Potsdam Institute for Climate Impact Research

Implications of the Paris Agreement for near term action with a view to the long term ambition

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ALPS International Symposium, Tokyo, 10 February 2016

Leibniz Association

The AMPERE, LIMITS, CD-LINKS, and MILES project have received funding from the European Union under FP7, Horizon 2020, and EuropeAid

PIK: Mission

- PIK addresses crucial scientific questions in the fields of global change, climate impact and sustainable development.
- Researchers from the natural and social sciences work together to generate interdisciplinary insights and to provide society with sound information for decision making.
- The main methodologies are systems and scenarios analysis, modelling, computer simulation, and data integration.


Photo H. Bach

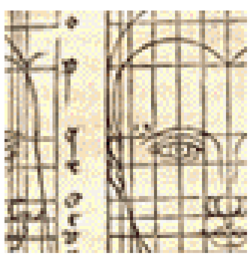
Michelson Building

Research Structures

Research Domain 1:
Earth System Analysis

Research Domain 2:
Climate Impacts and Vulnerabilities

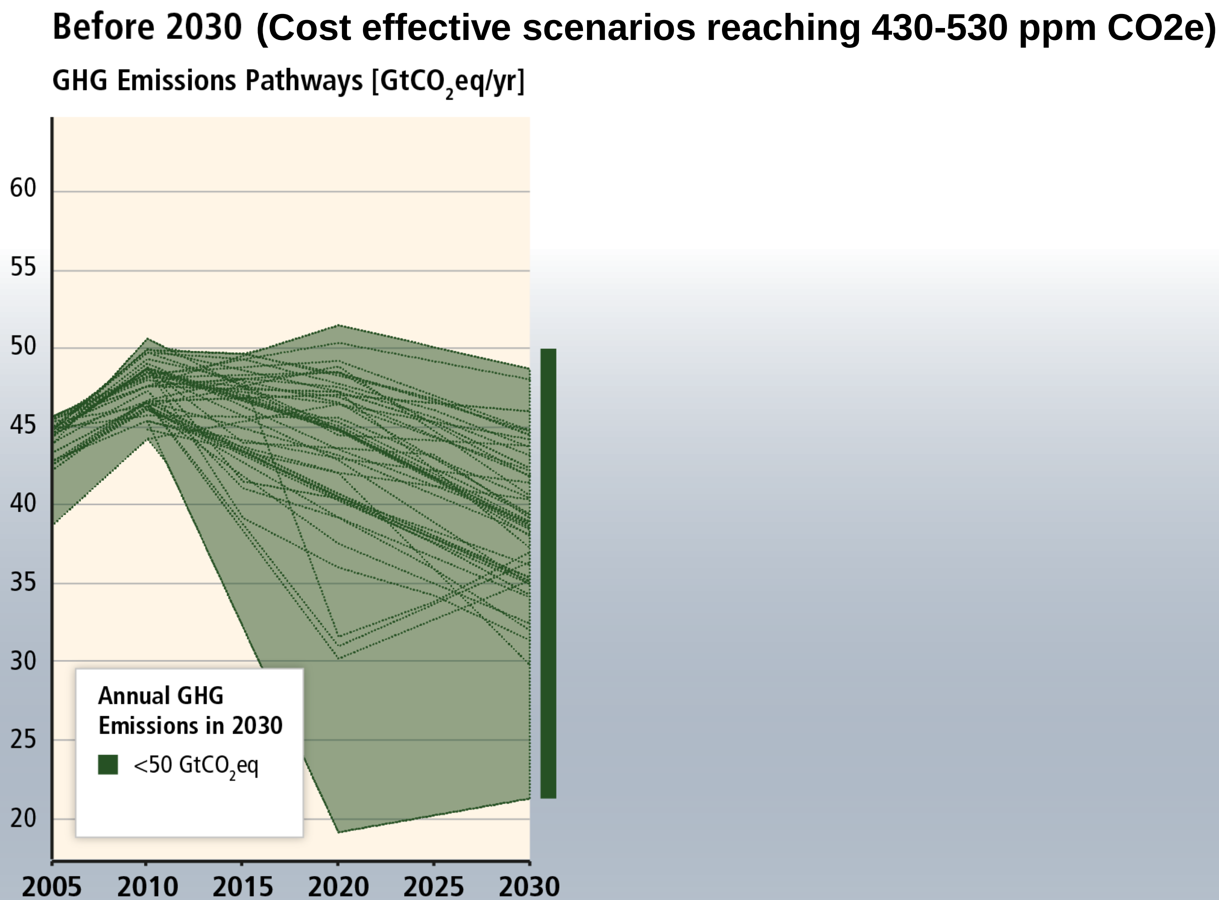
Research Domain 3:
Sustainable Solutions



Research Domain 4:
Transdisciplinary Concepts and Methods

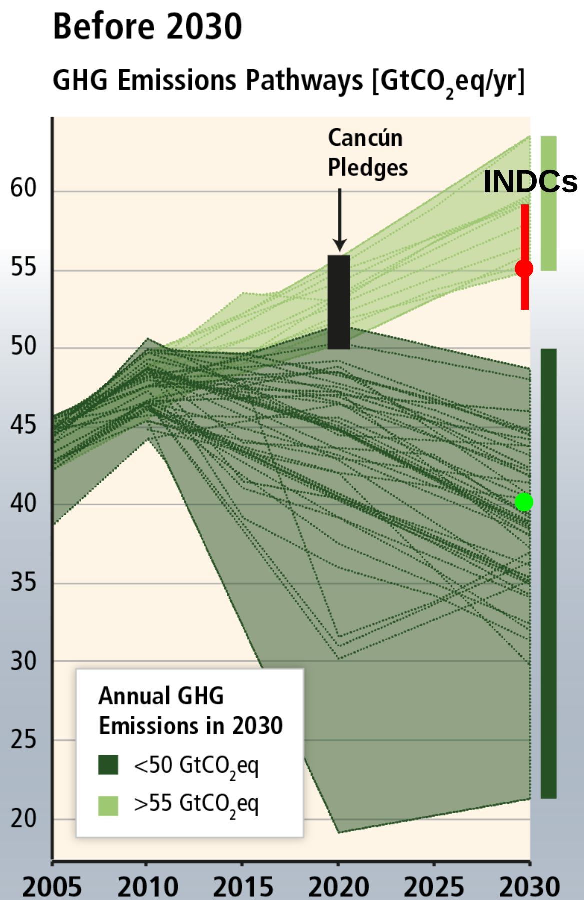
P I K

IPCC AR5 findings on the implications of mitigation action until 2030 for limiting warming to 2ºC



Adapted from Figure SPM.5

IPCC AR5 findings on the implications of mitigation action until 2030 for limiting warming to 2ºC



Adapted from Figure SPM.5

IPCC WG3 AR5, Section 4.1:

"Estimated **global GHG emissions levels in 2020 based on the Cancún Pledges are not consistent with cost-effective long-term mitigation trajectories** that are at least as likely as not **to limit temperature change to 2ºC** relative to pre-industrial levels …, but they do not preclude the option to meet that goal (high confidence).

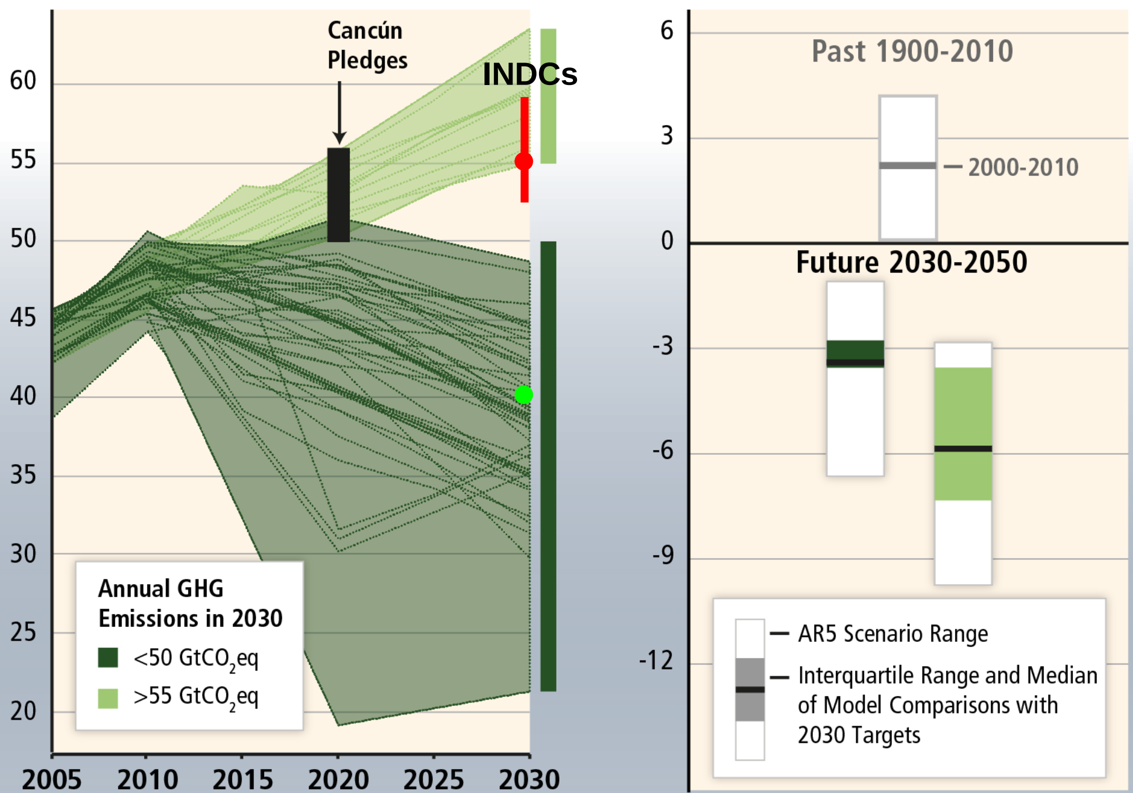
…

The **Cancún Pledges are broadly consistent with cost-effective scenarios that are likely to keep temperature change below 3ºC** relative to preindustrial levels."

Moderate mitigation until 2030 increases the difficulty and narrows the options for limiting warming to 2°C.

Before 2030 | **After 2030 (Scenarios reaching 430-530 ppm CO2e)**

GHG Emissions Pathways [$GtCO_2eq/yr$] | Rate of CO_2 Emission Change [%/yr]



Adapted from Figure SPM.5

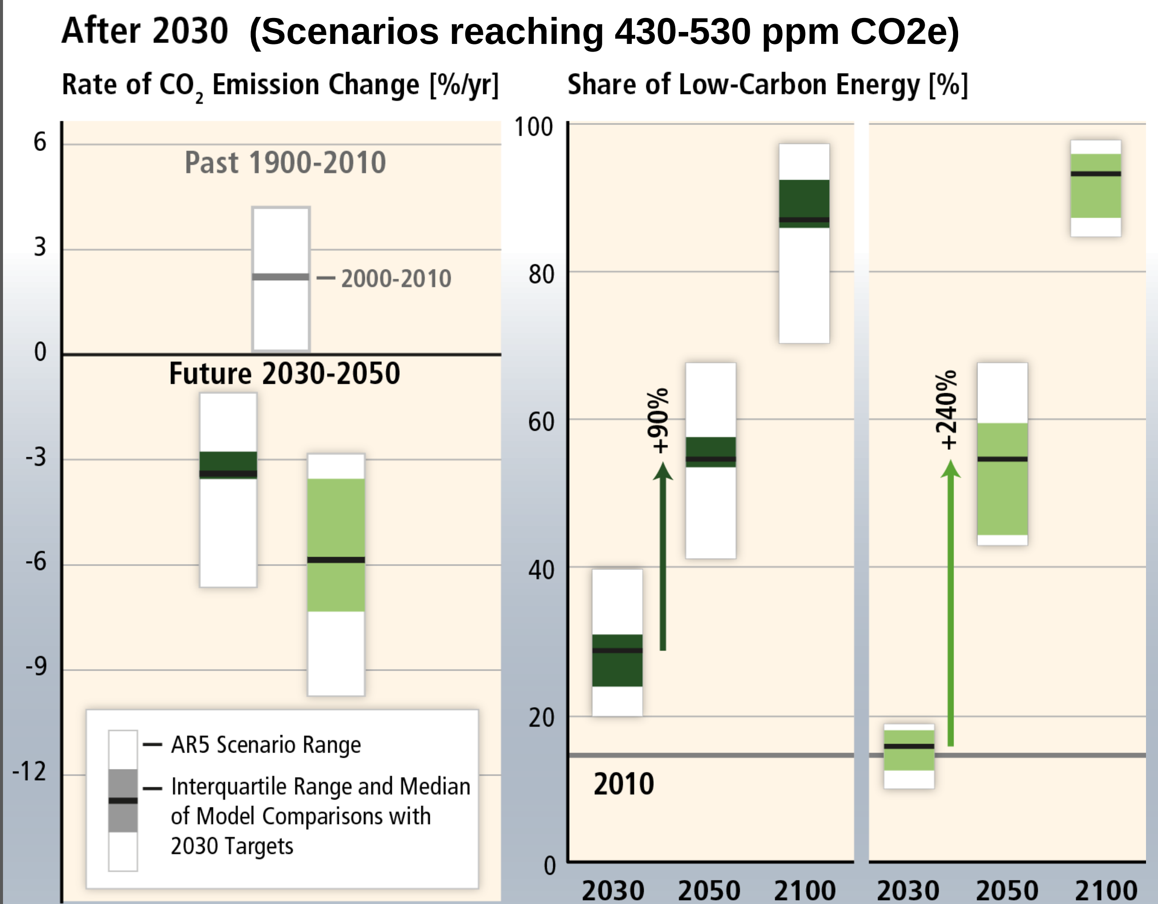
IPCC WG3 AR5, Section 4.1:

"Delaying mitigation efforts beyond those in place today through 2030 is estimated to substantially increase the difficulty of the transition to low longer-term emissions levels and **narrow the range of options consistent with maintaining temperature change below 2°C** relative to pre-industrial levels (*high confidence*)."

Moderate mitigation until 2030 increases the difficulty and narrows the options for limiting warming to 2°C.

IPCC WG3 AR5, Section 4.1:

"**Scenarios with annual GHG emissions above 55 $GtCO_2eq$ in 2030** are characterized by substantially **higher rates of emissions reductions from 2030 to 2050** …; much **more rapid scale-up of low-carbon energy** over this period …; a **larger reliance on CDR technologies** in the long term …; and **higher transitional and long term economic impacts**."



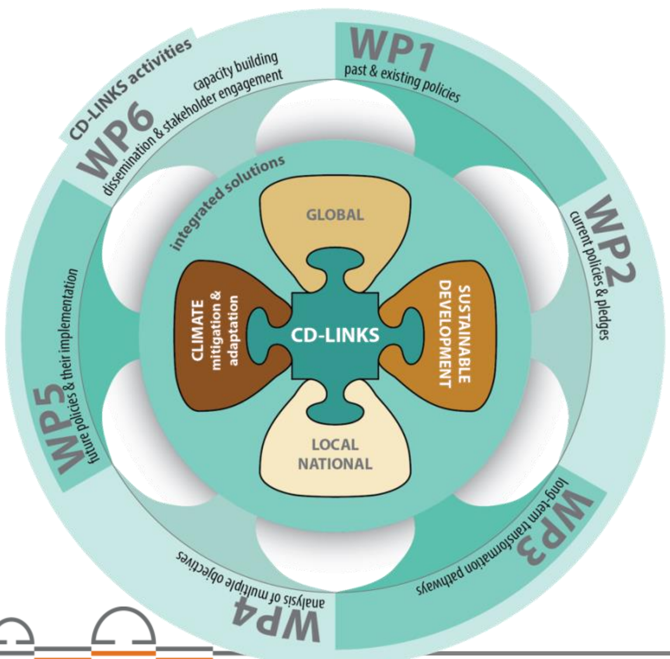
Adapted from Figure SPM.5

Post-Paris process requires connecting global & national analysis

Increased collaboration between national & global energy-economy and IA modelling teams desirable

CD-Links project

www.cd-links.org



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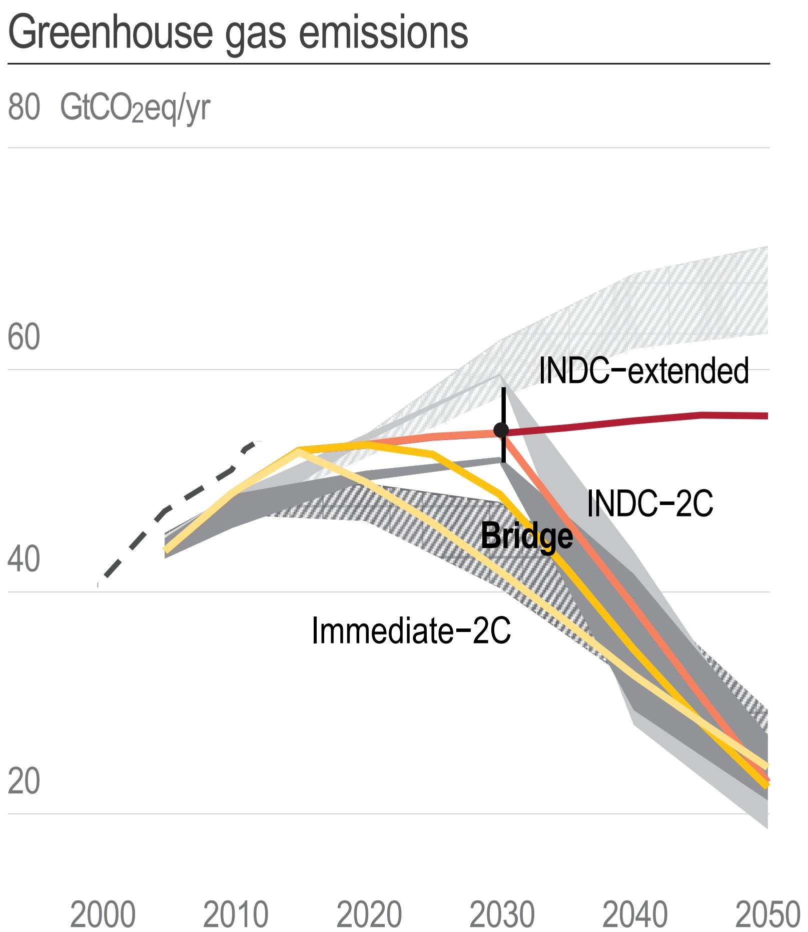
This project is funded by the European Union.

Key message: Paris Agreement needs to include strengthening mechanisms to build bridge from INDCs to staying below 2°C

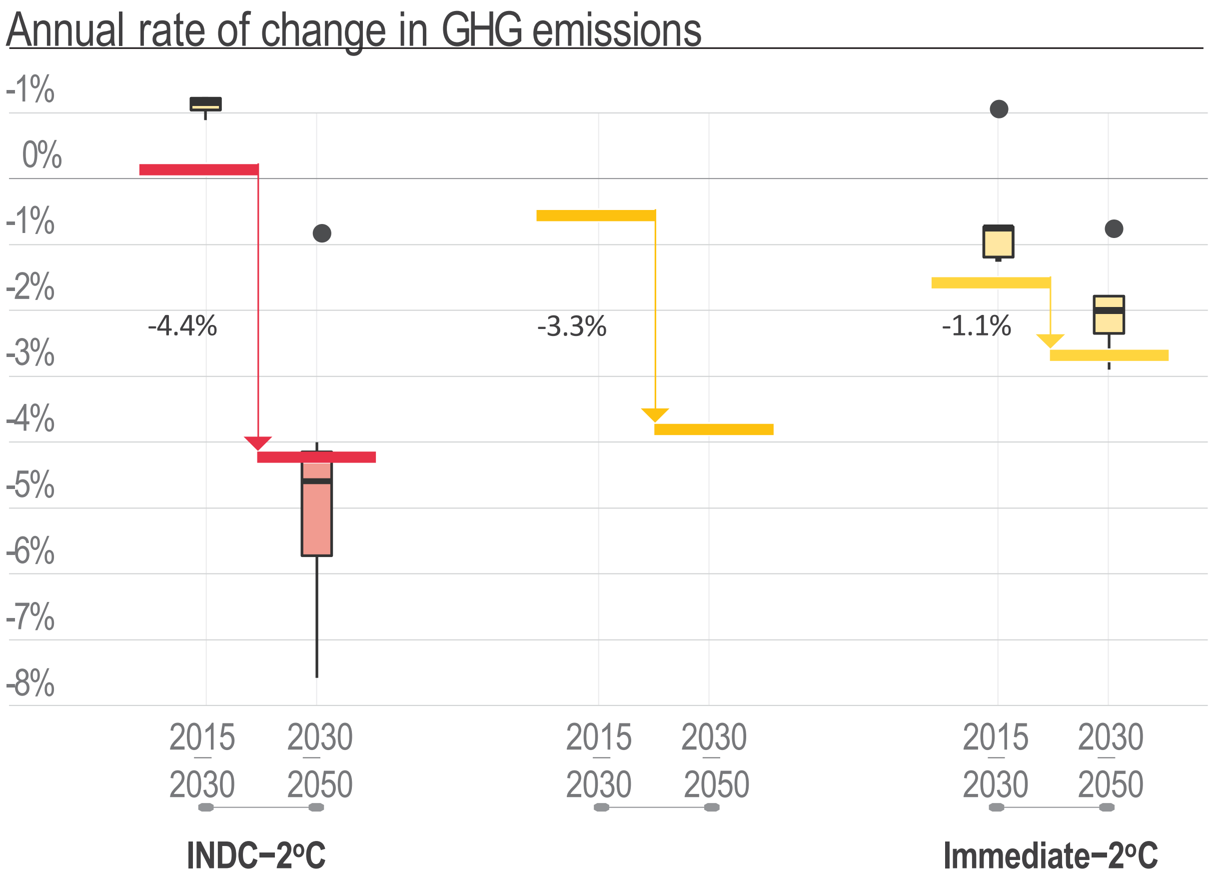


Source: REMIND model calculations, EDGAR (JRC/PBL, historical emissions), PBL INDC Tool calculations (www.pbl.nl/indc INDC range and best estimate, vertical black line and circle) and IPCC AR5 scenario database

- INDCs are significant deviation from current trends and policies
- But not sufficient to stay below 2°C goal
- Mechanisms for rapid strengthening can send signal of commitment to long term goal to investors.
- Early restructuring of investments can shave additional 5 $GtCO_2eq$ off trajectory in 2030 and reduce the risk of disruptive, rapid, costly change
- Regular ratcheting up of NDCs foreseen in the Paris Agreement needs to be exploited fully.

Source MILES project report (Spencer, Pierfederici et al., IDDRI, PIK): www.iddri.org/Publications/Beyond-the-numbers-Understanding-the-transformation-induced-by-INDCs

Increase in GHG emissions reduction rate



The colored bars denote the scenarios of this study, while the boxplots show results from the FullTech-450-OPT (right) and FullTech-450-HST (left) scenarios of the AMPERE study, respectively. The boxes denote the interquartile range, while the whiskers show the full range. Two outliers in the AMPERE study (scenarios with >800EJ potential for biomass) are represented by dots.

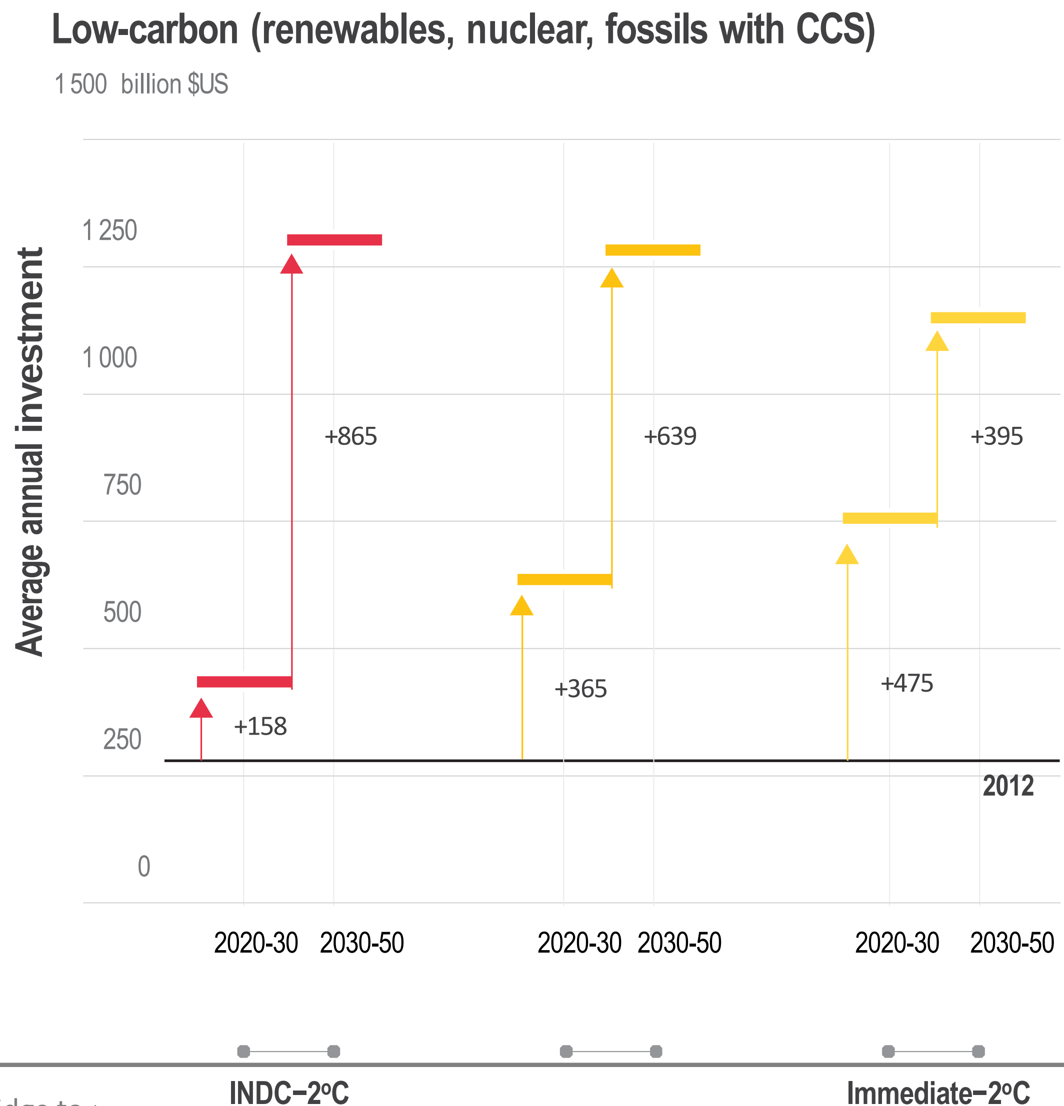
Source: REMIND model analysis, and IPCC AR5 scenario database

Source:
Figure 44 of MILES report

Investors will respond to Paris Agreement (only) if commitment to long term goal is credible

Investment into low-carbon power generation capacity increases under INDCs, but not enough.

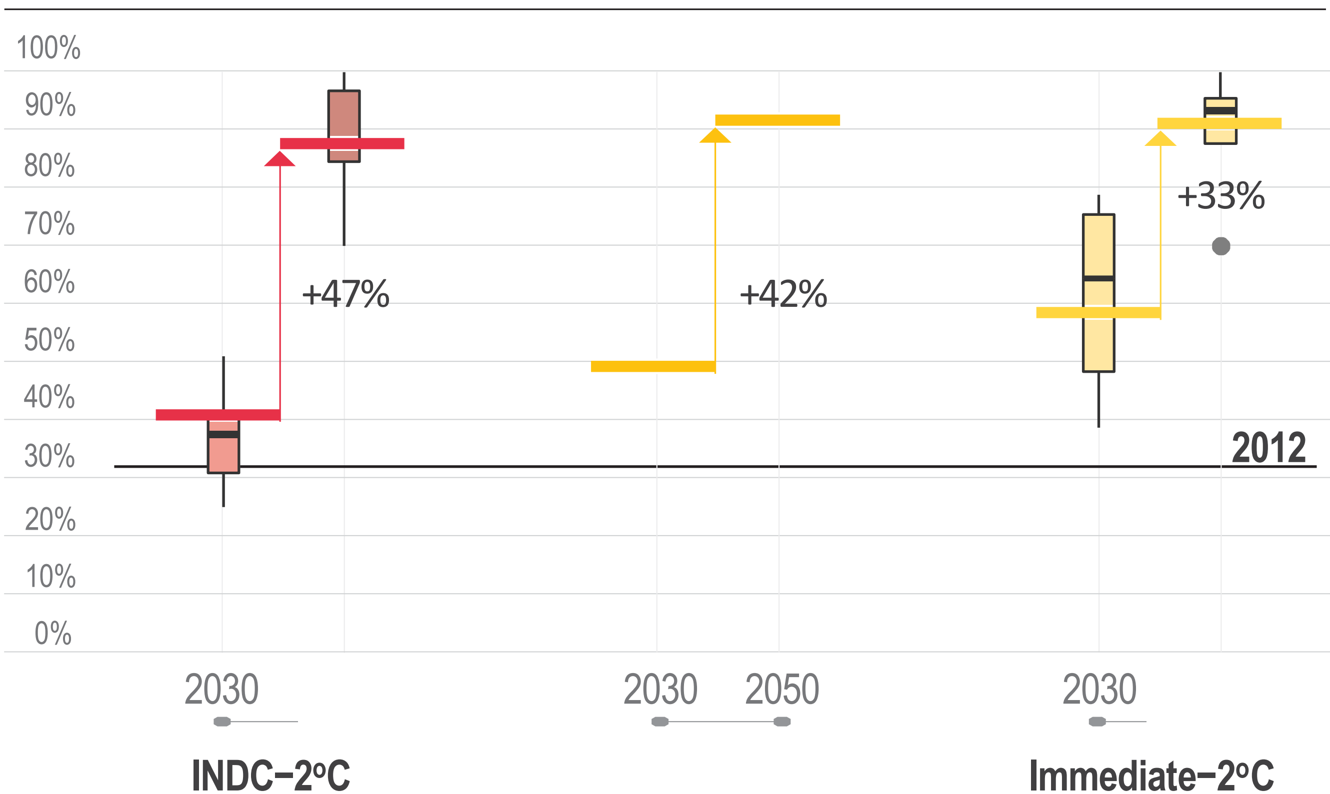
Source: Figure 49 of MILES report



Horizontal lines in the background mark the respective 2012 historic value (IEA 2014b)
Source: REMIND model analysis and IEA

Increasing low-carbon electricity deployment

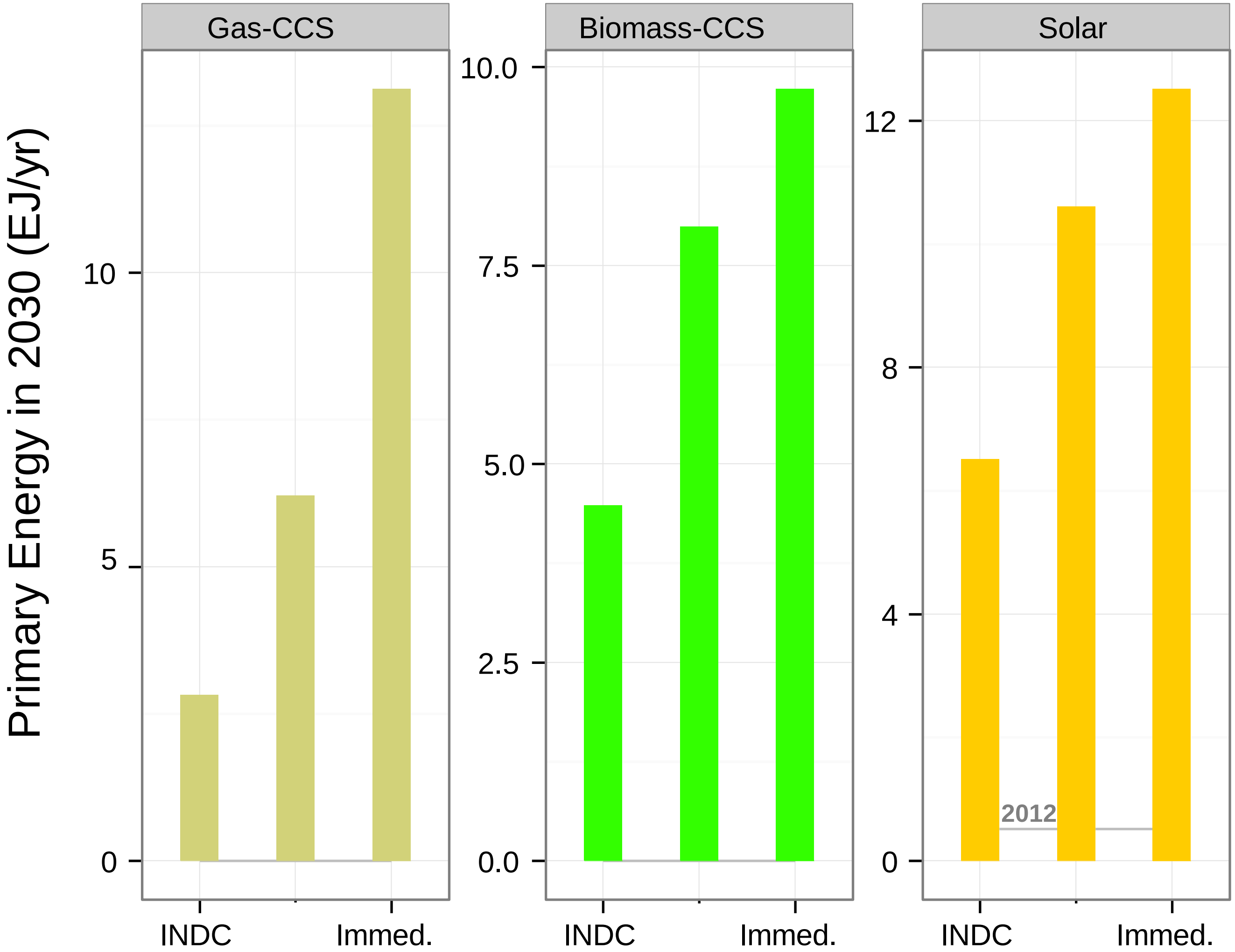
Low-emissions electricity share at the global level



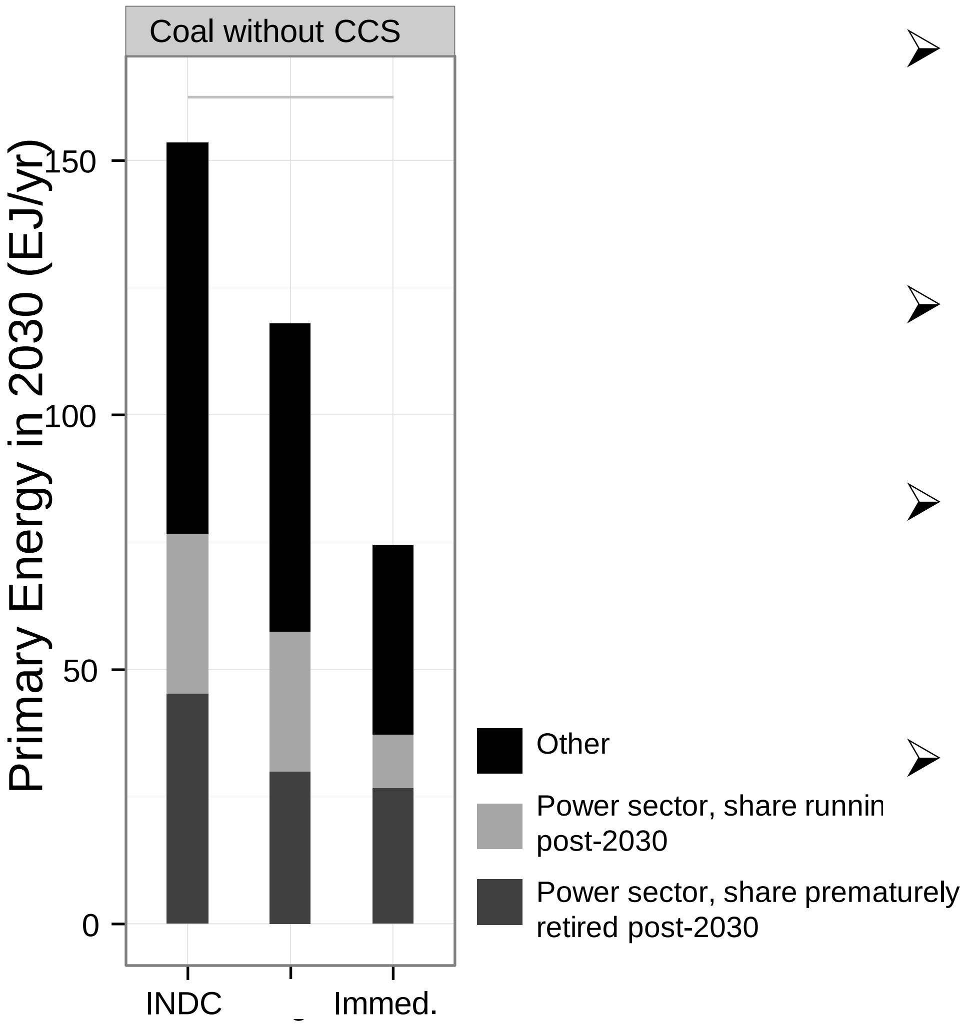
The boxplots represent the results from the FullTech-450-OPT (right) and FullTech-450-HST (left) scenarios of the AMPERE study, respectively and the horizontal line in the background marks the 2012 historic value (IEA 2014). Source: REMIND model analysis, IEA, and IPCC AR5 scenario database

Source:
Figure 45 of MILES report

Some low-carbon technologies are in particular need for stronger incentives than provided by INDCs



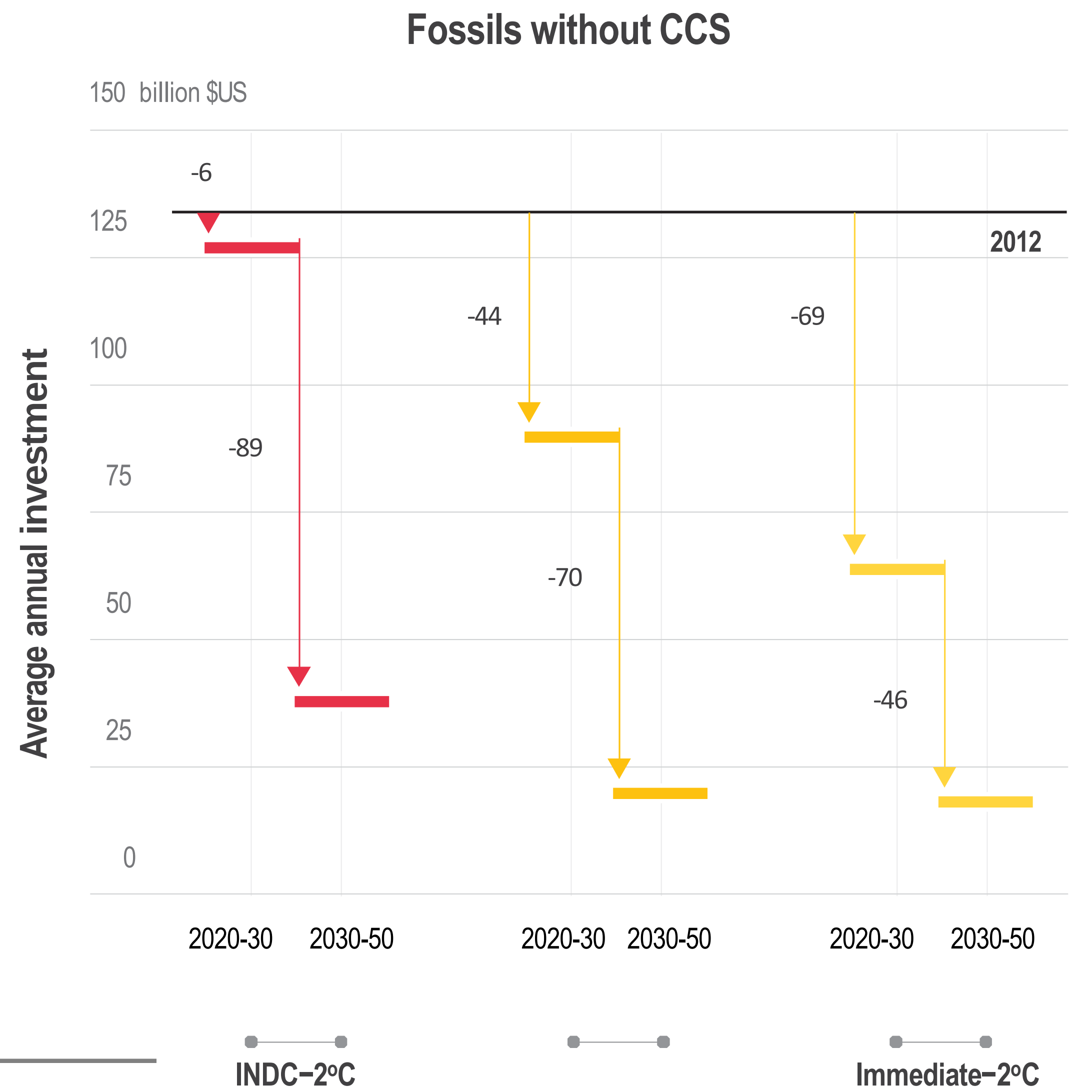
Insufficient coal phase-out under INDCs



- Coal is primary fossil fuel to be reduced in cost-effective 2°C scenario (by >50% in 2030)
- INDCs are not sufficient to initiate strong reduction in coal use
- Bridge scenario cuts total coal use and coal use in power sector by more than 25%.
- Reduces premature retirement of coal plants by one third

Fossil fuel power investments not sufficiently reduced under INDCs, stronger disincentives needed

Investment into fossil fuel power capacity without CCS



Horizontal lines in the background mark the respective 2012 historic value (IEA 2014b)

Source: REMIND model analysis and IEA

Source: Figure 49 of MILES report

Policies for the bridge to 2°C

- Policies to incentivize low-carbon energy and disincentivize fossil fuel use (e.g. carbon pricing) are complementary. The 2°C transition needs both types of policies.

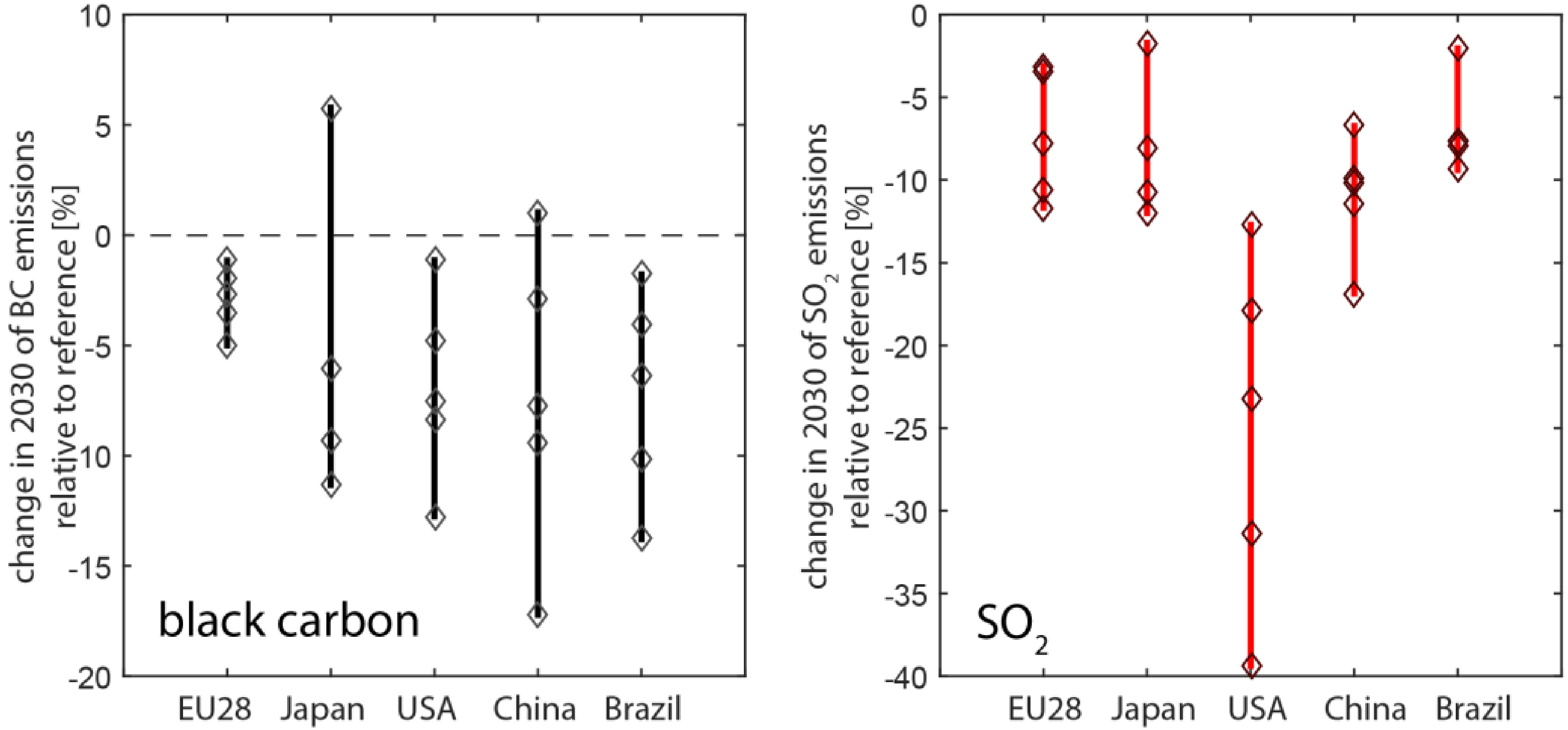
- Disincentives for unabated fossil fuel use (e.g. carbon pricing) are underrepresented in current policy plans.

- Rapid strengthening of such disincentives is needed to avoid further carbon lock-in and would send a strong signal to investors

- Explicit commitments to specific policy instruments (e.g. nationally determined carbon pricing) could play an instrumental role in ratcheting up INDCs.

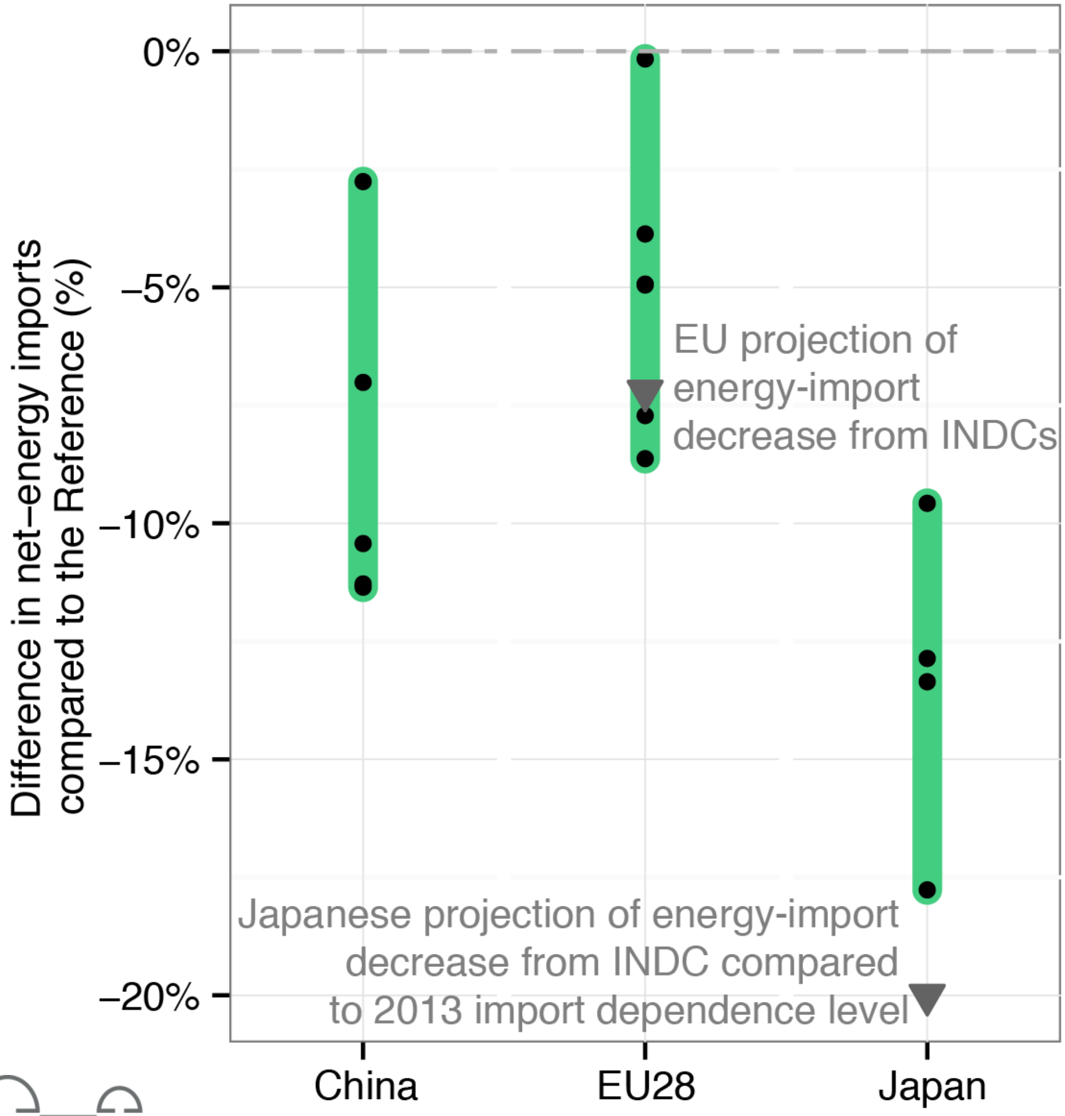
Co-benefits of INDCs: Improved Air Quality

Results based on MILES country studies and LIMITS study



Source: IIASA, MILES project October 2015

Co-benefits of INDCs: Energy Security



Results based on MILES country studies and EMF27, AMPERE, LIMITS

Source: IIASA, MILES project October 2015

Key messages: Co-benefits are significant

- **INDCs can lead to significant co-benefits** to climate mitigation, in terms of reductions in energy dependency and local air pollution.

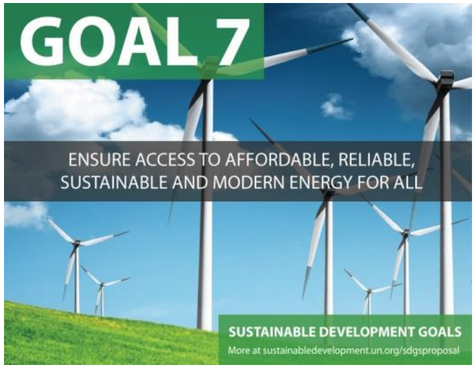
- **Such co-benefits can be a significant opportunity** to

  - develop ambitious national climate policies,

  - embed them in a broader sustainable development framework, and

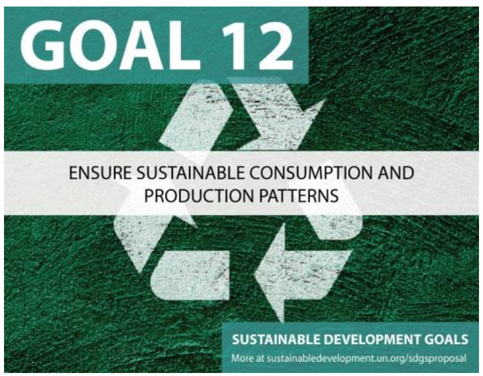
  - feed them into an international process of iteratively strengthening INDCs.

Assessing the Sustainable Development Goals (SDG)
- connected to climate change mitigation -

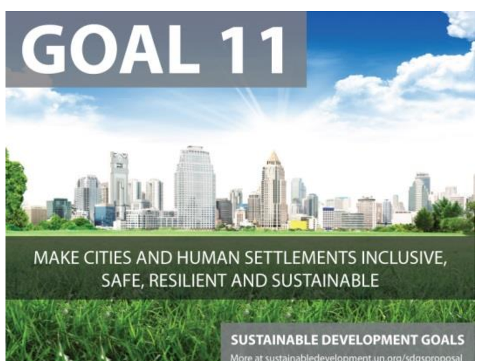


Sustainable resource use

Institutions



Infrastructure



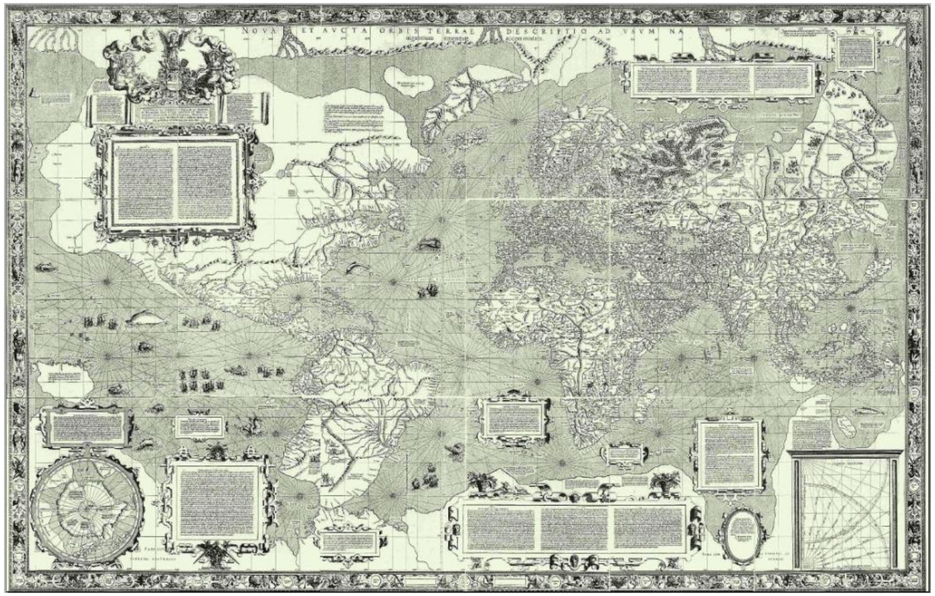
Need for scenarios to integrate knowledge

Areas of research that require attention include:

- Closing the loop between climate change, climate change impacts and adaptation, and mitigation
- Understanding climate policies in the context of a broader set of sustainable development objectives, including co-benefits and trade-offs for a range of societal objectives.
- Bridging global and regional scales (downscaling / upscaling) and time scales (short vs. long-term)

Scenarios as mapping tools

Mercator World Map, 1569



Scenarios provide maps of plausible futures.

When they are used to inform decisions, they provide maps of the „solution space“.

Decision makers can use them to navigate through this space.

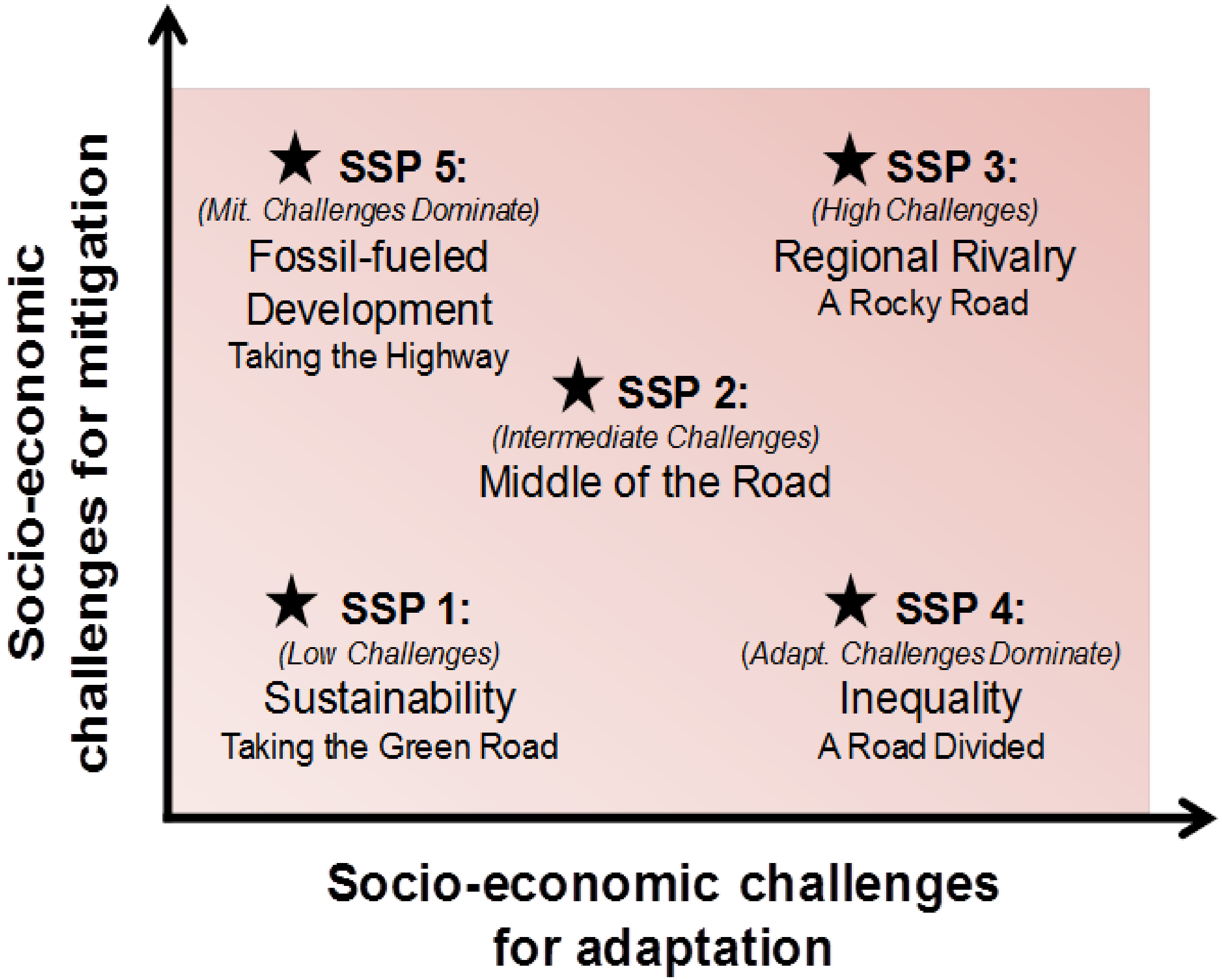
➔ ***Scenario developers are cartographers of the future***

“Maps may be imperfect and in strong need of improvement, but will be useful as long as navigation is served better with than without them.” (AMPERE Synthesis Report)

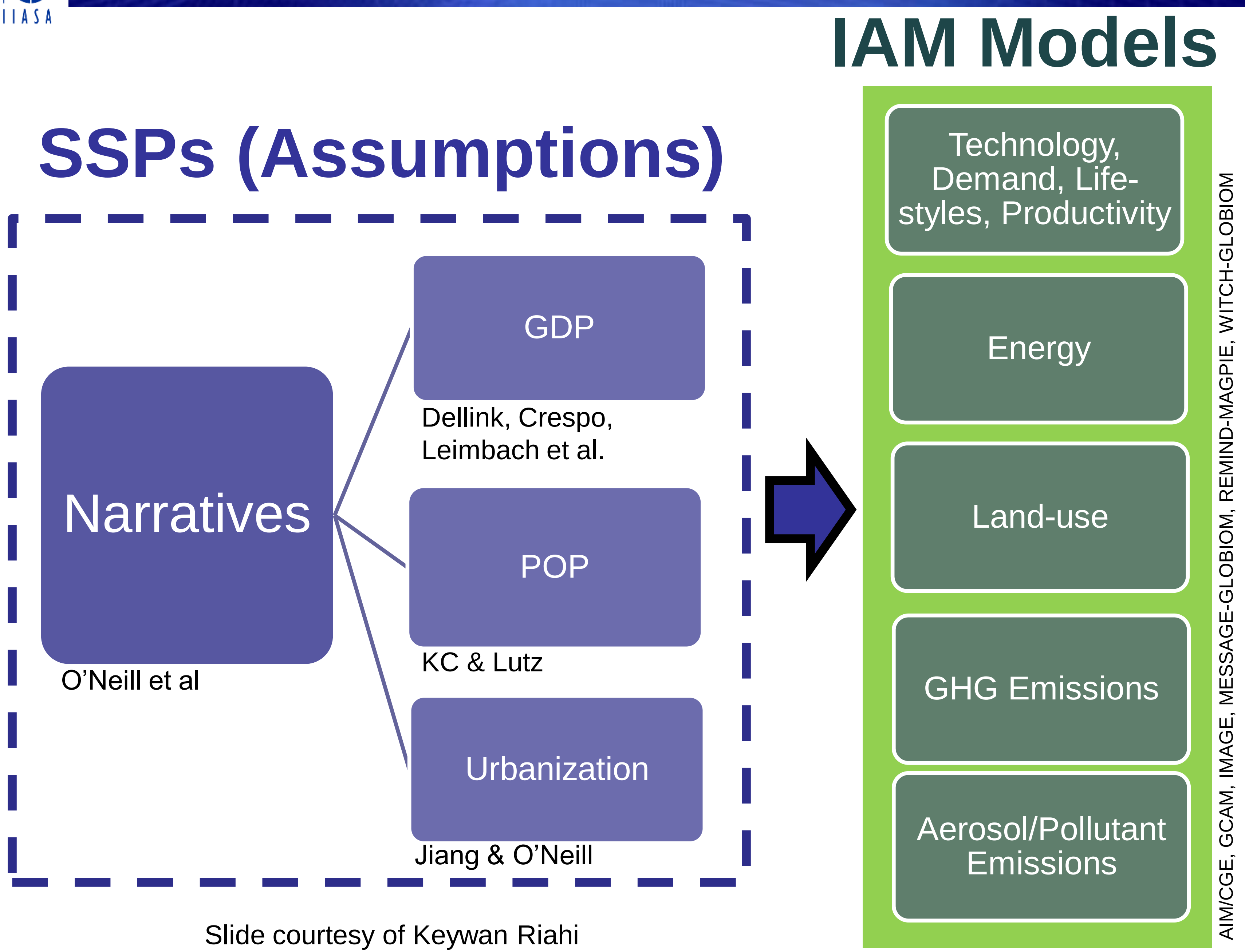
SSP Narratives link to SD agenda

Narratives play key role to

- link global and regional scenarios
- integrate hard to quantify societal dimensions (e.g. inequality, governance, human development)

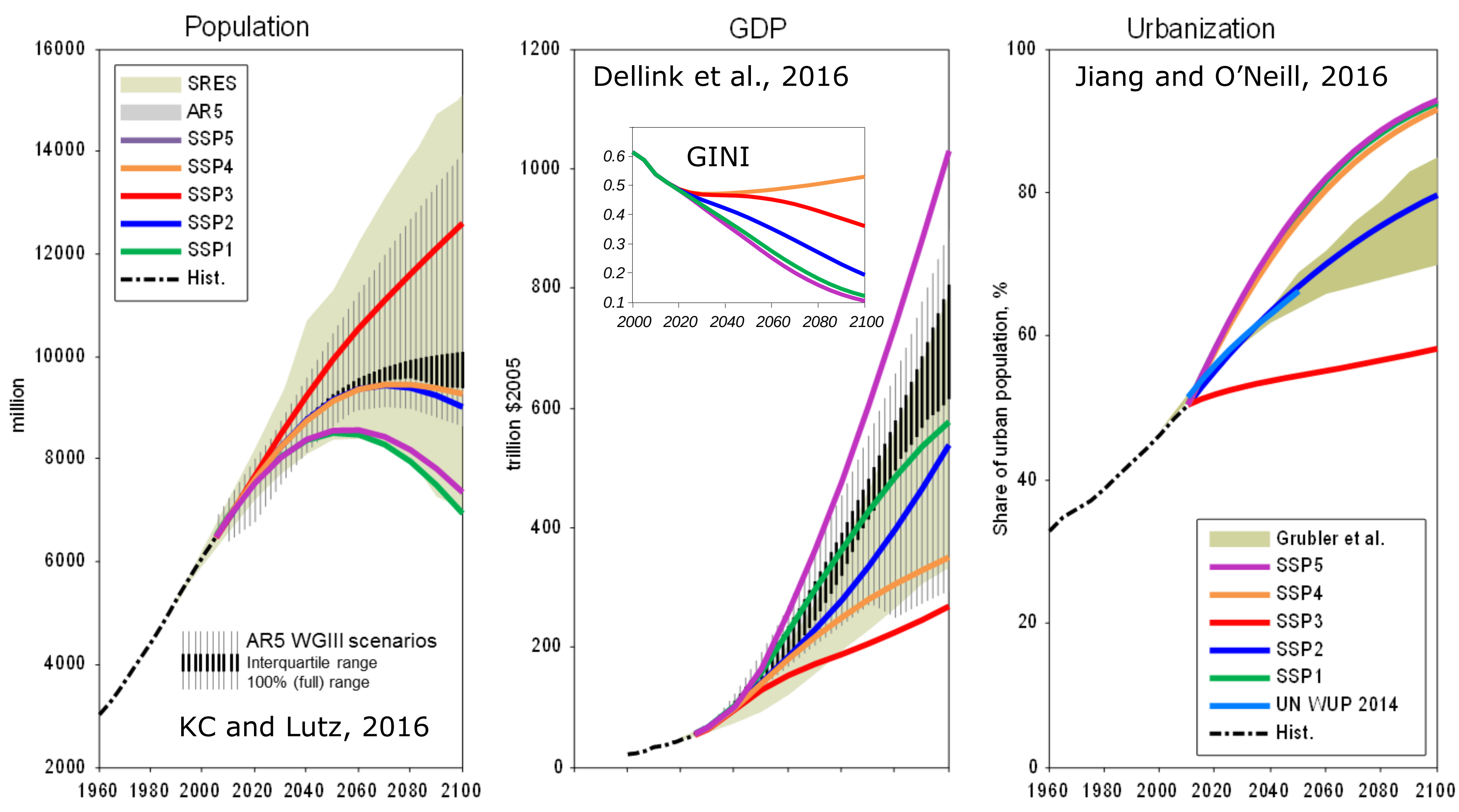


O'Neill, Kriegler et al., 2016



Slide courtesy of Keywan Riahi

SSP Socio-economic Drivers

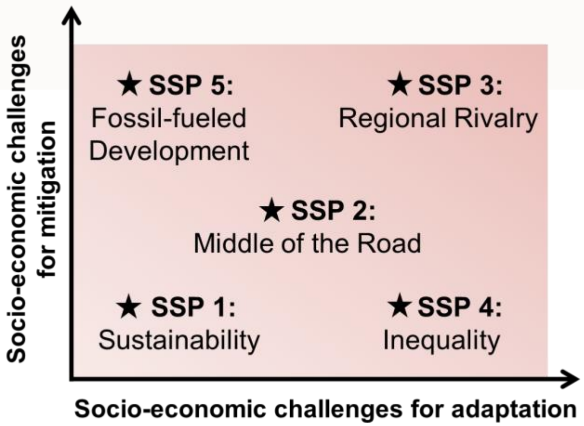


Gridded population projections now available for SSPs (NCAR)

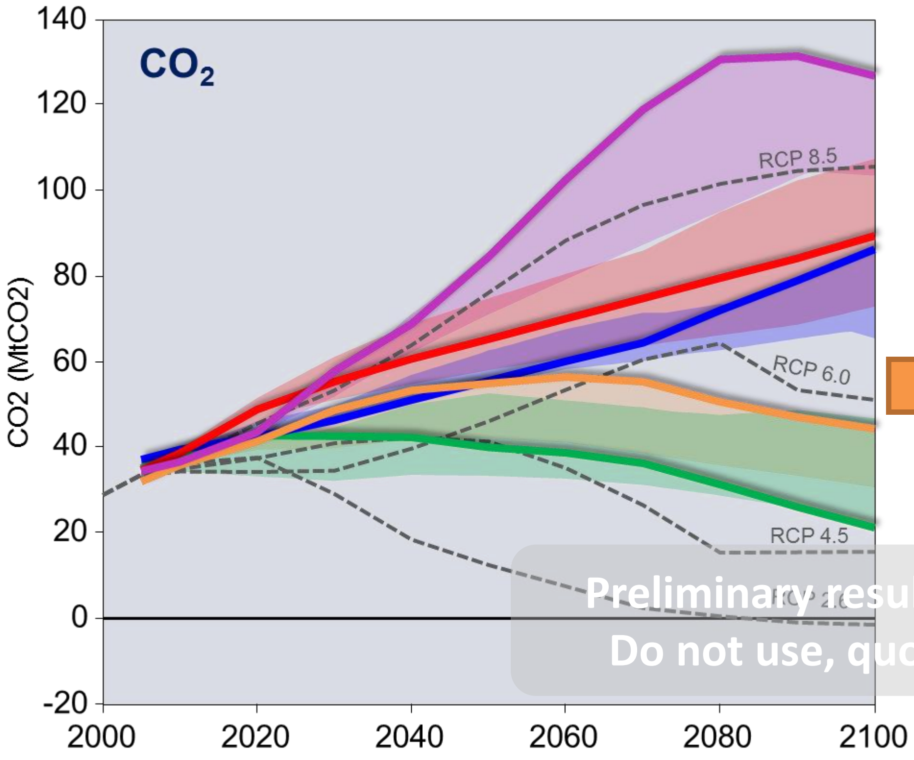
Work on spatial downscaling of GDP projections, inequality, governance indicators

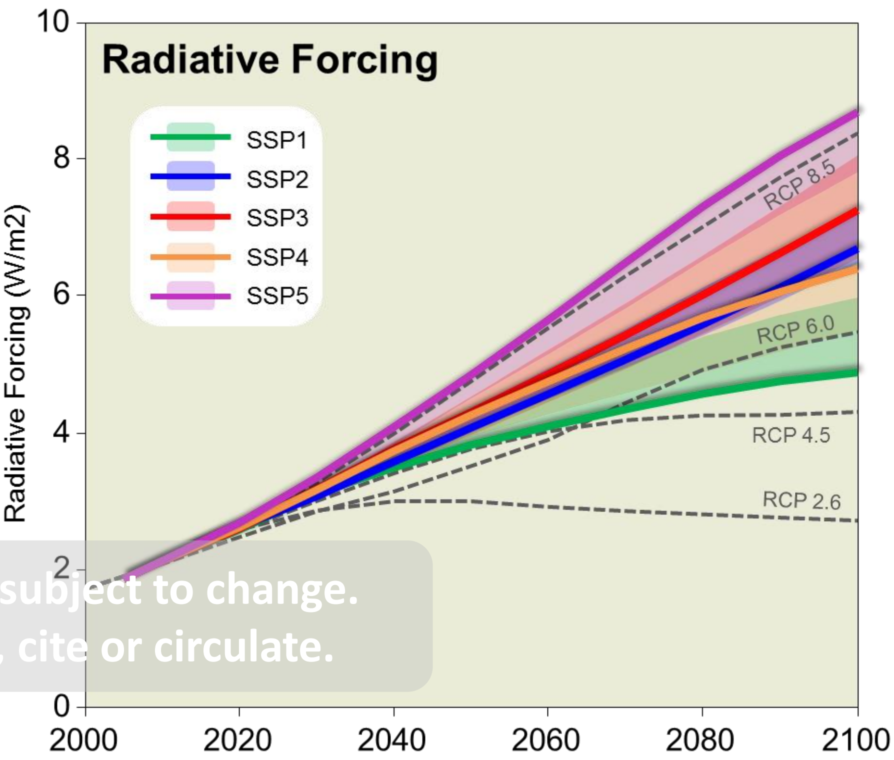
SSP IAM Scenarios

- Succeed SRES scenarios
- Basis for new climate change projections in scenarioMIP /CMIP6



SSP reference scenarios w/o climate policy (Marker & Uncertainty bands)



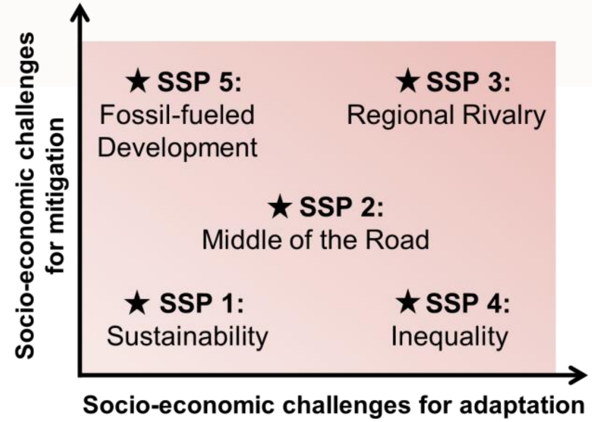


Preliminary results subject to change.
Do not use, quote, cite or circulate.

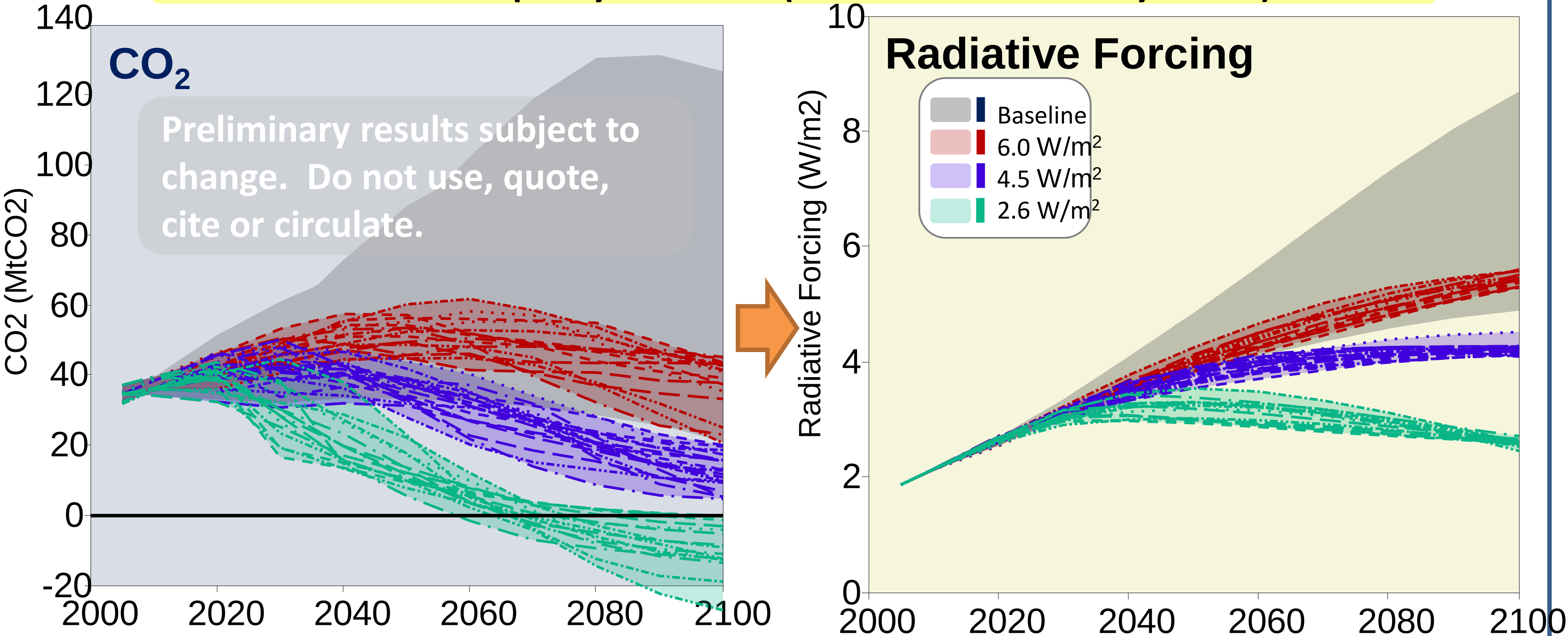
Riahi et al. (2016)

SSP IAM Scenarios

- Succeed SRES scenarios
- Basis for new climate change projections in scenarioMIP /CMIP6



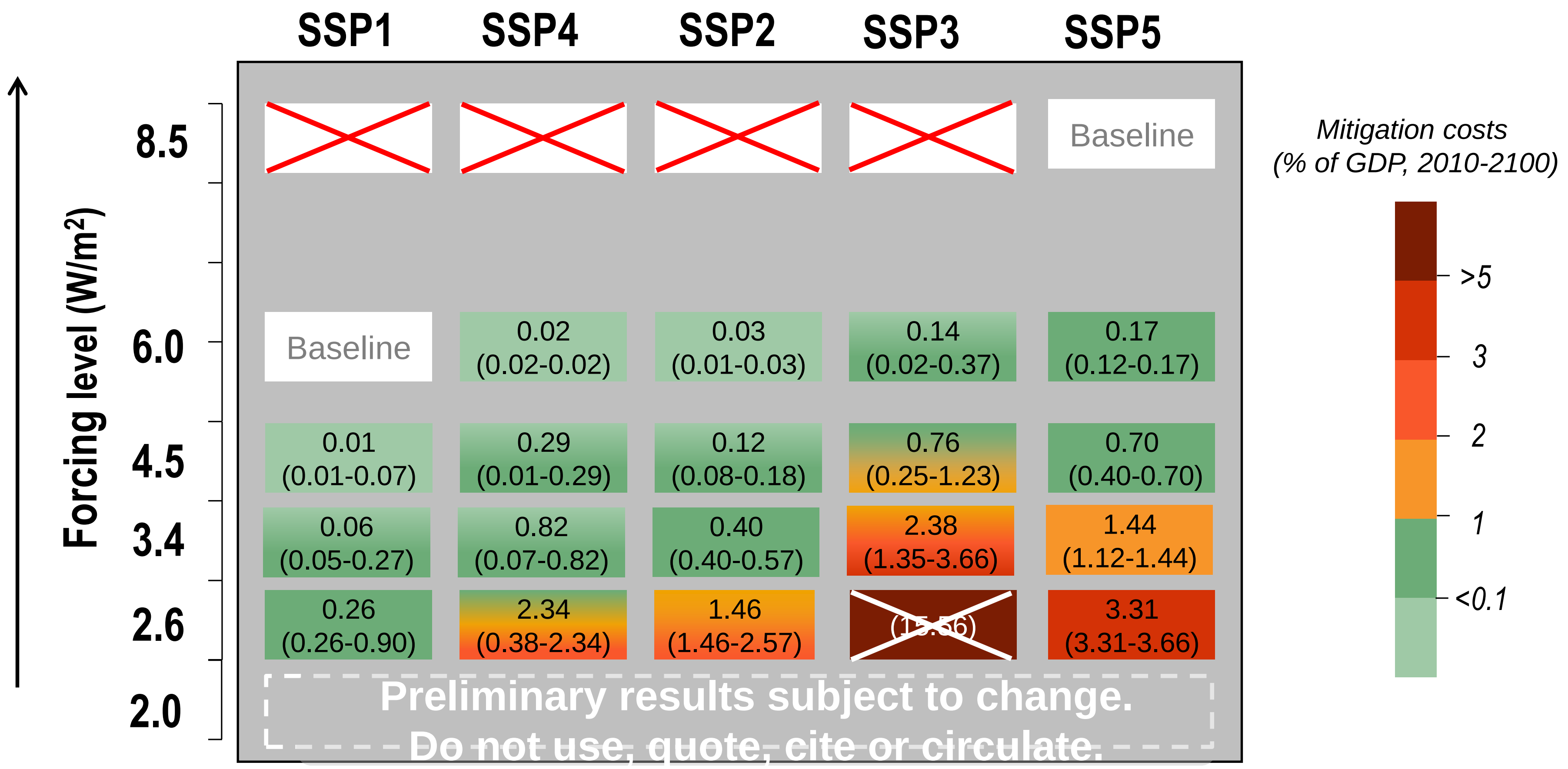
SSP climate policy scenarios (Marker & Uncertainty bands)



Riahi et al. (2016)

Feasibility and costs of targets greatly depend on combination of SSP and RCP

(Mitigation costs as % of GDP)



Riahi et al. (2016)

Special Issue Global Environmental Change

Riahi and van Vuuren (eds.) (to be published 1st half of 2016)

- **Overview: Riahi et al. (submitted)**
- **Narratives: O'Neill et al (online first)**
- **Population: KC & Lutz (accepted)**
- **GDP: (1) Dellink et al, (2) Crespo, (3) Leimbach et al (online first)**
- **Urbanization: Jiang & O'Neill (online first)**
- **5 SSP marker papers (submitted)**
- **Crosscut papers (submitted):**
  - **Energy (Bauer et al)**
  - **Land-use (Popp et al)**
  - **Air Pollution/Aerosols (Rao et al)**

Thank you