IPCC scenarios, integrated assessment models and key concepts for integrating climate change research across research domains

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Material in part courtesy of Keywan Riahi

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Overview

- A Brief History of (IPCC) Scenarios
- The "New Scenarios Process"
- Representative Concentration Pathways (RCPs)
- Shared Socioeconomic Pathways (SSPs)
- CMIP6/ScenarioMIP
- Equity and Fairness in Scenarios
- SSP Updates

A Brief History of (IPCC) Scenarios

IPCC: Climate Change Scenarios

IIASA

Projections

What can happen?

EXPLORATORY

- Socioeconomic projections
- Emissions, concentration, climate forcing projections
- Climate change projections
- Climate impact projections
- Integrated projections

Pathways

What should happen?
How to reach certain goals?

NORMATIVE

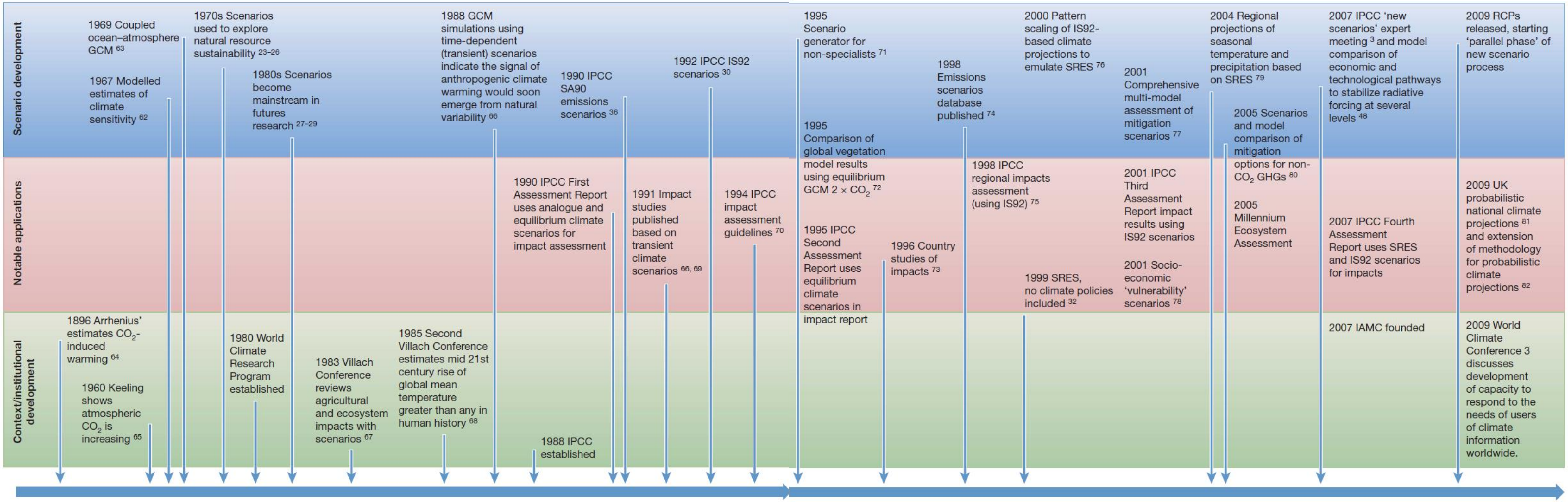
- Mitigation pathways
- Adaptation pathways
- Climate-resilient development pathways
- Integrated (transformation) pathways
- Sustainable development pathways

Used as a set

- Baseline and policy scenario pairs
- Multiple pathways to a single goal
- Set of pathways to different goals
- Range of projections spanning possible futures

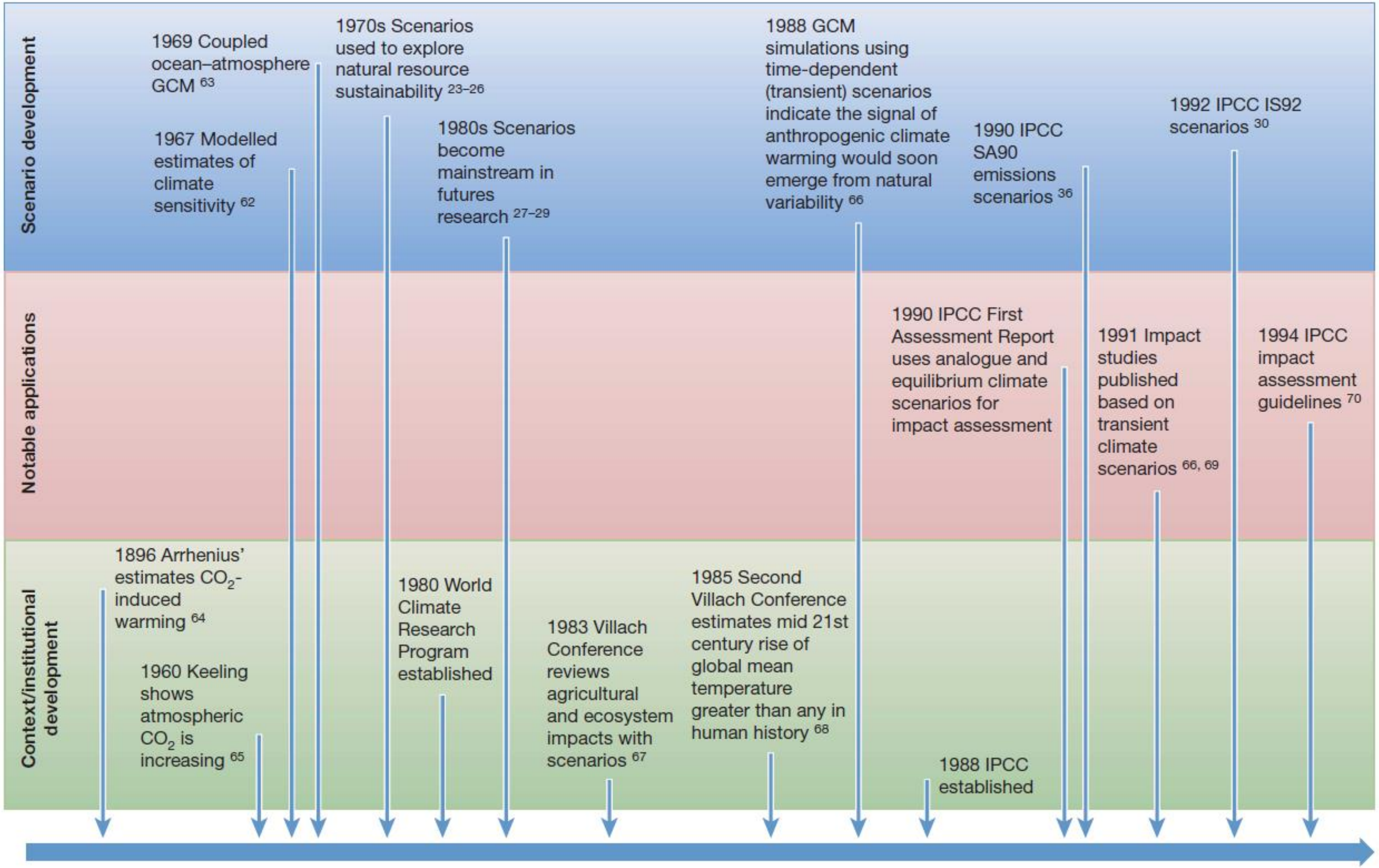
Source: Elmar Kriegler, SENSES project

History of (IPCC) scenarios (1896-2009)



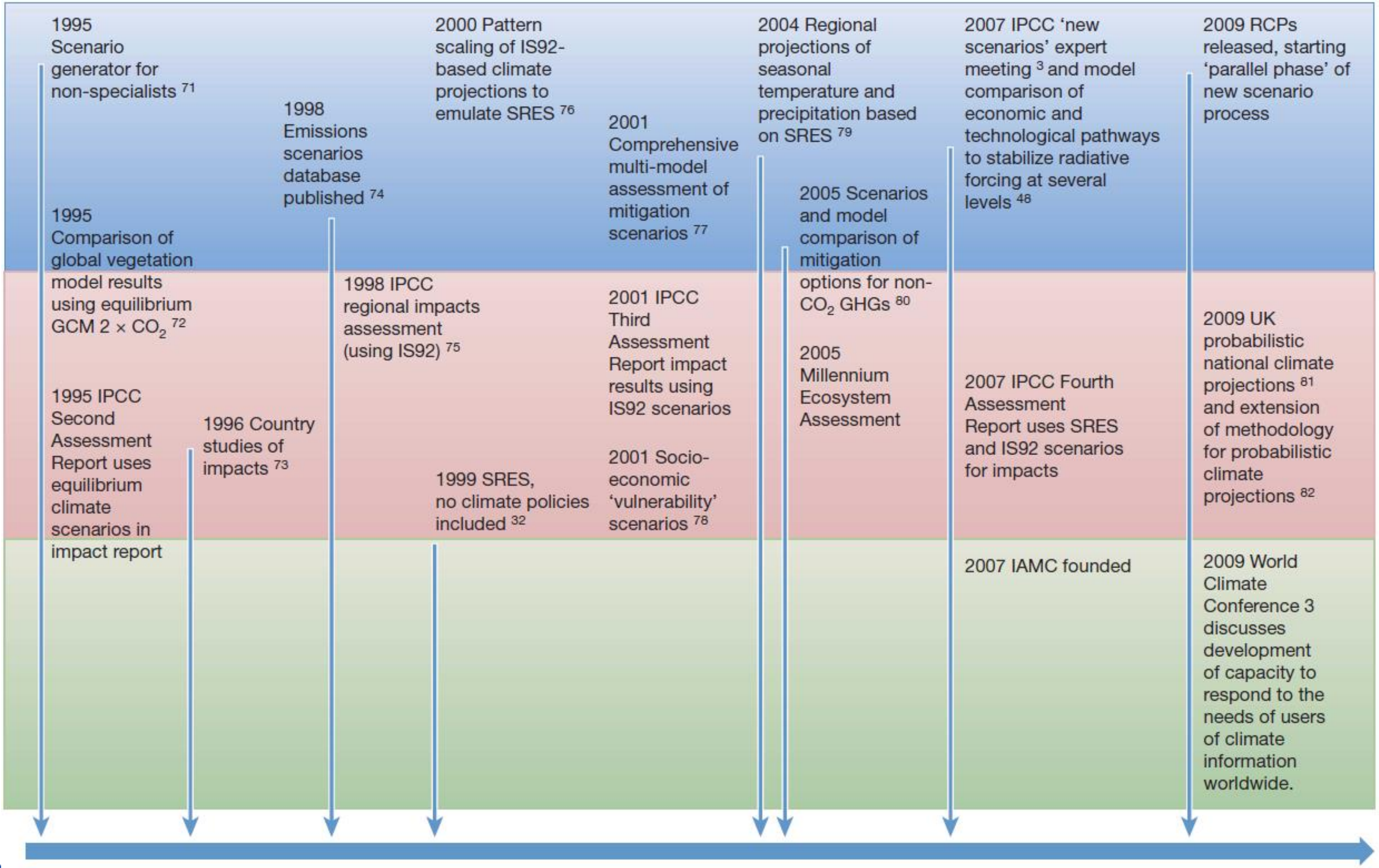
Source: Moss et al. 2010

History of (IPCC) scenarios (1896-1994)



Source: Moss et al. 2010

History of (IPCC) scenarios (1995-2009)



Source: Moss et al. 2010

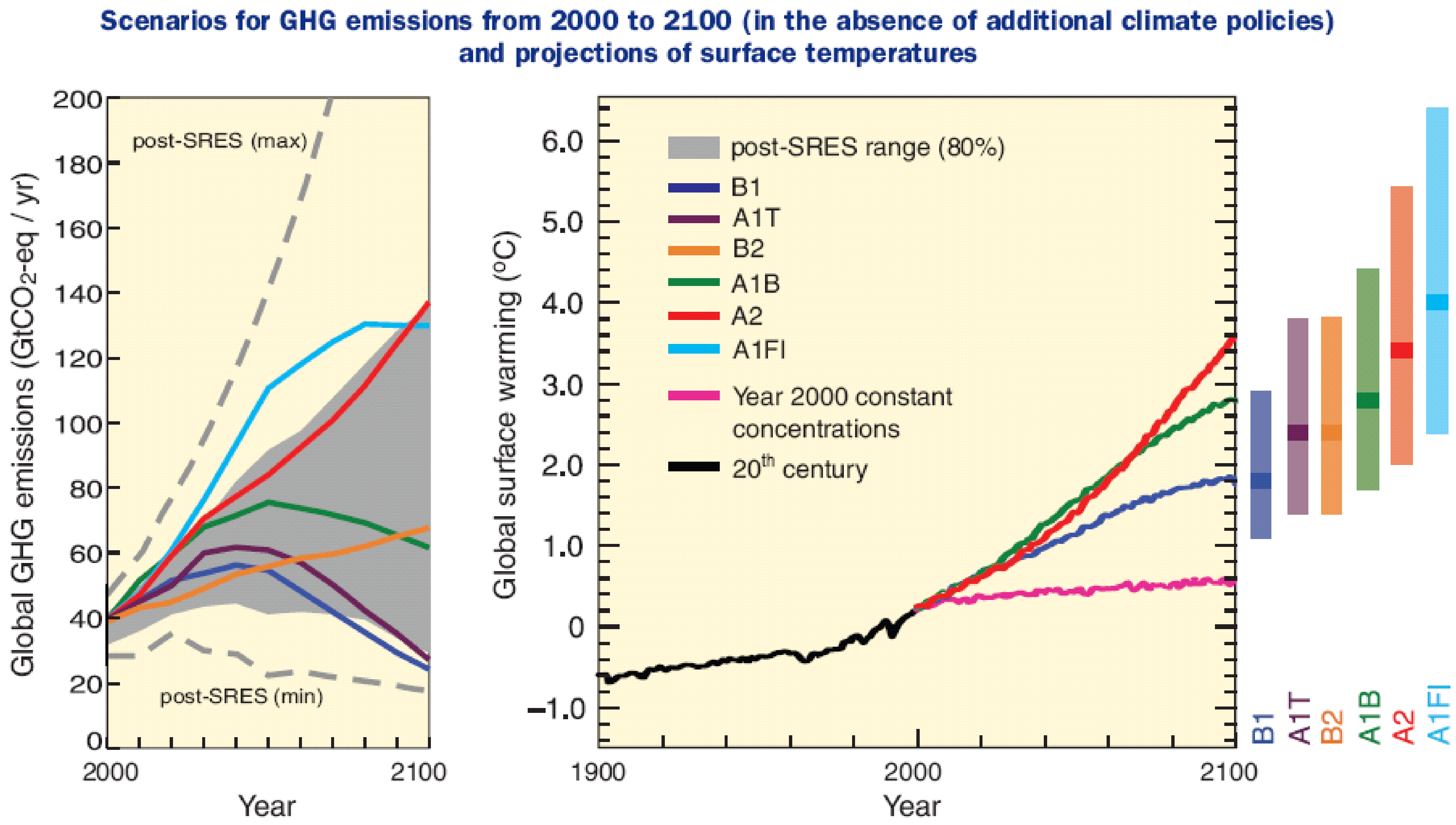
Scenarios in IPCC

A clarification

- last official “IPCC scenarios” were published in 2000 as part of the Special Report on Emissions Scenarios (SRES)
- since then, IPCC has only assessed scenarios that were published in the (peer-reviewed) literature

The “New Scenarios Process”

Introduction: Reasons for "new" scenarios



Source: IPCC AR4 (2007)

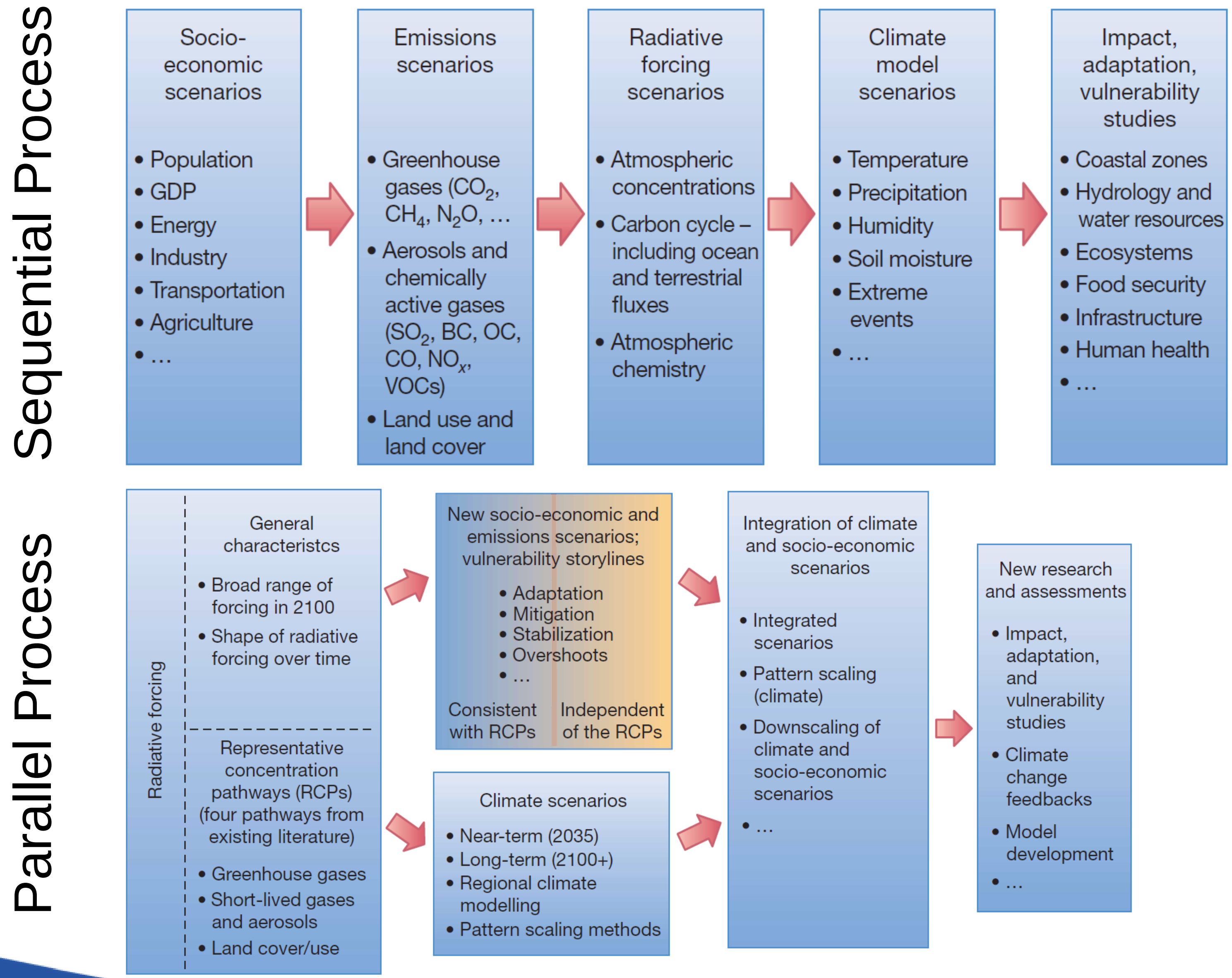
Reasons for “new” scenarios

Four important reasons to develop new community scenarios for climate assessment:

1. Need to cover a wider range of GHG concentrations (SRES only included baseline scenarios)
2. Need for a wider set of parameters (Climate models have become more complex; higher information need)
3. Need for scenarios that cover mitigation & adaptation issues (need for more collaboration between “WGs”)
4. Use more recent insight into trends in scenario drivers (update)

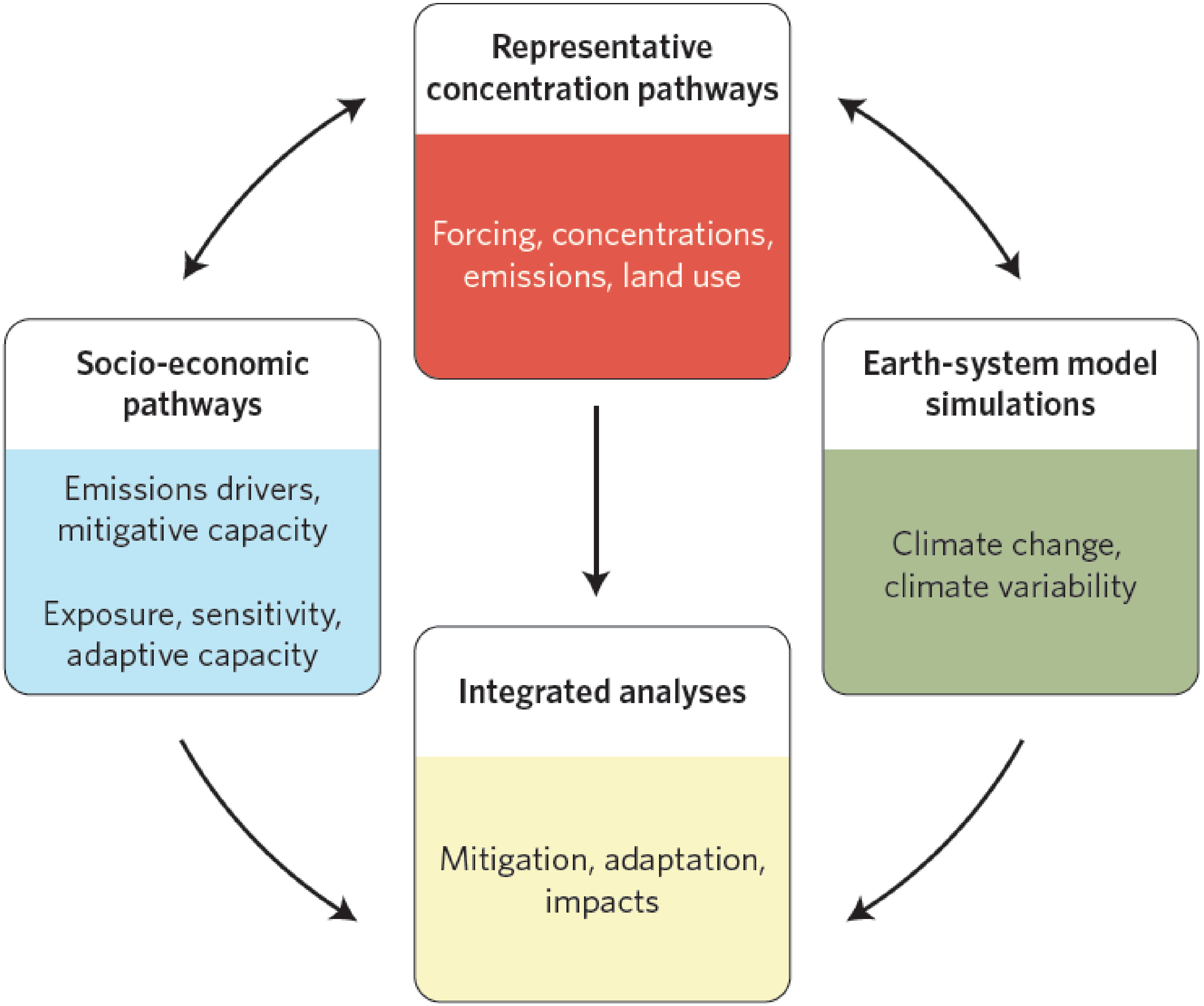
Source: Moss et al. 2010

Sequential vs. Parallel Process



Source: Moss et al. 2010

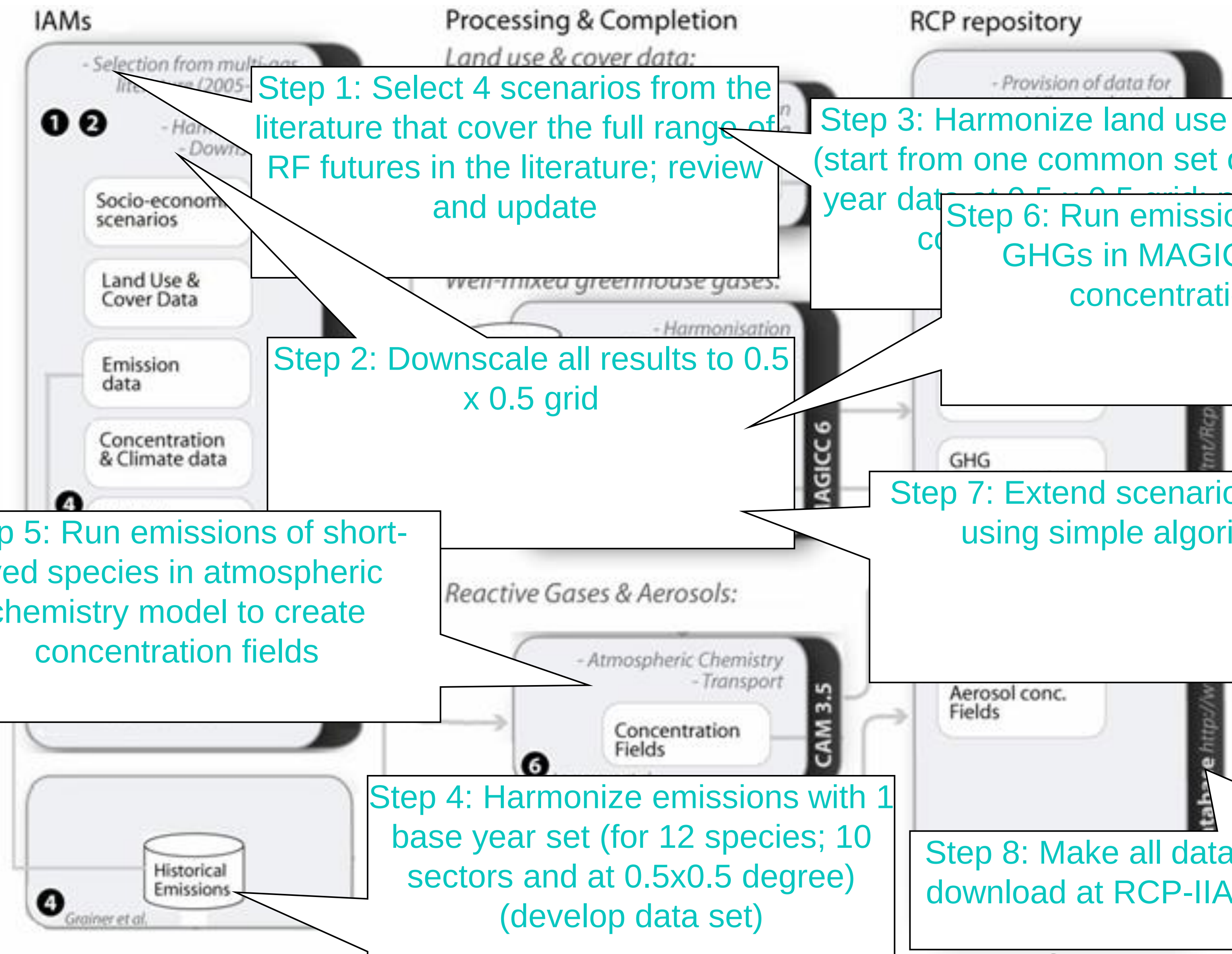
The Parallel Process



Source: O'Neill & Schweizer 2011

Representative Concentration Pathways (RCPs)

RCP workflow



Step 1: Select 4 scenarios from the literature that cover the full range of RF futures in the literature; review and update

Step 2: Downscale all results to 0.5 x 0.5 grid

Step 3: Harmonize land use output (start from one common set of base year data at 0.5 x 0.5 grid; provide c…

Step 4: Harmonize emissions with 1 base year set (for 12 species; 10 sectors and at 0.5x0.5 degree) (develop data set)

Step 5: Run emissions of short-lived species in atmospheric chemistry model to create concentration fields

Step 6: Run emissions of long-lived GHGs in MAGICC to create concentration data

Step 7: Extend scenarios to 2300 using simple algorithms

Step 8: Make all data available for download at RCP-IIASA database

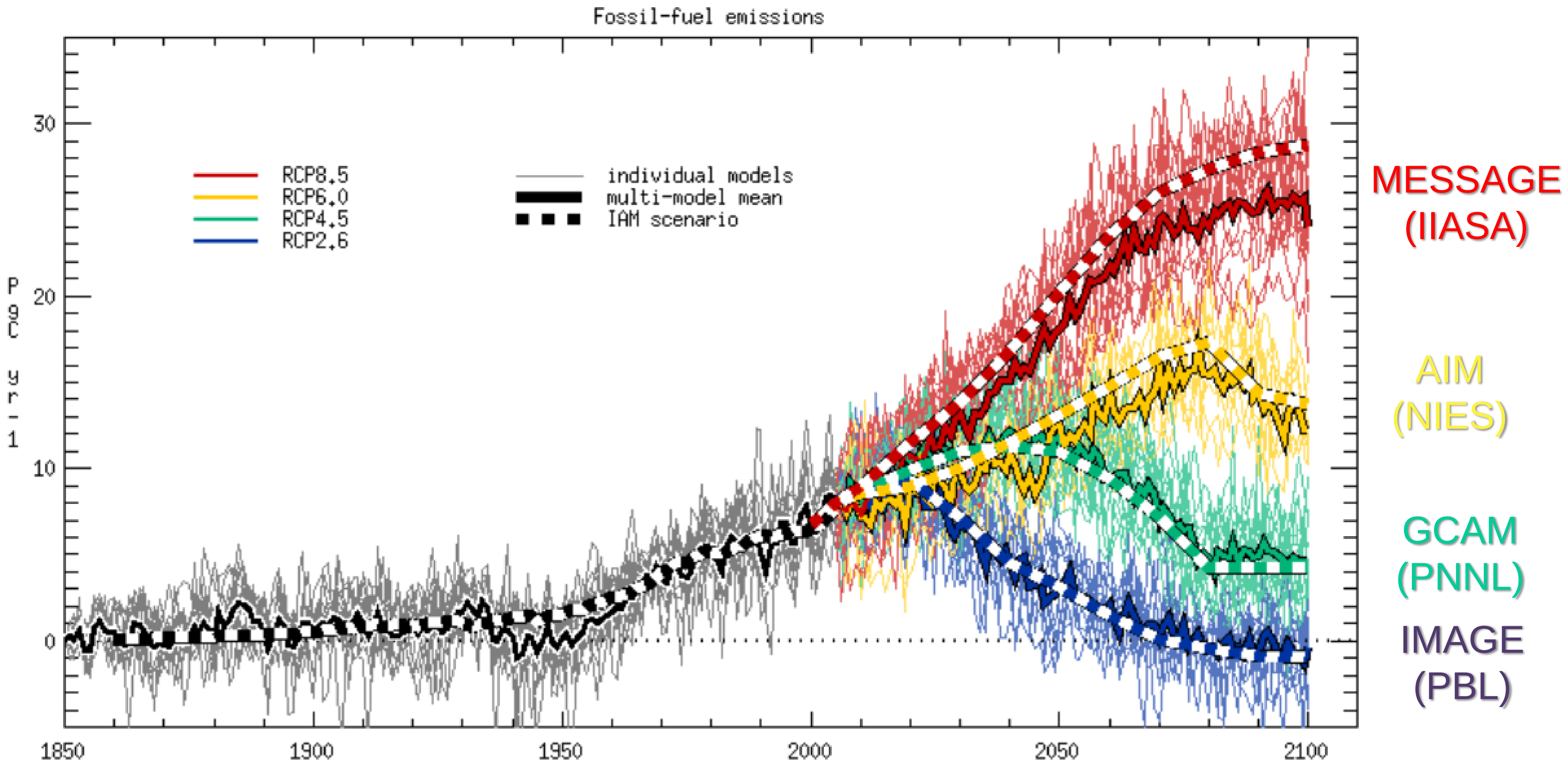
Source: van Vuuren et al. 2011

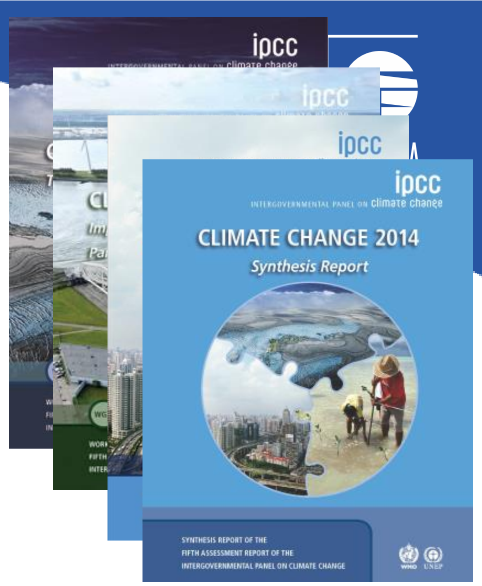
IAM Models Preparing the RCPs

Model	Home Institution
AIM Asia Integrated Model	National Institutes for Environmental Studies, Tsukuba Japan
GCAM Global Change Assessment Model	Joint Global Change Research Institute, PNNL, College Park, MD
IMAGE The Integrated Model to Assess the Global Environment	PBL Netherlands Environmental Assessment Agency, Bildhoven, The Netherlands
MESSAGE Model for Energy Supply Strategy Alternatives and their General Environmental Impact	International Institute for Applied Systems Analysis; Laxenburg, Austria

IIASA International Institute for Applied Systems Analysis

RCPs were run by climate models and assessed in AR5





Source: van Vuuren et al. 2011; Jones et al. 2013

Shared Socioeconomic Pathways (SSPs)

The Scenario Matrix Architecture

Challenge to mitigation

SSP5: Fossil fueled development

- Rapid growth, free trade
- High technology development,
- Environment and social goals not a priority: adaptive, technology-fix
- Focus on economic growth

Markets first

Clash of civilisations

SSP3: Regional rivalry

- Competition among regions
- Low technology development
- Environment and social goals not a priority
- Focus on domestic resources
- High population growth
- Slow economic growth dev. countries

SSP2:
Middle of the Road

SSP1:Sustainability

- Global cooperation
- Rapid technology dev.
- Strong env. policy
- Low population growth
- Low inequity
- Focus on renewables and
- efficiency
- Dietary shifts
- Forest protection

UN world

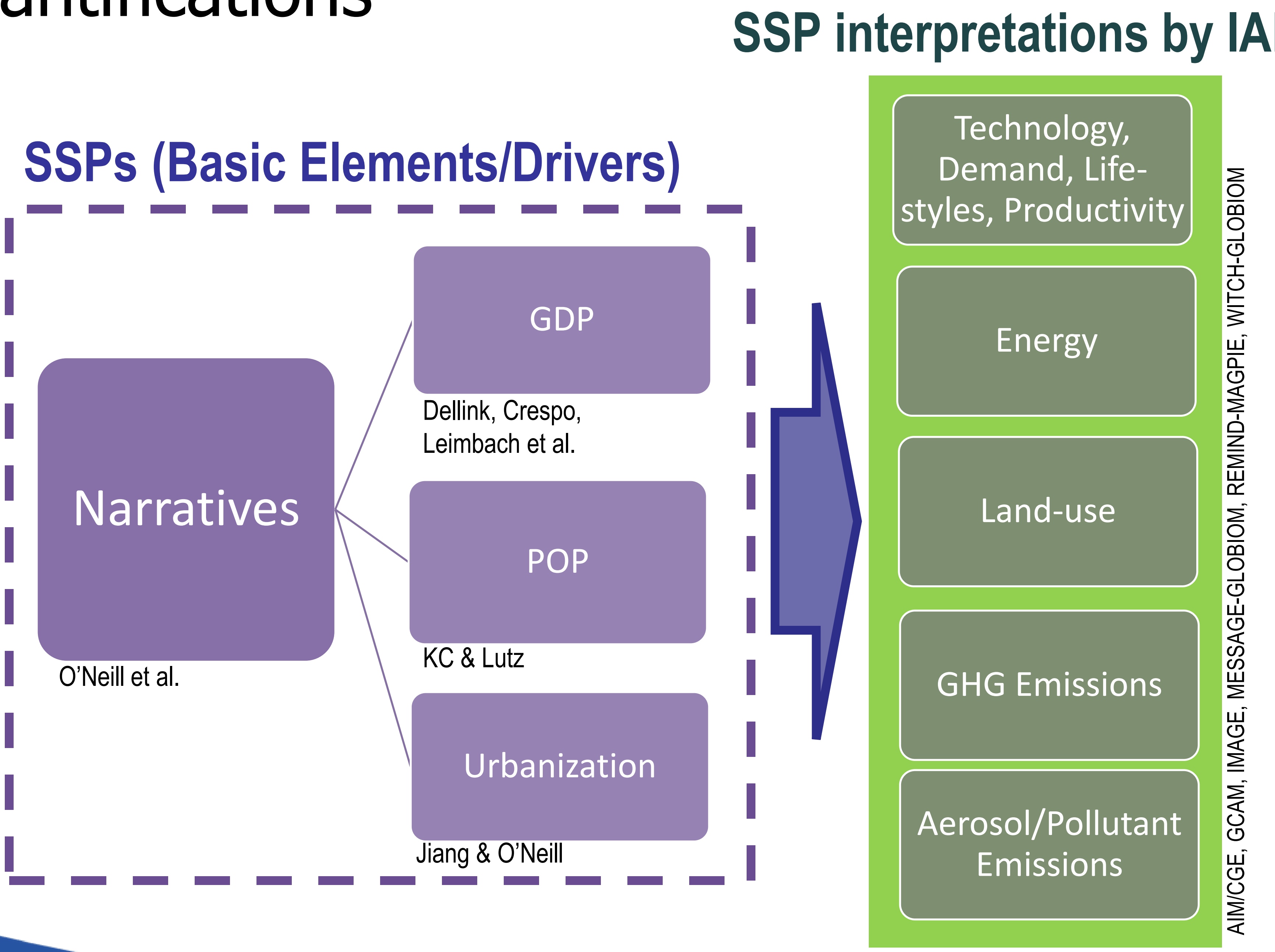
Have’s and have not’s

SSP4: Inequality

- Inequality across and within regions
- Low technology development
- Environment priority for those that can afford
- Limited trade

Challenge to adaptation

SSP Quantifications



Basic Elements and IAM Scenarios for the SSPs (GEC, 2017)

IIASA

Contents lists available at ScienceDirect

Global Environmental Change

journal homepage: www.elsevier.com/locate/gloenvcha

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The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview

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Community-wide effort

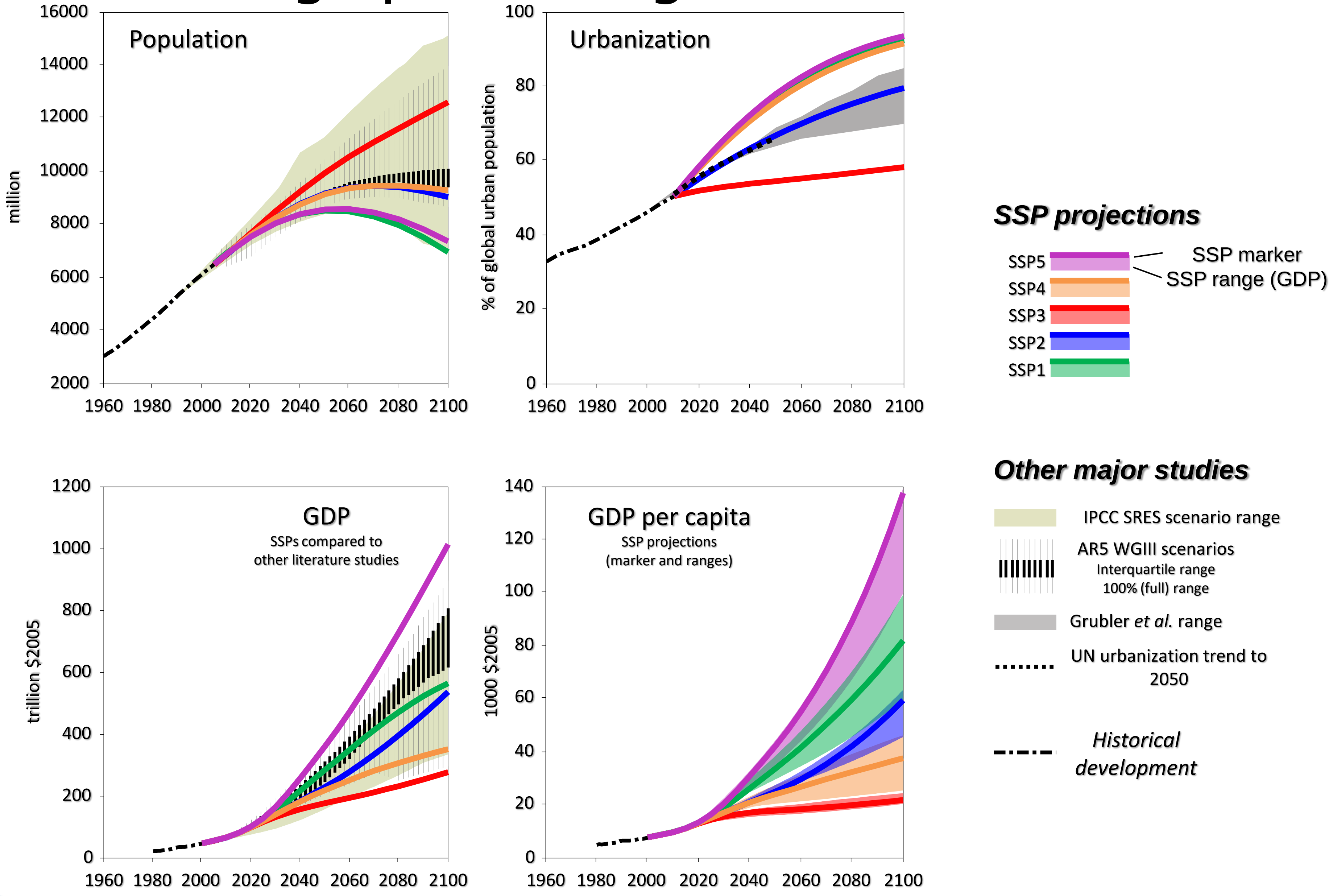
- Demographers
- Economists
- Impact & Vulnerability
- Integrated Assessment Modellers

Global Environmental Change Special Issue

- Overview (Riahi et al. 2017)
- Demographic projections (KC & Lutz 2017)
- GDP projections (OECD, IIASA, PIK 2017)
- Urbanisation projections (Liang & O'Neill 2017)
- Quantifications of SSPs (6 global IAM teams)
- Cross-cutting papers on energy, land and air pollution

Scenario data available at SSP database: https://tntcat.iiasa.ac.at/SspDb/

Economic & Demographic Change: five SSPs



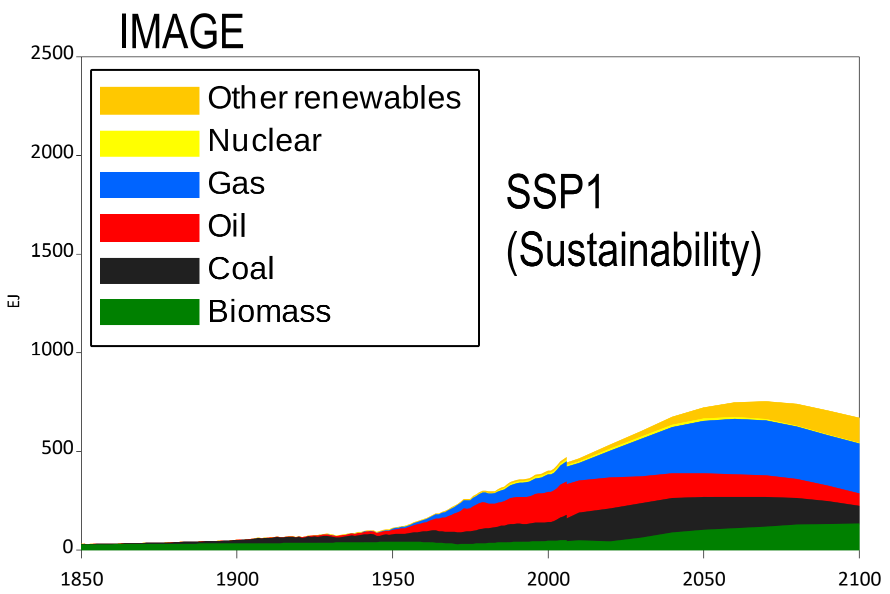
Sources: Overview: Riahi et al, 2017, GDP: Dellink et al, 2017; Urbanization: Jiang and O'Neill et al, 2017, Population: KC and Lutz, 2017

Reference SSP (IAM) Scenarios
(no climate policy beyond those in place before 2015)

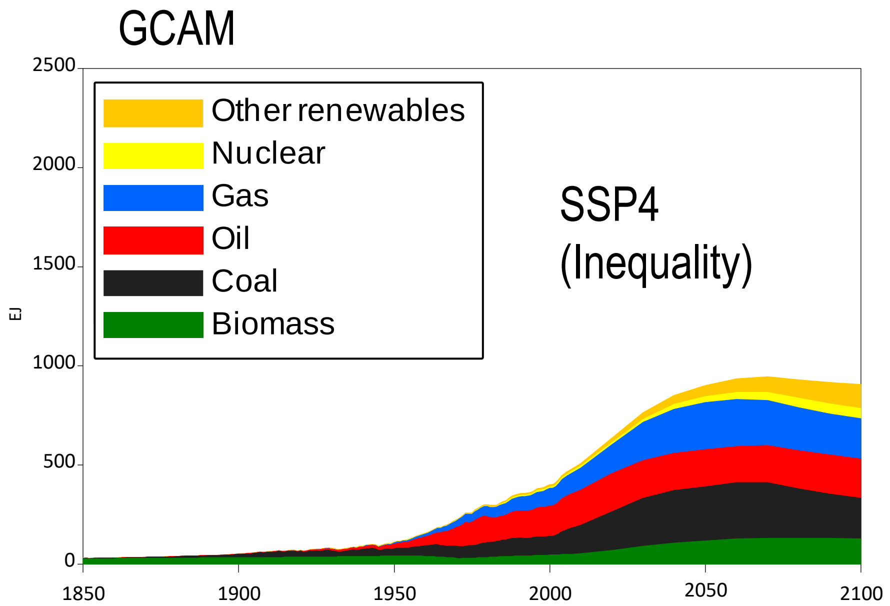
- Six IAM teams
- Five SSPs
- One representative Marker Scenario for each SSP
- For each SSP there are multiple IAM runs depicting uncertainty ranges

Energy – SSP Reference Cases

Two marker scenarios where mitigation is relatively easy



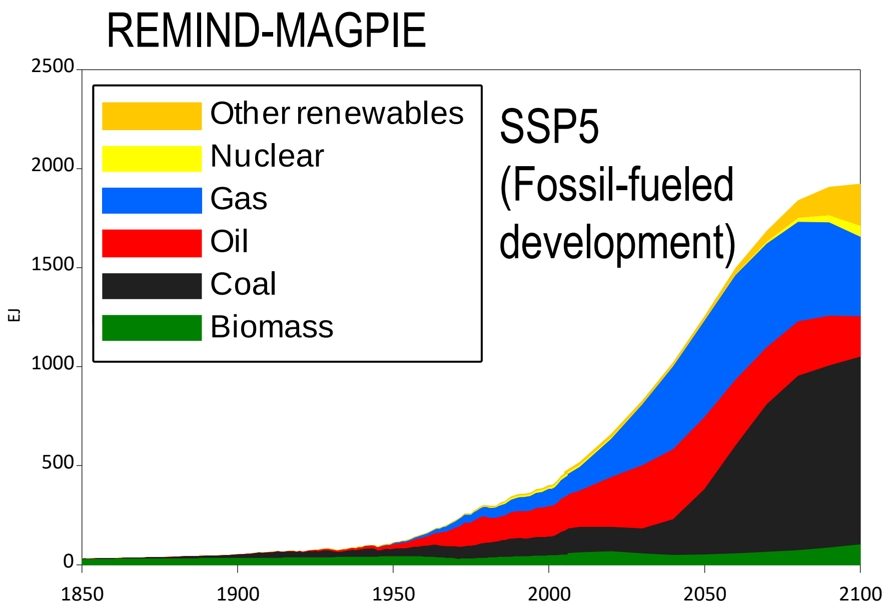
- Transition away from coal/oil
- Low demand

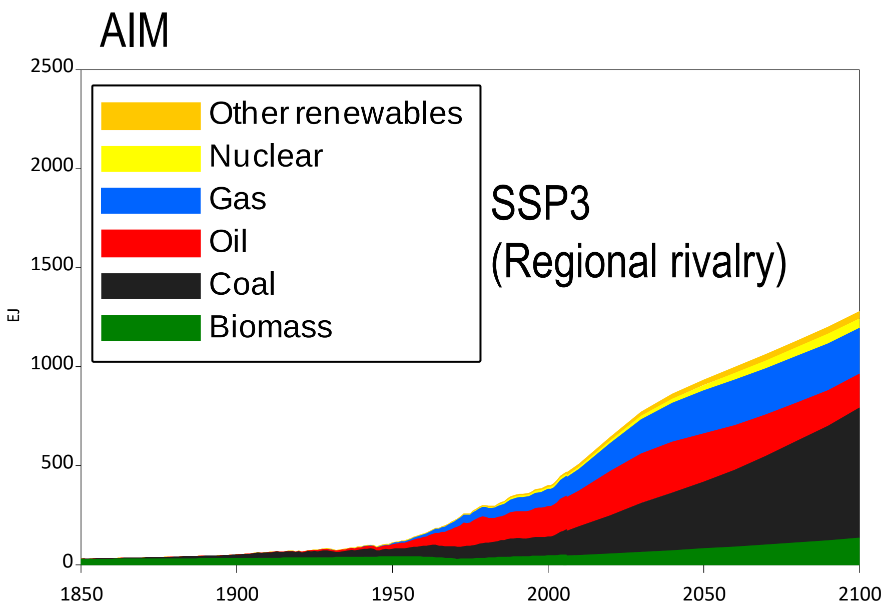


- High share of poor with low emissions
- Low/intermediate demand
- Technology available to the “elite”

Energy – SSP Reference Cases

Two marker scenarios where mitigation is relatively difficult



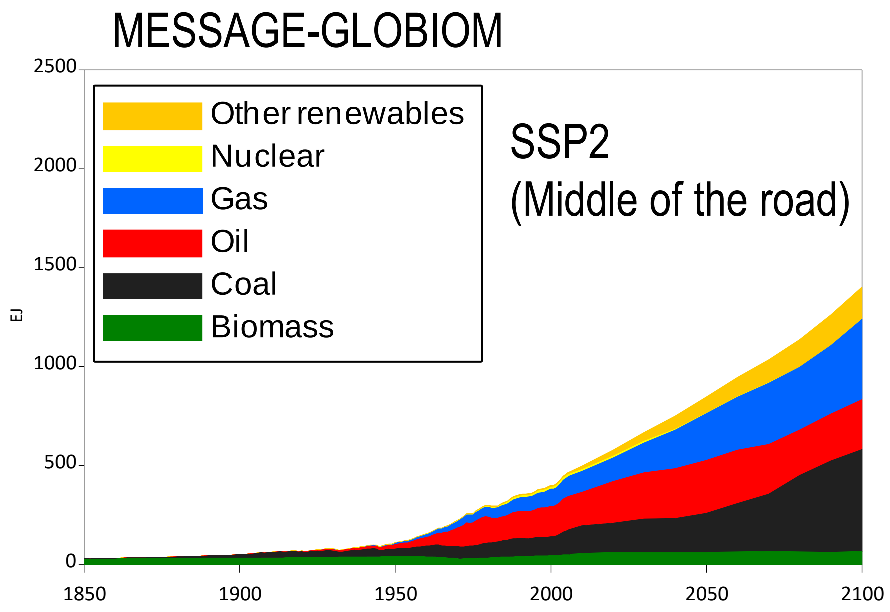


- Coal-intensive development
- Very high demand

- Fossil-intensive
- High poverty
- Slow technological change
- Strong fragmentation

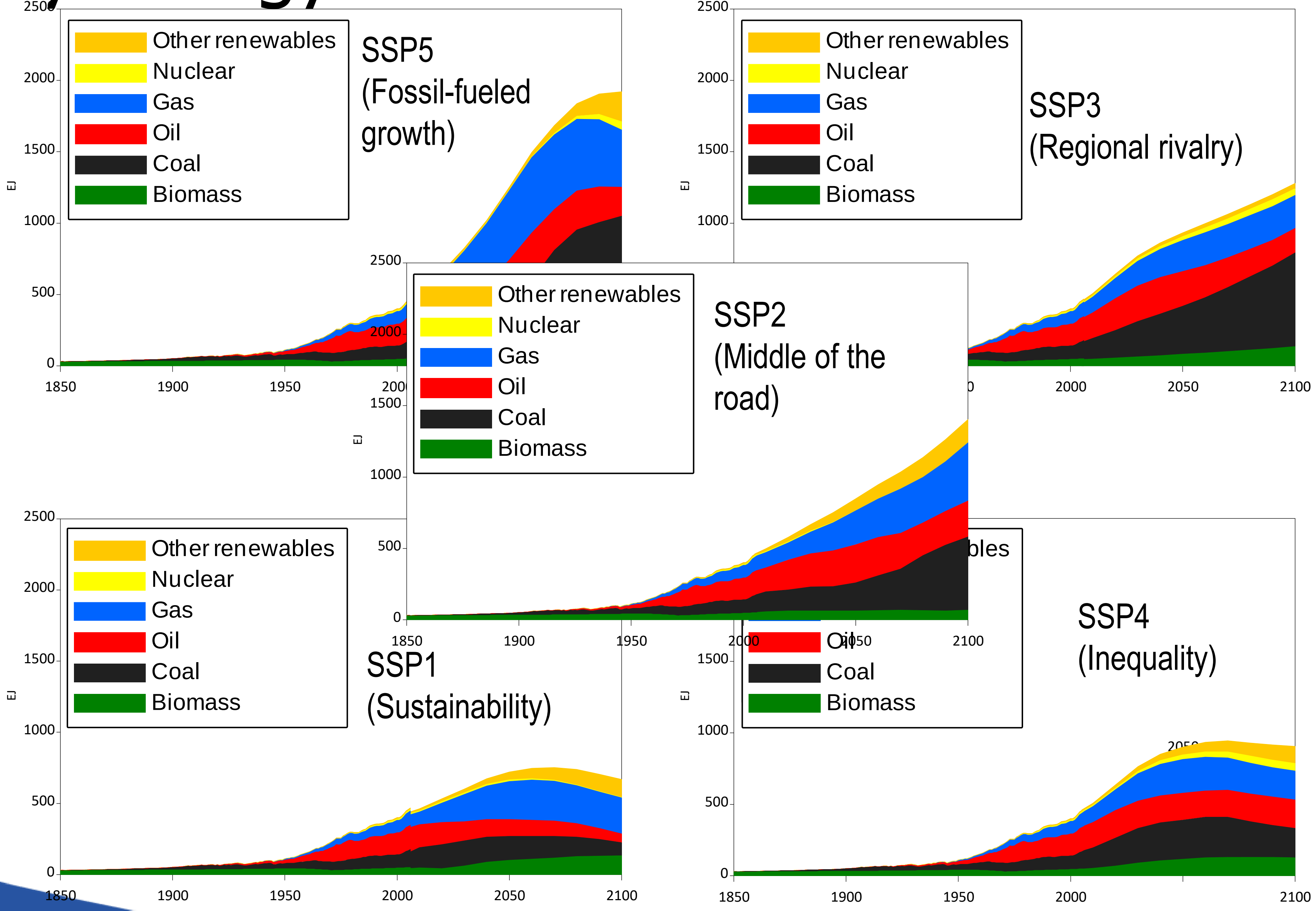
Energy – SSP Reference Cases

A central marker scenario with intermediate mitigation challenges



- Balanced technology
- Intermediate demand

Primary Energy – SSP Reference Cases



How were these pathways created?

Storylines

SSP5: Fossil fueled development

- Rapid growth, free trade
- High technology development,
- Environment and social goals not a priority: adaptive, technology-fix
- Focus on economic growth

SSP1:Sustainability

- Global cooperation
- Rapid technology dev.
- Strong env. policy
- Low population growth
- Low inequity
- Focus on renewables and efficiency
- Dietary shifts
- Forest protection

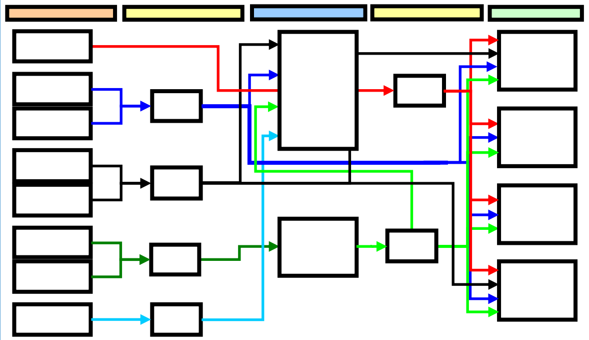
Qualitative assumptions

Table A.1: Qualitative assumptions for energy demand across SSPs

SSP Element	SSP 1 (Low / Med / High)	SSP 2 (Low / Med / High)	SSP 3 (Low)	SSP 3 (Med / High)	SSP 4 (Low)	SSP 4 (Med / High)	SSP 5 (Low / Med / High)
	Country Income Groupings						
Non-climate Policies							
Traditional Fuel Use	fast phase-out, driven by policies and economic development	intermediate phase-out, regionally diverse speed	continued realiance on traditional fuels		continued traditional fuel use	some traditional fuel use among low income housholds	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 level/high for local level)
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/mediu m	low	high
General Comments		some regional diversity retained					

Community

IAM



Modeling Team

Quantitative assumptions

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	**MODEL**	**SCENARIO**	**REGION**	**VARIABLE**	**UNIT**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
2	AIM/E-India [IIMA]	Reference	India	Capital Cost|Electricity|Biomass	US$2010/kWe	2284.664	2284.664	2284.664	2284.664	2284.664	2284.664	2284.664	2284.664	2284.66
3	AIM/E-India [IIMA]	Reference	India	Capital Cost|Electricity|Coal|IGCC	US$2010/kWe	2263.432	2263.432	2263.432	2263.432	2263.432	2263.432	2263.432	2263.432	2263.43
4	AIM/E-India [IIMA]	Reference	India	Capital Cost|Electricity|CSP	US$2010/kWe	7189.384	7189.384	7189.384	7189.384	7189.384	7189.384	7189.384	7189.384	7189.38
5	AIM/E-India [IIMA]	Reference	India	Capital Cost|Electricity|Gas|CC	US$2010/kWe	1276.799	1276.799	1276.799	1276.799	1276.799	1276.799	1276.799	1276.799	1276.79
6	AIM/E-India [IIMA]	Reference	India	Capital Cost|Electricity|Gas|CT	US$2010/kWe	526.7987	526.7987	526.7987	526.7987	526.7987	526.7987	526.7987	526.7987	526.798
7	AIM/E-India [IIMA]	Reference	India	Capital Cost|Electricity|Hydro	US$2010/kWe	3074.07	3074.07	3074.07	3074.07	3074.07	3074.07	3074.07	3074.07	3074.0
8	AIM/E-India [IIMA]	Reference	India	Capital Cost|Electricity|Nuclear	US$2010/kWe	4086.623	4086.623	4086.623	4086.623	4086.623	4086.623	4086.623	4086.623	4086.62
9	AIM/E-India [IIMA]	Reference	India	Capital Cost|Electricity|PV	US$2010/kWe	4648.405	4648.405	4648.405	4648.405	4648.405	4648.405	4648.405	4648.405	4648.40
10	AIM/E-India [IIMA]	Reference	India	Capital Cost|Electricity|Wind|Offshore	US$2010/kWe	3103.509	3103.509	3103.509	3103.509	3103.509	3103.509	3103.509	3103.509	3103.50
11	AIM/E-India [IIMA]	Reference	India	Capital Cost|Electricity|Wind|Onshore	US$2010/kWe	1693.652	1693.652	1693.652	1693.652	1693.652	1693.652	1693.652	1693.652	1693.65
12	AIM/E-India [IIMA]	Reference	India	OM Cost|Fixed|Electricity|Biomass	US$2010/kWe/yr	22.82728	22.82728	22.82728	22.82728	22.82728	22.82728	22.82728	22.82728	22.8272
13	AIM/E-India [IIMA]	Reference	India	OM Cost|Fixed|Electricity|Coal|IGCC	US$2010/kWe/yr	44.64246	44.64246	44.64246	44.64246	44.64246	44.64246	44.64246	44.64246	44.6424
14	AIM/E-India [IIMA]	Reference	India	OM Cost|Fixed|Electricity|Coal|PC	US$2010/kWe/yr	44.64246	44.64246	44.64246	44.64246	44.64246	44.64246	44.64246	44.64246	44.6424
15	AIM/E-India [IIMA]	Reference	India	OM Cost|Fixed|Electricity|CSP	US$2010/kWe/yr	117.8658	117.8658	117.8658	117.8658	117.8658	117.8658	117.8658	117.8658	117.865
16	AIM/E-India [IIMA]	Reference	India	OM Cost|Fixed|Electricity|Gas|CC	US$2010/kWe/yr	13.69637	13.69637	13.69637	13.69637	13.69637	13.69637	13.69637	13.69637	13.6963
17	AIM/E-India [IIMA]	Reference	India	OM Cost|Fixed|Electricity|Gas|CT	US$2010/kWe/yr	11.07591	11.07591	11.07591	11.07591	11.07591	11.07591	11.07591	11.07591	11.0759
18	AIM/E-India [IIMA]	Reference	India	OM Cost|Fixed|Electricity|Hydro	US$2010/kWe/yr	35.48955	35.48955	35.48955	35.48955	35.48955	35.48955	35.48955	35.48955	35.4895
19	AIM/E-India [IIMA]	Reference	India	OM Cost|Fixed|Electricity|Nuclear	US$2010/kWe/yr	99.52695	99.52695	99.52695	99.52695	99.52695	99.52695	99.52695	99.52695	99.5269
20	AIM/E-India [IIMA]	Reference	India	OM Cost|Fixed|Electricity|PV	US$2010/kWe/yr	105.0605	105.0605	105.0605	105.0605	105.0605	105.0605	105.0605	105.0605	105.060
21	AIM/E-India [IIMA]	Reference	India	OM Cost|Fixed|Electricity|Wind|Onshore	US$2010/kWe/yr	50.47305	50.47305	50.47305	50.47305	50.47305	50.47305	50.47305	50.47305	50.4730
22	AIM/Enduse[Japan]	JPN_MILES2_INDC80	Japan	OM Cost|Fixed|Electricity|Wind|Onshore	US$2010/kWe/yr	59.50295	59.50295	59.50295	59.50295	59.50295	59.50295	59.50295	59.50295	59.5029
23	AIM/Enduse[Japan]	JPN_MILES2_INDC80	Japan	Capital Cost|Electricity|Biomass	US$2010/kWe	3524.209	4007.529	4007.529	4007.529	4007.529	4007.529	4007.529	4007.529	4007.52
24	AIM/Enduse[Japan]	JPN_MILES2_INDC80	Japan	Capital Cost|Electricity|Coal|IGCC	US$2010/kWe	2894.886	2894.886	2894.886	2894.886	2894.886	2894.886	2894.886	2894.886	2894.88
25	AIM/Enduse[Japan]	JPN_MILES2_INDC80	Japan	Capital Cost|Electricity|Coal|PC|1	US$2010/kWe	2498.782	2498.782	2498.782	2498.782	2498.782	2498.782	2498.782	2498.782	2498.78
26	AIM/Enduse[Japan]	JPN_MILES2_INDC80	Japan	Capital Cost|Electricity|Coal|PC|2	US$2010/kWe	2315.909	2517.292	2517.292	2517.292	2517.292	2517.292	2517.292	2517.292	2517.29
27	AIM/Enduse[Japan]	JPN_MILES2_INDC80	Japan	Capital Cost|Electricity|Gas|CC|ACC	US$2010/kWe	1213.256	1213.256	1213.256	1213.256	1213.256	1213.256	1213.256	1213.256	1213.25
28	AIM/Enduse[Japan]	JPN_MILES2_INDC80	Japan	Capital Cost|Electricity|Gas|CC|ACC-High	US$2010/kWe	1547.214	1547.214	1547.214	1547.214	1547.214	1547.214	1547.214	1547.214	1547.21
29	AIM/Enduse[Japan]	JPN_MILES2_INDC80	Japan	Capital Cost|Electricity|Gas|CC|CC	US$2010/kWe	1152.593	1152.593	1152.593	1152.593	1152.593	1152.593	1152.593	1152.593	1152.59

reference | data | tech_variants

Source: Riahi et al. 2017, Krey et al. 2019

Qualitative Assumptions: Demand

Table A.1: Qualitative assumptions for energy demand across SSPs

SSP Element	SSP 1			SSP 2			SSP 3			SSP 4			SSP 5		
	Country Income Groupings														
	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 realiance on traditional fuels			continued traditional fuel use	some traditional fuel use among low income housholds		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 level/high for local level)		
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 retained											

Source: Riahi et al. 2017

Qualitative Assumptions: Fossil Fuels

Table A.2: Qualitative assumptions for fossil energy supply across SSPs

	SSP1 Sustainability	SSP2 Middle of the Road	SSP3 Regional Rivalry		SSP4 Inequality			SSP5 Fossil fueled development
			Country grouping		Country grouping by income			
			Exporter	Importer	Low	Medium	High	
Coal								
Macro-economy	cost driver	neutral	cost reducing		cost driver	cost driver	neutral	cost reducing
Technological progress	slow	medium	slow	fast	medium			very fast
National & environmental policy	very restrictive	supportive	very suportive		supportive	supportive	restrictive	very supportive
Conv. hydrocarbons								
Macro-economy	neutral	neutral	neutral		cost driver	neutral	cost reducing	cost reducing
Technological progress	medium	medium	medium		fast			very fast
National & environmental policy	restrictive	supportive	not supportive	supportive	supportive	supportive	restrictive	very supportive
Unconv. hydrocarbons								
Macro-economy	neutral	neutral	neutral		cost driver	neutral	cost reducing	cost reducing
Technological progress	slow	medium	slow	medium	medium			very fast
National & environmental policy	very restrictive	supportive	not supportive	very supportive	supportive	supportive	restrictive	very supportive
General								
Trade barriers	free trade	some barriers	high barriers		barriers			free

Source: Riahi et al. 2017

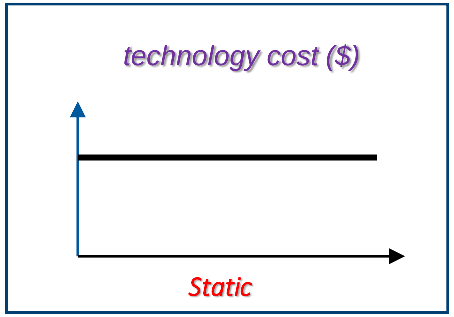
Qualitative Assumptions: Conversion

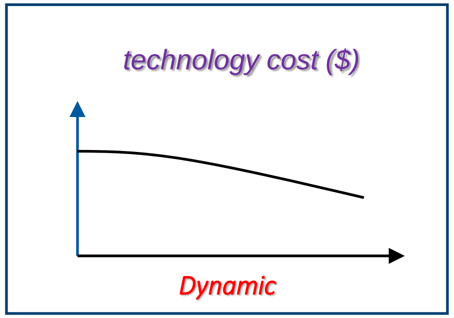
Table A.3: Qualitative assumptions for energy conversion technologies SSPs

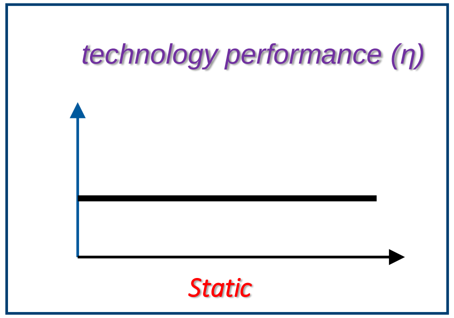
SSP Element	SSP 1			SSP 2			SSP 3			SSP 4			SSP 5		
	Country Income Groupings														
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Conventional and Unconventional Fossil Fuel Conversion (synfuel and syngas in parenthesis if different)															
Technology Development		Med			Med			Low		Low	Med	Med		Med (High)	
Social Acceptance		Low			Med			High		High	Low	Low		High	
Commercial Biomass Conversion															
Technology Development		High			Med			Low		High	High	High		Med	
Social Acceptance		Low			Med			High		High	High	High		Med	
Non-bio Renewables Conversion															
Technology Development		High			Med			Low		High	High	High		Med	
Social Acceptance		High			Med			Med		High	High	High		Low	
Nuclear Power															
Technology Development		Med			Med		Low	Low	Med	High	High	High		Med	
Social Acceptance		Low			Med		High	High	High	High	Med	Med		Med	
CCS (under climate policy only)															
Technology Development		Med			Med			Med		High	High	High		High	
Social Acceptance		Low			Med			Med		High	Med	Med		Med	

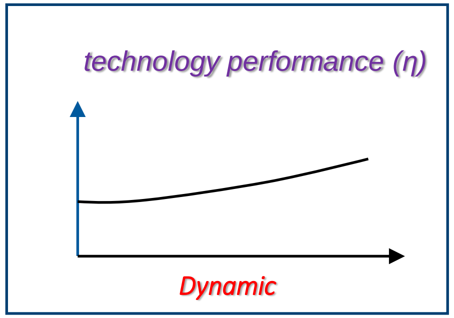
Source: Riahi et al. 2017

Projecting techno-economic parameters









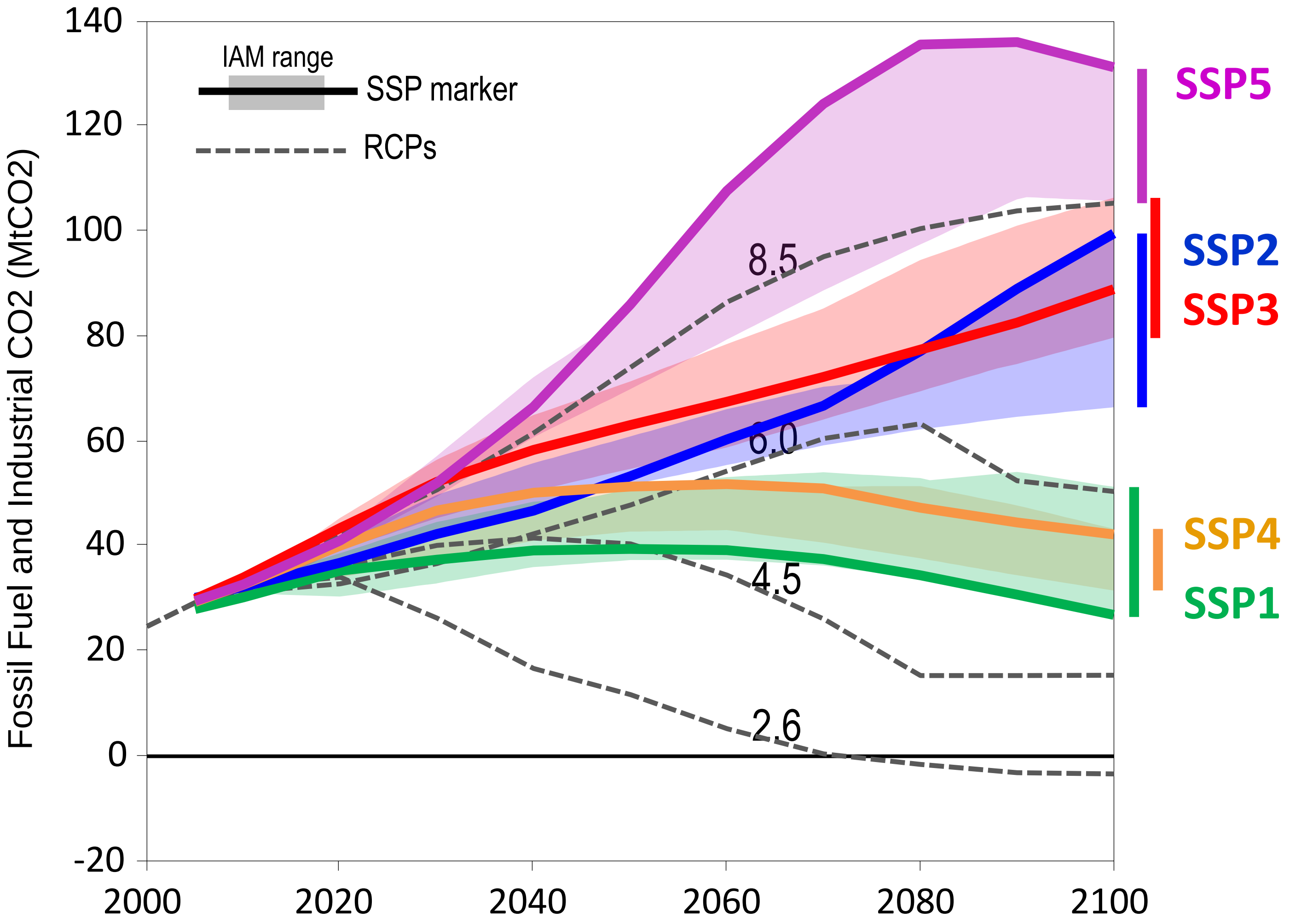
	Technology cost: Static	Technology cost: Dynamic
Technology performance: Static	▪ AIM/Enduse[Japan] ▪ AIM/E-India [IIMA] ▪ India MARKAL	▪ BLUES ▪ MESSAGEix-GLOBIOM_1.0
Technology performance: Dynamic	▪ REMIND 1.6 ▪ WITCH-GLOBIOM 4.4	▪ DNE21 +V.12A ▪ DNE21+ V.MILES ▪ GCAM 4.2_ADVANCE ▪ IMAGE 3.0 ▪ POLES MILES ▪ IPAC-AIM/technology_V1.0 ▪ PRIMES_V1

(using coal power plants as the example)

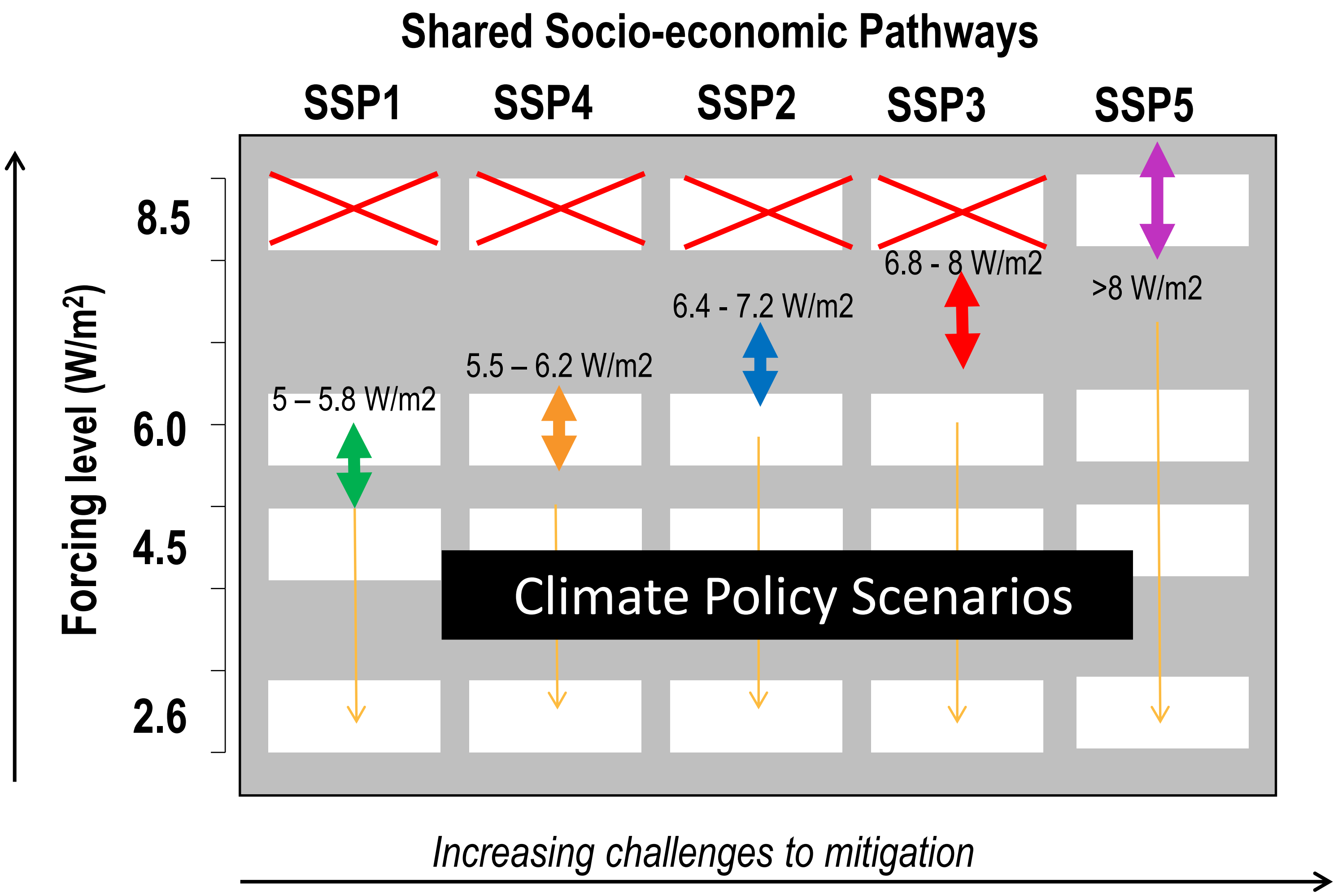
Source: Krey et al. 2019

Global CO_2 Emissions

SSP Reference scenarios and RCPs



SSP/RCP combinations based on reference IAM scenarios



Shared Policy Assumptions (SPAs)

SPAs describe policy assumptions consistent with the widely different challenges to mitigation across the SSP due to, e.g., fragmentation, lack of institutions, inequity, lack of technology, governance, etc..

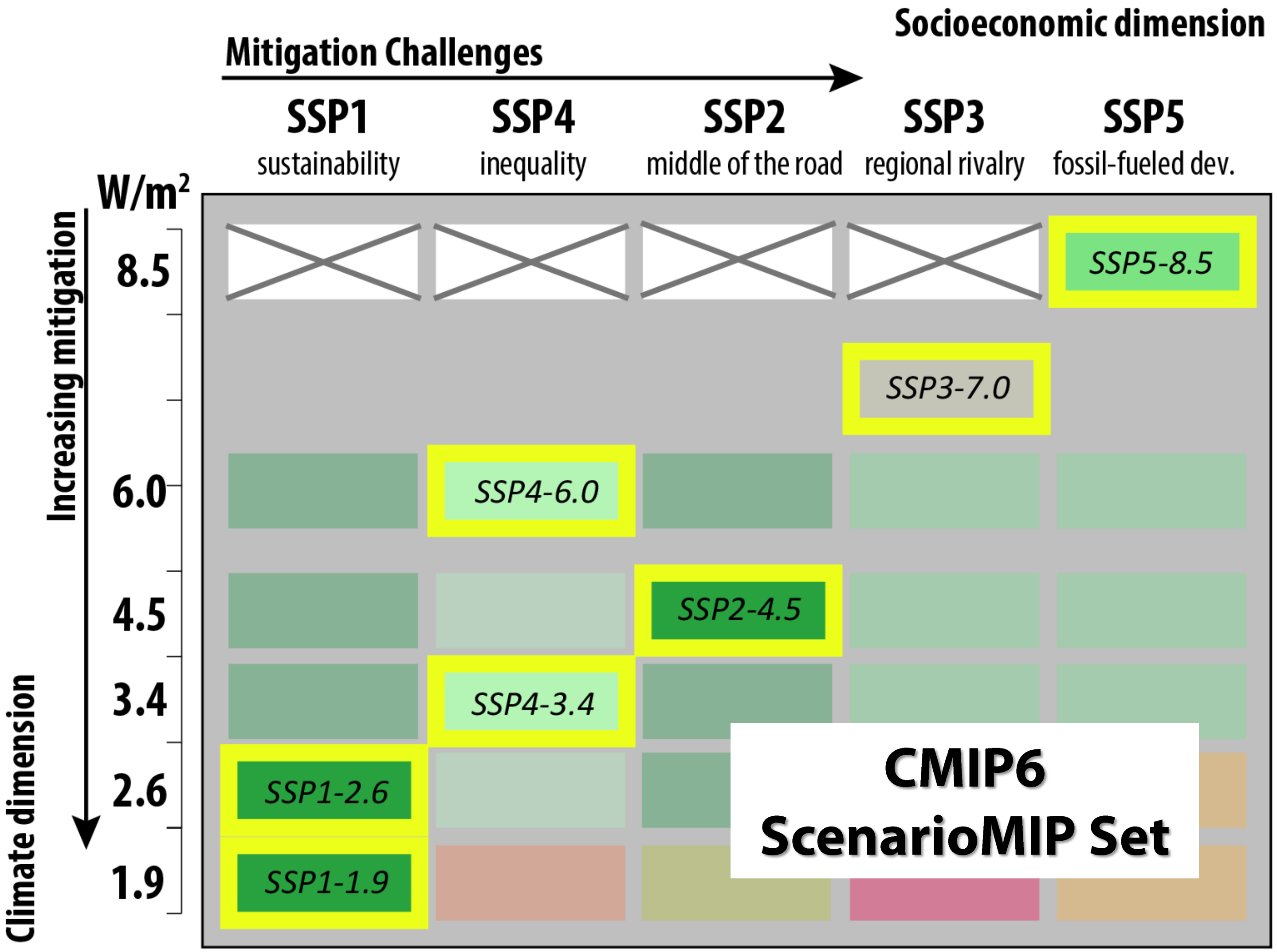
OUTDATED

Two main SPA dimensions

Accession rule and timing of regional participation	Effectiveness of [illegible]nd policies
SSP1, SSP4 Early accession will global coll[illegible]atio[illegible] as of 2020	***SSP1, SSP5*** Highly effective
[illegible]SP[illegible], S[illegible] Some [illegible]elays [illegible]ith low-[illegible]e regi[illegible]s join[illegible]g in 20[illegible]	***SSP2, SSP4*** Intermediately effective (limited REDD)
[illegible]SP3 [illegible]te a[illegible]sion[illegible] regions join as of 2020 and p[illegible] regions join at a certain income level	***SSP3*** Low effectiveness (implementation failures and high transaction costs)

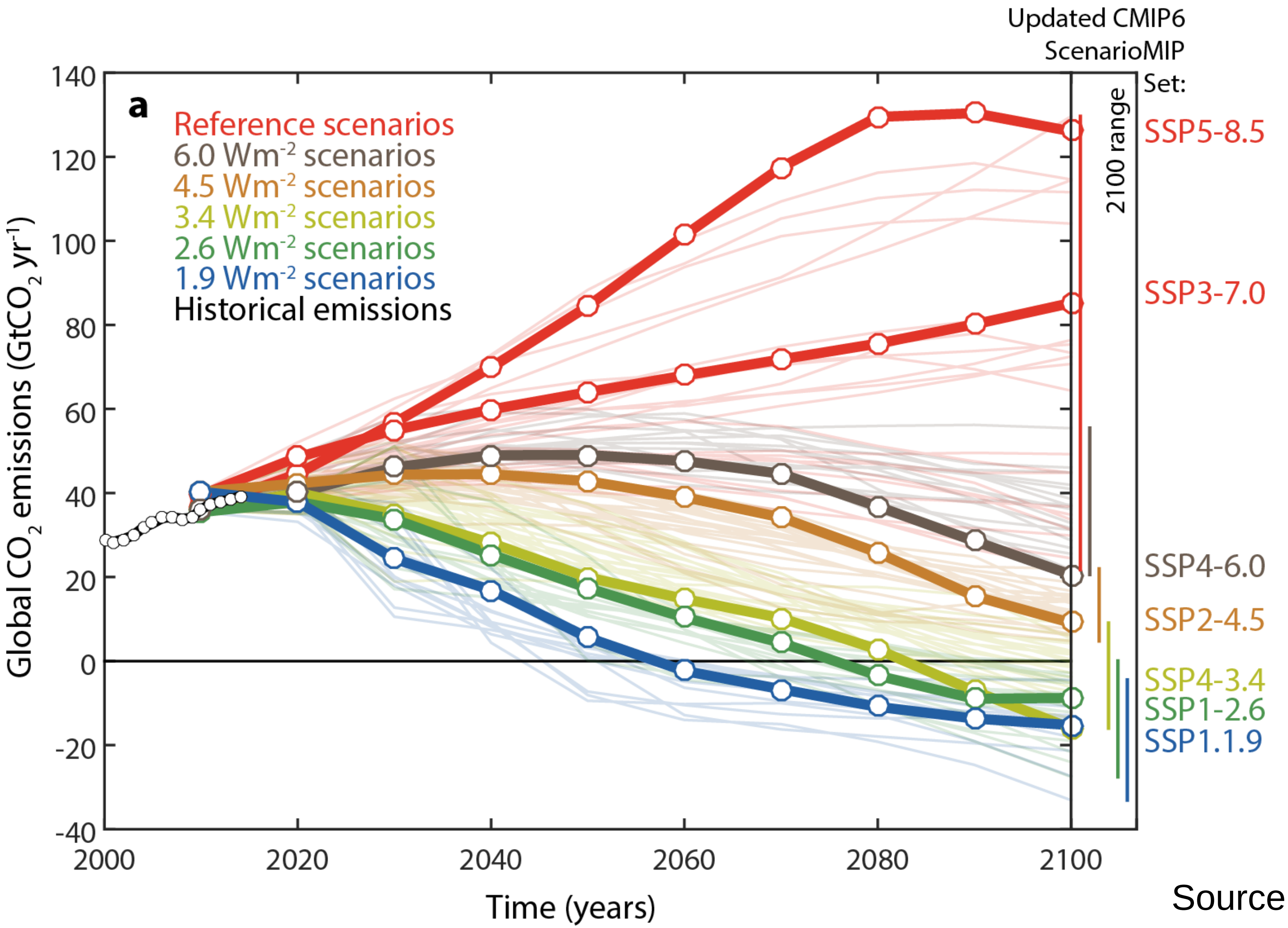
CMIP6/ScenarioMIP

RCP-SSP Matrix including mitigation pathways down to 1.9 W/m²



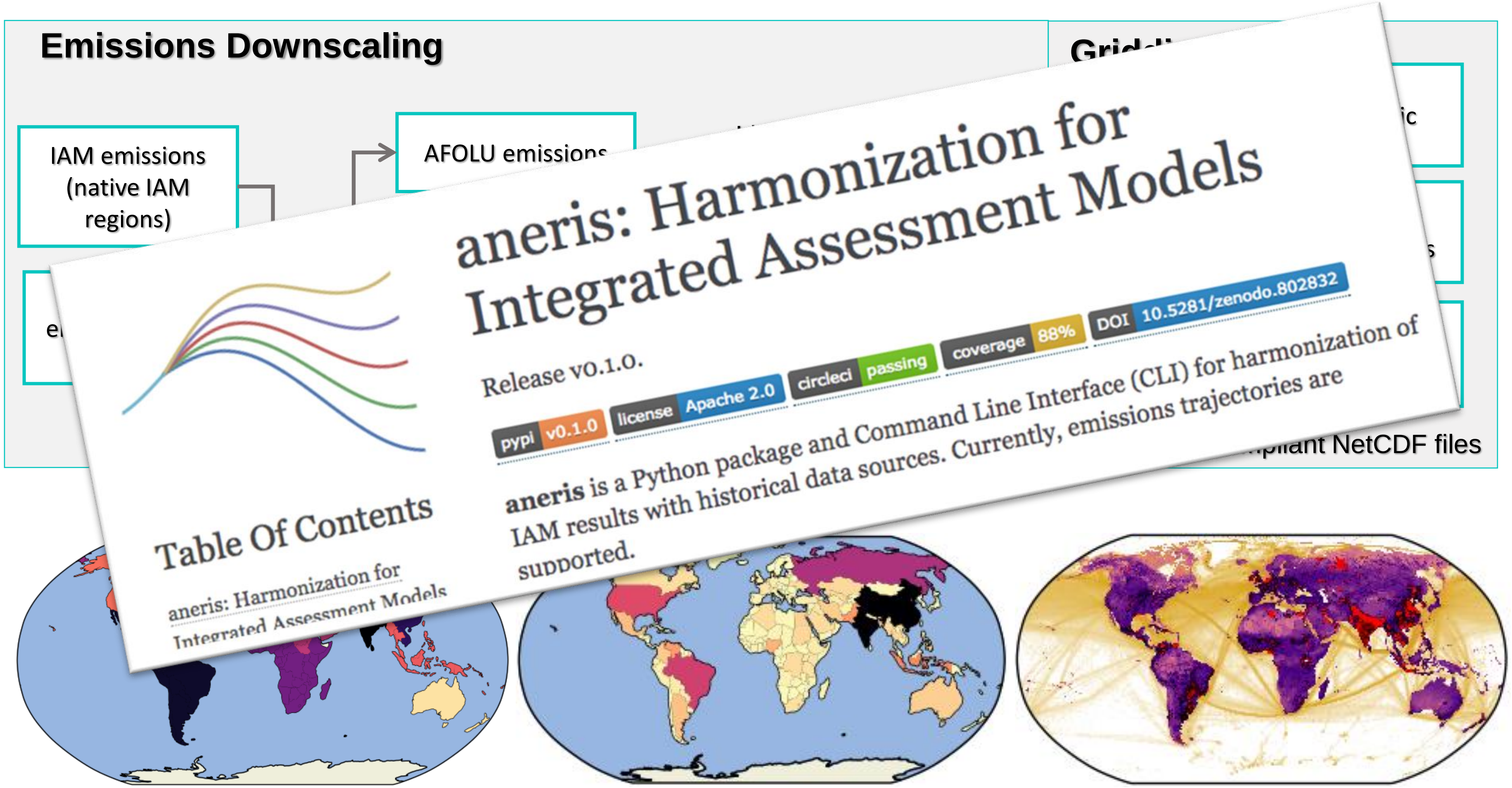
Source: Riahi et al. 2017, Rogelj et al. 2018

Global CO_2 Emissions



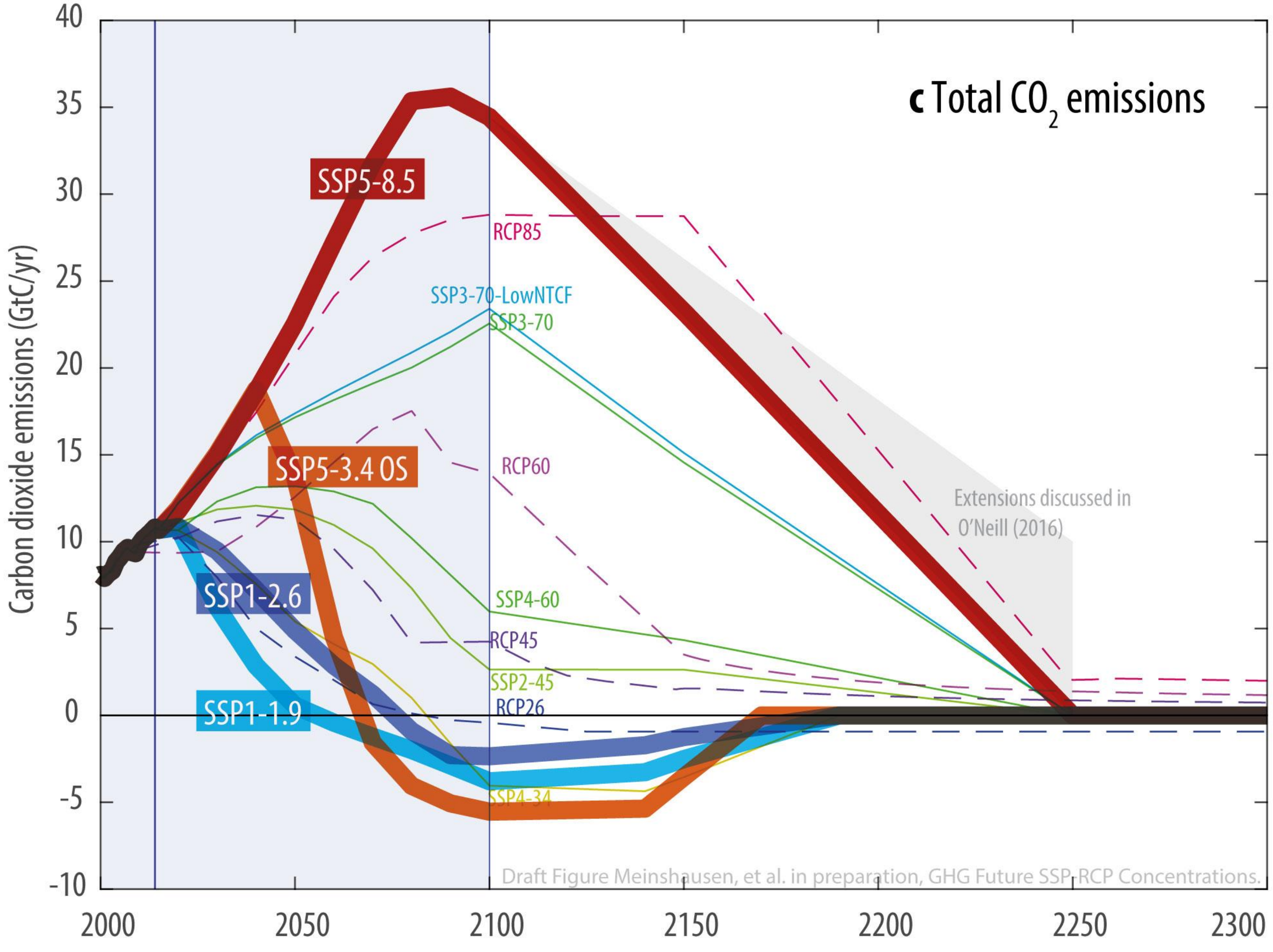
Source: Rogelj et al. (2018)

Harmonization and Downscaling of Emissions and Land-use for ESMs



Source: Gidden et al. (2019) https://doi.org/10.5194/gmd-12-1443-2019, Feng et al. (2020) https://doi.org/10.5194/gmd-13-461-2020, Hurtt et al. (2019) https://doi.org/10.5194/gmd-13-5425-2020

Extension of the CMIP6 Emissions beyond 2100



Source: Meinshausen et al. (2020), https://doi.org/10.5194/gmd-13-3571-2020

Equity and Fairness in Scenarios

New fair share analysis based on AR6 pathways indicate the need of increasing finance flows

IIASA

POLICY FORUM

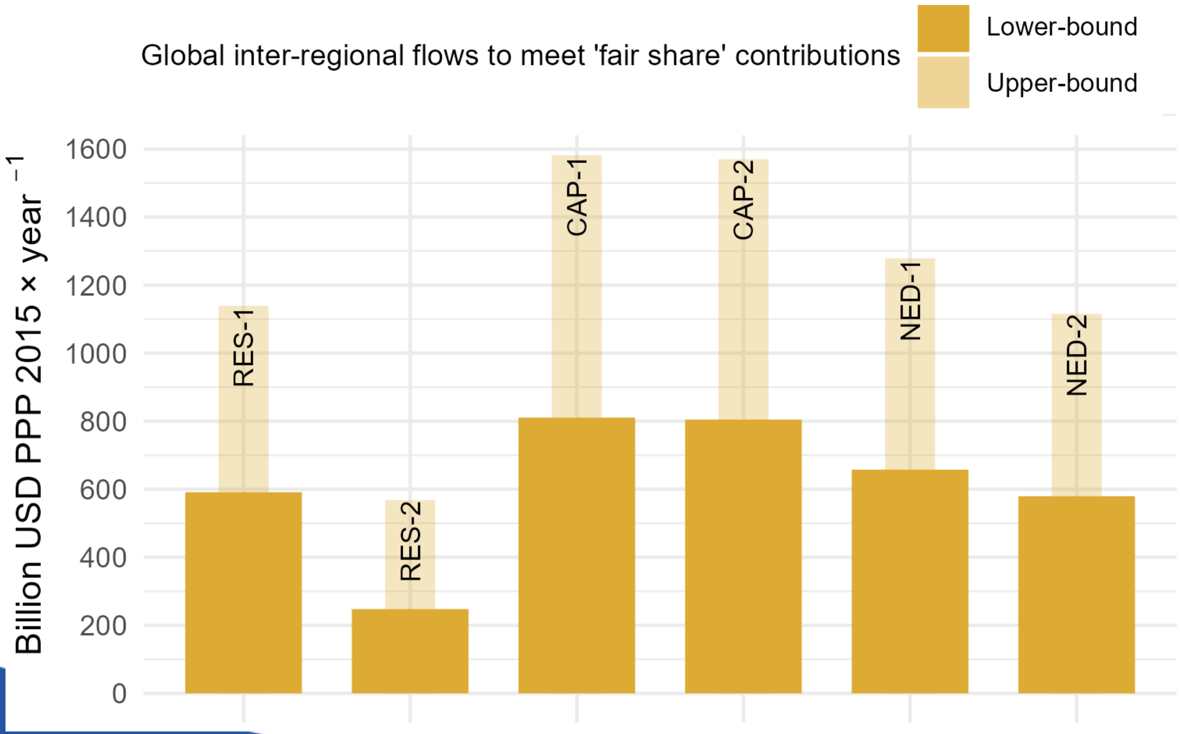
CLIMATE POLICY

Fairness considerations in global mitigation investments

Current mitigation finance flows are inadequate and unfair

By Shonali Pachauri[1], Setu Pelz[1], Christoph Bertram[2], Silvie Kreibiehl[3], Narasimha D. Rao[1,4], Youba Sokona[5,6], Keywan Riahi[1]

is evident from the USD 2.4 trillion world energy investment in 2022 estimated by the International Energy Agency. The IPCC



Investments in (most) AR6 pathways follow a cost-effectiveness approach (consistent with Article 3 of Paris Agreement).

The pathways, however, do not address the issue of who is financing the regional investments.

New assessment of equitable and fair finance (of the investments of the AR6 pathways) suggest a major increase of finance flows from Annex-1 to non-Annex-1 regions.

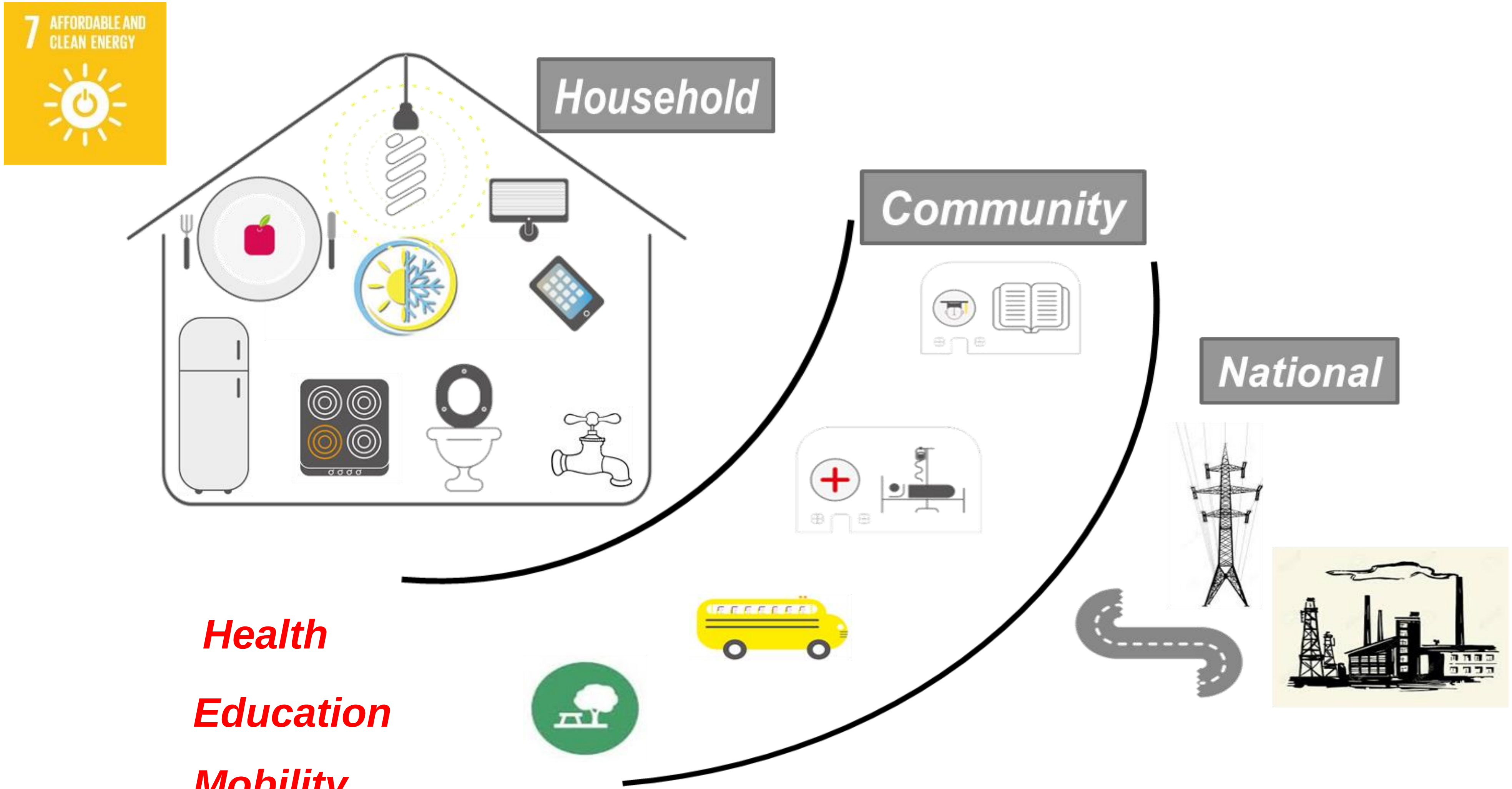
Source: Pachauri et al. (2022)

Fairness indicators

Name	Indicator (Unit)	Description	Source
Responsibility R1	1850 CO2FFI (GtCO 2)	Cumulative net anthropogenic fossil fuel and industry (CO2-FFI) emissions from 1850-2019	IPCC WGIII AR6, Ch2
Responsibility R2	1990 CO2FFI (GtCO 2)	Cumulative net anthropogenic fossil fuel and industry (CO2-FFI) emissions from 1990-2019	IPCC WGIII AR6, Ch2
Capability C1	GDP per Capita in 2019 (USD PPP 2017 / capita)	Total gross domestic product (GDP) per capita, for the year 2019	World Bank World Development Indicators
Capability C2	Capital stock per capita in 2019 (USD PPP 2017 / capita)	Total capital stock per capita, for the year 2019	Feenstra, Inklaar, & Timmer (2015)
Needs N1	Decent living standards deprivation in 2015 (average % deprived across all dimensions)	The average share of regional population estimated deprived across all dimensions of the decent living standards for the year 2015	Rao & Min, (2018), Kikstra et al. (2021)
Needs N2	Climate risk in 2030 (% of regional population)	The share of regional population facing acute climate risk in 2030	Byers et al. (2018)

Source: Pachauri et al. (2022)

Energy for Poverty Eradication



Health

Education

Mobility

Supporting Infrastructure

Rao & Min, *Soc. Ind. Res.*, 2018

Decent Living Standards – Material basis for Well-being

DLS Indicators

Dimension	Unit
Food	kCal, Micronutrition
Shelter Comfort	m^2, Durable (ºC, RH)
Basic appliances	Stove, TV, Fridge
Health/Educ	$$
Clothing	Kg
Water/Sanit	Access, m^3
Mobility	P-km

Physical Wellbeing

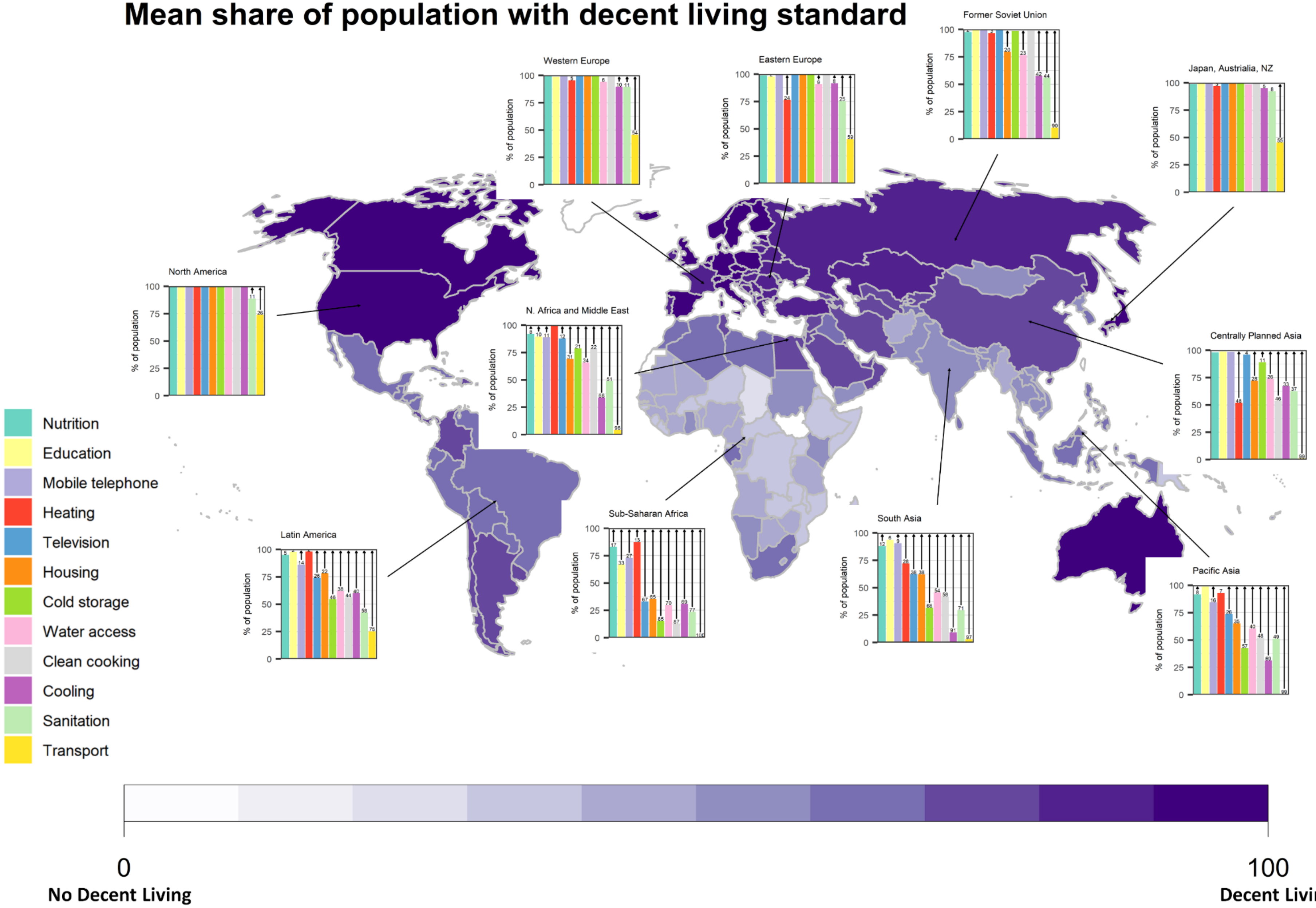
Dimension	Description/ (Minimum) Thresholds
Housing	Safe, durable (permanent), min space (10 m^2/cap)
Thermal comfort	AC Use (26°C, 60% Humidity), 1 bedroom, nights only. Heating to 18°C
Nutrition	Macro- and micronutrients (protein, zinc, iron, calories)
Clean ckg	LPG or electricity cook stoves
Water	65 l/cap/day, indoor access
Sanitation	Sewage distribution (urban only)
Appliances	Fridge: <200 l; TV; cell phone per adult
Health care	$665 per capita (national)
Education	$1000 -$1500 per student (national)
Mobility Infrastructure	10K p-km motorized; paved roads; public transit

Social Wellbeing

Rao & Min, *Soc. Ind. Res.*, 2018

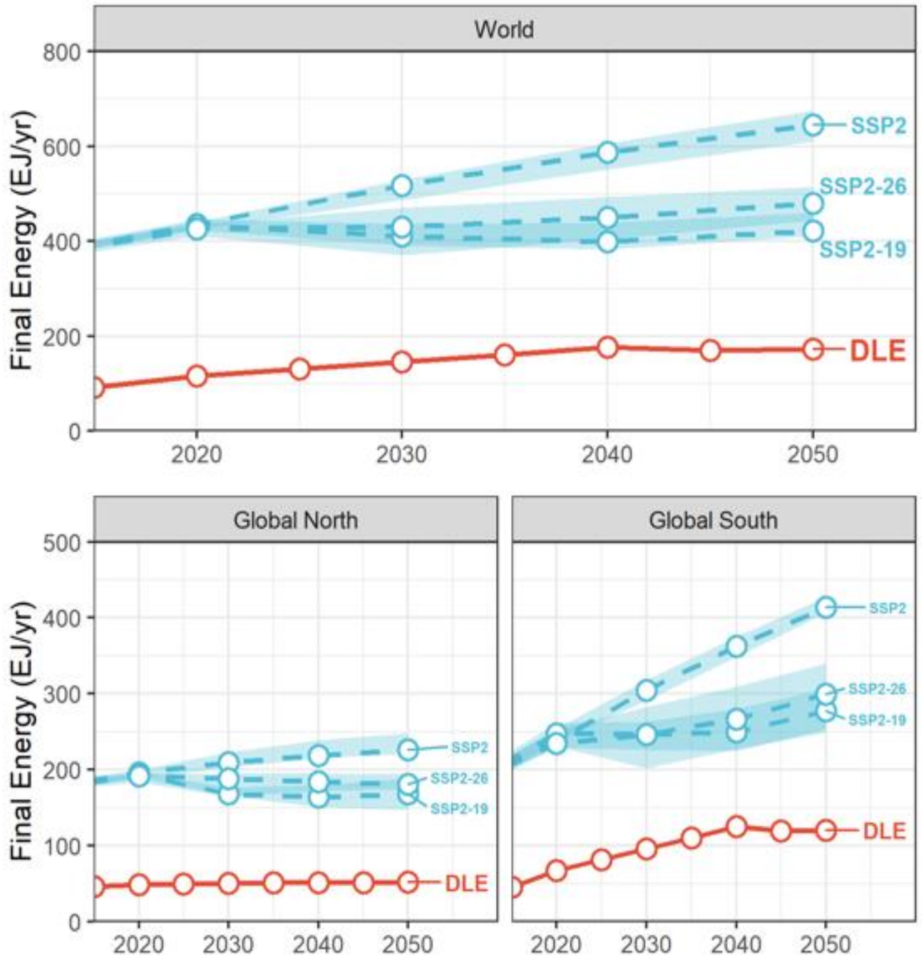
Decent Living Gaps – Today

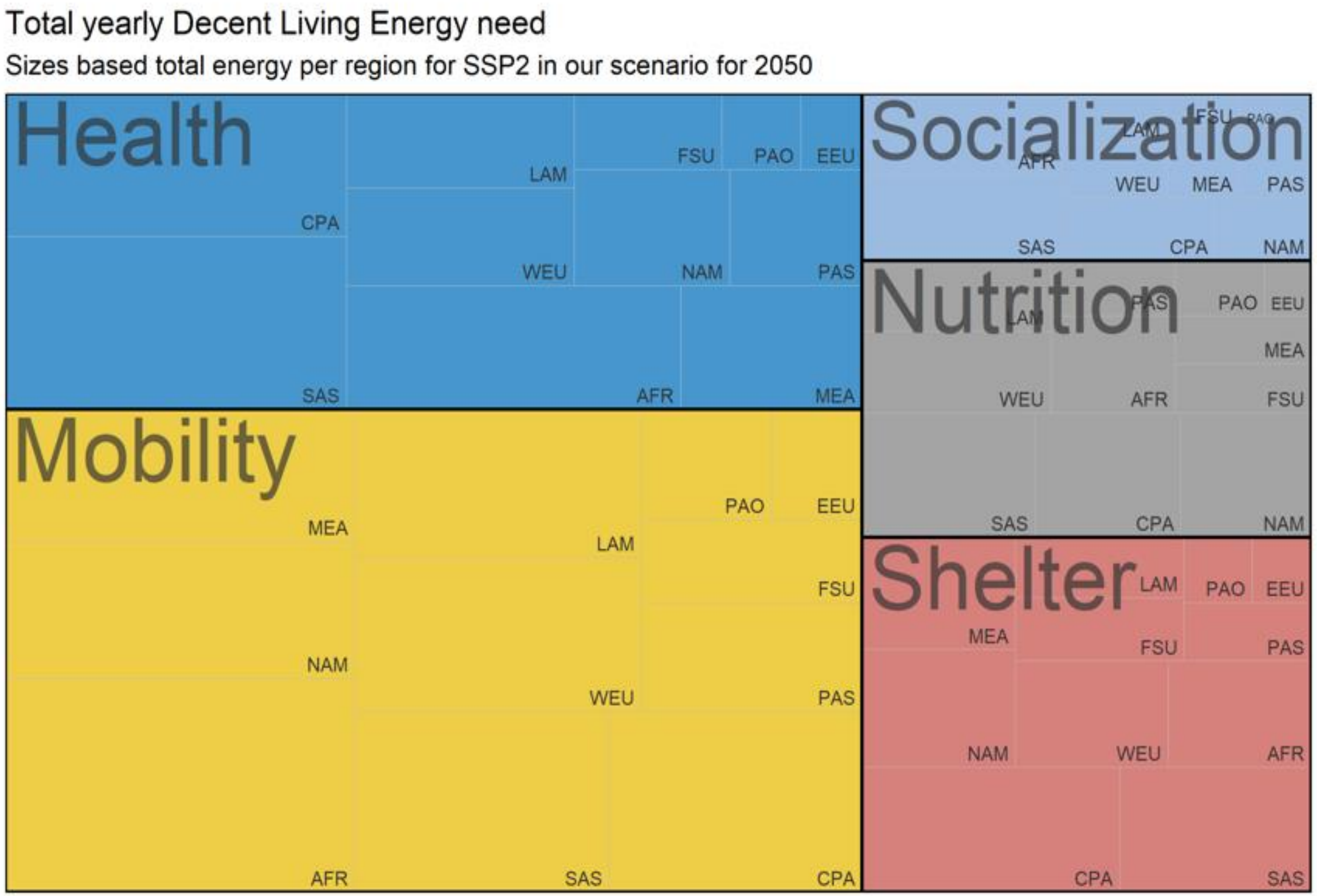
Mean share of population with decent living standard



Source: Kikstra et al. 2022

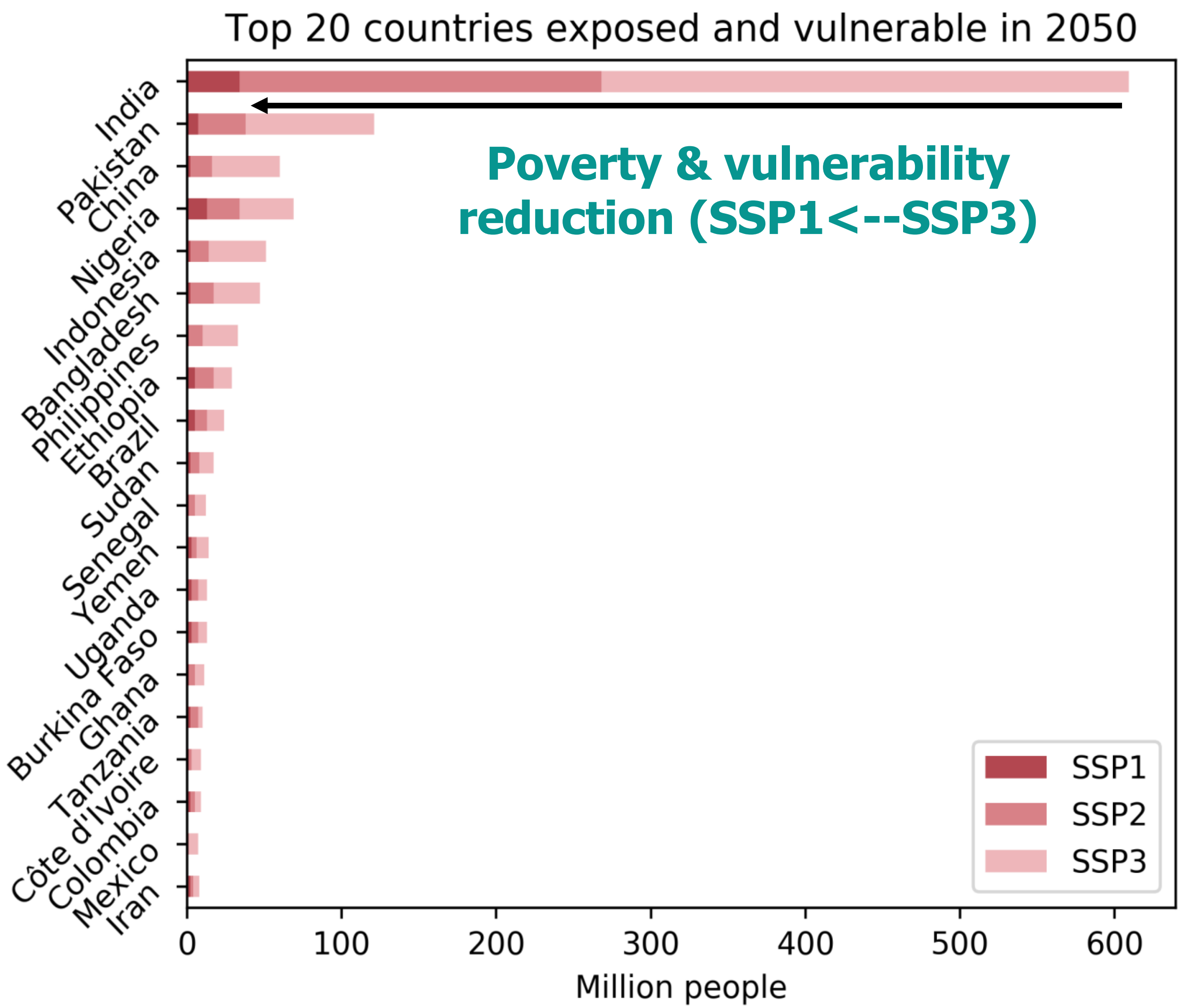
Energy needs for DLE significantly less than lowest scenarios in the literature





Kikstra et al., 2022

Benefits of development, reducing vulnerability to climate extremes



Source: Byers et al. (2018)

SSP Updates

ICONICS
The International Committee on New Integrated Climate Change Assessment Scenarios

IAMC
Integrated Assessment Modeling Consortium
Founded 2007

Towards updated and revised SSPs...

- Basic elements of SSPs were developed about 10 years ago
- New process has started to provide updates along different phases:
  1. Numerical updates of existing SSPs ()
  2. Update/extend existing narratives
  3. Add and/or replace SSPs
  4. Revisit and modify framework where necessary

Review process of new SSP quantifications (I)

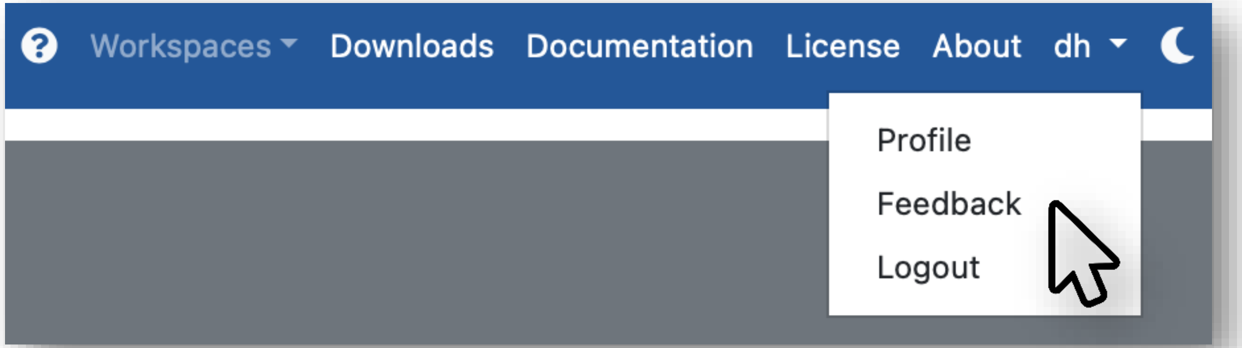
The updated SSP projections for GDP and population to be reviewed via the IIASA Scenario Explorer infrastructure

Process:

⇒ Updated SSP projections available via a public Scenario Explorer available at http://data.ece.iiasa.ac.at/ssp

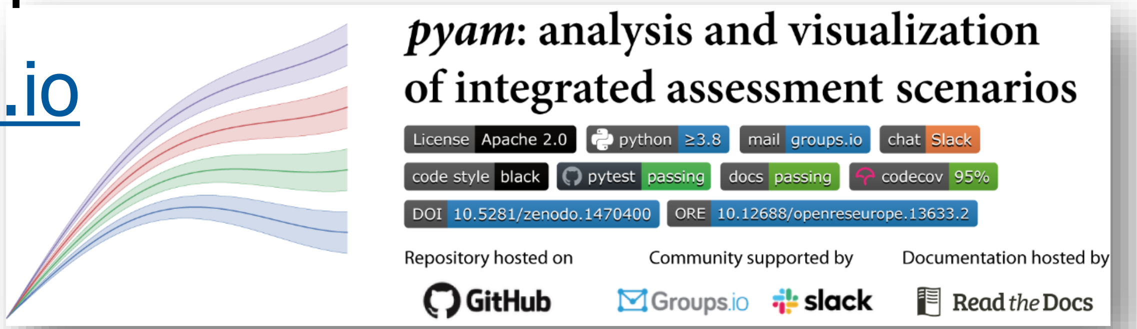
⇒ Feedback possible until Friday, **September 8, 2023**

⇒ Feedback option only available for registered users



Three approaches for reviewing and working with the updated SSP projections

- The interactive Scenario Explorer
  ⇒ Create a workspace, select scenario and data in a panel
  ⇒ See the tutorials at https://software.ece.iiasa.ac.at/ixmp-server
- Download the projections data as xlsx files
  ⇒ Go to the "Downloads" tab
- The open-source Python package pyam
  ⇒ Visit https://pyam-iamc.readthedocs.io



Some guidelines for submitting a review

Please provide the following information in a review
(via the SSP-Scenario-Explorer feedback form)

⇒ Your name and institution

⇒ The type/source of projections (GDP or population)

⇒ The specific region/variable/year where your comment applies

Please be as precise as possible

⇒ A detailed description of your comment/remark/question

- ⇒ Projections x for country y after year z should be higher, because …
- ⇒ Projections x are not consistent with source y …

Thank you very much for your attention!

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Volker Krey

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Energy, Climate & Environment (ECE) Program

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