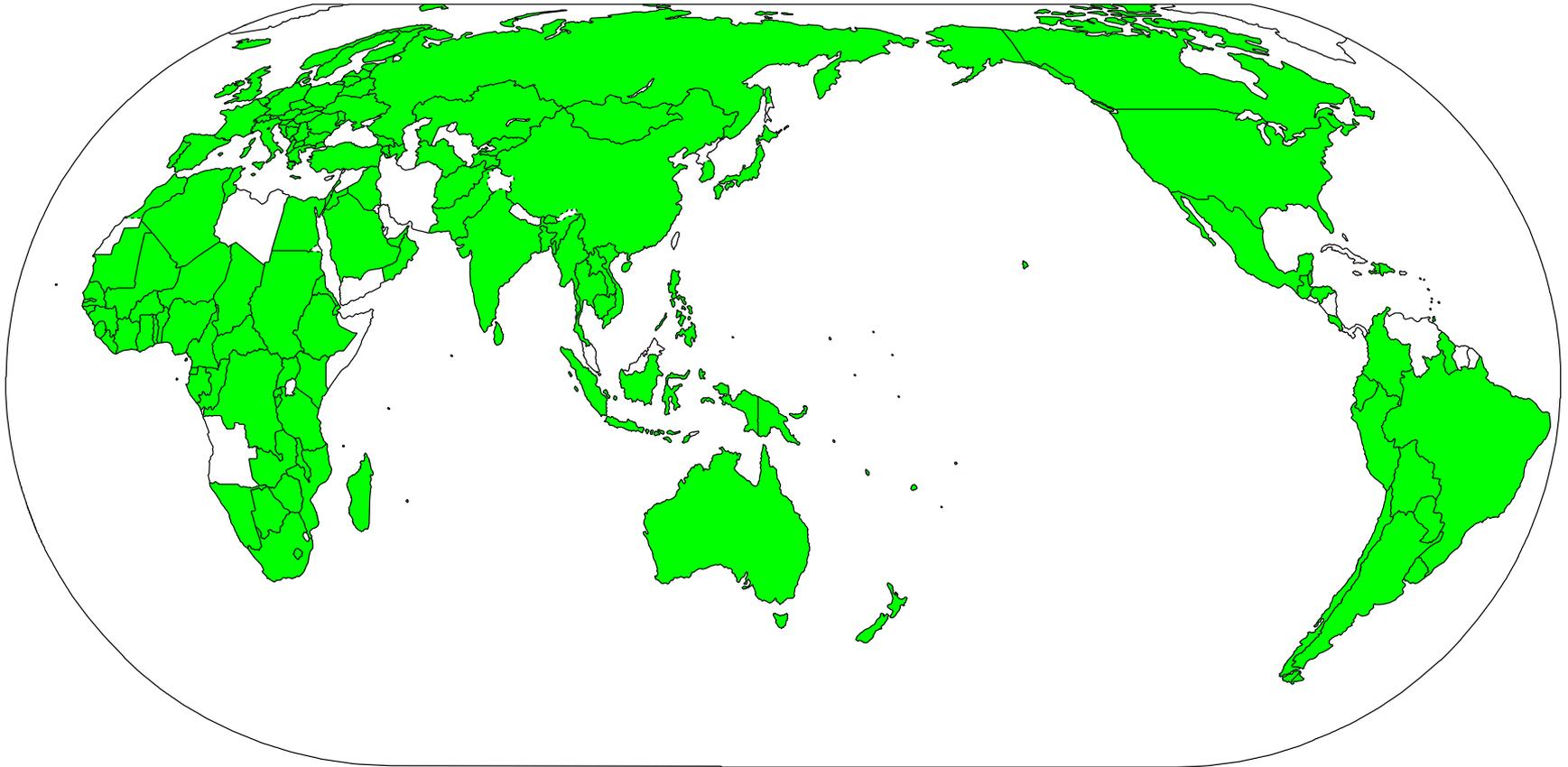


Assessment of INDCs using AIM/CGE [Global]

Shinichio Fujimori and Toshihiko Masui
National Institute for Environmental Studies

The 21st AIM International Workshop
Ohyama Memorial Hall, NIES, Tsukuba, Japan
November 13-14, 2015

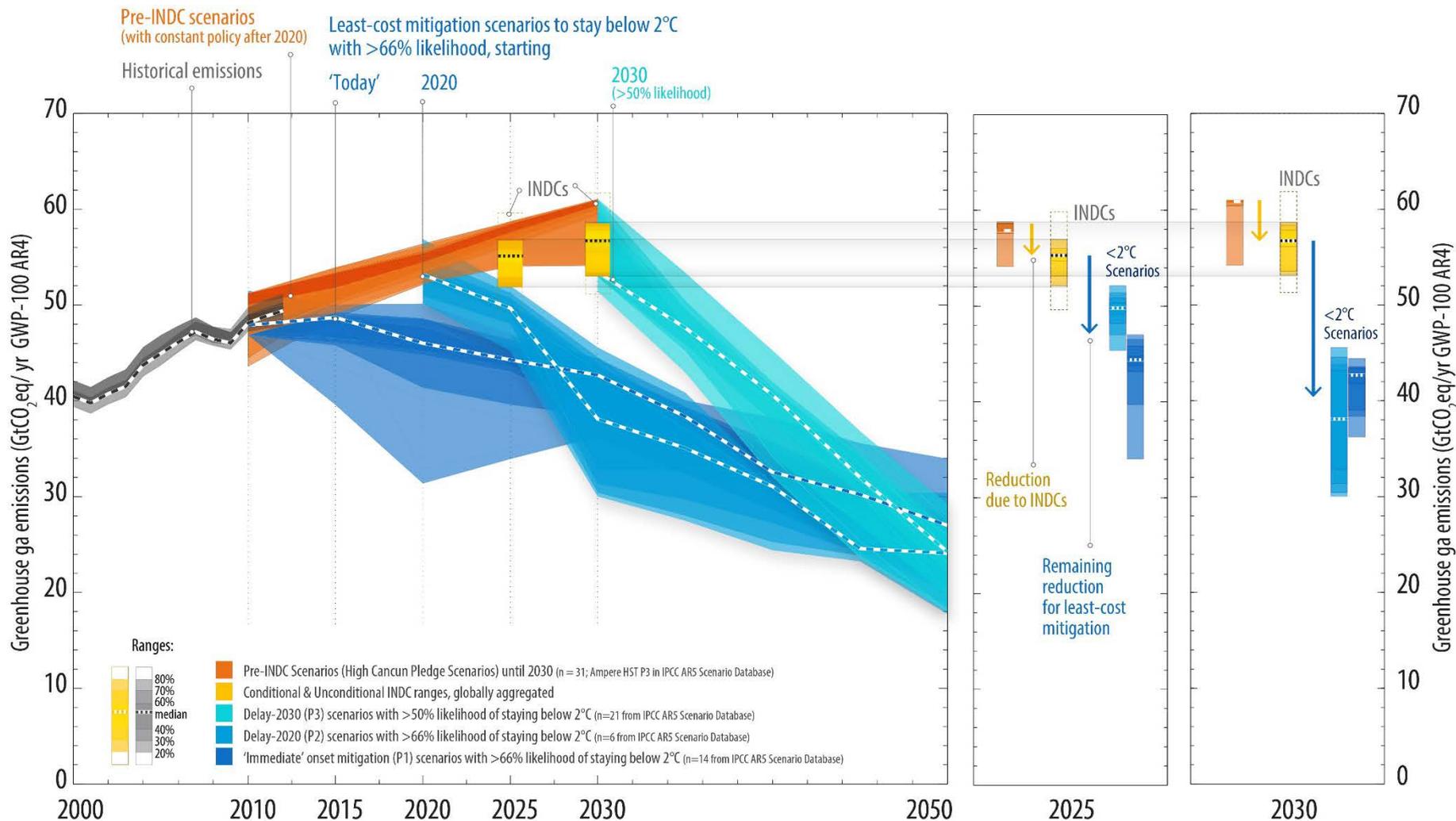
Countries submitting INDCs



As of November 13, 2015

GHG emissions in 2010 from submitted countries cover more than 90% of the total emissions.

Assessment of INDC by UNFCCC



Toward COP21 and beyond

- Many institutes are assessing the INDCs;
 - Climate Action Tracker <http://climateactiontracker.org/>
 - PBL, Netherlands <http://infographics.pbl.nl/indc/>
 - Climate Interactive <https://www.climateinteractive.org/tools/scoreboard/>
 - CAIT Climate Data Explorer, WRI <http://cait.wri.org/indc/>
 - IEA <http://www.worldenergyoutlook.org/energyclimate/energyandco2trendsintheindcscenario/>
 - The Road through Paris, Climate Nexus <http://www.theroadthroughparis.org/negotiation-issues/indcs-submitted-date-0>
 - OECD Climate Change Mitigation: Policies and Progress <http://www.oecd.org/environment/cc/climate-change-mitigation-9789264238787-en.htm>
 - UNEP, Emission GAP Report

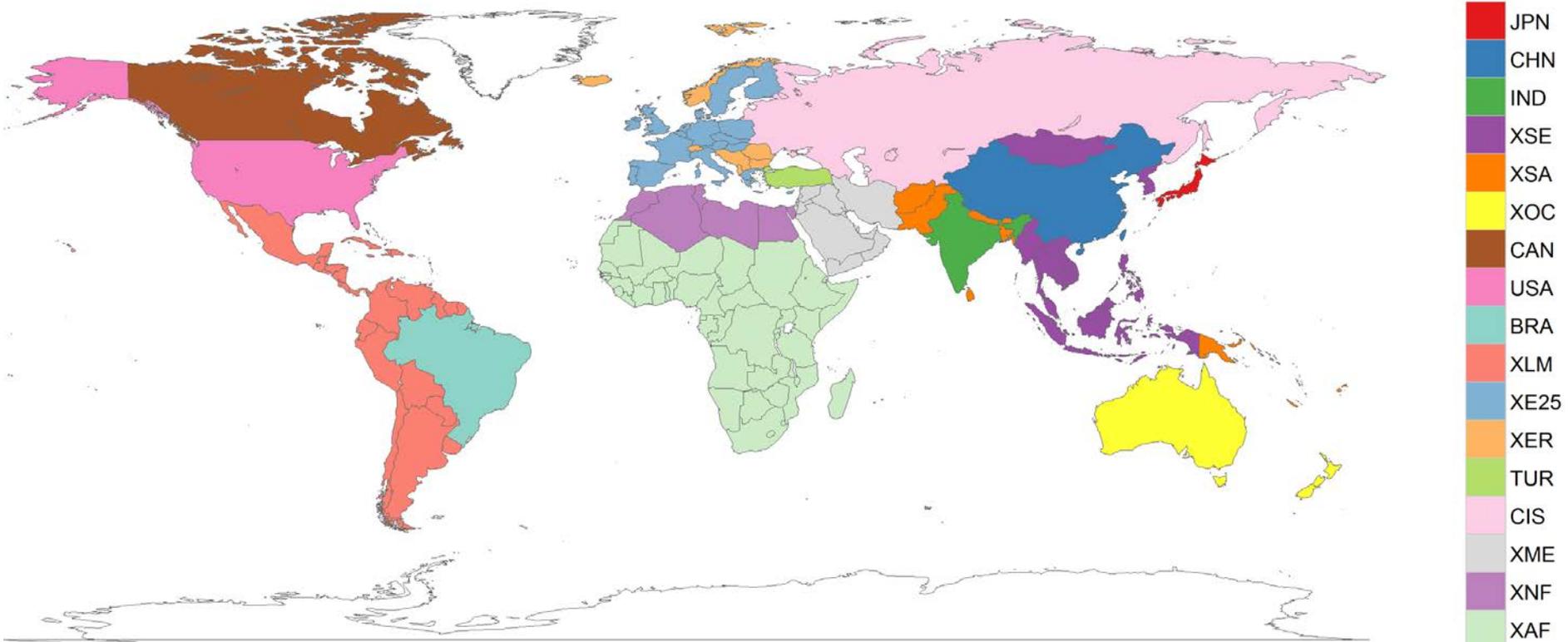
Assessment of INDCs using AIM/CGE[Global]

- Many countries have already submitted their INDCs.
- Some organizations have already assessed the submitted INDCs.
- By COP21 in Paris, the fundamental discussion will be done such as the relationship between INDCs' total commitment and 2°C target in 2030.
- AIM team also tries to assess the INDCs toward 2°C target using Global CGE model.
 - Difference of mitigation pathways to achieve 2°C target?
 - Difference of economic impacts between optimal case and INDC case to achieve 2 °C target?

Our preliminary assessment of INDCs using AIM/CGE [Global]

- Global computable general equilibrium model with 17 regions, 43 sectors and 23 commodities developed by Dr. Shinichiro Fujimori.
- Emissions from both energy, land use and others can be covered.
- Recursive dynamics up to 2100.
- Gas types: CO₂, CH₄, N₂O, SO_x, NO_x, CO, BC, OC, VOC, and NH₃
- Simple climate model, MAGICC6, is linked to show the future climate condition.
- This model is utilized to assess SSPs (Shared Socio-economic Pathways) to show the future scenarios.
- The detailed model description, please see the following website; <http://www.nies.go.jp/social/dp/pdf/2012-01.pdf>

Definition of 17 regions of AIM/CGE [Global]



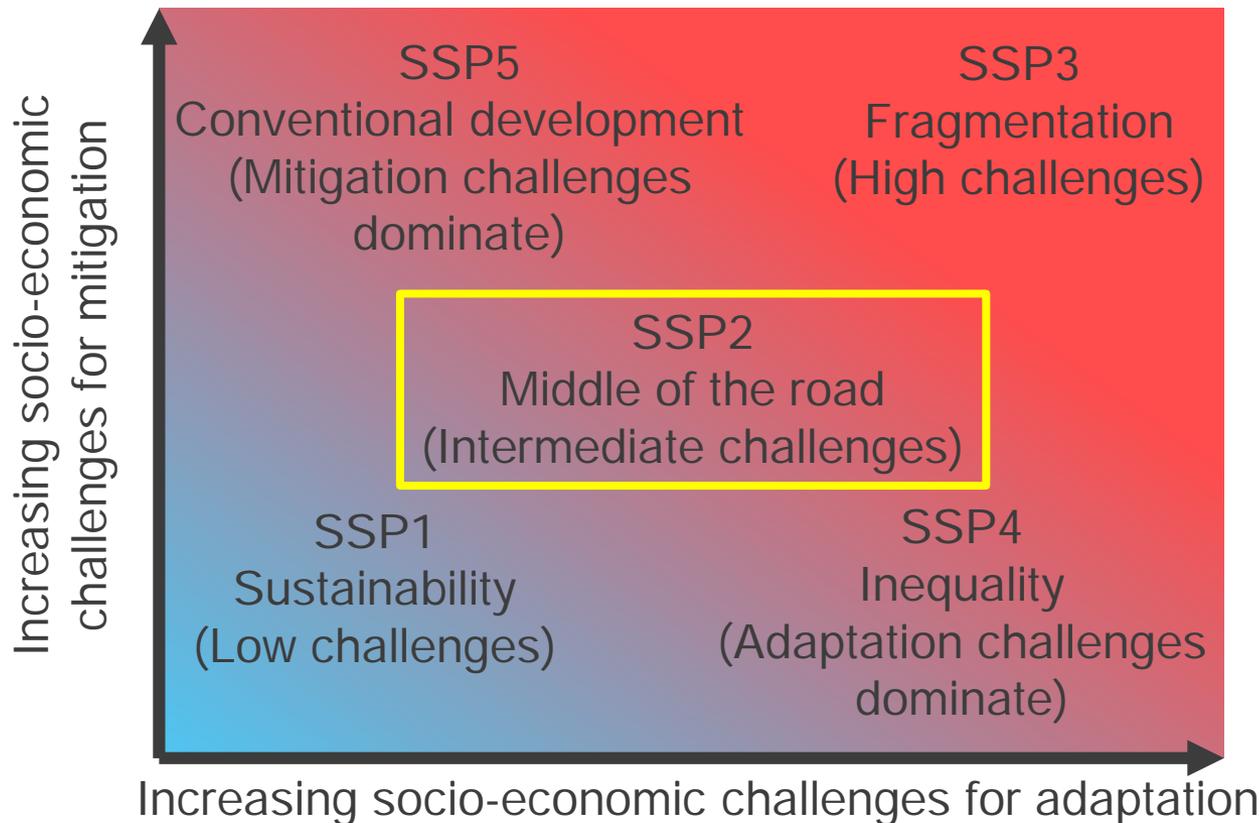
Main outputs from AIM/CGE [Global]

- Socio-economic activities
 - GDP
 - Population (exogenous)
- Emissions
 - Kyoto 6 gas
 - Air Pollutants
- Climate
 - Radiative forcing
 - Global mean temperature
- Mitigation costs
 - GDP loss
 - Consumption loss (welfare loss)
- Prices
 - Carbon price
 - Energy prices
 - Agricultural product prices
- Energy
 - Primary energy supply
 - Electricity supply by technologies
 - Final energy demands by sectors
- Agriculture and land use
 - Agricultural products and consumption
 - Land use change

Basic assumptions

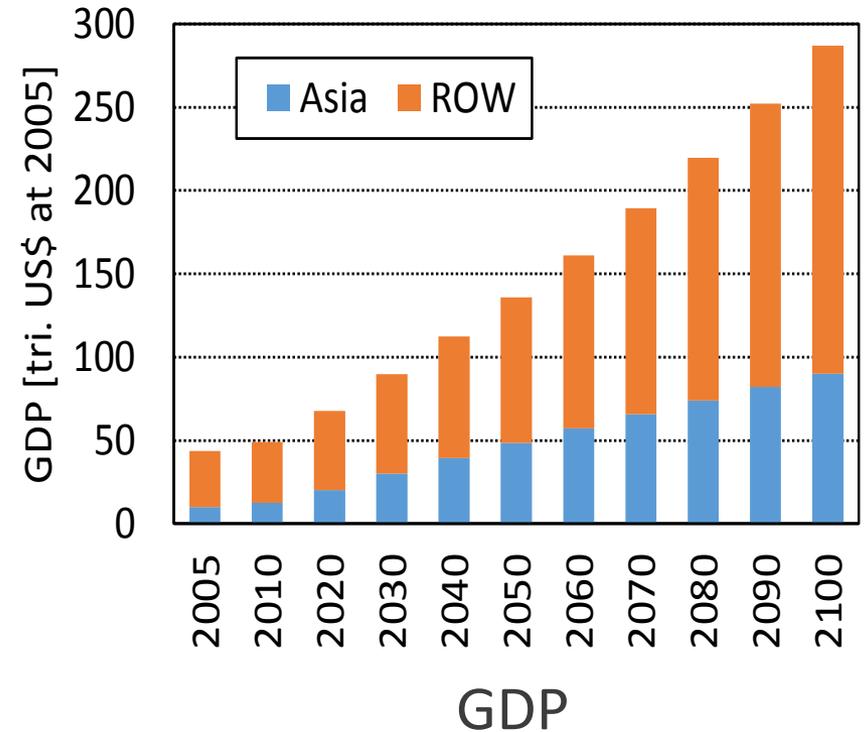
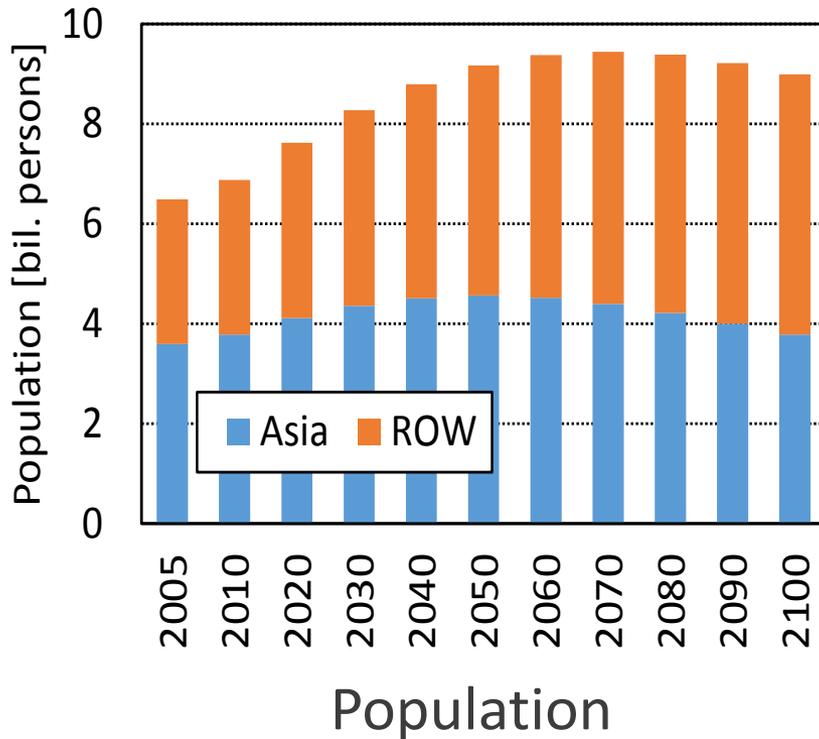
Socio-economy up to 2100

- Future changes of population, GDP, technology and preference will follow SSP2 "middle of the road."
 - New scenario sets to assess the future climate change mitigation and adaptation.
 - The basic assumptions of GDP and population are different from the forecasts by each national government.



Source: Brian O'Neill et al. (2012)

Future population and GDP (SSP2)



If the driving forces such as population, GDP, available technologies, preference and so on are different, the GHG emission pathway is different.

Mitigation scenarios

Scenario	Contents
Ref	No climate policy.
2.6W_opt	Mitigation efforts consistent with Cancun pledges until 2020 and then the efforts increase to achieve the long term 2 ° C target.
INDC_2.6W	Cancun pledges in 2020, INDCs in 2030, and then implementation of mitigation policies to achieve the 2 ° C target. (Cumulative GHG emissions during the 21 st century will be the same as those in 2.6W_opt.)
INDC_cont	Cancun pledges in 2020, INDCs in 2030, followed by the same carbon price for INDC.

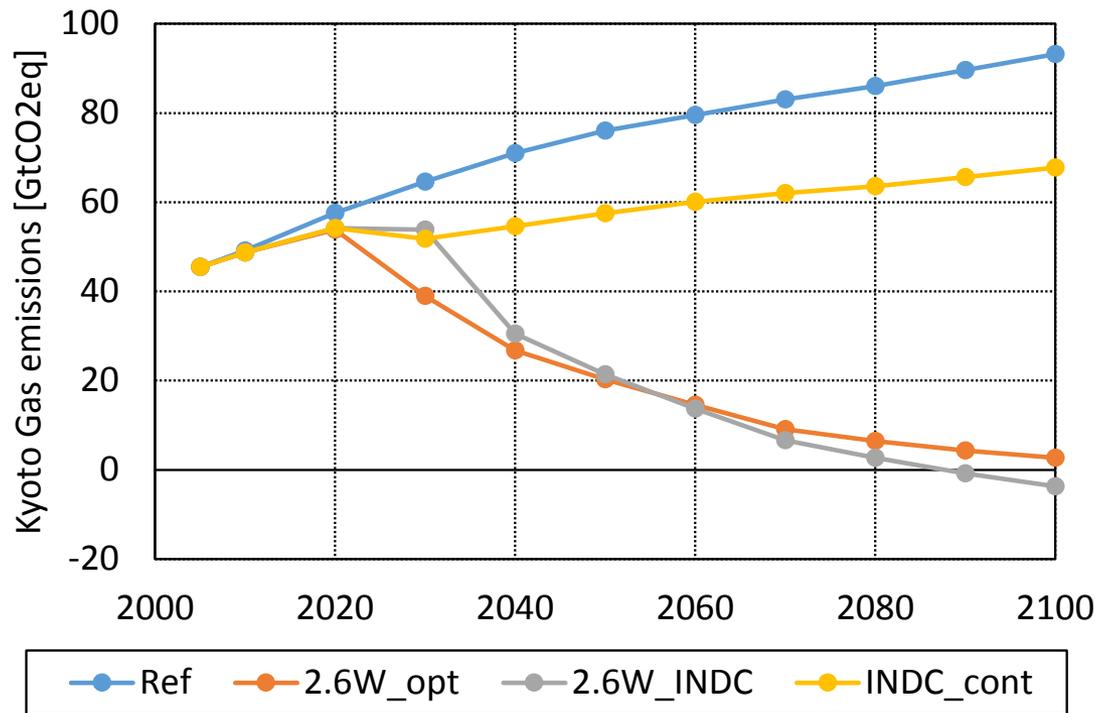
* RCP2.6 is the lowest emission scenario among the 4 RCPs (Representative Concentration Pathways). In this analysis, the cumulative emissions during 21st century should be the same with those in RCP2.6.

Preliminary conclusions from Global results.

Targets proposed in INDCs are meaningful and necessary to develop low carbon society. However, achievement of the 2°C target i.e. global mean temperature increase to be below 2°C compared to the pre-industrial level will depend on the revision of INDCs and mitigation measures after 2030. The mitigation measures in Asia, where the GHG emissions are expected to increase, become more important.

Result 1

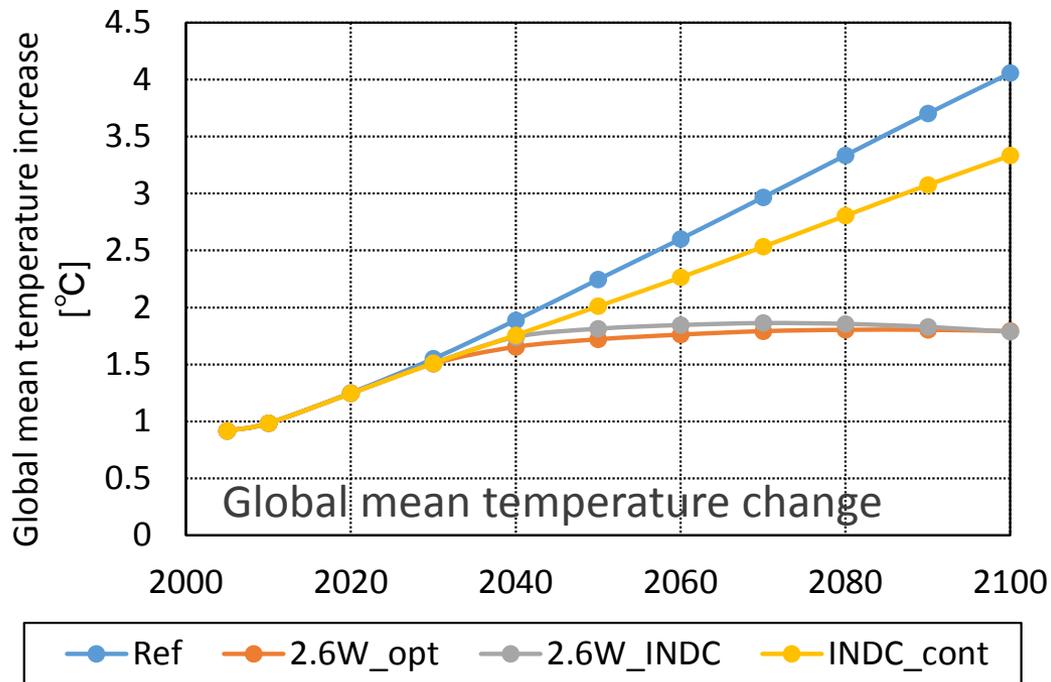
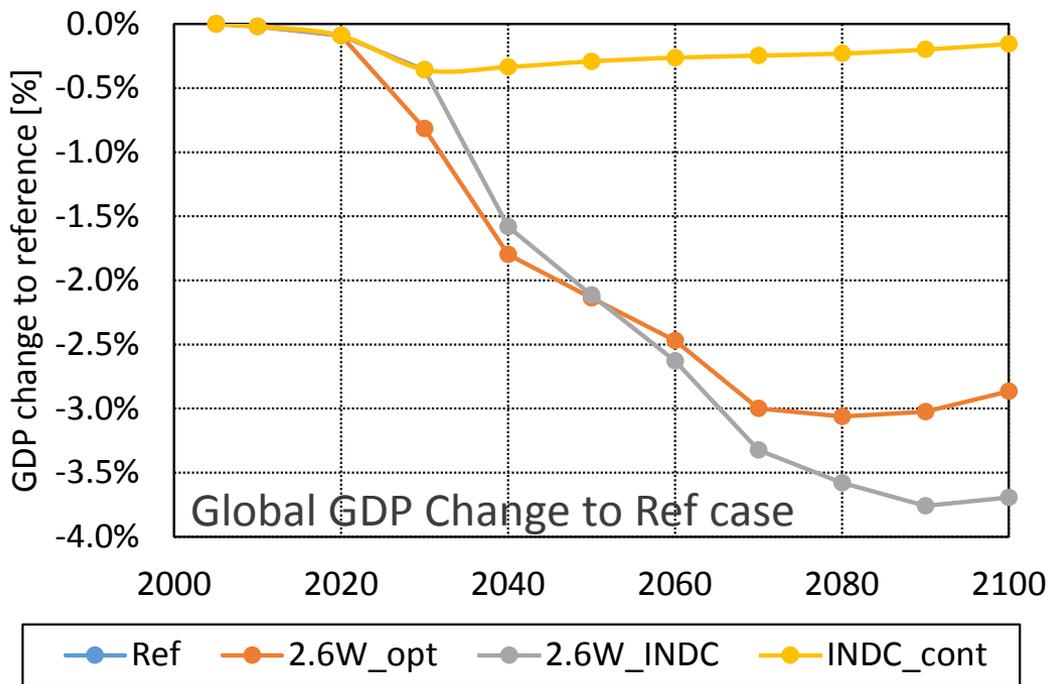
- Due to the mitigation efforts consistent with INDC commitments, the global GHG emissions will reduce by 0.4 GtCO₂ in 2030 compared to the emission level in 2020 assuming the fulfillment of Copenhagen pledges. The implementation of INDCs is meaningful toward low carbon society.



Result 2

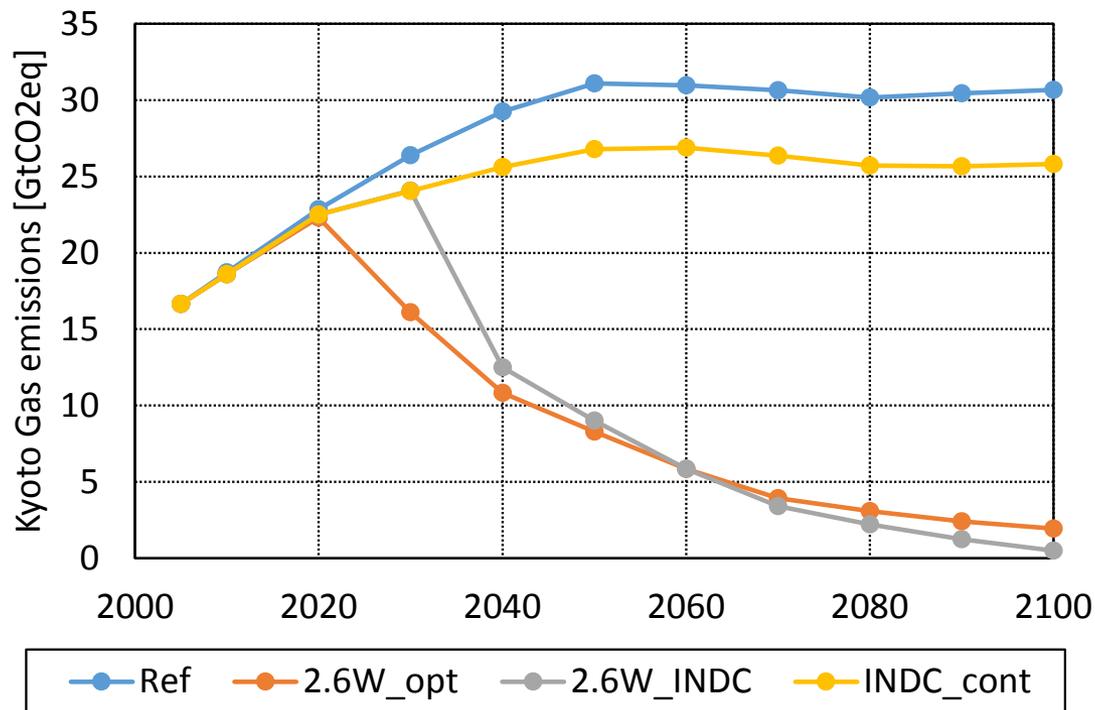
- On the other hand, in the INDC_cont case, where GHG reduction efforts will no longer be enforced after INDC, GHG emissions will increase again after 2030. The global GHG emissions in 2030 after the INDC achievement will be 14.8 GtCO₂ more than those in 2.6W_opt, which complies with 2 °C target. In this case, the GHG emissions reduction in the latter half of the 21st century in 2.6W_INDC case need to be greater compared to those in 2.6W_opt to achieve the long term 2 °C stabilization target.

Result 2



Result 3

- Although the GHG emissions in Asia in 2030 will exceed those in 2020, they will decrease by 2.3 GtCO₂ compared with those in 2030 in Ref case. Toward the low carbon society, the more GHG emission reduction in Asia will be required through the measures such as technology transfer.



From target setting to concrete actions

- Although the present mitigation target (INDC) is not enough to achieve the 2 °C target, we will have to show the roadmap to achieve this target as a first step.
- From the process exploring the concrete actions based on model simulation, we can propose the more ambitious target and roadmap.

Series of workshop proposed by Jae

The international workshops and their venue still to be determined



- ▶ **Spring 2016**—A first look at the large-scale implications of the new agreement and the INDCs' environmental, economic, energy, land-use, trade, and equity implications. The first workshop tees-up issues taken up in the 2nd and 3rd workshops.
- ▶ **Fall 2016**—A detailed, country-by-country look at the INDCs and the policies and measures that governments are proposing to use to implement them, including the United States, China, the EU, and India
- ▶ **Spring 2017**—Interactions of nationally determined, complex, multi-instrument policies in a globally connected world—implications for environment, economy, energy, land-use, trade, and equity—winners, losers, and free riders—lessons and transition strategies.



AIM team will support this activity to promote the GHG reduction in the world.