Emission Projections of GHGs and Air Pollutants in ASEAN: Toward the Global 2 °C Target

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Greenhouse Gases, Short-Lived Climate Pollutants (SLCPs) Air Pollutants

What are the situation in ASEAN among ASIA and the world?
Global Anthropogenic Historical Emissions

SLCPs and air pollutants emissions from South-east and South Asia has been on the increase

Source) made by author from EDGER 4.3.2
Emission features between ASIA & OECD are different. (i.e. major emissions sources are different)

Characteristics of ASEAN are in between ASIA and OECD.

Source) made by author from EDGER 4.3.2
To reduce tropospheric O₃, **combinations of mitigation measures are necessary but complicated**

Reduction measures on transport sector is primary important, next building sector, and next ???
Socio-economic: historical trend and future projections in Asia

Characteristics of socio-economic dynamics are different depending on countries & scenarios. South-east and South Asia has been rapidly increasing, following the past China.
Greenhouse Gases, Short-Lived Climate Pollutants (SLCPs) Air Pollutants

How much we need to reduce? What are Science-Policy agenda?
Without more mitigation, global mean surface temperature might increase by 3.7 – 4.8°C by 2100.

To stay below 2°C, the range of GHG emissions are roughly between 30-50 Gt CO₂ eq in 2030.

To stay below 2°C, 41–72% reductions by 2050 compared to the 2010 level are required.

Different colors show different categories which achieve the same CO2-eq concentration at the point in 2100.
Even if the NDCs collectively lower GHGs emissions compared to where current policies stand, but still imply a median warming of **2.6–3.1 °C by 2100**

Emission gaps between the INDCs and 2°C median pathway are **14 Gt CO2eq by the unconditional INDCs, 11 Gt CO2eq by the conditional INDCs, in 2030**

Submitted (Intended) Nationally Determined Contributions by UNFCCC nations are not enough for achieving the 2°C target

In 2030

Around 11-14 GtCO2eq emission GAP

(note) CO2 emission in Asia in 2010 = around 10GtCO2

CO2 emission in OECD in 2010 = around 12GtCO2

For achieving 2 degree target, it is important to accelerate Low Carbon measures and SLCP measures
Research Questions

Q1: How can we fill the Gap between NDCs and 2 degree target in Asia and ASEAN?

Q2: What kinds of advantage and disadvantage, from the view points of air pollutants and SLCPs reduction, when considering deep decarbonization?
AIM/Enduse[Global] – Major characteristics

- Bottom-up type model with detailed technology selection framework with optimizing the total system cost, assessing technological transition
- Recursive dynamic model (=Calculating year by year)
- Analyzing effects of policies such as carbon/energy tax, subsidy, regulation and so on.

World
32 regions

12 Asian regions

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Note1) ✔ shows the coverage of target gases in the model
Note2) Within the same gas-type,
- ✔ shows most major emitting sector
- ✔ shows 2nd major emitting sectors
- ✔ shows relatively emitting sectors
- ✔ shows minor sectors
Overview of Bottom-up type methodology: AIM/Endues model

This analysis consists of three parts:
1) setting future socio-economic growths,
2) estimating future service demands of each demand sector by using service demand models,
3) analyzing combinations of mitigation options by using a technology bottom-up model.
Overview of mitigation measures

Around 200 - 300 mitigation measures are set in the AIM/Enduse model. Mitigation measures are selected depending on policy push and regulation, carbon pricing, subsidy.

Four major groups of 200 – 300 mitigation measures on GHG and air pollutants

① **End-of-pipe mitigation measures**
- desulfurization equipment [=SO₂ reduction],
- denitrification equipment [=NOx reduction],
- dust-collecting equipment [=BC, PM reduction],
- fertilization management in agriculture [=N₂O reduction],
- manure management [=CH₄, N₂O reduction],
- waste management [=CH₄ reduction]

② **Improvement of quality of fuels**
- shifting from high sulfur-content fuel to low-sulfur content fuel [=SO₂ reduction]

③ **Improvement of energy efficiency**
- high-energy efficient technologies and reduction of energy [=CO₂ • APs • BC reduction],
- Low-carbon power supply and electrification in demand side [=CO₂ • APs • BC reduction]

④ **Drastic energy shifting**
- shifting from coal to renewables or natural gas [=CO₂ • APs • BC reduction],
- diffusion of hydrogen-fuel from renewables [=CO₂ • APs • BC reduction]
Baseline Anthropogenic Emissions Scenario in ASEAN

1) Uncertainty of PM emissions is large, 2) emissions related to non-energy are necessary to be calibrated
Deep decarbonization measures have multiple effect for reducing large amount of air pollutants & SLCPs.
**2 °C Mitigation Scenario in ASEAN**

- **Major mitigation sectors are different by gas, i.e. combination of multi-sector measures are important.**
- **Caveats are that 1) emissions from natural sources are out of scope, 2) technology database in this model does not consider some innovative technologies and non-energy related technologies due to the lack of information about cost, efficiency, etc.**
Acknowledgment

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