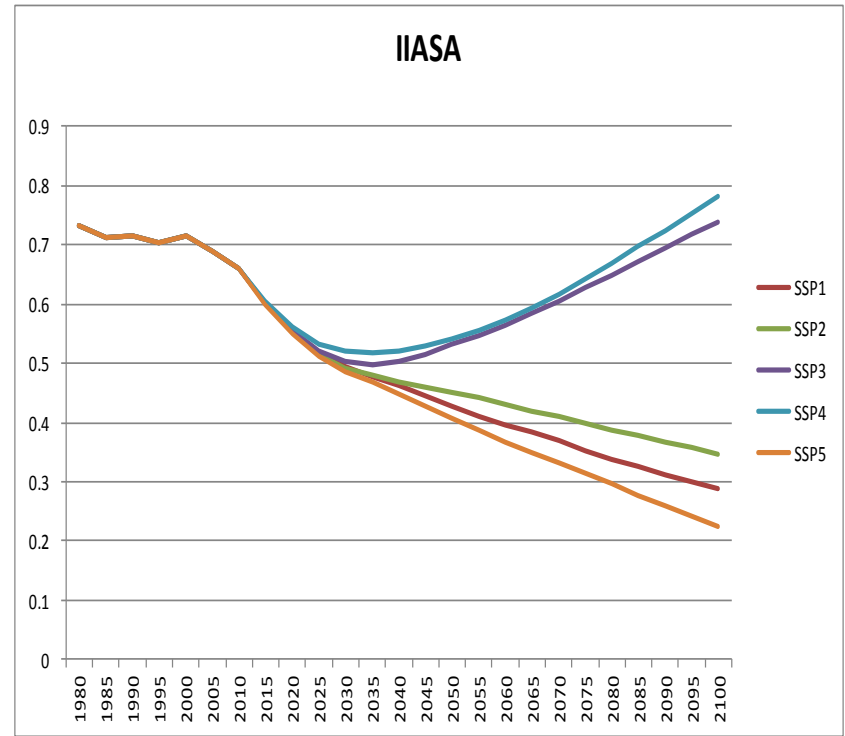
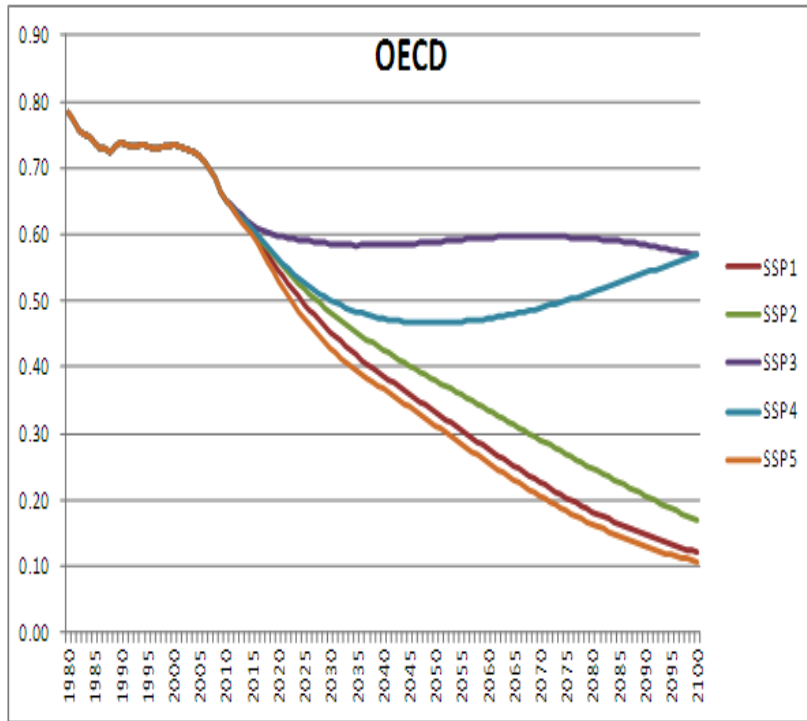
Region	Scenario	Variable	Unit	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075	2080
World	IIASA POP - SSP1_v5_120427	Population	million			6869.855	7209.737	7504.769	7752.297	7968.464	8150.960	8296.060	8394.935	8445.110	8453.283	8424.095	8362.788	8271.176	8150.71	
World	IIASA POP - SSP2_v5_120427	Population	million			6869.855	7267.545	7650.804	8001.978	8314.352	8596.569	8856.808	9089.272	9285.297	9444.458	9570.951	9670.401	9747.802	9804.1	
World	IIASA POP - SSP3_v5_120427	Population	million			6869.855	7320.974	7789.482	8244.971	8660.944	9060.321	9469.205	9882.461	10282.502	10663.517	11035.268	11406.682	11786.547	12172.7	

The interface also includes 'Output Options' (Microsoft Excel, Portable Network Graphics, Scalable Vector Graphics) and a 'Notes' section with details about the projections. The footer shows '© 2012 IIASA ENE program' and 'current user: guest | logout'.

Additional Slides

Inequality across models

Global GINI



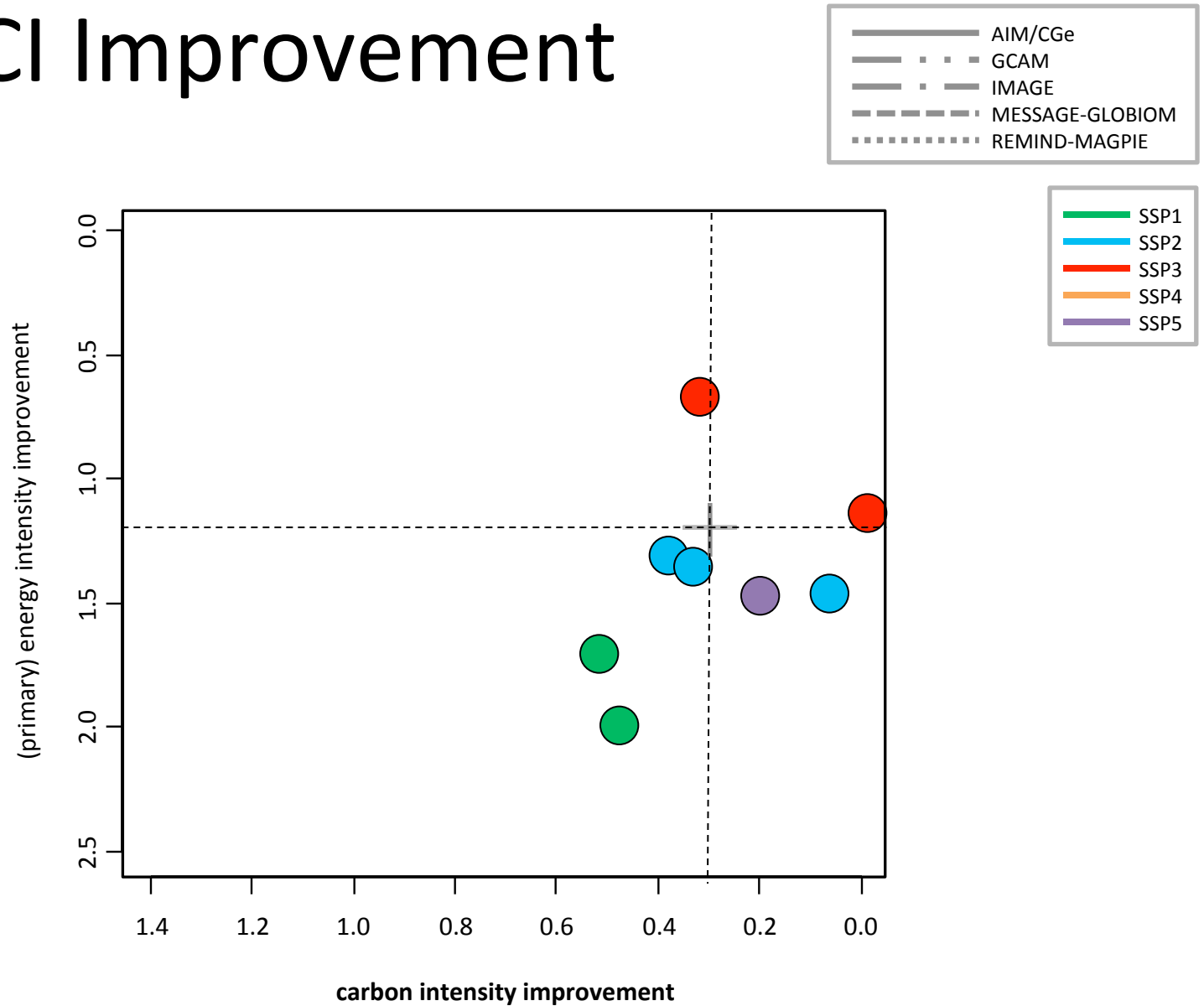
Country Groupings

- For defining these scenarios we distinguish among three groups of countries:
- ***High Fertility Countries (HiFert)***: Countries with current level of fertility less than 2.9 children per woman (2005-2010).
- ***Low Fertility Countries (LoFert)*** Countries with current level of fertility less than or equal to 2.9 not belonging to Rich OECD countries (see below)
- ***High Income-OECD Countries (Rich-OECD)*** As per the definition of World Bank.

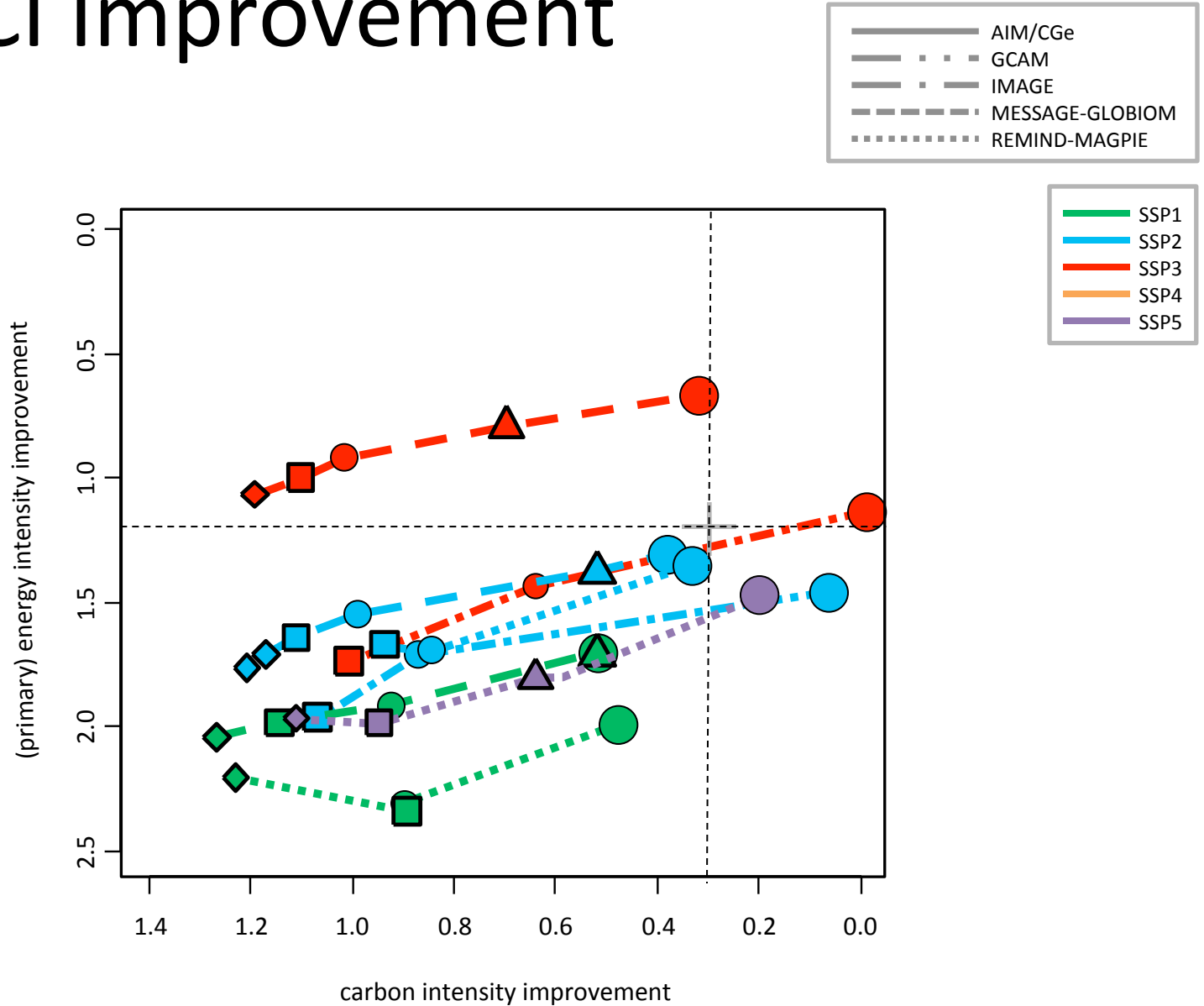
Education Scenarios

- ***The fast track (FT)*** scenario is extremely ambitious; it assumes that all countries expand their school systems at the fastest possible rate, which would be comparable with best performers in the past such as Singapore and South Korea .
- ***The global education trend (GET)*** scenario is more moderately optimistic and assumes that countries will follow the average path of school expansion that other countries already somewhat further advanced in this process have experienced.
- ***The constant enrollment rate (CER)*** scenario assumes that countries only keep the proportions of cohorts attending school constant at current levels.
- ***The most pessimistic scenario, constant enrollment numbers (CEN)***, assumes that no more schools at all are being built and that the absolute number of students is kept constant, which under conditions of population growth means declining enrollment rates.

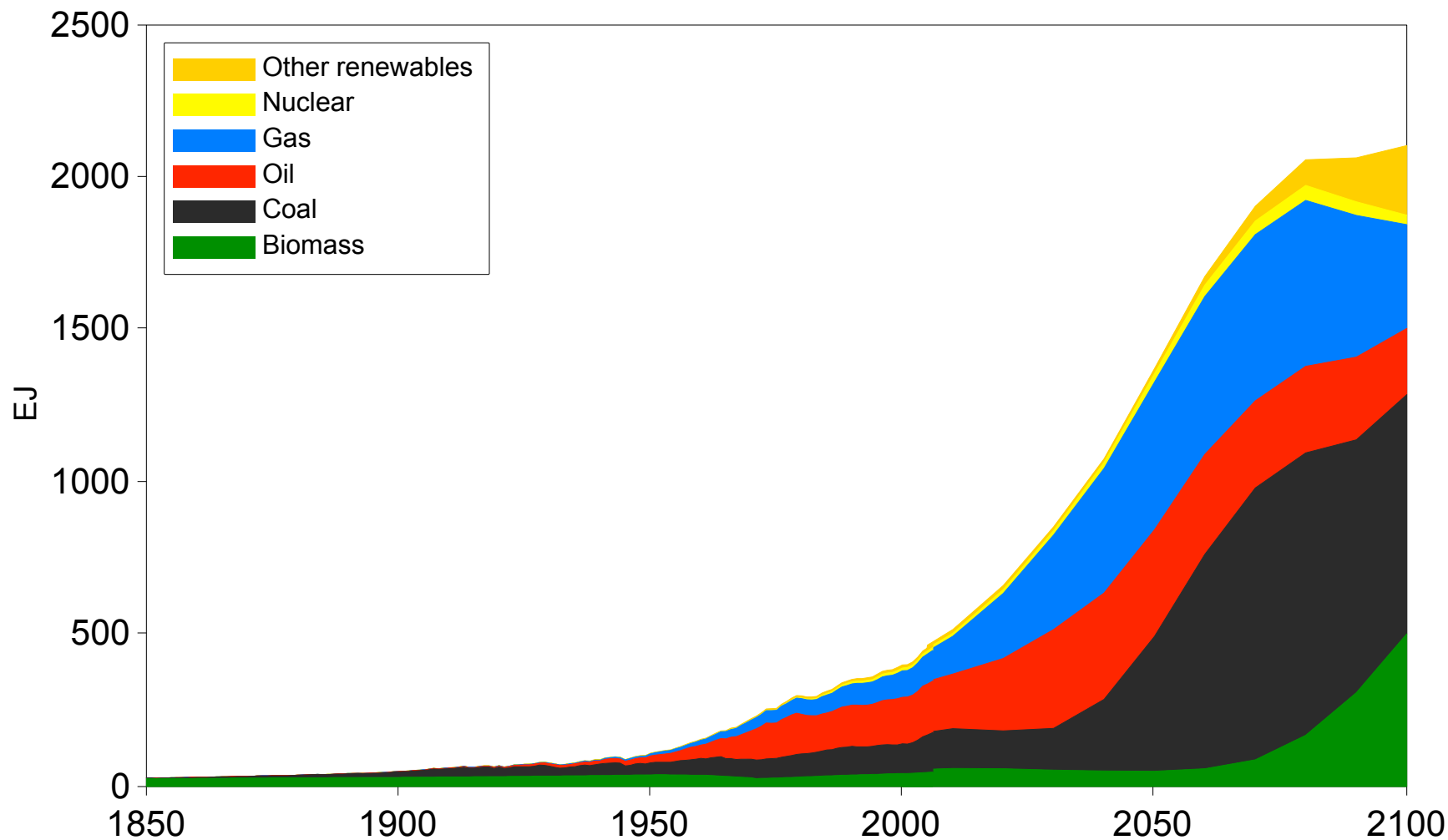
PEI / CI Improvement



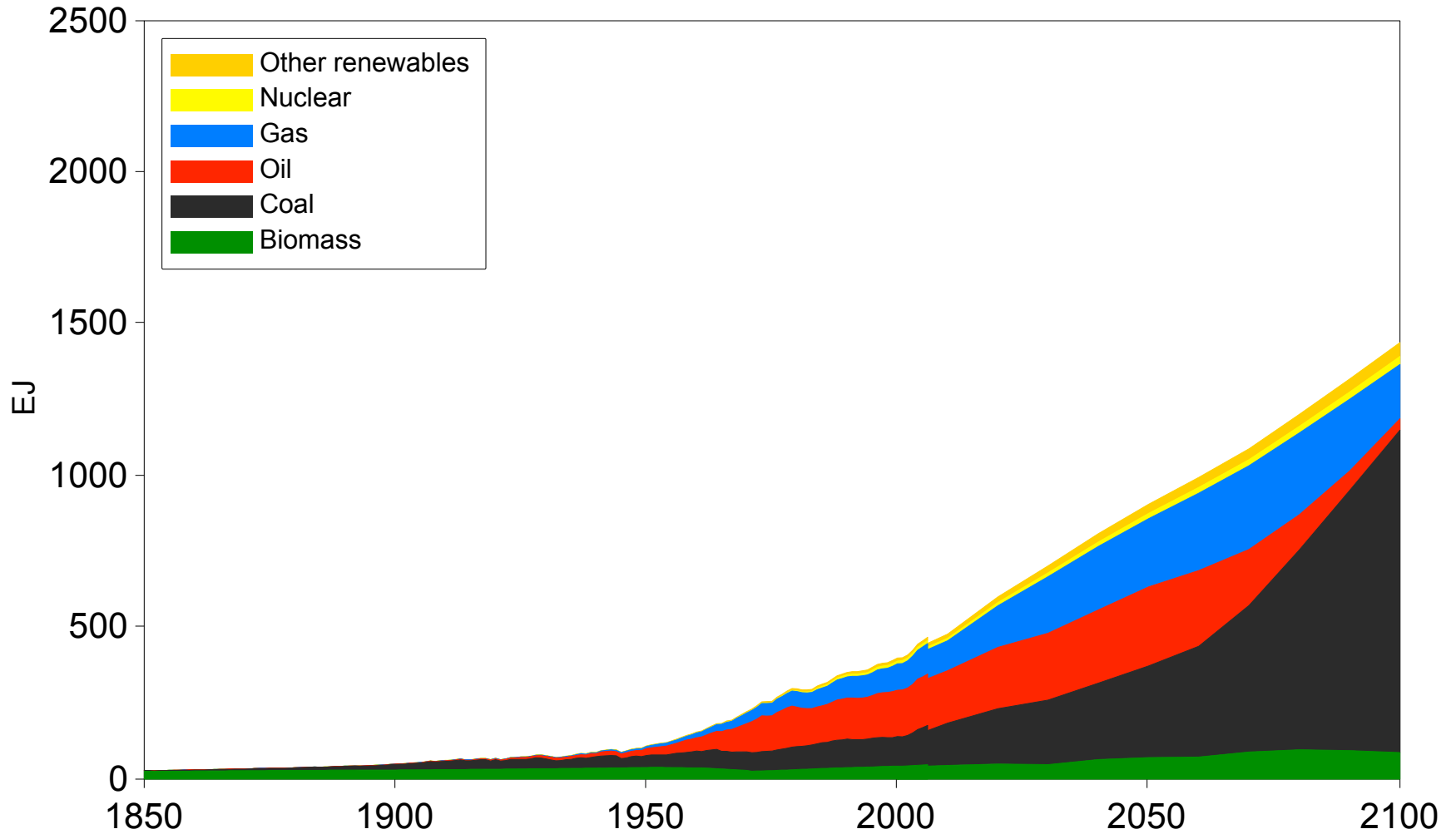
PEI / CI Improvement



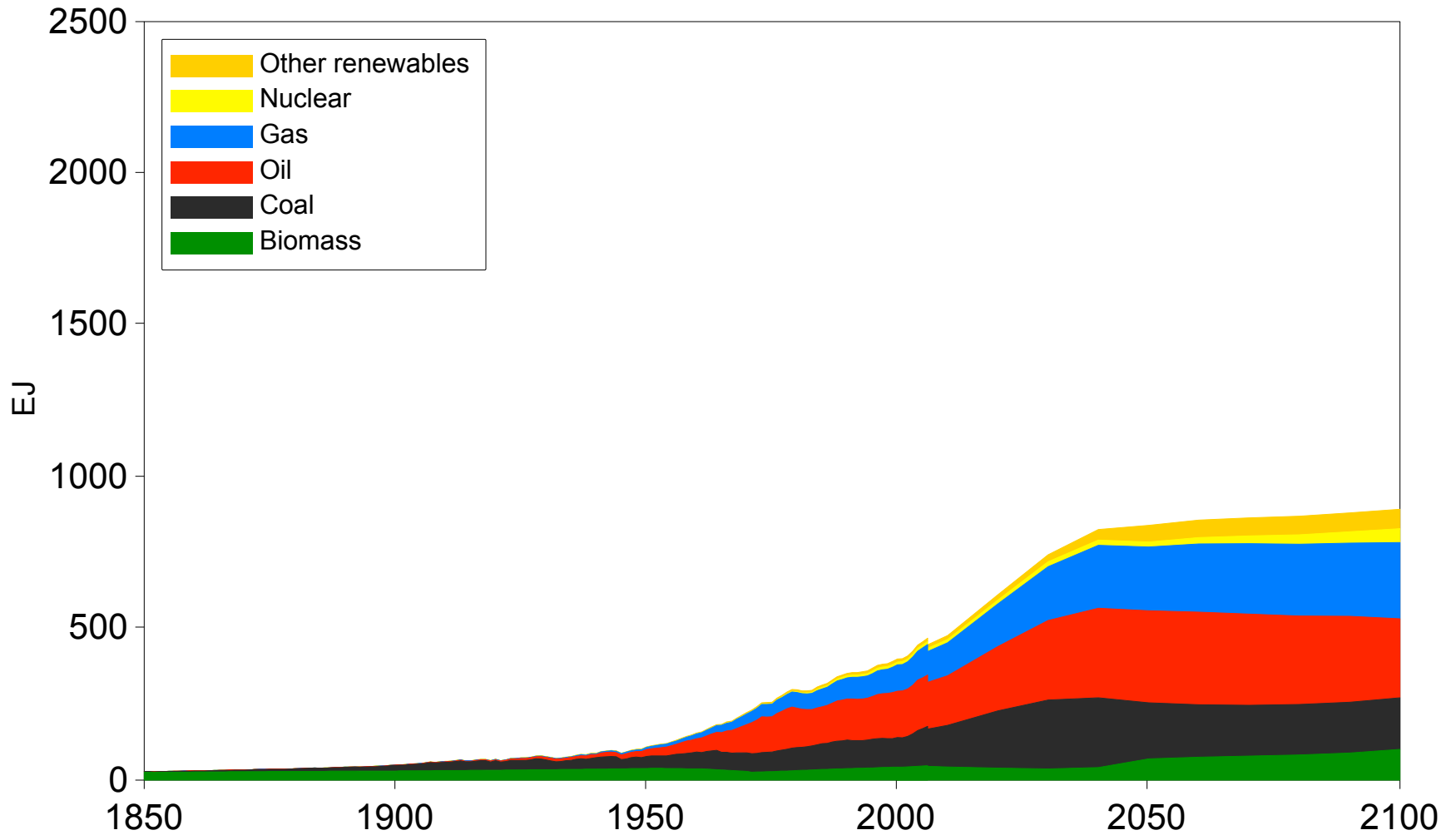
Global Primary Energy - SSP5 REMIND-MAGPIE



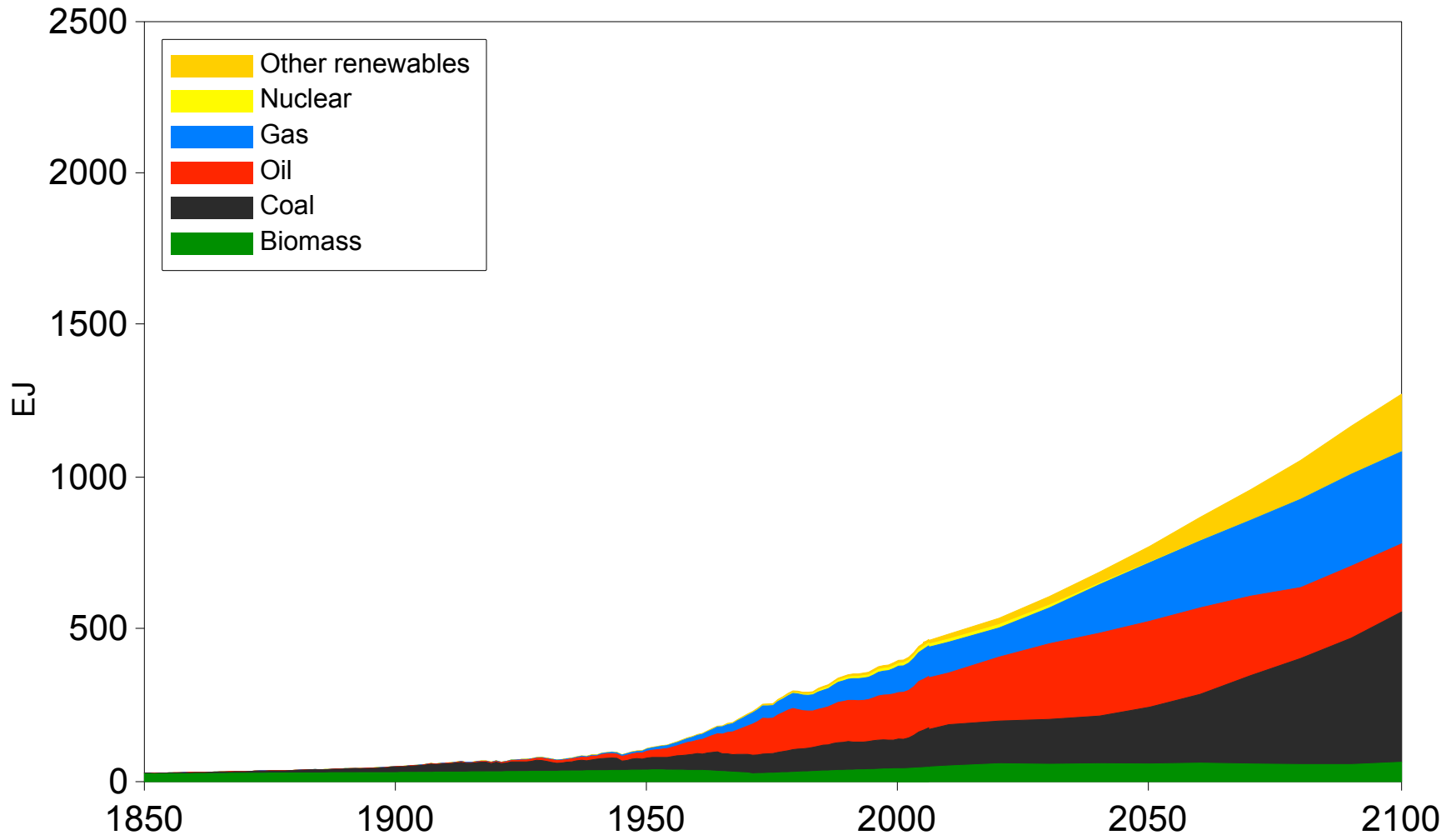
Global Primary Energy - IMAGE SSP3



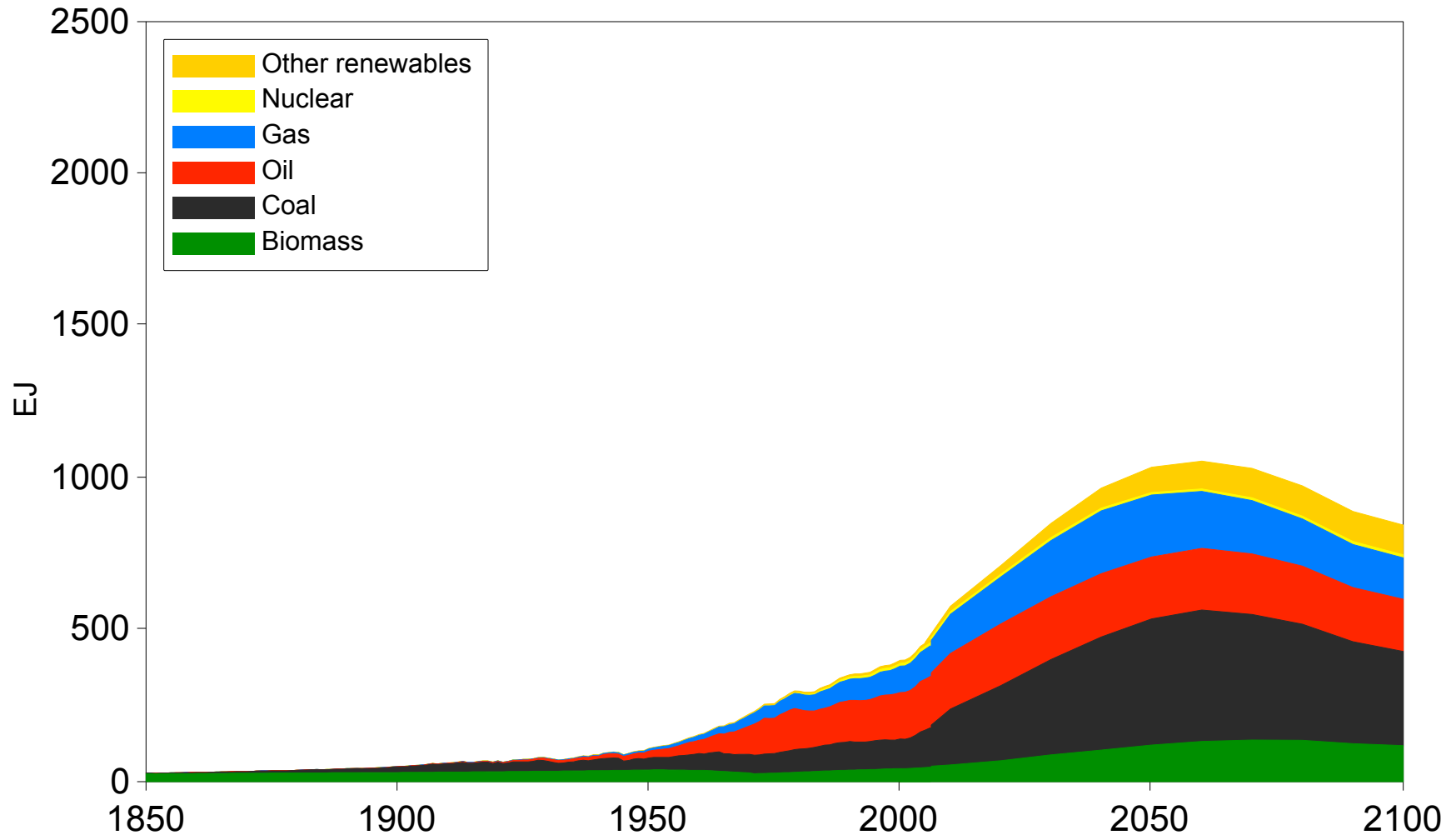
Global Primary Energy - AIM/CGE SSP4-Ref-SPA0-V1



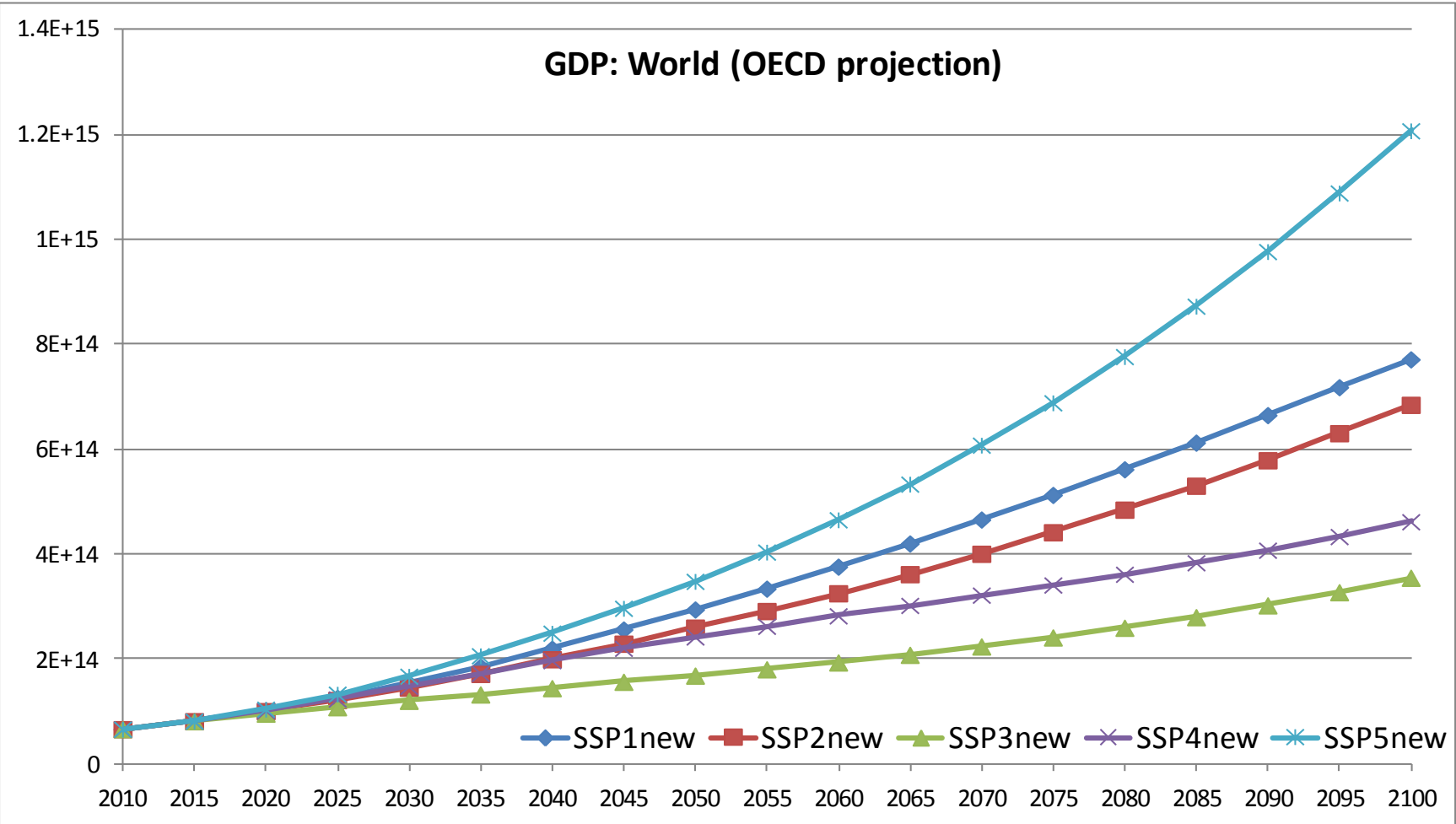
Global Primary Energy - MESSAGE-GLOBIOM SSP2-Ref-SPA0-V1



Global Primary Energy – SSP1 GCAM



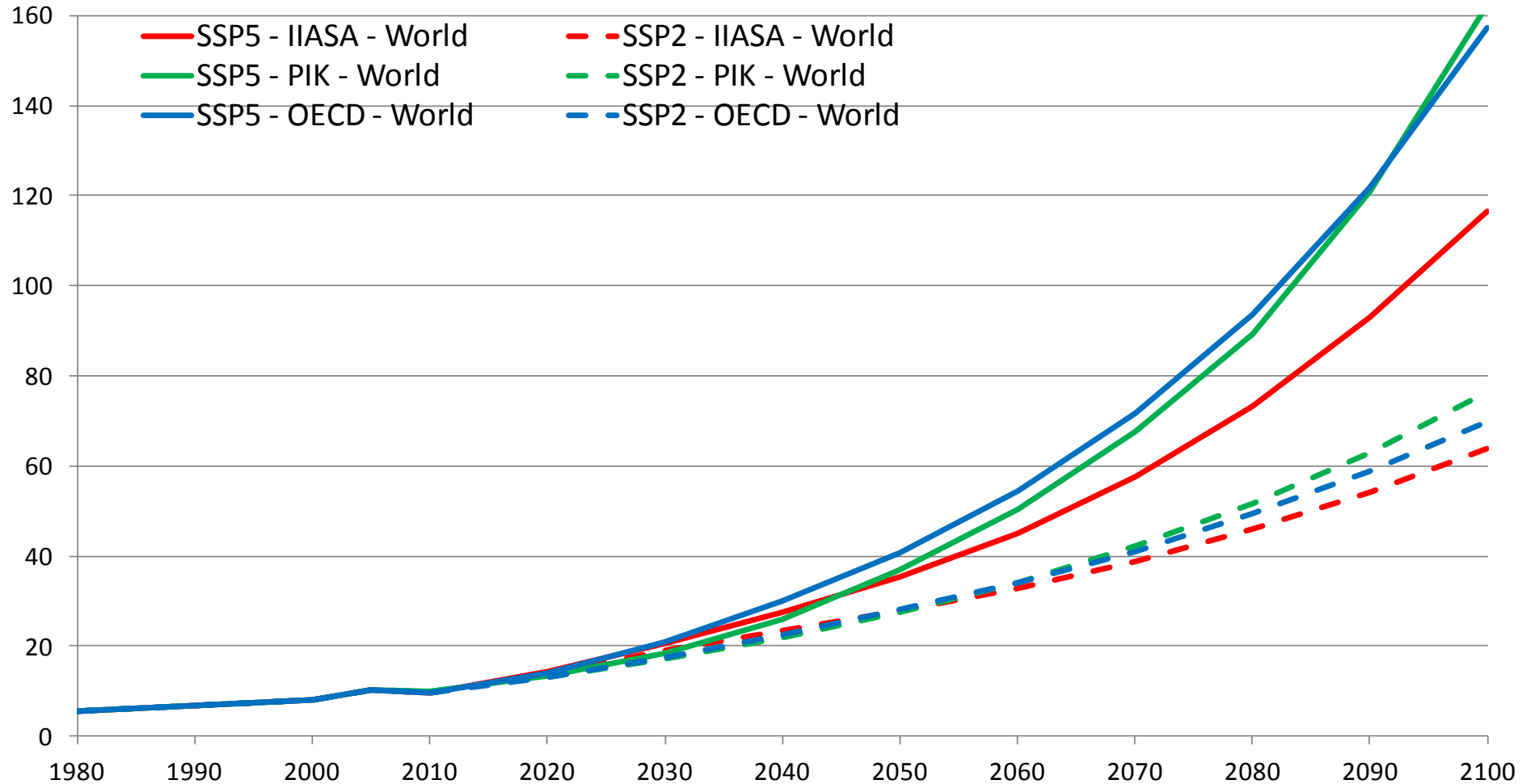
SSP5>SSP1>SSP2>SSP4>SSP3



Source: preliminary SSP database

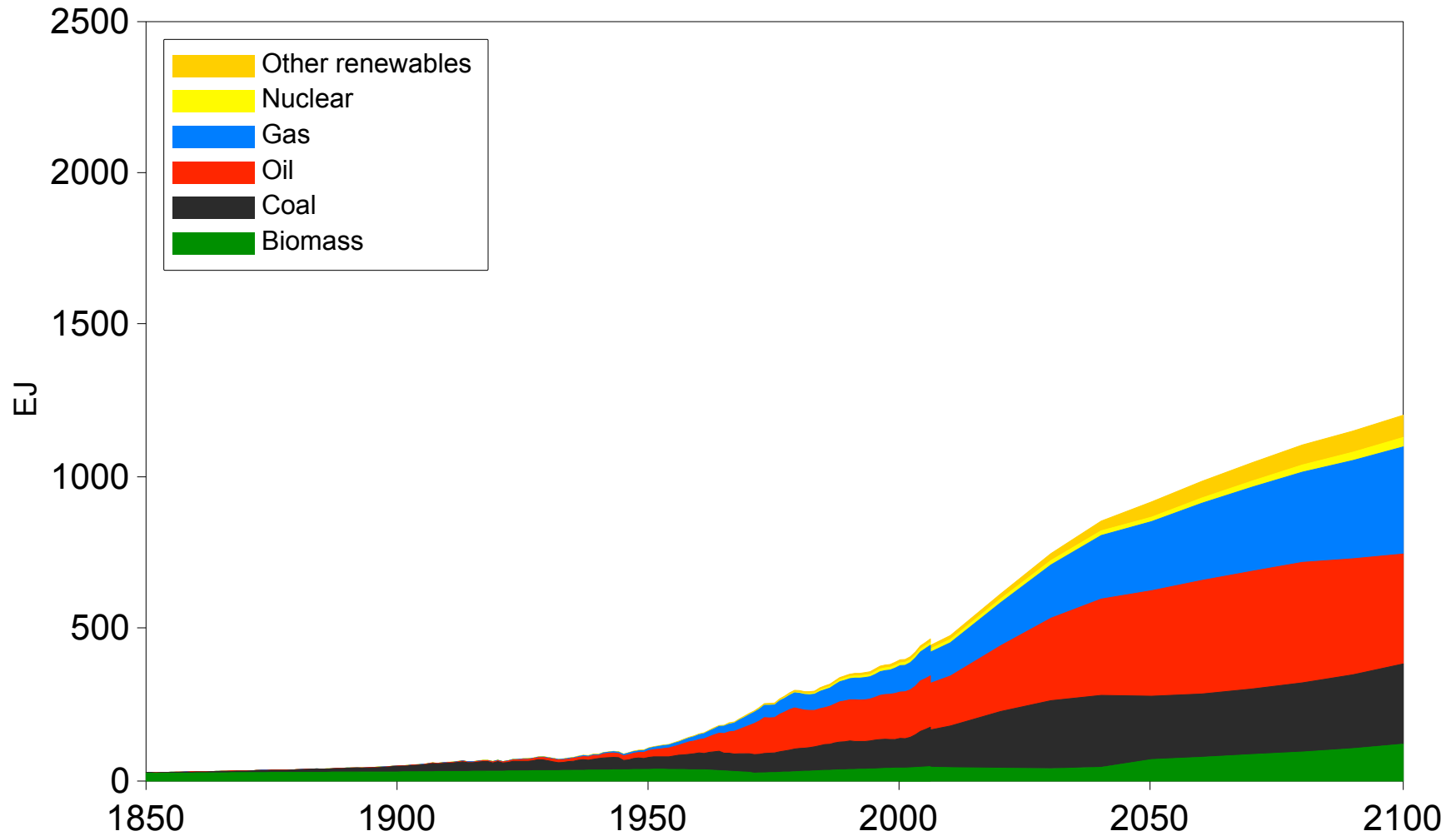
Global GDP levels by scenario

SSP - Per Capita GDP (billion US\$2005PPP / million people)



Source: preliminary SSP database

Global Primary Energy – SSP2 AIM



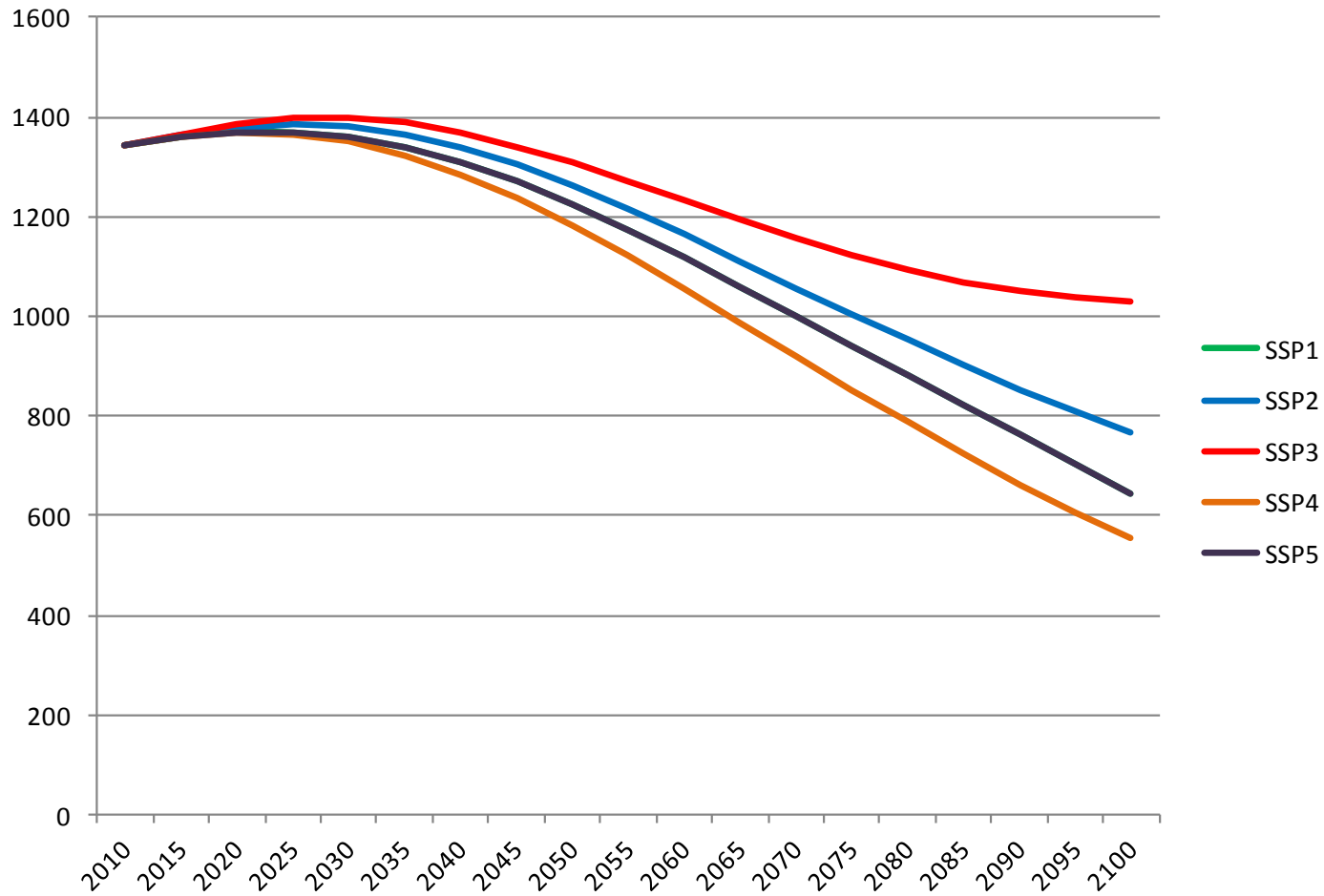
Population assumptions consistent with SSP Storylines

SSP Element	SSP 1			SSP 2			SSP 3			SSP 4			SSP 5		
	HiFert	LoFert	Rich-OECD	HiFert	LoFert	Rich-OECD	Country Groupings			HiFert	LoFert	Rich-OECD	HiFert	LoFert	Rich-OECD
							HiFert	LoFert	Rich-OECD						
Demographics															
Population															
Fertility	Low	Low	Med	Med	Med	Med	High	High	Low	High	Low	Low	Low	Low	High
Mortality	Low	Low	Low	Med	Med	Med	High	High	High	High	Med	Med	Low	Low	Low
Migration	Med	Med	Med	Med	Med	Med	Low	Low	Low	Med	Med	Med	High	High	High
Education	High	High	High	Med	Med	Med	Low	Low	Low	Low	Low	Med	High	High	High
	(FT)	(FT)	(FT)	(GET)	(GET)	(GET)	(CER)	(CER)	(CER)	(CEN)	(CER)	(GET)	(FT)	(FT)	(FT)

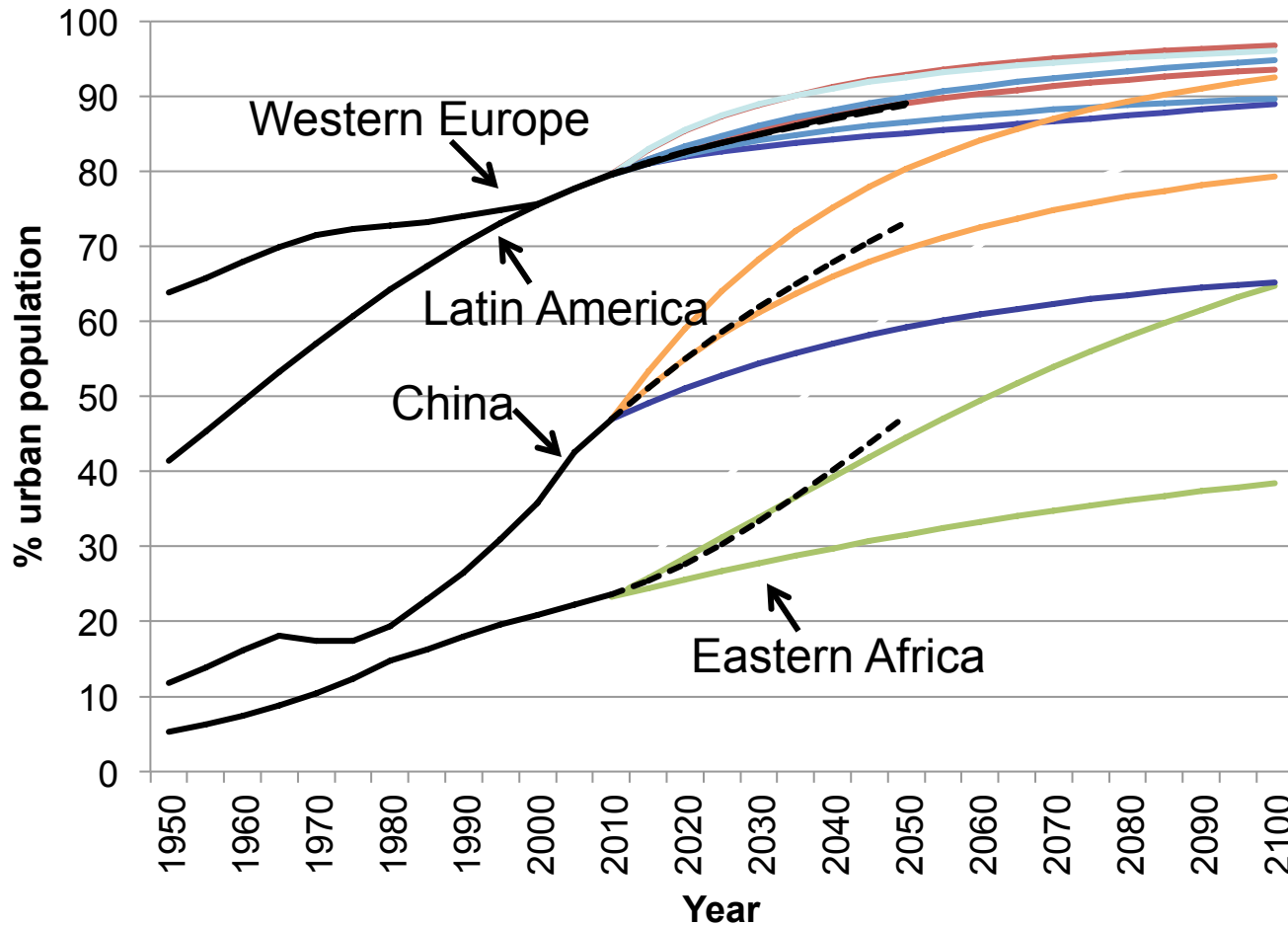
High challenges for adaptation

Low challenges for adaptation

China - population for five SSPs



Urbanization Projection Results



SSP 1	Fast
SSP 2	Central
SSP 3	Slow
SSP 4	Fast/Central
SSP 5	Fast

