Is 1.5oC feasible?
- Pathways of the net zero GHG emissions -

Toward realizing 2°C/1.5°C target: Why deep decarbonization is required and what kinds of pathways can achieve it?

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15 November 2016, COP22

Marrakech, Morocco

How much efforts do we need to stay below 2°C/1.5°C?

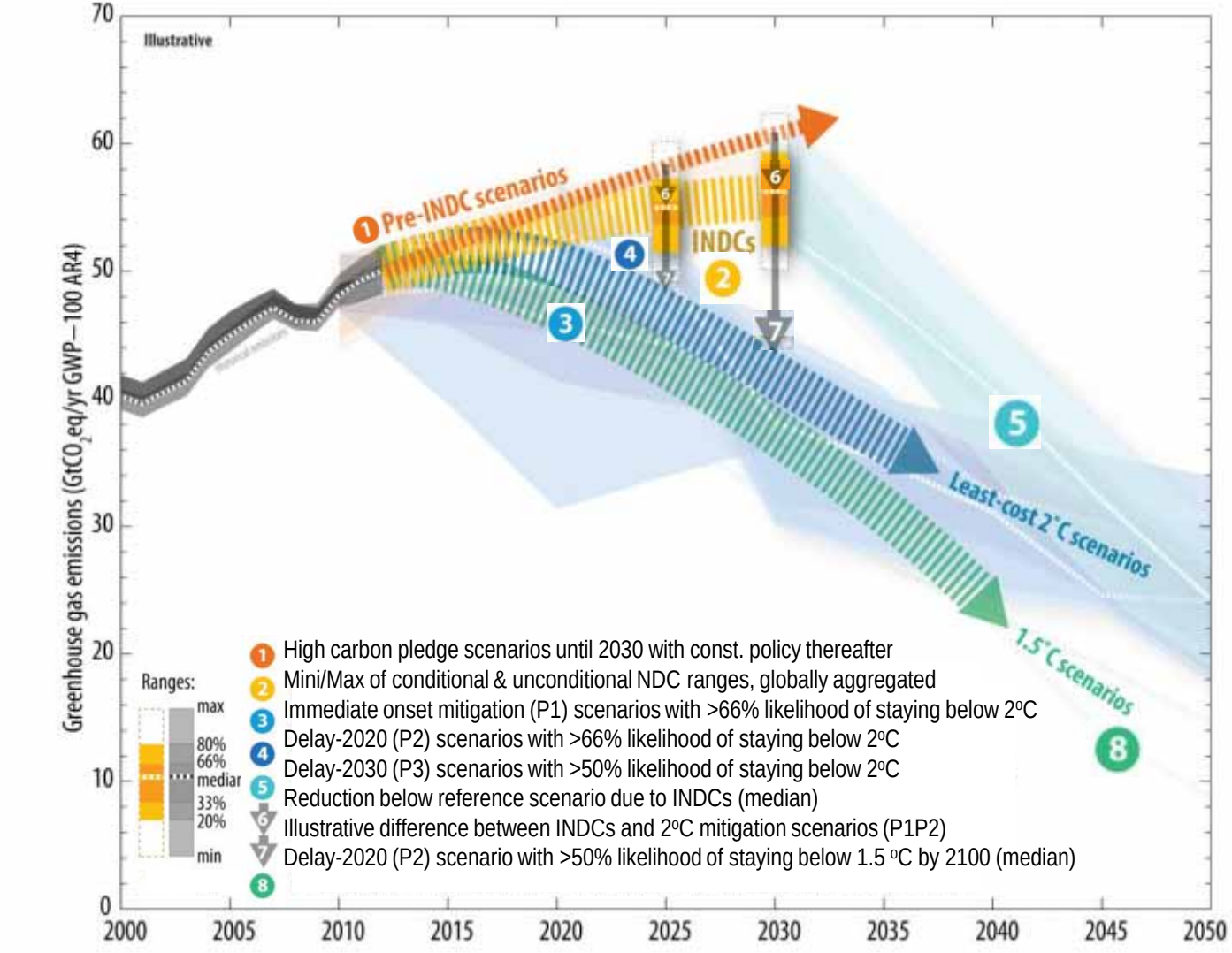


Figure 2 Comparison of global emission levels in 2025 and 2030 resulting from the implementation of the intended nationally determined contributions and under other scenarios

Source: UNFCCC/CP/2016/2

Why it is so important to curve GHG emissions?

Temperature increase after GHG emissions will go down. Ocean thermal expansion continues even after GHG emissions will go almost zero.

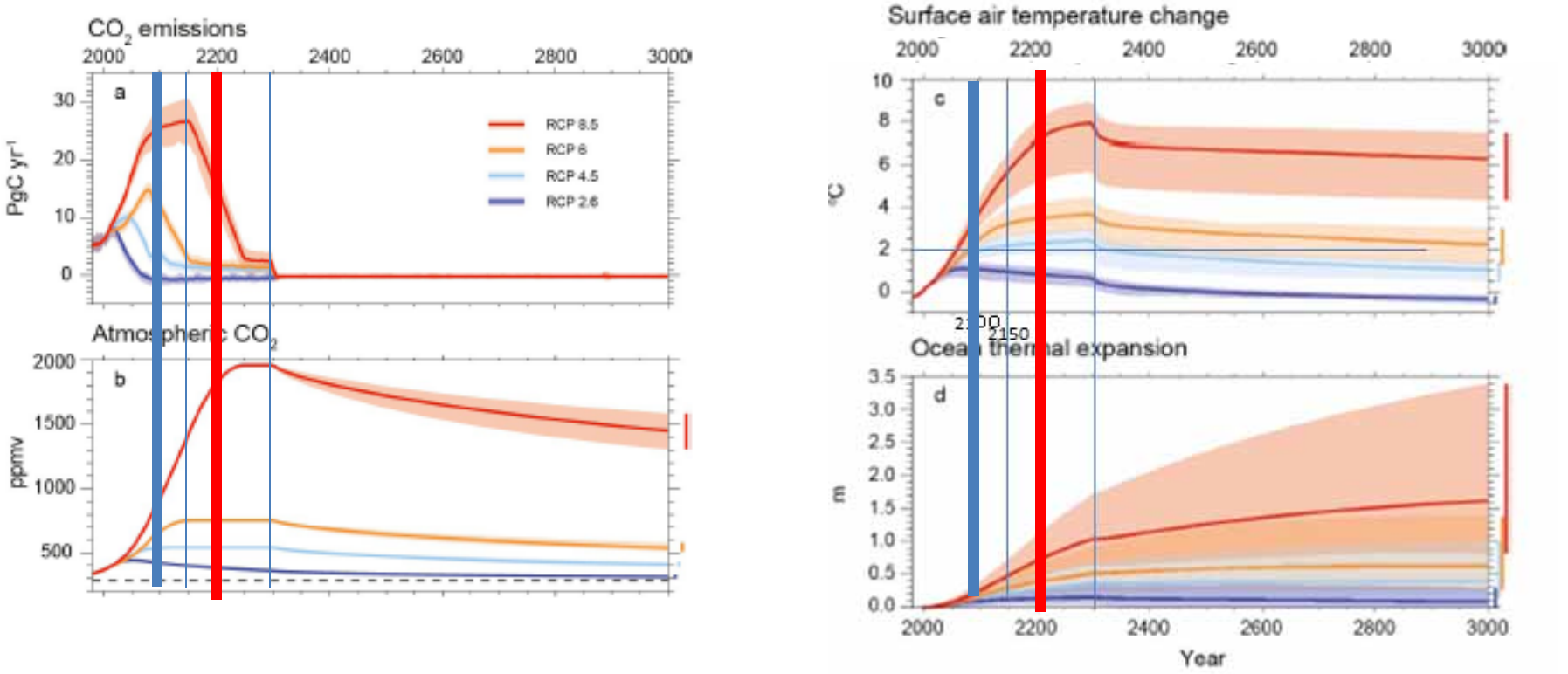
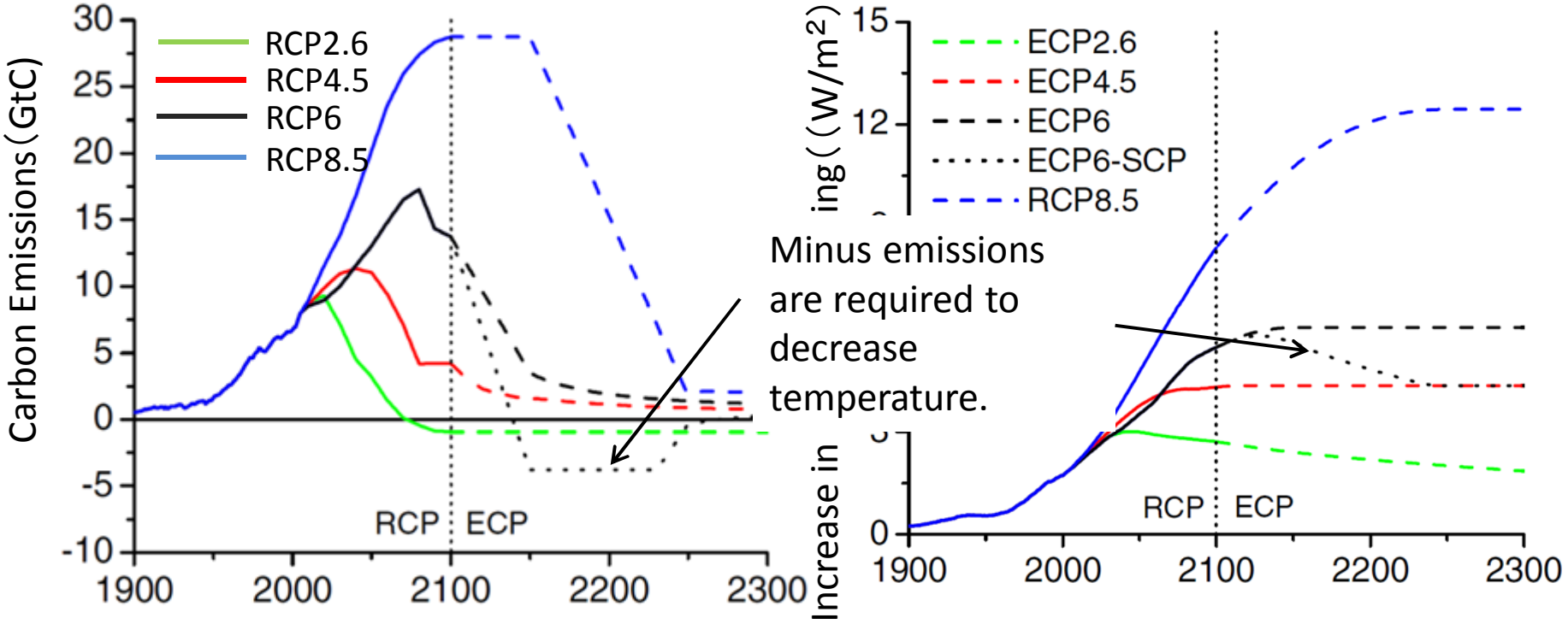


Figure 12.44: a) Compatible anthropogenic CO_2 emissions up to 2300, followed by zero emissions after 2300, b) prescribed atmospheric CO_2 concentration up to 2300 followed by projected CO_2 concentration after 2300, c) global mean surface temperature change and d) ocean thermal expansion as simulated by EMICs for the four concentration driven RCPs with all forcings included (Zickfeld et al., 2013). A 10-year smoothing was applied. The drop in temperature in 2300 is a result of eliminating all non-CO_2 forcings along with CO_2 emissions. Shadings and bars denote the minimum to maximum range. The dashed line on panel (b) indicates the pre-industrial CO_2 concentration.

Source : IPCC AR5 WG3 Fig 12.44

It is very difficult to lower CO2 concentrations in the atmosphere

Will ecosystems be back when the temperature will be lowered after it becomes high?



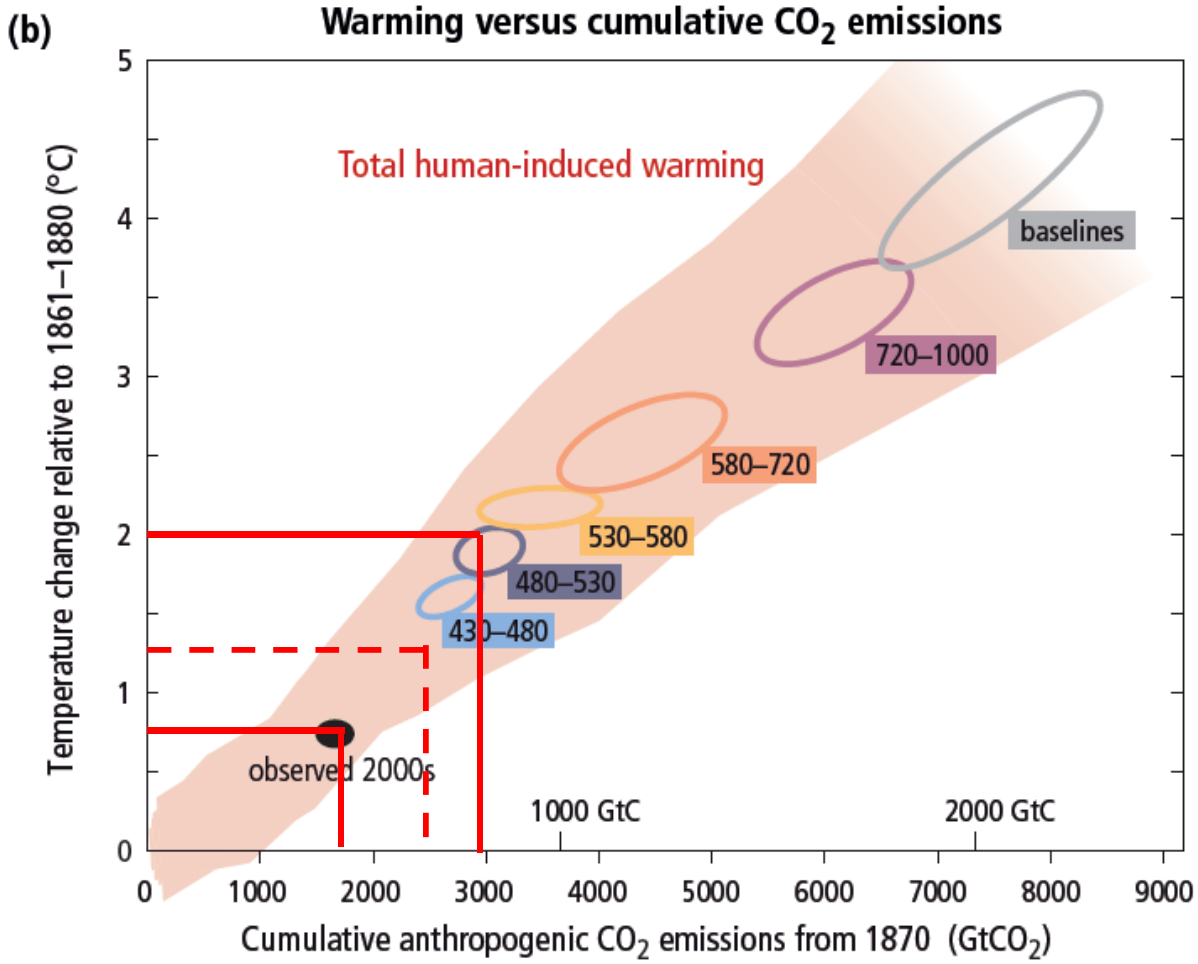
CO_2 emissions pathways in four Representative Concentration Pathways (RCPs) used for IPCC 5th Assessment Report (left) and corresponding increase in radiative forcing (right).

AIM ASIA-PACIFIC INTEGRATED MODEL

(Source: Detlef P. van Vuuren et al., 2011)

How much is carbon budget left?

Warming versus cumulative CO_2 emissions



Multi-model results show that limiting total human-induced warming to less than 2°C relative to the period 1861–1880 with a probability of >66% would require cumulative CO_2 emissions from all anthropogenic sources since 1870 to remain below about 2900 $GtCO_2$ (with a range of 2550 to 3150 $GtCO_2$ depending on non-CO_2 drivers). About 1900 $GtCO_2$ had already been emitted by 2011.

The rest = (2900 – 1900) $GtCO_2$
= 1000 $GtCO_2$

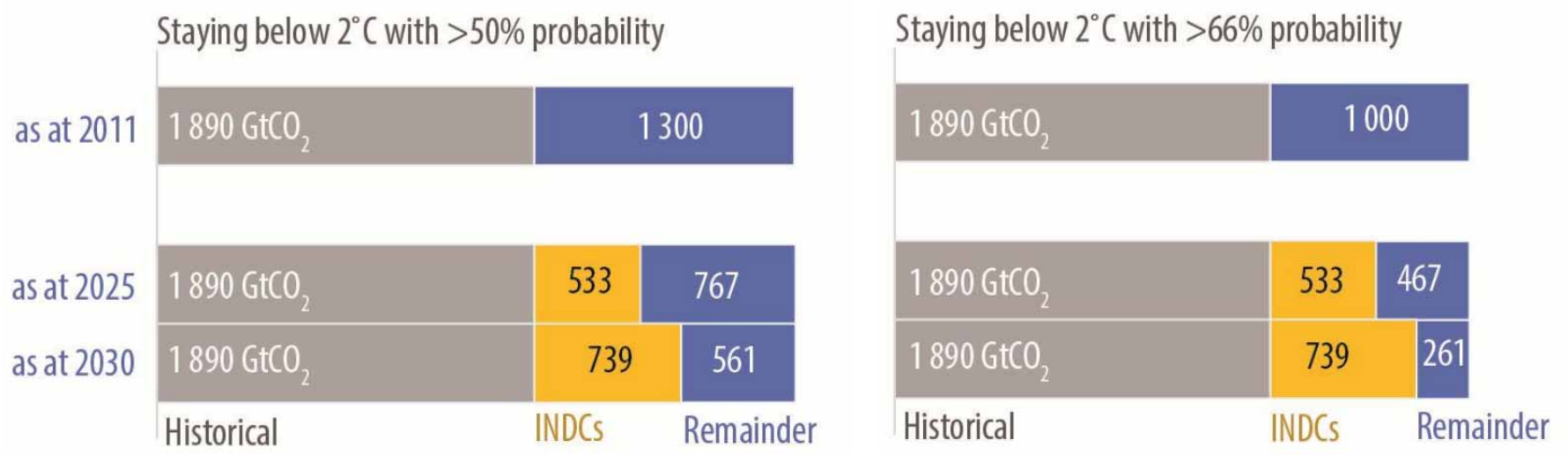
Source: IPCC AR5 Synthesis Report Figure SPM.5

CO2排出量　32.6　GtCO2 in 2012　（EDMC）

GHG emission in 2010 = 49 $GtCO_2$（IPCC AR5）

CO_2 Emissions Budget for Staying Below 2°C

Comparison of cumulative CO2 emissions under different scenarios

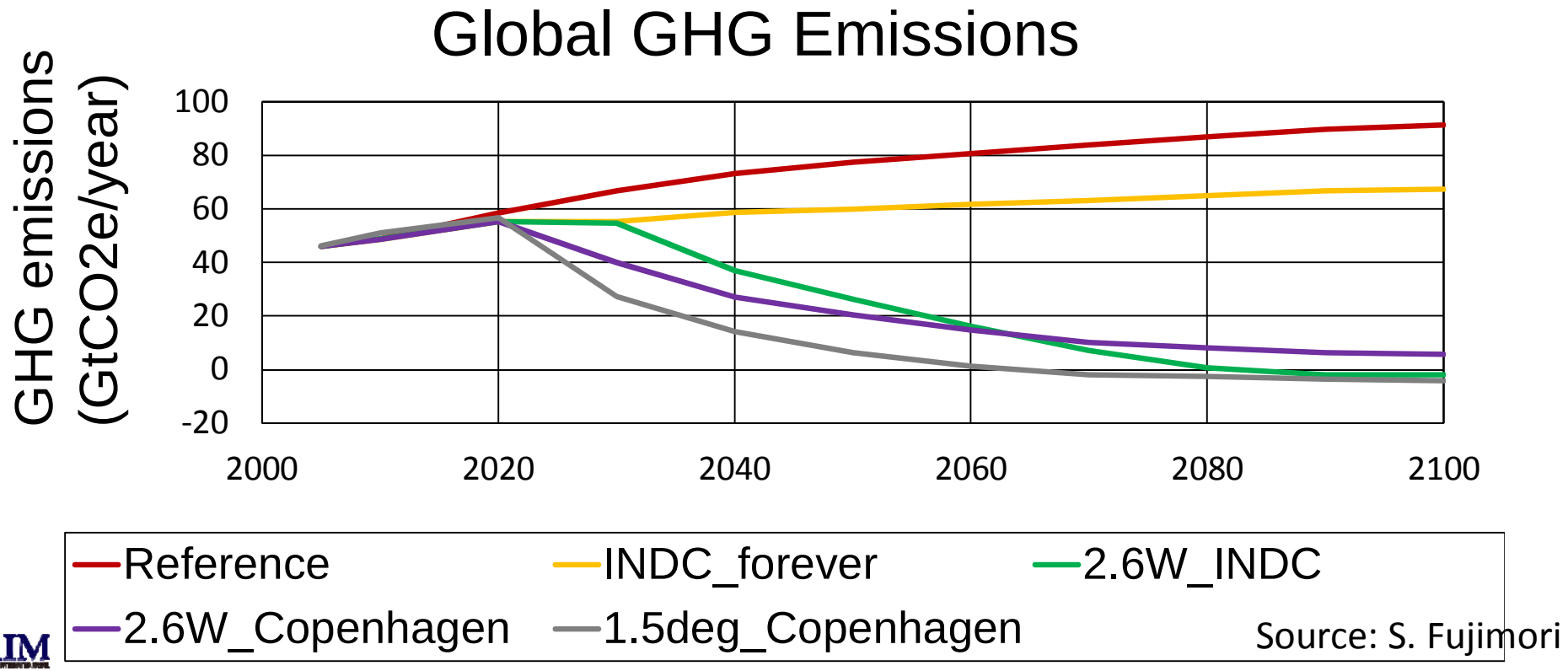


Source: Intergovernmental Panel on Climate Change Fifth Assessment Report scenario database and own aggregation.
Abbreviation: INDCs = intended nationally determined contributions

Source: UNFCCC/CP/2016/2

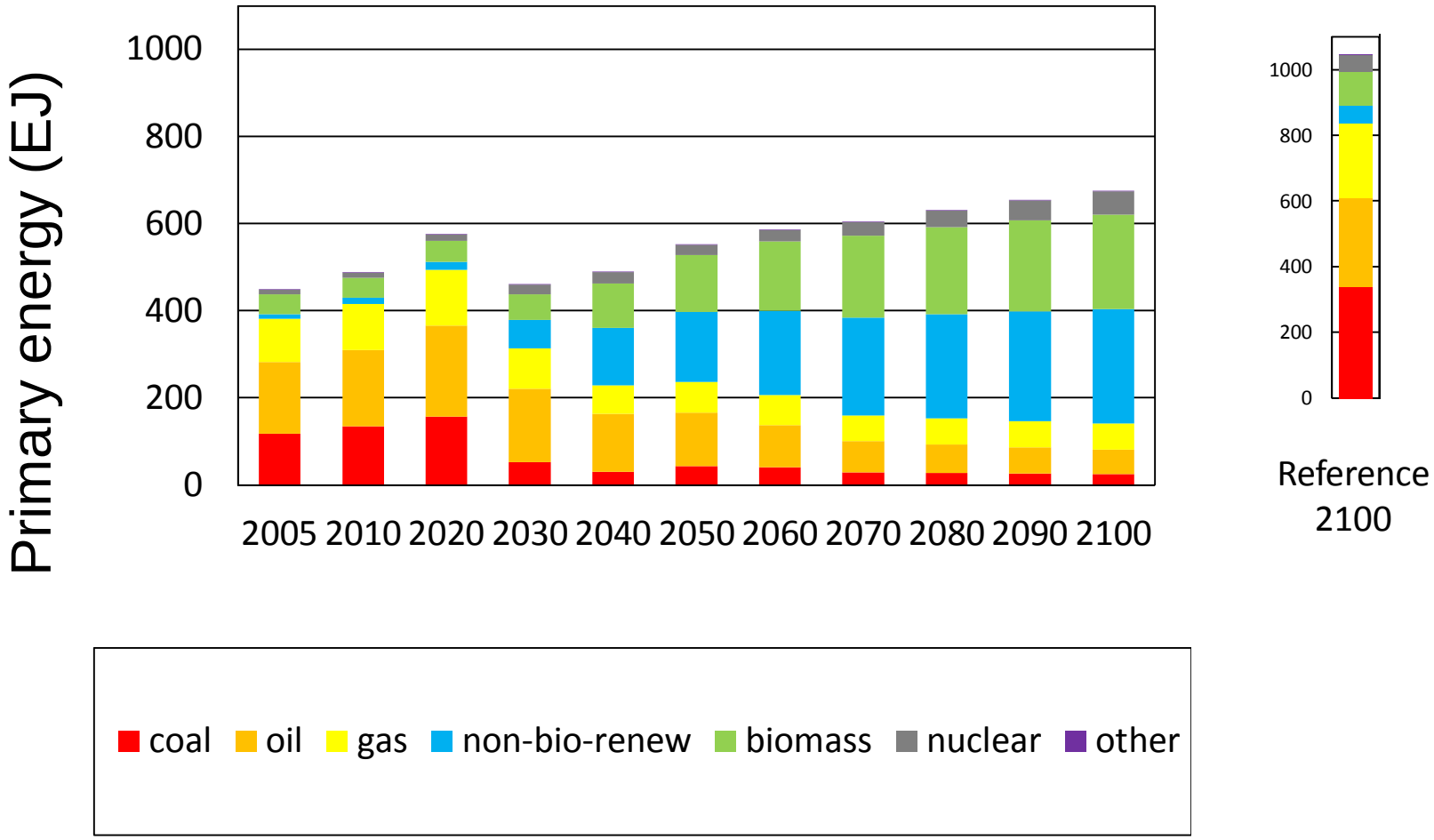
Is there a feasible path to limit the average temperature increase to 1.5 ºC. Challenges?

- Lower the GHG emissions earlier in order to keep low the total cumulative GHG emissions. We cannot expect much of minus emissions.
- Move the world towards increased share of renewables.
- The world needs to recognize how important it is to start reduction earlier.



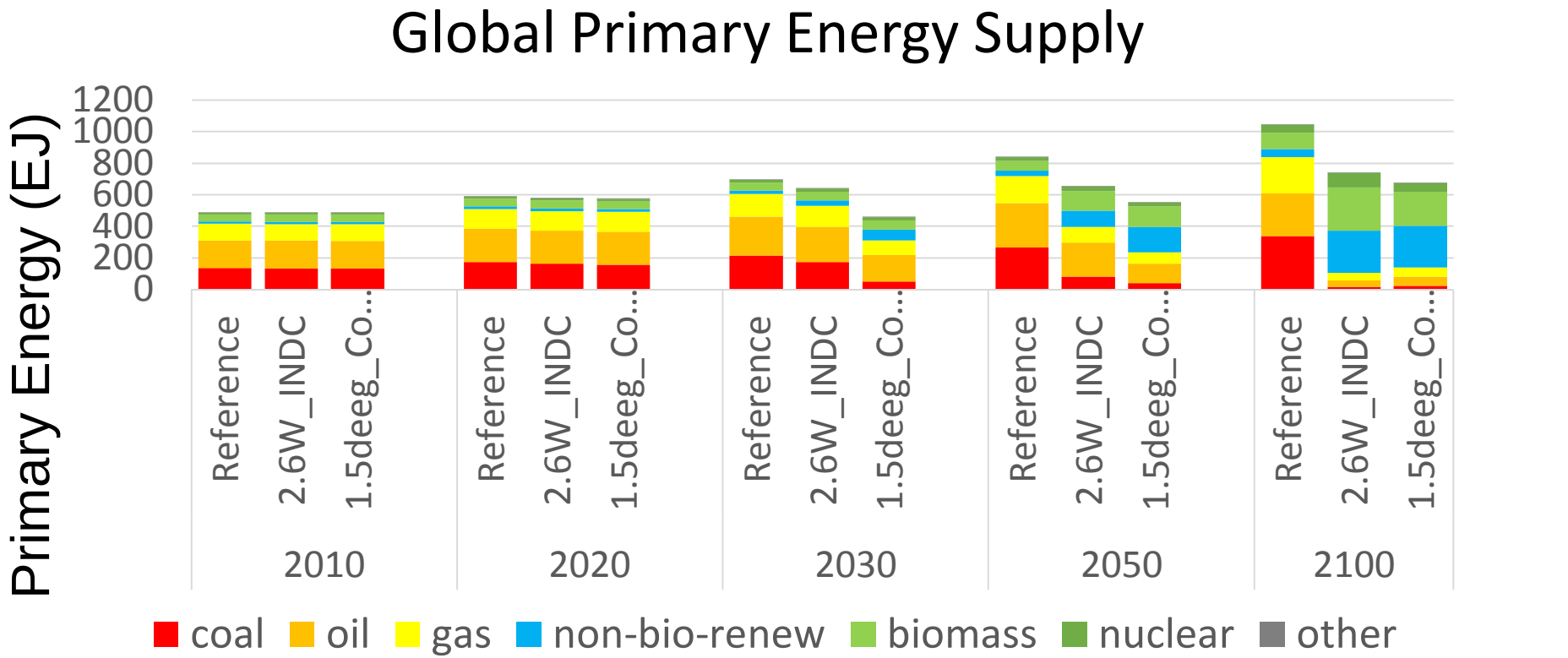
Source: S. Fujimori

Global primary energy supply (1.5 deg_Copenhagen)



Increasing the capacity of renewables is a key in achieving 1.5 ºC target.

- As the availability of renewables in 2030 is limited, the amount of primary energy in 2030 in 1.5deg_Copenhagen scenario becomes much lower than in 2030 in 2.6W_INDC and other scenarios because of CO_2 constraint.
- The amount of primary energy consumption in 2100 in 1.5 degree scenario is 65% of that in the reference. This is due to energy efficiency improvement.



Source: S. Fujimori

Impacts of Climate Change

Scenarios under the ICA-RUS (Integrated Climate Assessment – Risks, Uncertainties and Society) project

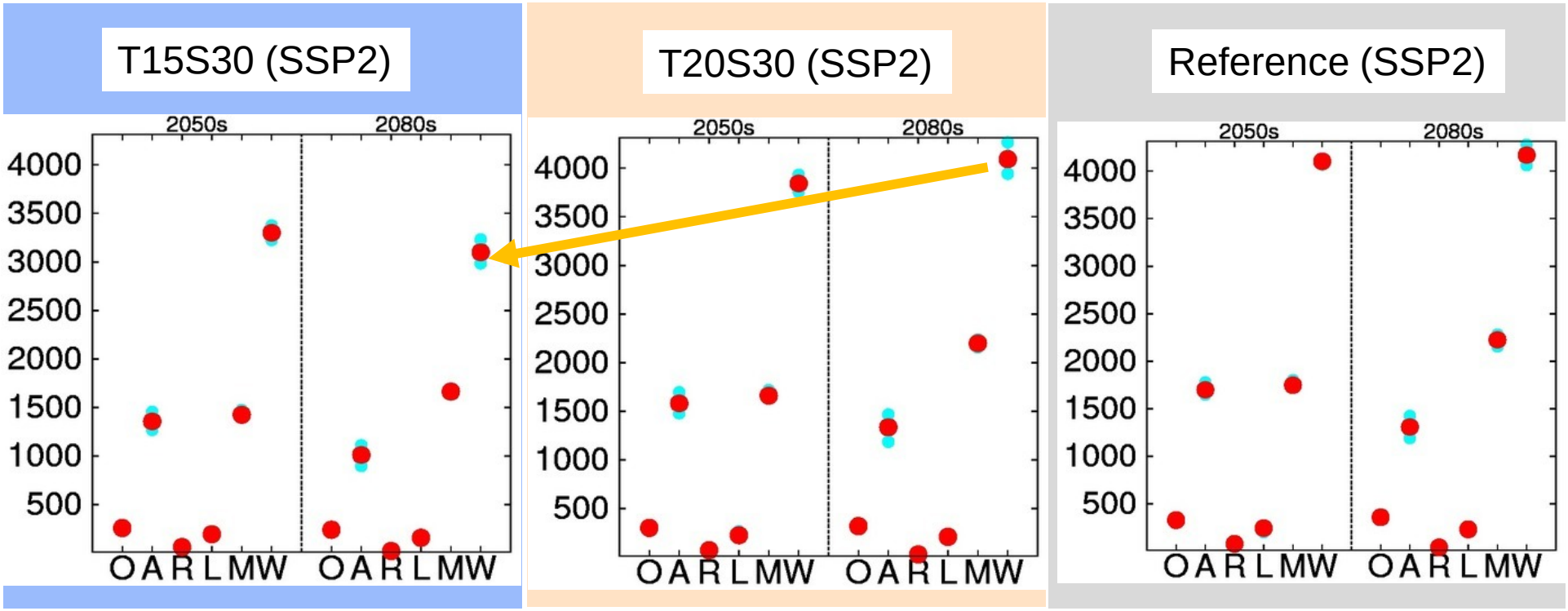
Strategies	Targeted temperature level relative to preindustrial [ºC]	Assumed climate sensitivity [ºC]	Probability of meeting the target
Reference (SSP2)	-	3.0	-
T15S30	1.5	3.0	~ 50%
T20S30	2.0	3.0	~ 50%

http://www.nies.go.jp/ica-rus/en/

Source: Takahashi @ AIM workshop

Change in water-stressed population (2050 & 2080) [million : Relative to 1981-2000]

- The impacts on Asia and Middle East and Africa are large because of their population and intensity of impacts.
- Under the 1.5 scenario, world water-stressed population could be mitigated.

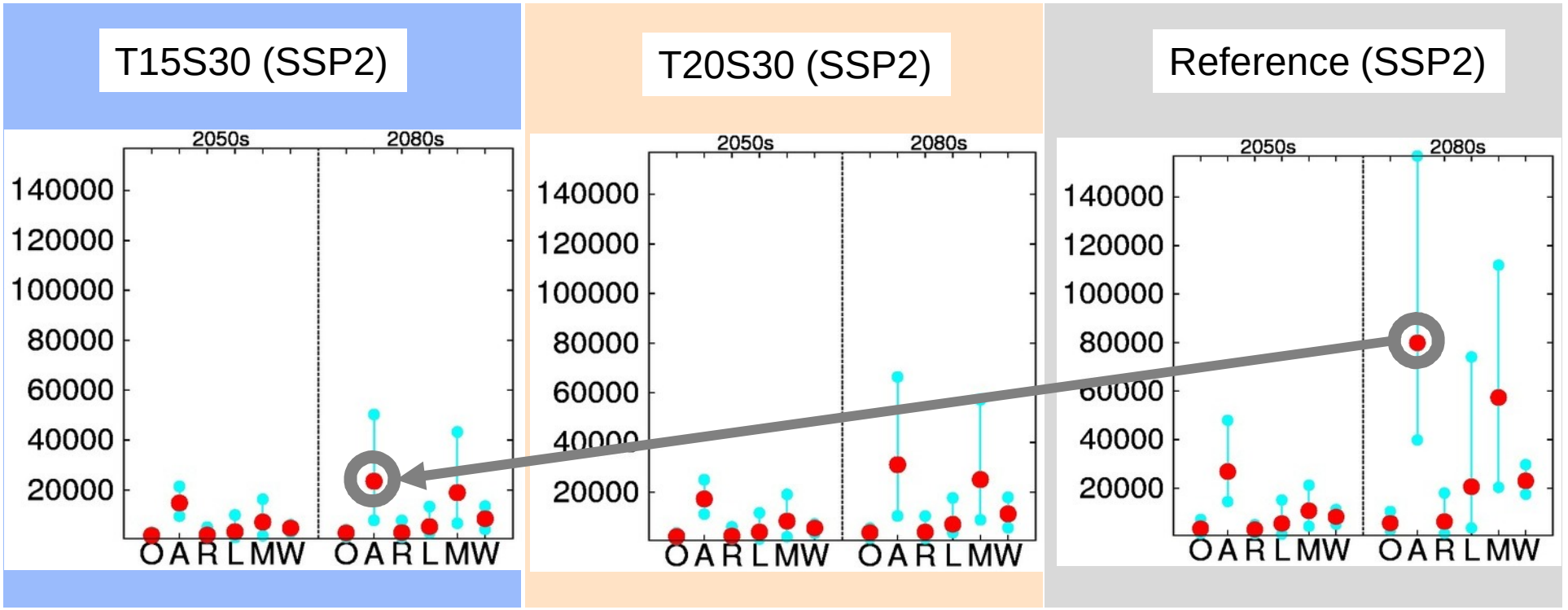


O: OECD90 ; **A**: Asia ; **R**: FSU and East Europe ; **L**: Latin America ;
M: Middle East and Africa ; **W**: World

Data from ICA-RUS project

Percent change in economic asset exposed to flooding [%] (2050 & 2080)

- The impact on asset exposed to flooding (% change) in Asia is the highest in all scenarios.
- GHG emission mitigation efforts lower the impacts, especially in the 1.5 scenario.



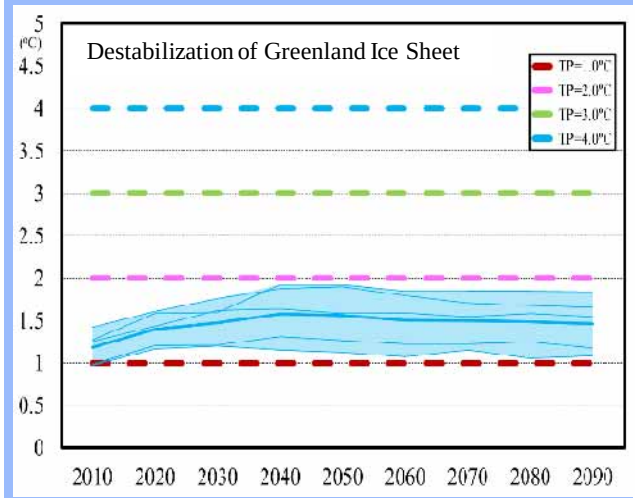
O: OECD90 ; **A**: Asia ; **R**: FSU and East Europe ; **L**: Latin America ;
M: Middle East and Africa ; **W**: World

Data from ICA-RUS project

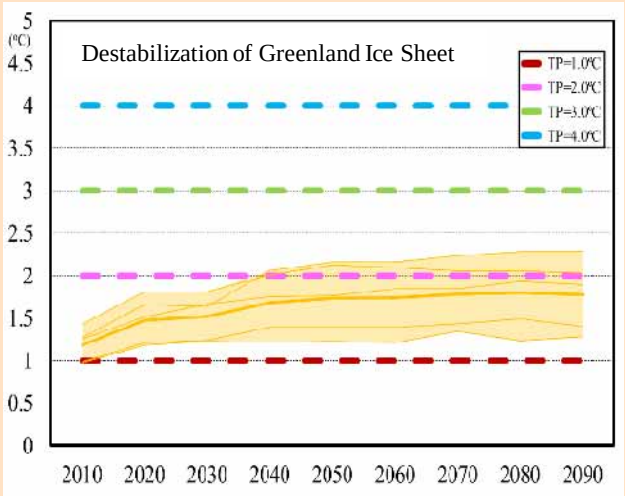
The tipping point temperature of Greenland Ice Sheet

- According to IPCC AR5, the tipping point for destabilization of the Greenland ice sheet can be crossed at a global temperature rise of between 1℃ and 4 ℃ from pre-industrial levels.
- Under T15S30, it would probably not be reached in this century if the tipping point temperature is 2 ºC.
- The tipping point of 2 ºC would be passed during the 2040s with T20S30 (depending on the climate model).

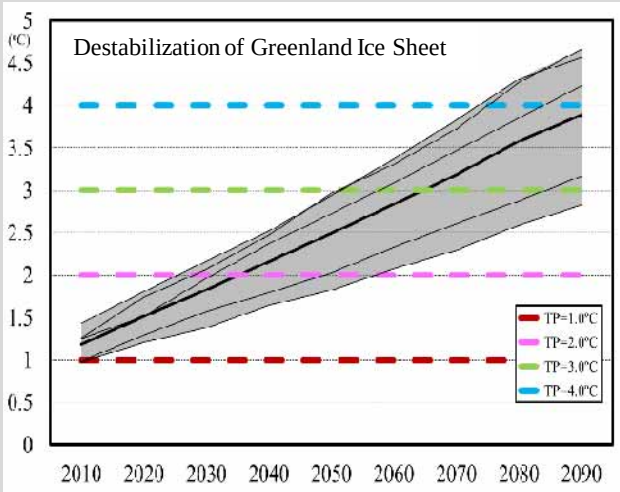
T15S30 (SSP2)



T20S30 (SSP2)

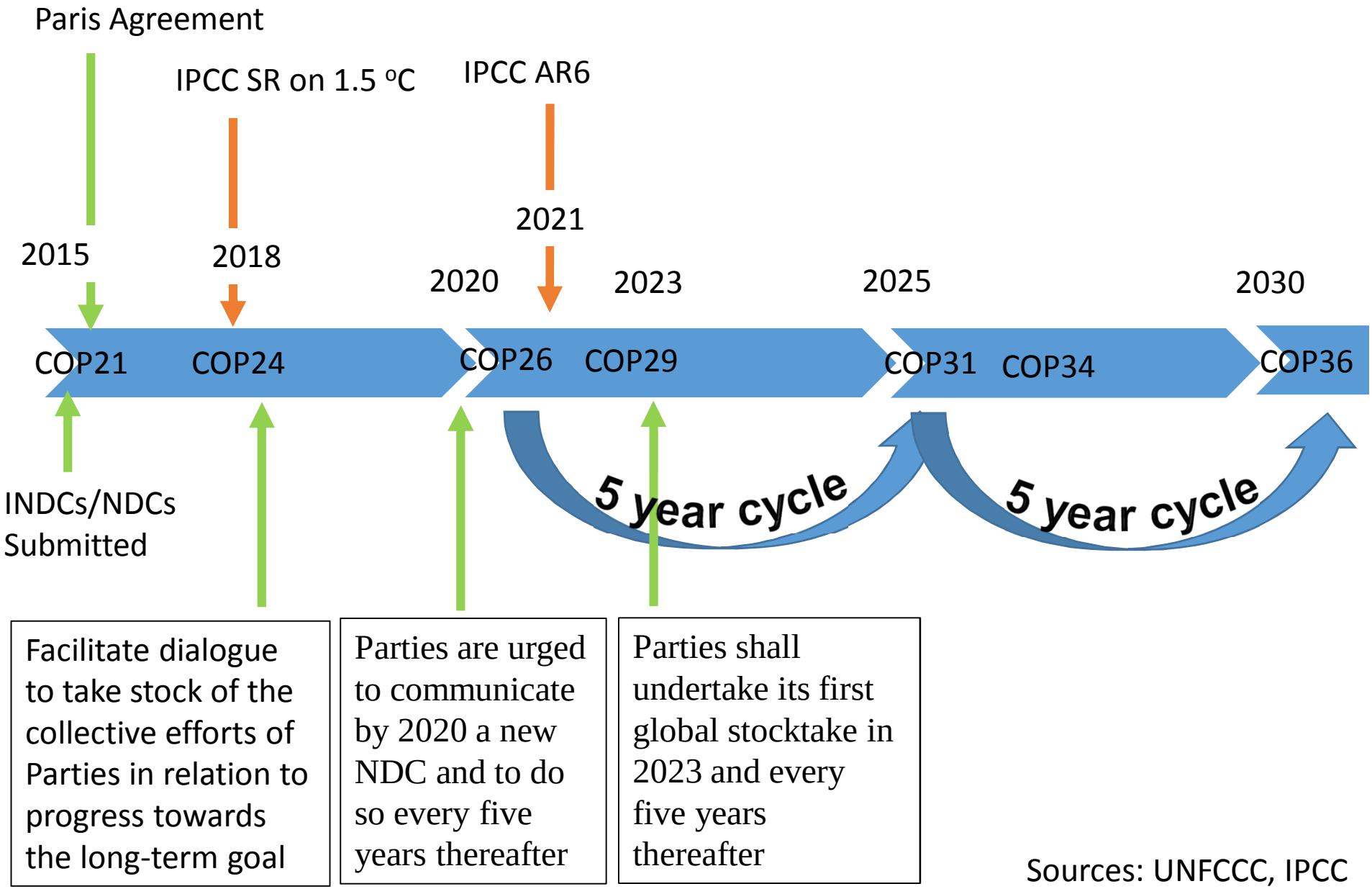


Reference (SSP2)



Data from ICA-RUS project

How could NDCs be more ambitious?



Sources: UNFCCC, IPCC

Urgent to-do-list toward Low Carbon Society (LCS)

While implementation of INDCs is a meaningful step toward reduction in global GHG emissions until 2030, it alone will not lead to further GHG cuts. In order to meet either 1.5 ^{o}C or 2 ^{o}C target, INDCs would have to be revised and additional long-term countermeasures have to be implemented. Therefore, a transition toward LCS demands many more and early efforts that are designed and implemented in a concerted and consistent manner.

Below are a do-list which requires an urgent movement.

- **Radical international agreements and monitoring mechanism under UNFCCC**.

In order to ensure the implementation of INDCs and verify them, countries need to set up processes in the form of their own legal systems and to gather reliable and transparent data. Accelerated negotiations are required to arrive at agreements on unresolved issues such as making countries commit to drastic emission reduction targets and designing and implementing more ambitious policies that meet the expectations of LCS.

Urgent to-do-list toward Low Carbon Society (LCS) (Cont'd)

- **Strong policy push, legal framework and financial incentives to ramp up investment in low-carbon technology.**

Direct governmental support for low carbon technology R&D is required to catch up with energy demands by renewables in 2030. If not, energy supply needs to be lowered in the 1.5 scenario which may cause decrease of GDP. While investments in low-carbon systems must be boosted through strong incentives, investments in high-carbon systems must be de-incentivized and legally challenged.

- **Establishment and scale-up of low-carbon infrastructures**.

Low-carbon infrastructures, such as public and efficient transportation systems for both long-distance and intra-city movements, facilities network for EV charging and supply of other low-carbon energy carriers, logistical chains for procurement and supply of equipment and spares for low-carbon technologies, smart grid systems and systems for recycling and sustainable waste management need to be urgently established. This will enable the majority of people to access such energies, technologies and systems at low marginal costs.

Urgent to-do-list toward Low Carbon Society (LCS) (Cont'd)

- **Networks to spread local-scale and city level decarbonisation through local governments and leaders**.

The world's cities account for 70% of global energy demands. Initiatives such as C40, WMCCC and ICLEI have demonstrated that networks and actions involving local level government leaders and civil society organizations have committed to implement low carbon policies. Spreading such networks can result in speedier mitigation implementation at local levels.

- **Inter-disciplinary climate modeling and research to estimate real costs and benefits.**

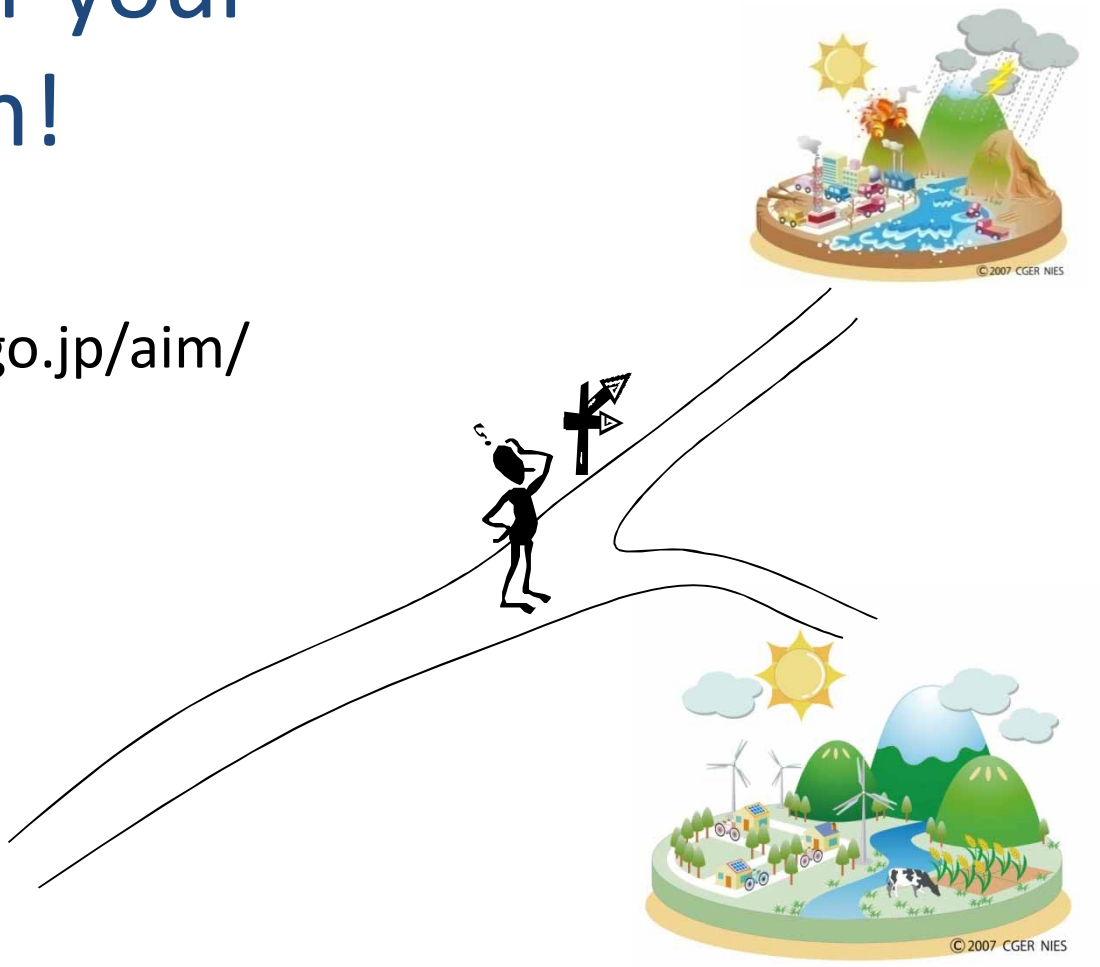
Science-based policy is a key to promote transition toward LCS. Although lots of climate studies have cautioned about serious and irreversible impacts, current policies cannot meet the target to prevent serious climate impacts. More researches are required to link science and policy communities. Inter-disciplinary climate research that combines natural sciences and engineering with economics and other social sciences would help to correctly emphasize the costs and benefits, and thereby communicate both the urgency and the desirability of reducing GHG emissions.

http://lcs-rnet.org/pdf/publications/lcs_Primer_on_Low_Carbon_Societies_e.pdf

Thank you for your attention!

http://www-iam.nies.go.jp/aim/

http://lcs-rnet.org/



You must be the change you wish to see in the world.

- Mahatma Gandhi