ICONICS | International Committee on New Integrated Climate Change Assessment Scenarios

The Shared Socio-Economic Pathways (SSPs): An Overview

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SSP population by IIASA[1], urbanization by NCAR[4], GDP by Dellink et al., IIASA[1], PIK[3]; SSP IAM scenarios by IIASA[1], PBL[2], PIK[3], PNNL[5], NIES[6], FEEM[7]

WHY NEW SCENARIOS FOR CLIMATE CHANGE RESEARCH?

- Socio-economic scenarios used to derive emissions scenarios without (baseline scenarios) and with climate policies (mitigation scenarios)
- Emissions scenarios used to derive climate change projections
- Climate change projections and socio-economic scenarios used to evaluate climate impacts and adaptation measures

Previous set of socio-economic scenarios are 15 years old (SRES, 2000).
New socio-economic scenarios are needed (➔ SSPs).

THE SHARED SOCIO-ECONOMIC PATHWAYS (SSPs)

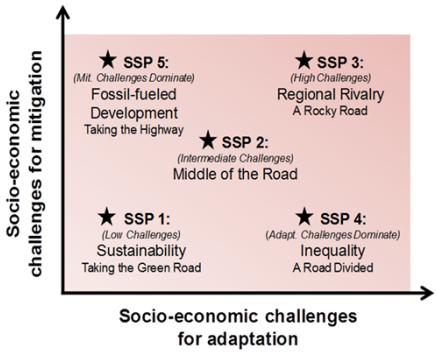

Fig. 1 Overview of SSPs
(Narratives in O'Neill et al., 2016, Glob Env Change, online first)

***SSP1**: low challenges for mitigation (resource efficiency) and adaptation (rapid development)*
***SSP3**: high challenges for mitigation (regionalized energy / land policies) and adaptation (slow development)*
***SSP4**: low challenges for mitigation (global high tech economy), high for adapt. (regional low tech economies)*
***SSP5**: high challenges for mitigation (resource / fossil fuel intensive) and low for adapt. (rapid development)*

- Should cover policy-relevant scenarios space ➔ Pathways with different socio-economic challenges for mitigation and adaptation
- Should relate to previous generation of emissions scenarios (RCPs) and climate projections (CMIP5) for seamless transition of impacts, adaptation, vulnerability (IAV) analysis ➔ Scenario matrix architecture

Basic SSPs consist of a *narrative* outlining broad characteristics of the global future and country-level *population*, *GDP*, *urbanisation* projections
SSPs are not scenarios themselves, but their building blocks.

SCENARIO MATRIX ARCHITECTURE

- Climate change scenarios (incl. socio-economics, emissions, climate response) determined by SSP (columns) and anthropogenic forcing of climate system (rows)
- Both information needed for IAV, mitigation, and integrated analysis.

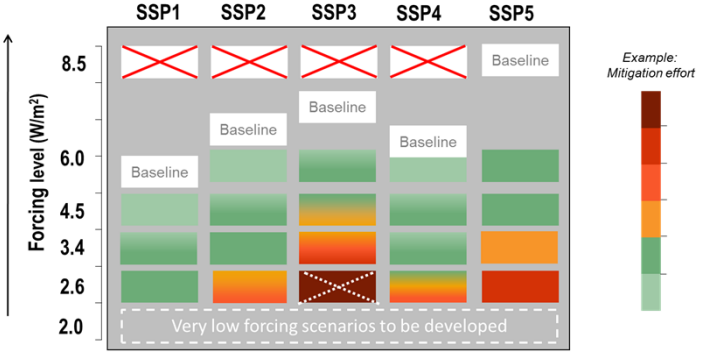

***Fig. 2** Scenario matrix specified by SSPs and forcing levels. Scenarios populate individual cells providing information about mitigation benefits and costs (shown here as example). It is distinguished between baseline scenarios without and mitigation scenarios with mitigation policies. The climate forcing in the baseline depends on the SSP, and only reaches RCP8.5 levels in SSP5. Stringent mitigation levels (RCP2.6) could not be accessed by a set of IAMs in SSP3.*

SSP POPULATION, GDP AND ECONOMIC GROWTH PROJECTIONS

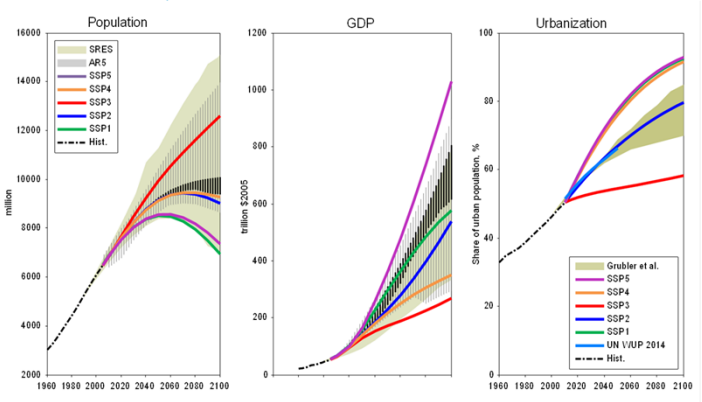

***Fig. 3** Projections of population (KC & Lutz, 2016), economic growth (Dellink et al., 2016) and urbanization (Jiang & O'Neill, 2016; all in Glob Env Change, online first) across SSP.*

SSP Land Use-Energy-Economy-Emissions Scenarios

The SSPs were implemented in six integrated assessment models (IAMs) to derive associated baseline and mitigation scenarios. For each SSP, there is a marker IAM scenario and a range of non-marker scenarios. Scenarios will be published soon in Glob Env Change (Riahi et al., 2016).

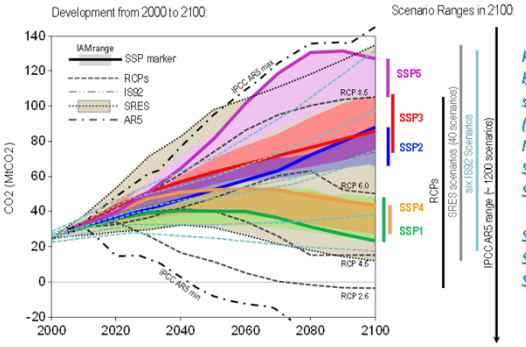

Fig. 4 Range of SSP baseline emissions scenarios by IAMs (preliminary data)
Markers:
SSP1 – IMAGE (PBL)
SSP2 – MESSAGE-GLOBIOM (IIASA)
SSP3 – AIM (NIES)
SSP4 – GCAM (PNNL)
SSP5 – REMIND-MAgPIE (PIK)

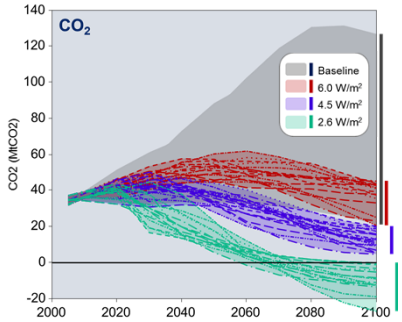

Fig. 5 Range of SSP mitigation scenarios for different forcing targets (preliminary data). Mitigation scenarios reaching 3.4 W/m2 in 2100 have also been developed. Work on deriving very low mitigation scenarios compatible with 1.5°C is ongoing.

INTENDED USES OF THE SSPs AND ASSOCIATED SCENARIOS

SSPs aim not directly at decision makers but at climate change analysts preparing climate policy analysis based on the SSPs

- Link IAV and mitigation analysis more explicitly to socio-economic development
- Enable better integration of mitigation, adaptation and climate impact research in future assessments (AR6)
- Initiate open community process to build richer socio-economic data repository for climate change reseach.

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