Assessment of INDCs using AIM/CGE[Global] (Ver.1)

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By October 2nd, 2015, 120 countries/regions in the world submitted their Intended Nationally Determined Contributions (INDCs). The greenhouse gas (GHG) emissions from these countries in 2010 accounts for almost 90% of the total global GHG emissions. Before the 21th Conference of Parties (COP21) that will be held in Paris from November 30th, 2015, National Institute for Environmental Studies (NIES) and Mizuho Information Research Institute (MHIR) assessed the submitted INDCs under the following cases on the future GHG emission trajectory.

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

【Main conclusion】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. Therefore mitigation measures in Asia, where the GHG emissions are expected to increase, become more important.

Three main results

Result 1: Due to the mitigation efforts consistent with INDC commitments, the global GHG emissions will reduce by 2 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 13 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 3: Although the GHG emissions in Asia in 2030 will exceed those in 2020, they will decrease by 2 GtCO2 compared with those in 2030 in Ref case. The more GHG emission reduction in Asia will be required through the measures such as technology transfer.

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This report is the fast-track version and does not reflect all the information in all INDCs. The results may be revised due to the revisions of the future socio-economic scenario and the revised INDCs to be submitted in the future. The more detailed results will be presented at the web site of the AIM team in NIES, http://www-iam.nies.go.jp/aim/index.html.

Result 1: Due to the mitigation efforts consistent with INDC commitments, the global GHG emissions will reduce by 2 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.

When the submitted INDCs are calculated based on a certain socio-economic assumption, the estimated global GHG emissions in 2030 will be 52 GtCO2 corresponding to the submitted INDCs under certain socio-economic assumptions. The emission level is 2 GtCO2 less than those in 2020 represented by Copenhagen Pledge (Fig. 1). This means that the measures by INDCs will be able to make the global GHG emissions peak out by 2030, and they are meaningful to realize low carbon society.

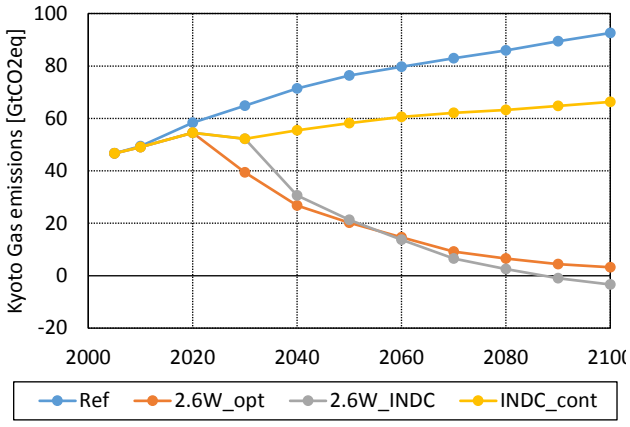

Fig. 1 Trend of global GHG emissions

Fig. 2 shows the trend of the global primary energy supply. In 2030, INDCs will be able to lead the reduction of the global primary energy supply through the energy saving, and the switch from fossil fuels to non-fossil energy. In 2.6W_INDC pegged with the 2 °C target, this trend after 2030 will be more likely, and the total primary energy will be around 60% compared with Ref. Moreover, 75% of total supply will be renewable energy.

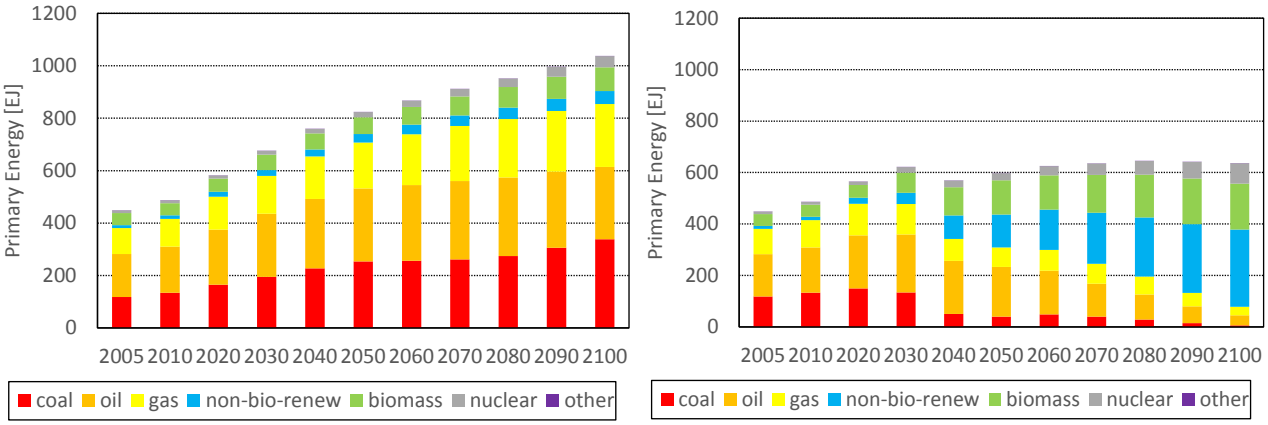

Fig. 2 Trends of global primary energy supply (Left: Ref, Right: 2.6W_INDC）

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 13 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.

The global GHG emissions in 2030 under INDCs will be larger by 13GtCO2 than those in 2.6W_INDC, which

is equivalent with the 2 °C target. This means that in order to achieve the 2 °C target, strengthening of INDCs and more reduction of GHG emissions after 2030 are needed, and the emissions in 2100 will be negative as shown in Fig. 1. As a result, GDP in 2100 in 2.6W_INDC compared to that in Ref will decrease by 2.5% as shown in Fig, 3. In order to achieve the 2 °C target, revision of INDCs and the long-term countermeasures will be important. The global mean temperature increase in 2100 compared with the pre-industrial level will be 4 °C in REF scenario, and 3.3 °C in INDC_cont as shown in Figure 4.

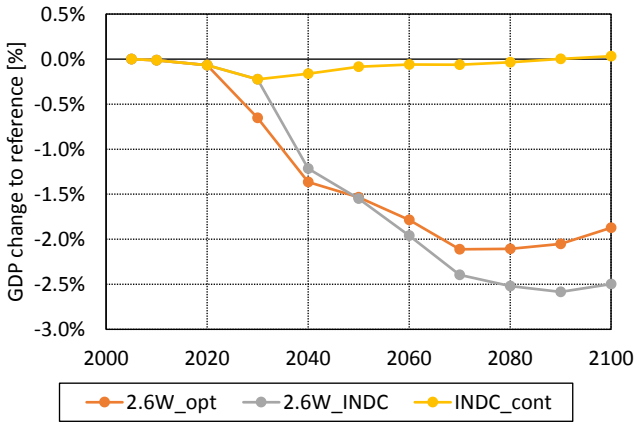

Fig. 3 Global GDP change to Ref

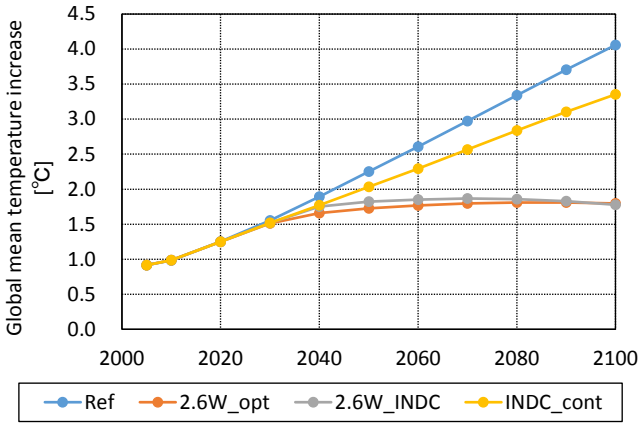

Fig. 4 Global mean temperature change to the pre-industrial level

Result 3: Although the GHG emissions in Asia in 2030 will exceed those in 2020, they will decrease by 2 GtCO2 compared with those in 2030 in Ref case. The more GHG emission reduction in Asia will be required through the measures such as technology transfer.

The share of GHG emissions in Asia to the global total was 36% in 2010, and it will increase to 45% in 2030 even if the INDCs are achieved. With the INDCs achievement in 2030, the GHG emissions in Asia in 2030 will be less than those in Ref, but more than those in 2020 as shown in Fig. 5. This means that the mitigation measures in Asia need to be strengthened. After 2050, the GHG emissions in Asia will decrease even though in Ref case. This is due to the socio-economic scenario after 2050.

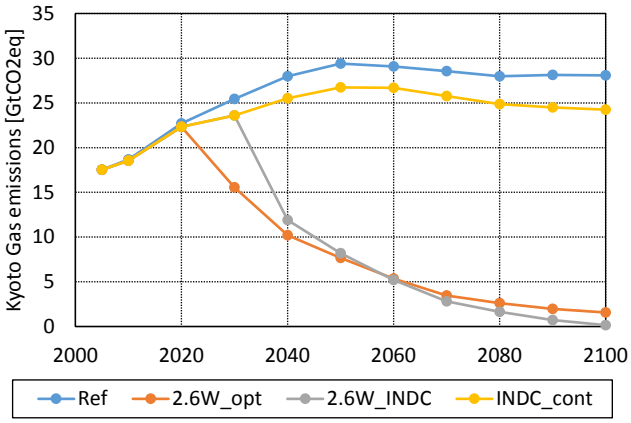

Fig. 5 GHG emissions in Asia

Significance of 2 °C target: To prevent the most severe impacts of climate change, “Cancun Agreement” was adopted in December 2010 by the parties of the UNFCCC, in which they agreed to commit to a maximum temperature rise of 2°C above pre-industrial levels, and to consider lowering that maximum to 1.5°C in the near future. There is quite a wide range of views on this agreement. Some argue that achieving the agreement is virtually impossible or unacceptably costly. Others emphasizes the existence of impacts unavoidable even with achieving the agreement and claim the necessity of lowering the maximum. It is worth noting that the agreement is a political decision of the parties considering scientific evidences on climate risks and it is not solely deduced from the evidences without any value judgement.

Appendix: About AIM/CGE [Global] used in this report

AIM (Asia-Pacific Integrated Model) has been developed by National Institute for Environmental Studies, Kyoto University and Mizuho Information Research Institute collaborating with research institute in Asian countries in order to assess the climate change impacts, mitigation potential, economic impacts due to the mitigation. For more detail on the project, please visit our website, http://www-iam.nies.go.jp/aim/index.html.

AIM/CGE [Global] is a global computable general equilibrium model with dynamic recursive system up to the year 2100. The model is disaggregated into 17 regions in the world. Economic activity is disaggregated into 43 sectors and 23 commodities. The resolution on energy and agriculture cab be treated in detailed. For each commodity and production factor, the domestic and international market is defined, and the activity level is decided to balance each supply and demand through the price mechanism. The treated gases are CO2, CH4, N2O, SOx, NOx, CO, BC, OC, VOC and NH3. The climate change is assessed using MAGICC6, a simple climate model. For more detailed explanation on the model, please see Fujimori et al. (2012) to visit the following website; http://www.nies.go.jp/social/dp/pdf/2012-01.pdf.

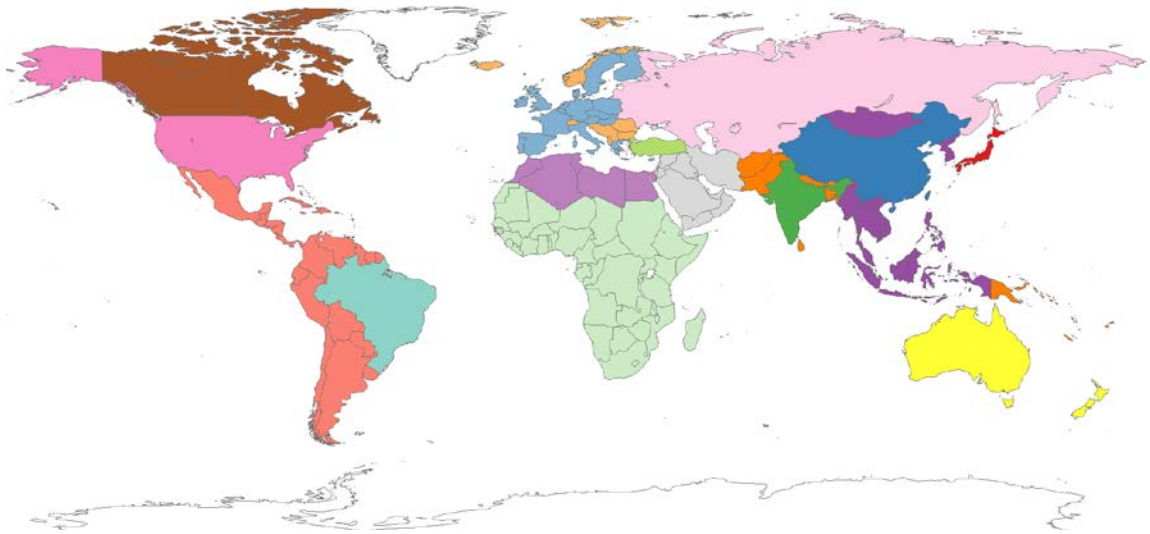

Fig. 6 Regional classification in AIM/CGE [Global]

In this quantification, as the future socio-economy, SSP2, the middle of road, is selected among the five Shared-Socioeconomic Pathways. Fig. 7 represents the global population and GDP trends in SSP2. Because the population in Asia will increase by 2050, the contribution of Asia to energy demand will be more and more. After 2050, the population in Asia will decrease, and as a result, the share of Asia will gradually decrease. Note that the numerical results are changed when these assumptions are changed.

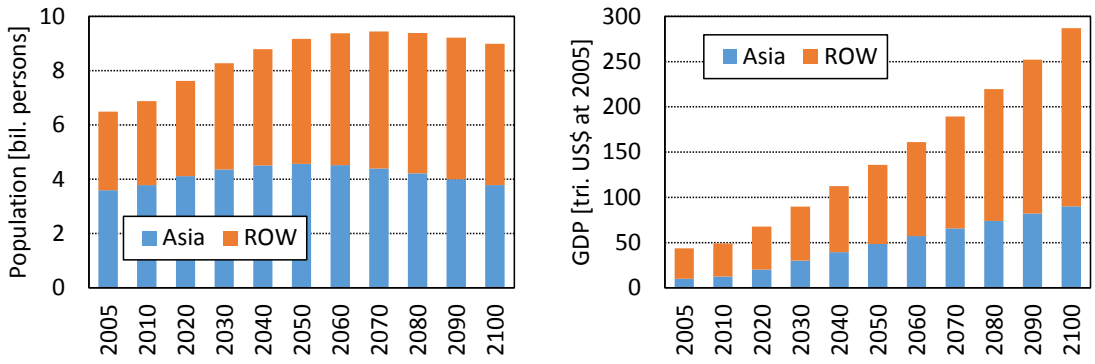

Fig. 7 Global population (left) and GDP (right) trends used for this quantification