Reduction Potentials in Asian Countries as Contribution of Decarbonizing Technologies

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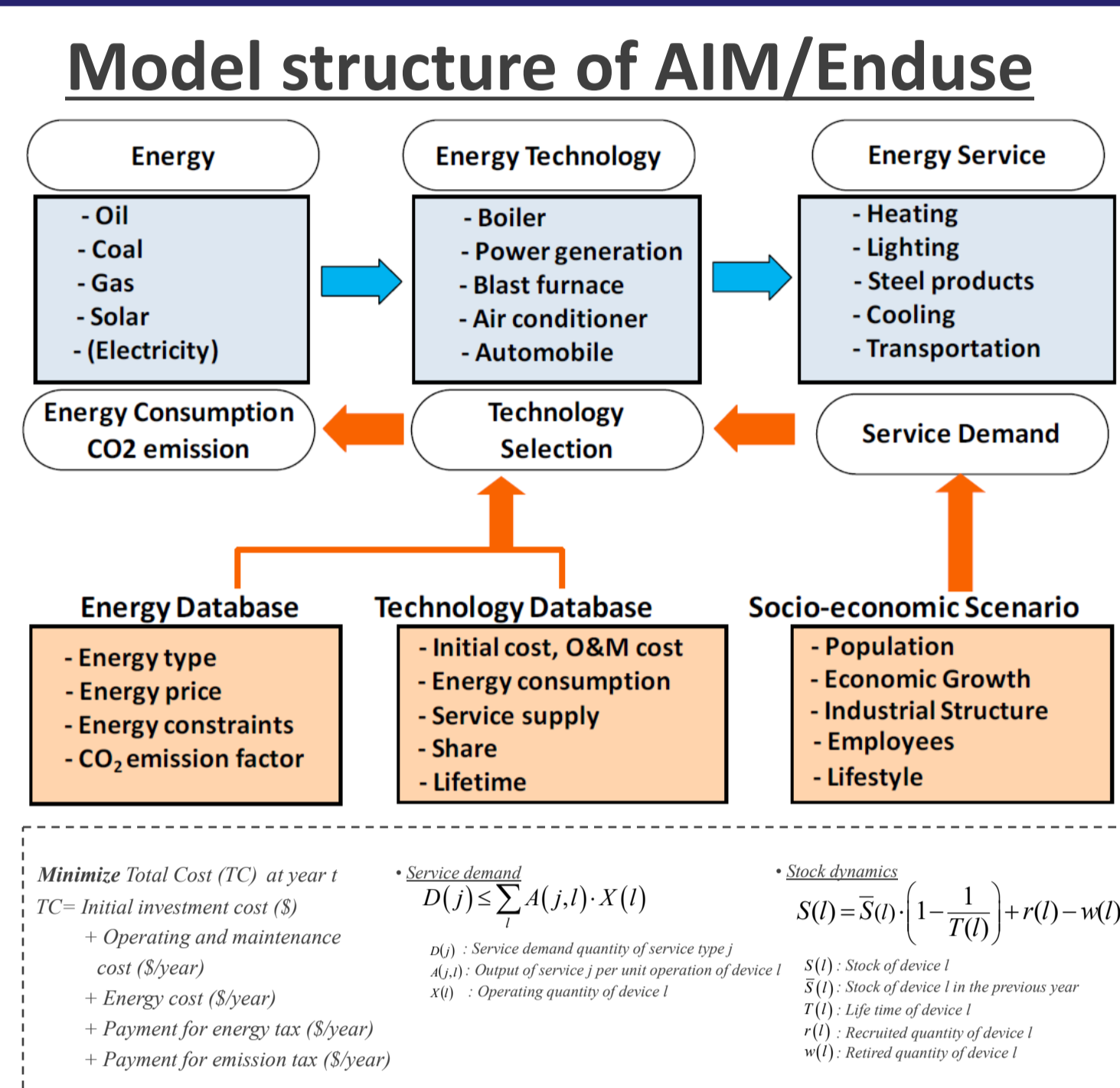
Background

● **The need for an acceleration of NDC and long-term GHG reduction targets at the country level**
- NDC (Nationally Determined Contribution) targets already proposed at the individual country level are not sufficient to achieve the 2 degree and 1.5degree targets outlined in the Paris Agreement, and it will be necessary to accelerate GHG emissions reduction.

● **The need for emission reductions in line with the development of Asian countries**
- In Asia, where GHG emissions are expected to increase significantly, there is a need for both economic development and strengthened efforts to reduce emissions, particularly in countries with high GHG emissions such as China and India. Other problems with economic growth, such as air pollution, have to be solved simultaneously.

● **The need for support from developed countries to developing countries**
- For the NDCs of countries such as Thailand and Indonesia, in addition to the reduction targets set by those countries, there are separate reduction targets for when international technical support is available from developed nations such as Japan.

Purpose

● **Analysis on further reduction of GHG emissions for setting more ambitious NDC targets for 2030**

● **Analysis on air pollutant reductions as co-benefits of decarbonization in the 2 degree scenario for 2050**

● **Analysis on GHG reduction potential with a contribution from Japanese decarbonizing technologies**

- Preliminary estimations were carried out for China and India. We estimated emission pathways using a technology selection framework by AIM/Enduse.

Methodology

Model structure of AIM/Enduse

$$\text{Minimize } Total\ Cost\ (TC)\ at\ year\ t$$
TC = Initial investment cost ($)
+ Operating and maintenance cost ($/year)
+ Energy cost ($/year)
+ Payment for energy tax ($/year)
+ Payment for emission tax ($/year)

- Service demand $D(i) \le \sum_l A(j,l) \cdot X(l)$
- Stock dynamics $S(l) = \tilde{S}(l)\left\{1 - \frac{1}{T(l)}\right\} + r(l) - w(l)$

Example of technology dataset

● Low Carbon Technologies

Energy Sector	Efficient power generation; coal and gas with CCS; hydropower; wind power; solar PV; geothermal; bioenergy; ocean; PHS; reinforcing electricity interconnection; Hydrogen generation (electrolysis)
Transport Sector	Efficient train, maritime, and aviation; NGV; BEV, PHEV, FCEV; biofuels; eco-driving
Building Sector	Energy-efficient buildings (e.g. insulation); high-efficiency equipment and appliances; electric heat pump water heaters; electrification for heating, cooling, and cooking; energy-management systems
Industry Sector	Energy-efficient industrial processes; CCS for iron making and cement lime; high-efficient boiler, furnace, and motor; industrial heat pump; agricultural machines; bioenergy use

● End-of-pipe Technologies

Desulfurizer	Limestone injection, Wet FGD, High-efficiency FGD
Denitrator	Combustion improvement, Selective reduction, Non-selective reduction
Dust Collector	Cyclone, Wet scrubber, Fabric filters, Electronic precipitator

● **In order to conduct quantitative analysis of NDC targets and the 2 degree scenarios in China and India, GHG emissions up to 2050 were estimated using a sequential dynamic system technology selection framework, AIM/Enduse.**
- A sequential dynamic system is used to estimate the combination of technologies that minimizes total costs (technical introduction, operation and maintenance costs) to meet service demands imposed externally.
- For the socio-economic scenario, energy services were calculated based on an "SSP2" which concerns factors such as moderate population growth and GDP, and is taken from the Shared Socio-Economic Pathways.
- GHG emissions scenarios were analyzed in a countermeasure scenario that achieves a reduction equivalent to the 2 degree target (corresponding RCP 2.6) in 2050, in addition to the current BaU scenarios.
- We work in collaboration with researchers in the relevant countries to refine the estimates while incorporating regional policy and technical information.
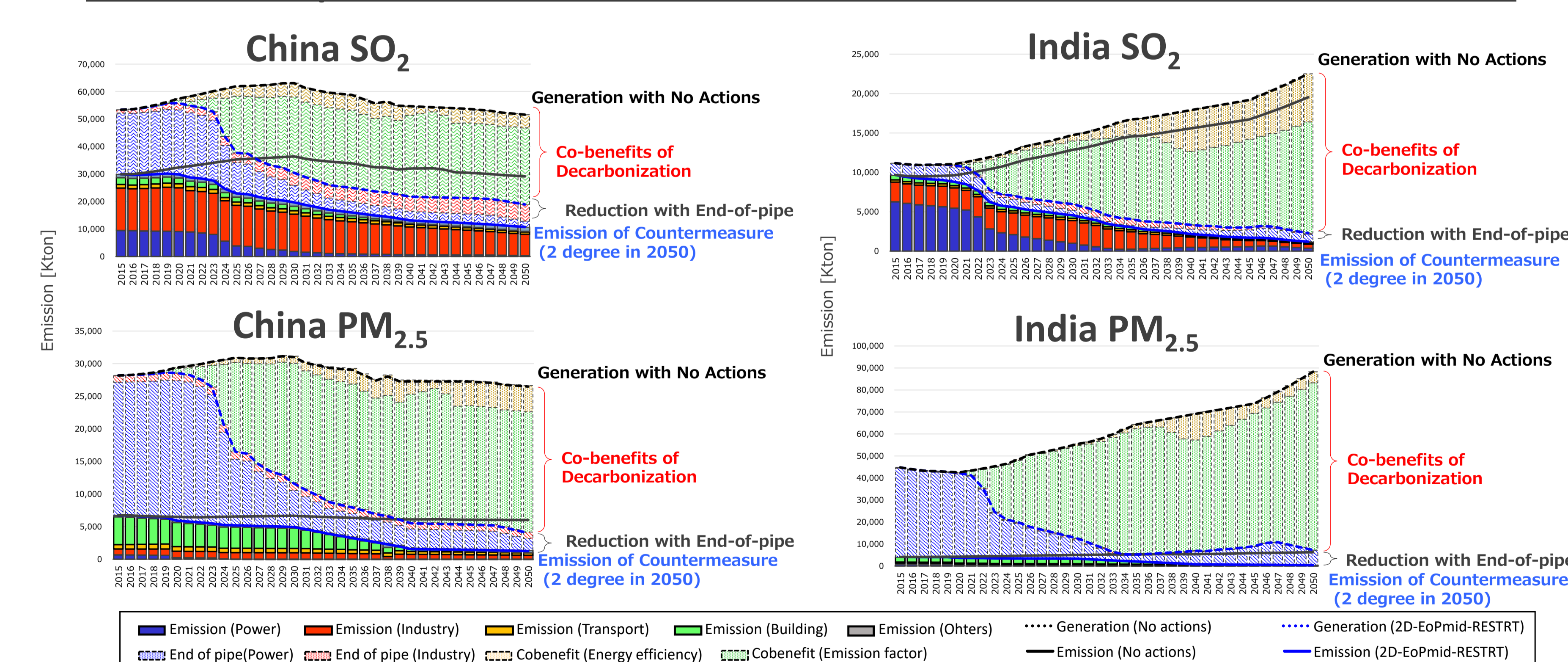
Result

● In 2030, emissions for BaU scenario may be equivalent to or below the NDC reduction targets in China and India. In particular, emissions in 2030 for the 2 degree scenario will be about two thirds (China) or a half (India) of NDC reduction target.
● This result suggests that by implementing countermeasures to achieve the 2 degree target in 2050 earlier, there is a room for further deepening the current NDC targets of China and India.

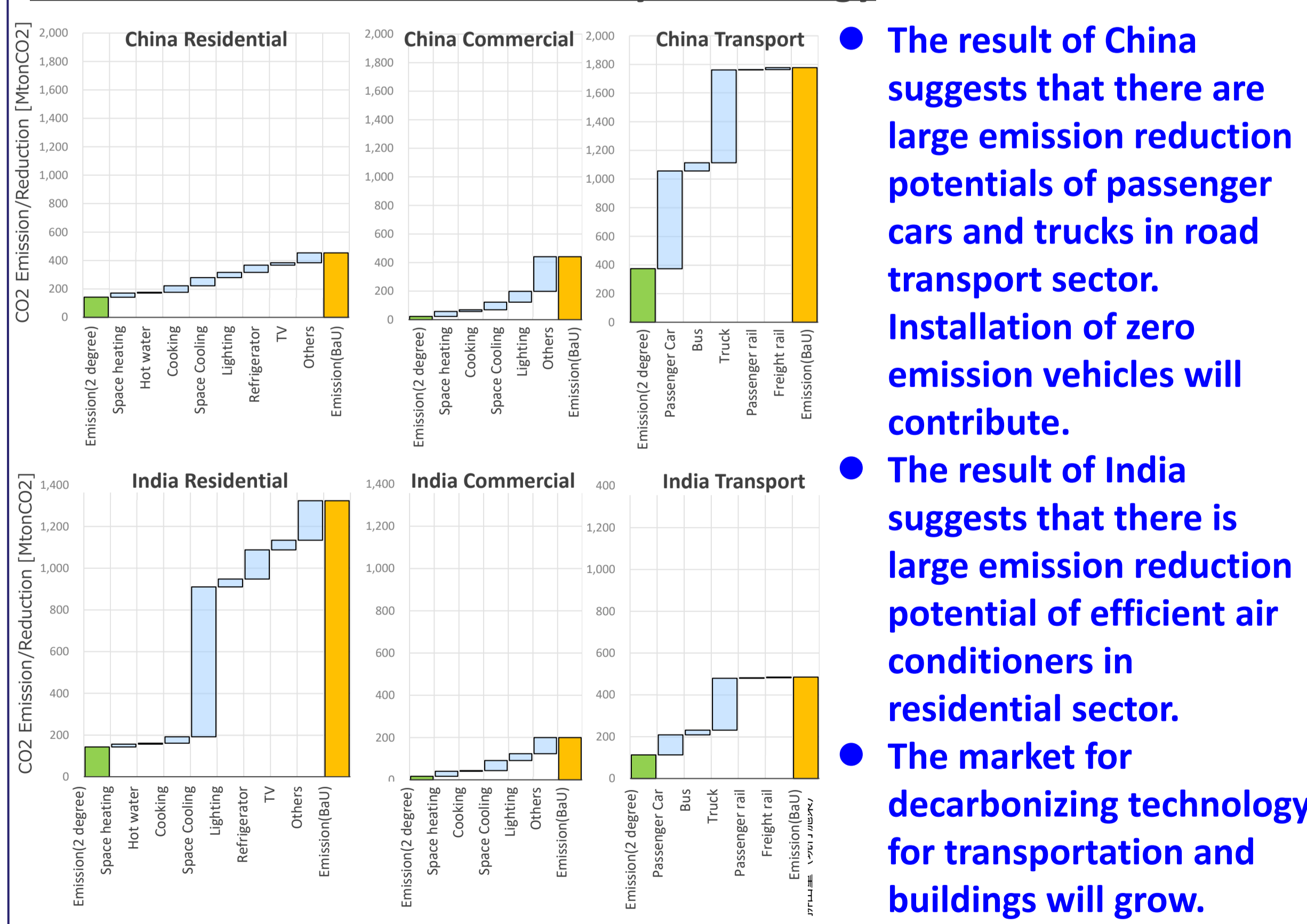### Estimated CO_2 emission and reduction of BaU scenario and the 2 degree scenario
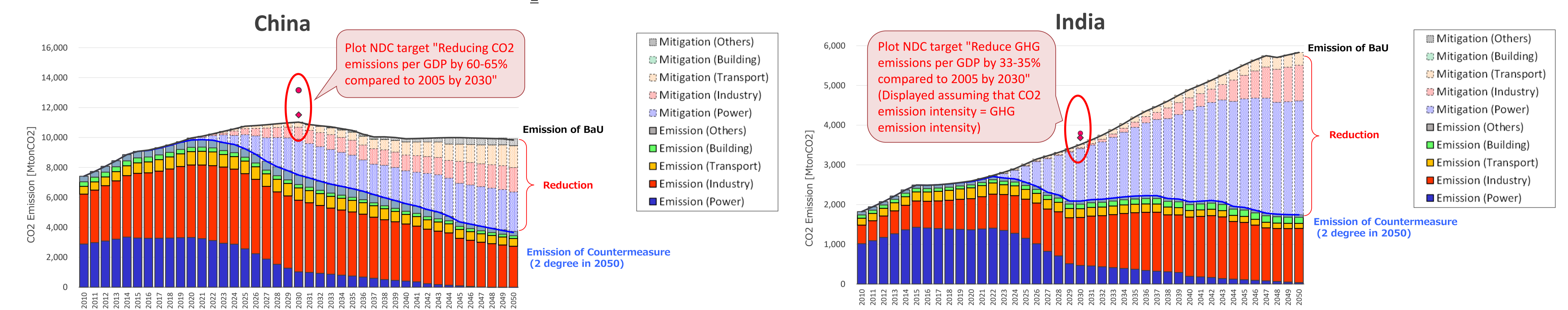
● By taking actions to achieve the 2 degree target, we will gain large co-benefits of reduction of air pollutants.

Estimated air pollutant emissions and reductions as co-benefits with decarbonization

Emission Reduction Potentials by Technology

● The result of China suggests that there are large emission reduction potentials of passenger cars and trucks in road transport sector. Installation of zero emission vehicles will contribute.
● The result of India suggests that there is large emission reduction potential of efficient air conditioners in residential sector.
● The market for decarbonizing technology for transportation and buildings will grow.

Next Step

- We will continue to conduct analysis while expanding the scope of research, such as the target countries and the intensity of the emission scenarios (1.5 degree target, as well as 2).
- We will continue to prepare data on the efficiency and price information of Japanese technology going forward, to refine the model output from AIM/Enduse.
- We will work continuously in collaboration with researchers in the relevant countries to refine estimates while incorporating regional policy and technical information.

Conclusion

● In the current NDC targets, GHG emissions exceed emissions per capita needed to achieve the 2 degree target. It is suggested that by implementing countermeasures to achieve the 2 degree target in 2050 earlier, there is a room for further deepening of the current NDC targets of China and India.
● By taking actions to achieve the 2 degree target, we will gain a large co-benefits of reduction of air pollutants.
● In the Asian region, the ratio of emissions from energy combustion and waste is high. In developing Asian countries where future economic development is expected, there is a high possibility that a contribution to emissions reduction is made using decarbonizing technology from developed countries including Japan. Especially in building and transport sectors, the decarbonization market is expected to grow in line with further significant GHG reduction.