Socio-economic drivers in SSP2 and future challenges of 1.5 degree target

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National Institute for Environmental Studies

Workshop on Energy Models and Applications
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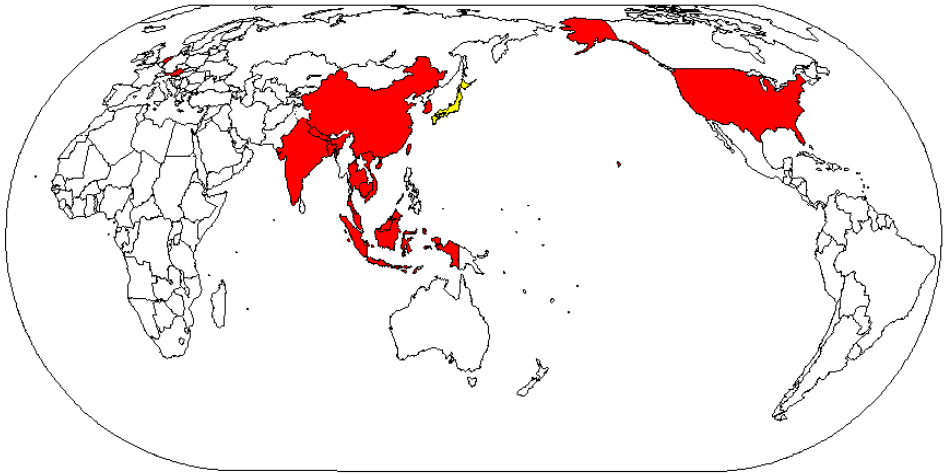
AIM ASIA-PACIFIC INTEGRATED MODEL

What is AIM (Asia-Pacific Integrated Model)?

AIM Project, development of an integrated assessment model to assess mitigation options to reduce GHG emissions and impact/adaptation to avoid severe climate change damages, started in 1990.

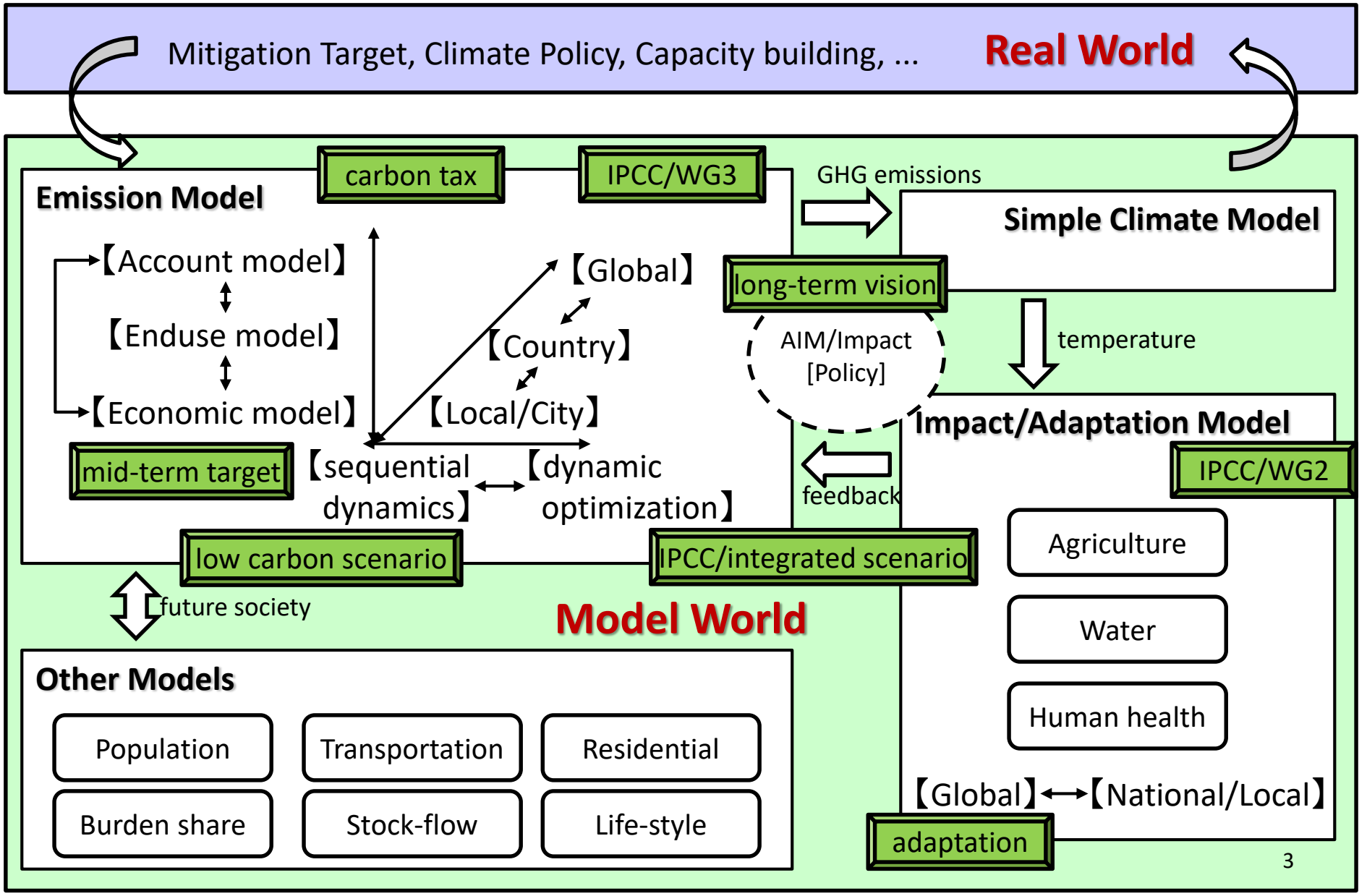
The model is extended to assess sustainable development policies together with Asian researchers.

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



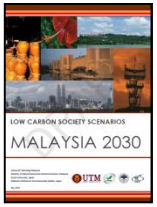
The 21st AIM International Workshop 2015, NIES

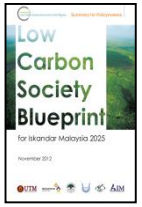
Overview of AIM

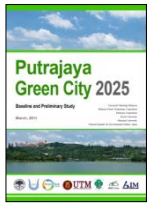


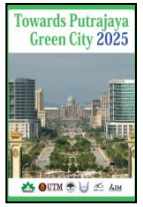
Results on Asian Low Carbon Scenarios

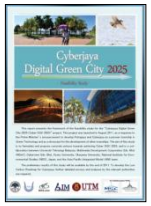
Communication and feedbacks of LCS study to real world

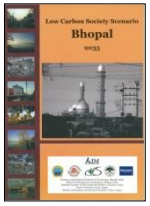


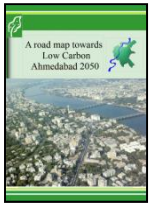


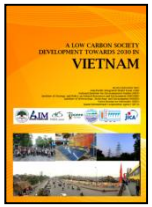


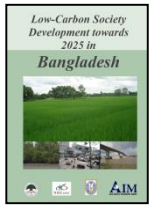


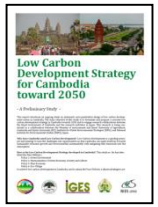












Malaysia

Putrajaya

Cyberjaya

Iskandar Malaysia

India

Bhopal

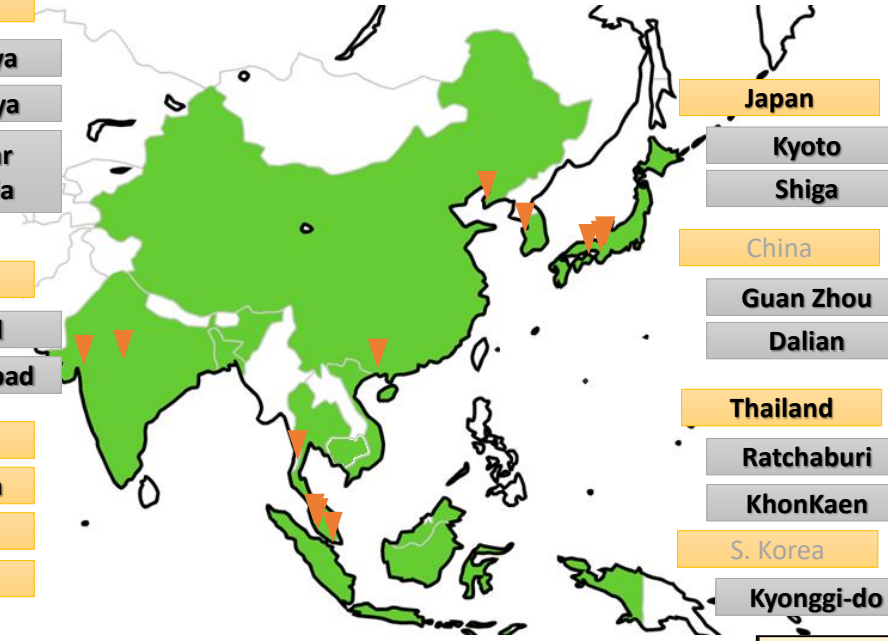
Ahmedabad

Vietnam

Bangladesh

Indonesia

Cambodia



Japan

Kyoto

Shiga

China

Guan Zhou

Dalian

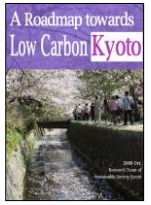
Thailand

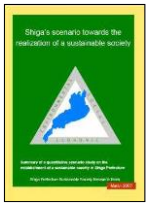
Ratchaburi

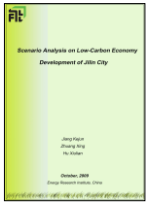
KhonKaen

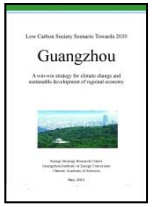
S. Korea

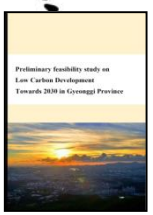
Kyonggi-do

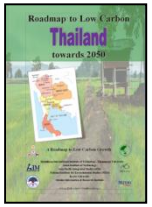












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http://2050.nies.go.jp/

How to realize Low Carbon Asia?

-From Model to Real World-

- How to implement actions assessed by models?
- In Asian countries, some activities have already been implemented toward the LCS at their own initiatives. Sharing information among countries becomes important in order to realize "leap-frog development"

Training workshop on model at NIES（2013.6.10）

Policy dialogue on mitigation target in Indonesia（2013.10.9）

Researchers introducing their countries' activities at ISAP（2013.7.24）

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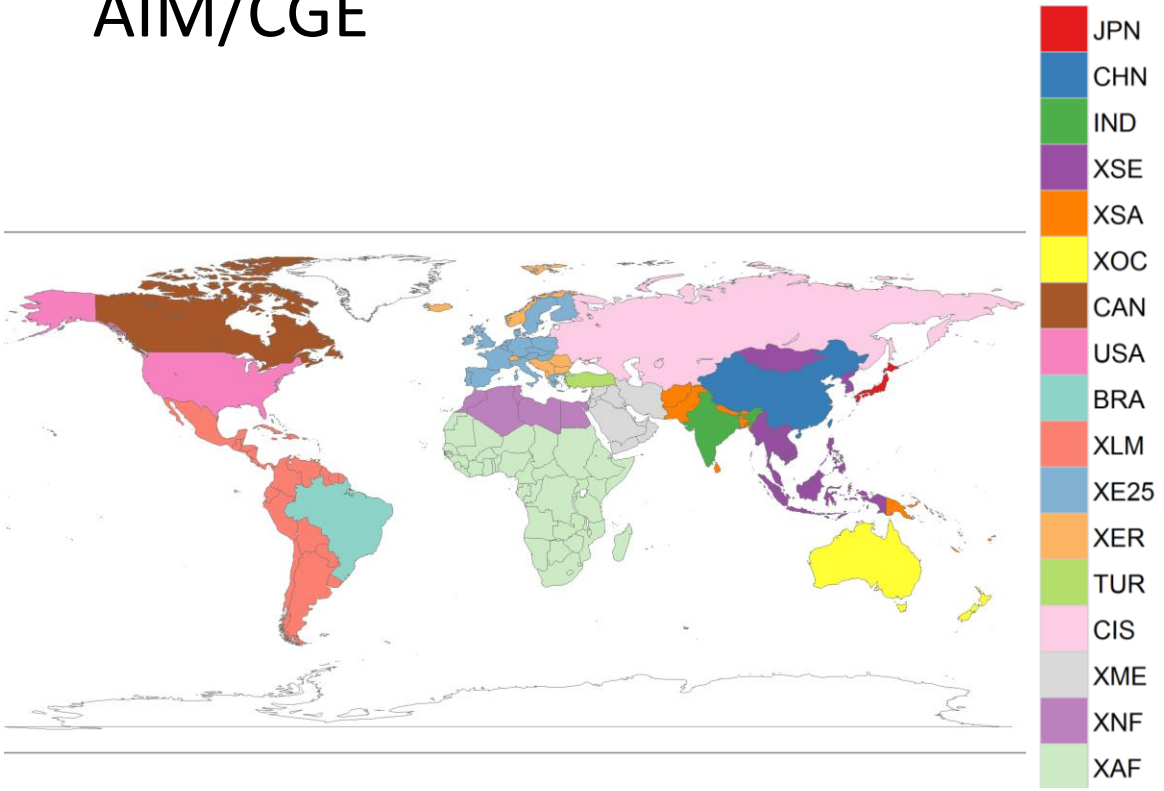
AIM/CGE

- General equilibrium global economic model
- 43 industrial sectors (Energy and agriculture are highly disaggregated) and 17 region.
- Recursive dynamic
- Domestic and international market is assumed



- Emissions; CO2, CH4, N2O, SOx, NOx, CO, BC, OC, VOC, NH3
- Simplified climate model MAGICC is used to make climate information

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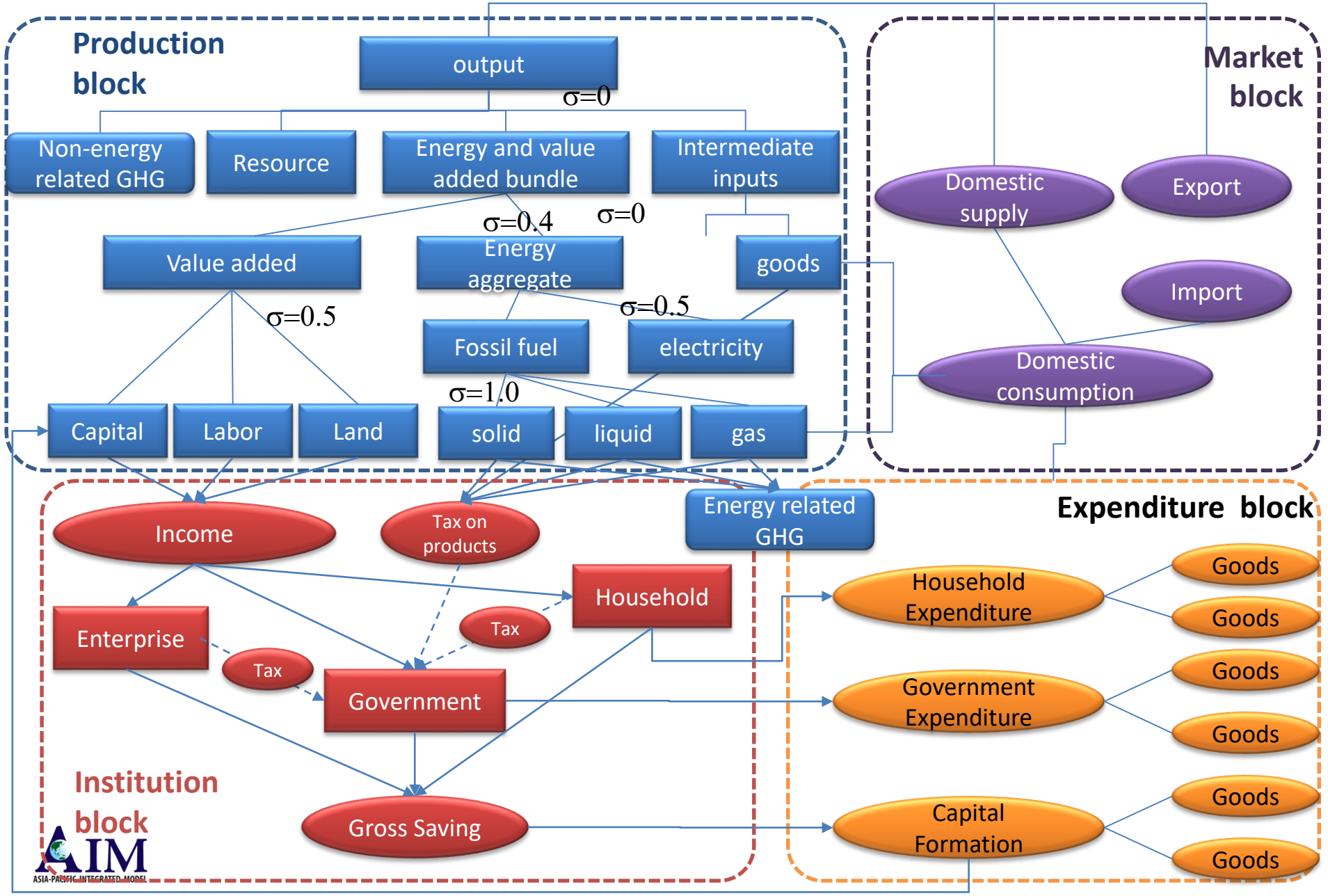
Model structure



AIM/CGE

- GHG emissions
  - CO2
    - Energy-related: fossil fuel consumption and combustion
    - Non-energy related: land use change (the difference of forest land area from that of the previous year multiplied by the carbon stock density) and industrial processes (in proportion to the level of activities, i.e., output)
  - CH4
    - Rice production
    - Livestock
    - Fossil fuel mining
    - Waste management sectors
  - N2O
    - Fertilizer applications
    - Livestock manure management
    - Chemical industry

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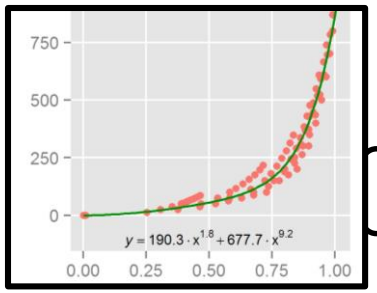
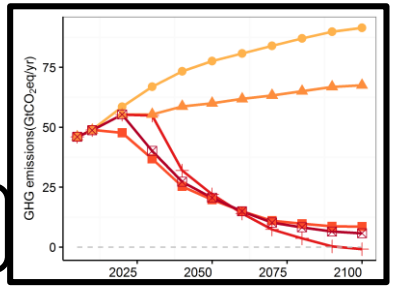


DICE type optimization model AIM/Dynamic



MAC curve

GHG emissions pathway

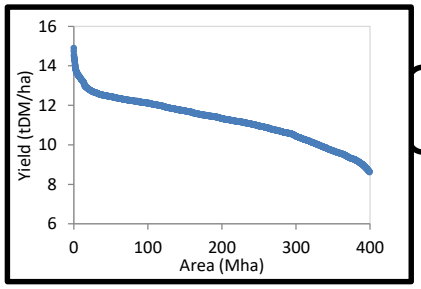
Recursive Dynamic Economic model AIM/CGE

Activity

AIM/AFOLU

MAC and land use

Enduse information



Biomass supply curve

Transport and energy demand

Land use and agriculture price

Energy and carbon price

Transport model AIM/Transport

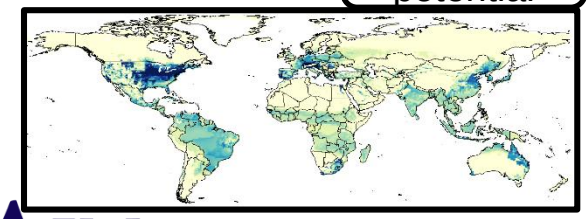
Gridded land use

Land allocation model AIM/PLUM

Energy production and consumption

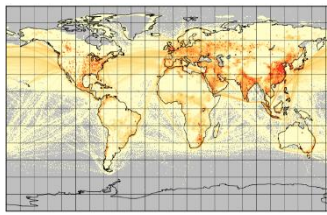
GHG and air pollutant emissions

Biophysical potential



Simplified climate MAGICC

Emissions downscaling AIM/DS



Global mean temperature

Gridded emissions

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Title: Socio-economic drivers in SSP2 and future challenges of 1.5 degree target

- Paris Agreement has confirmed that we'll hold the increase in the global average temperature to well below 2 degree above pre-industrial levels. At the same time, we will be pursuing efforts to limit the increase to 1.5 degree. The 1.5 degree is significantly safer than 2 degree situation against the risks and impacts of climate change. It also represents much larger challenges, efforts and costs.

- To facilitate collaboration among climate change research communities, a new scenario framework was established. SSPs (Shared Socioeconomic Pathways) are combined with RCPs (Representative Concentration Pathways) to frame scenario architecture.
  - SSP2 is seen to be the continuing of the current social, economic and technological trend, leaving the world face moderate challenges to mitigation and adaptation.
  - SSP1 is the green road, in which the challenge of mitigation and adaptation are lower than SSP2.

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Research Questions

- Research Questions
  - 1) Would it be possible to achieve 1.5 degree if we maintain current socio-economic trend (SSP2)?
  - 2) What key drivers in SSP2 are essential for the feasibility of mitigation and keep the temperature increase under 1.5 degree? How much burden in climate policy is relieved if socio-economic drivers go towards SSP1?

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Scenario settings

Table 1 Scenario settings	
Scenarios	Descriptions
SSP2_HighTech	low cost for renewables, CCS, nuclear as in SSP1
SSP2_Lifestyle	low preference for meat, industrial, transportation as in SSP1
SSP2_GDPPOP	GDP and POP are same as SSP1
SSP2_AEEI	higher Autonomous Energy Efficiency Improvement as in SSP1
SSP2_Bio	lower bioenergy tech cost and higher social preference as in SSP1

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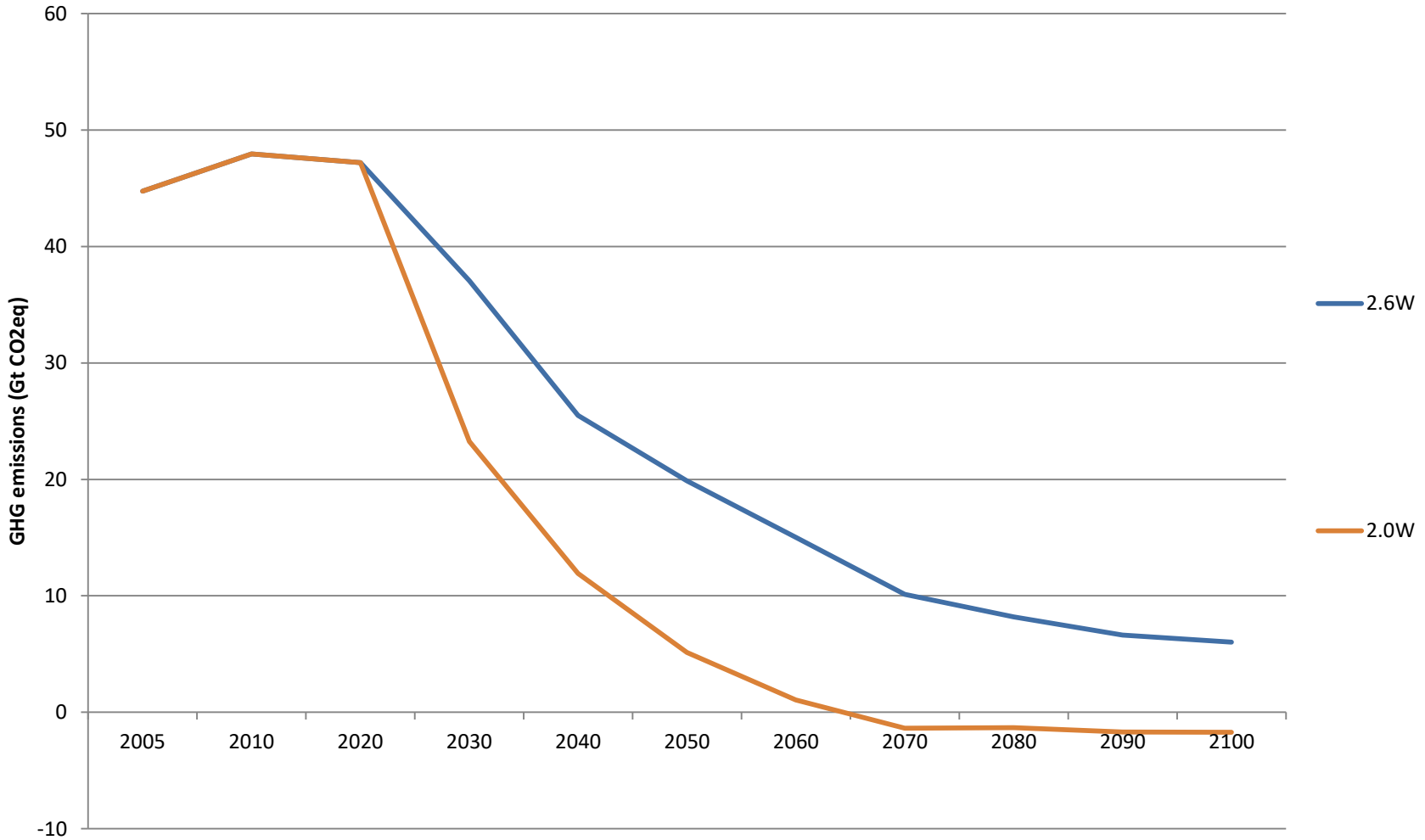
Emissions Pathways



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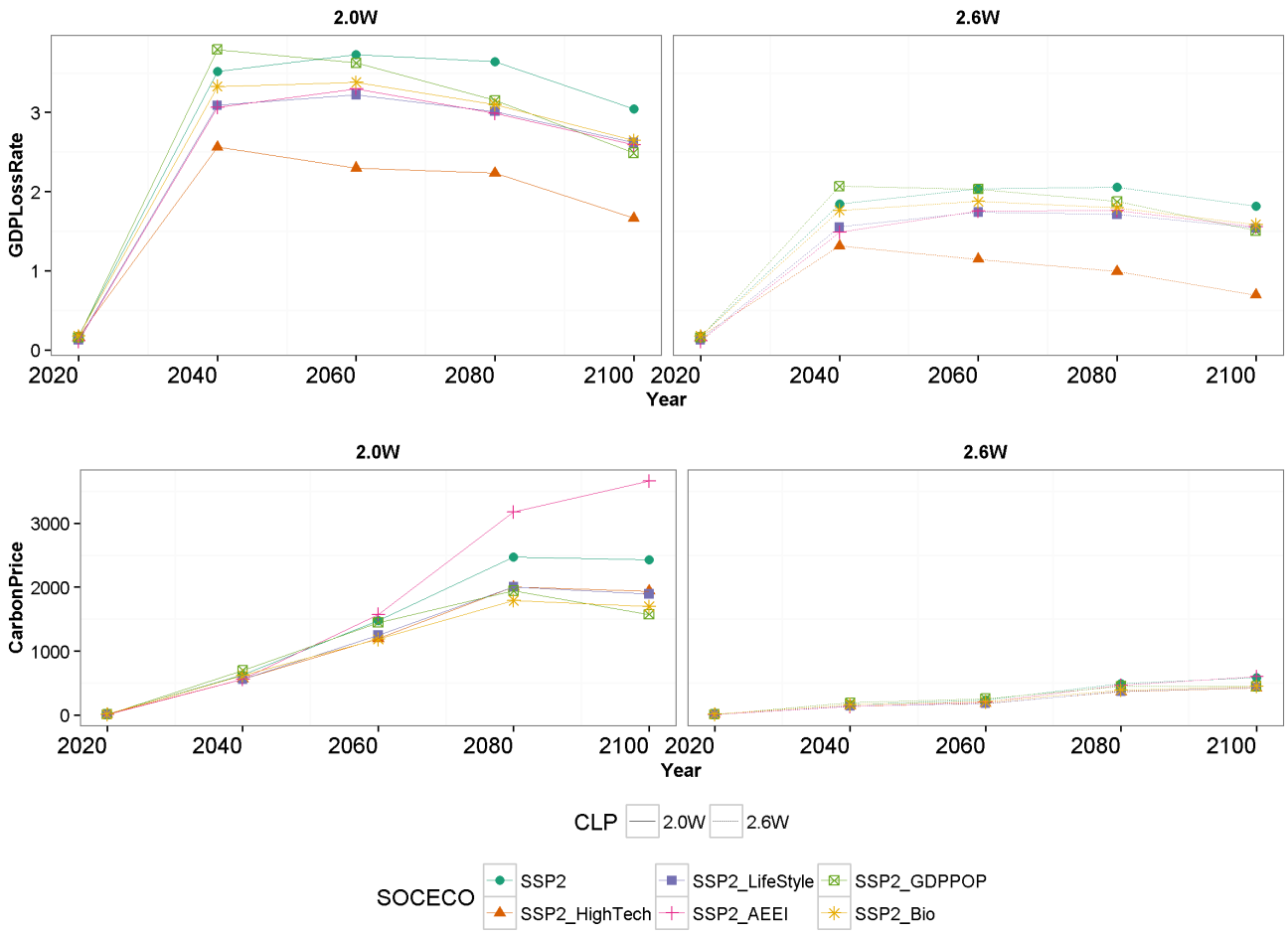
Mitigation cost



- Hightech scenario has lowest GDP loss rate.
- Except for GDPPOP scenario, other SSPs scenarios are have less GDP loss rate than SSP2 scenarios.
- In 2.6W scenario and the former century of 2.0W scenarios, carbon price does not change much in SSPs scenarios. In 2100 year of 2.0W scenario, carbon price shows large differences among SSPs scenarios.

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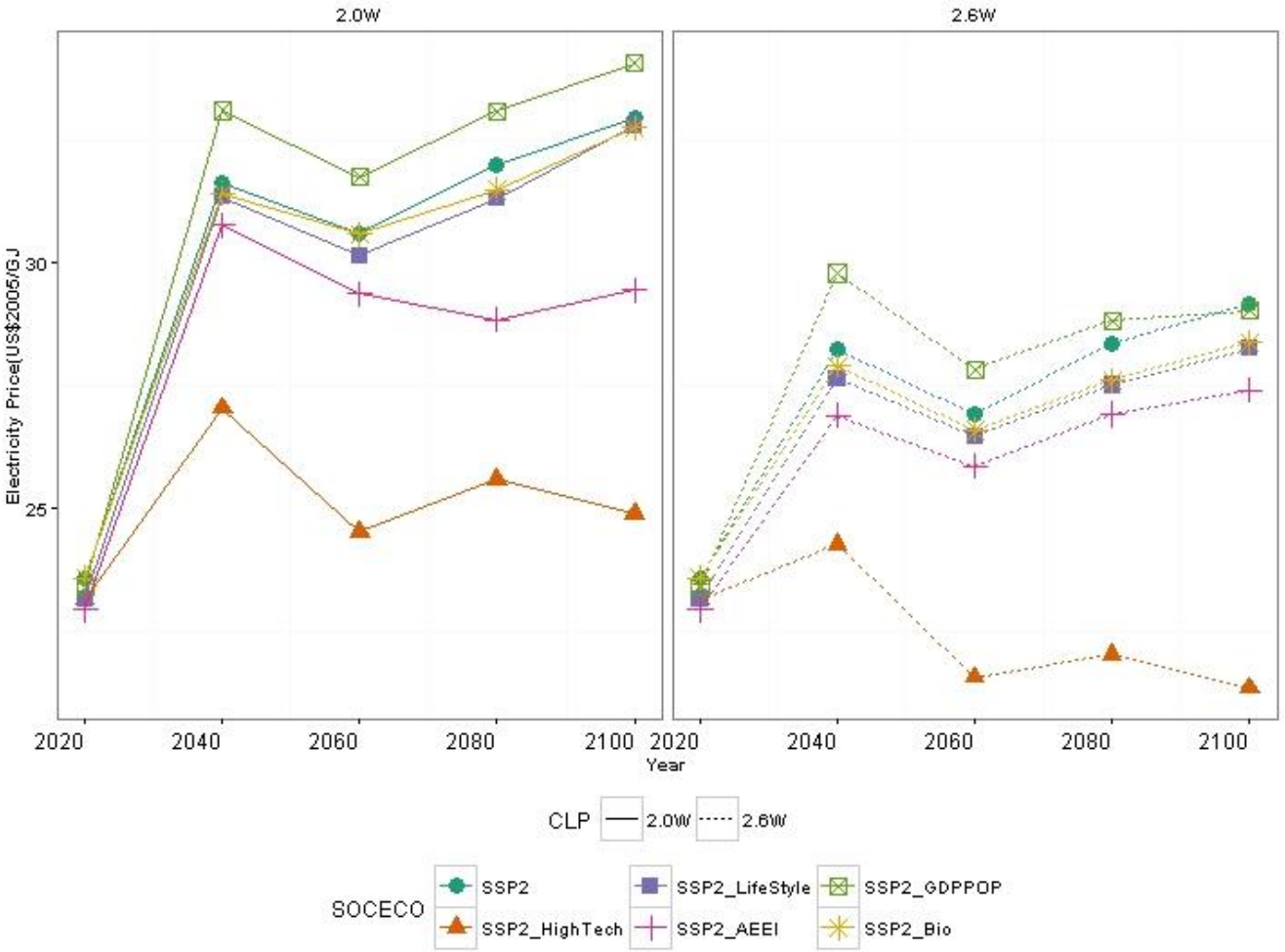
Energy prices



- Hightech scenario has much lower energy price than other SSP scenarios
- Low energy price is the key factor that guarantee the lower mitigation cost for RCP climate policy scenarios

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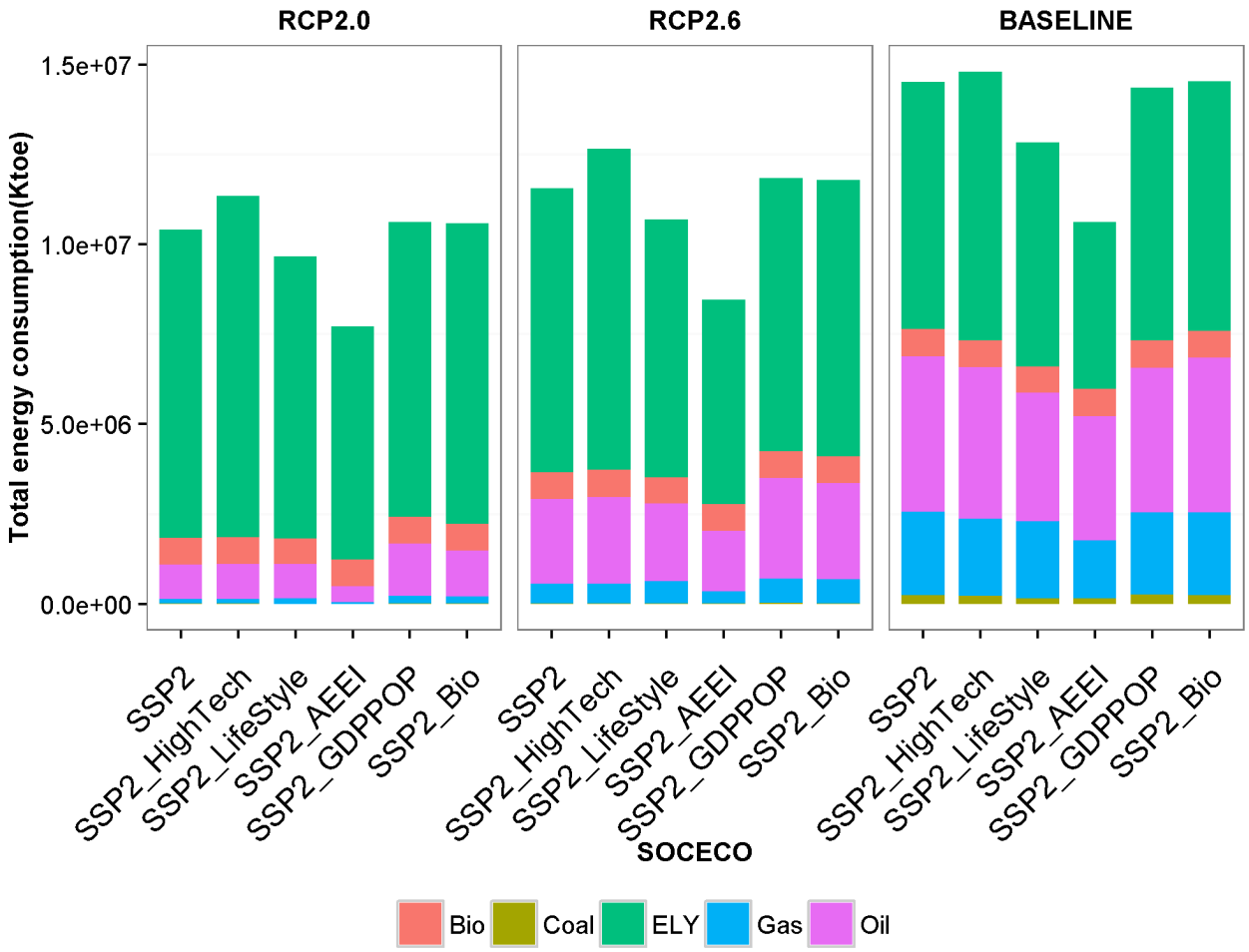
Energy demand



- Lifestyle and AEEI scenarios has least total energy demand.
- The difference among socio-economic scenarios mainly comes from Baseline.

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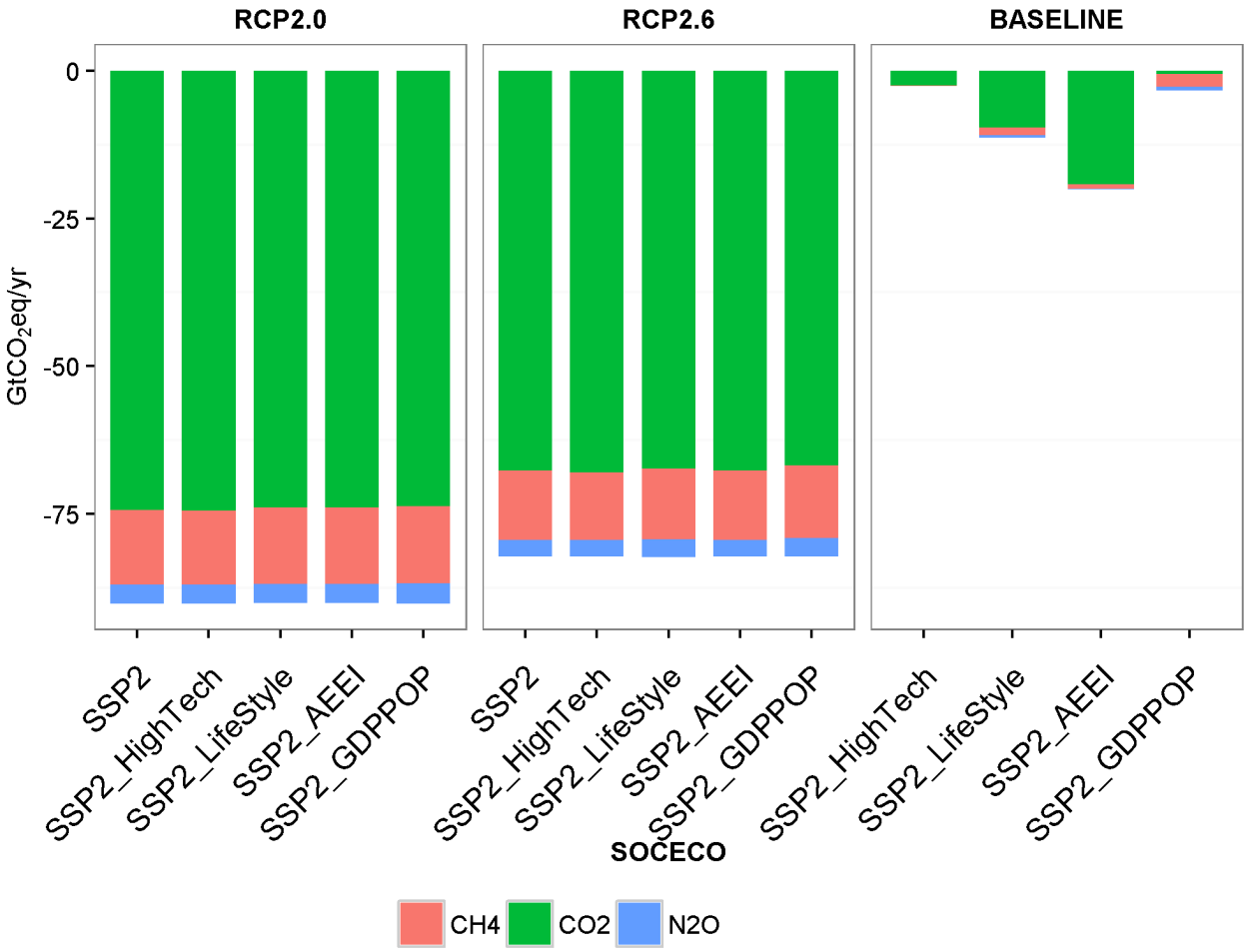
Kyoto gases



- Baseline emissions is the major difference source.
- AEEI and lifestyle has large emission reduction in BaU.
- Lifestyle and GDPPOP reduces non-CO2 in baseline.
- Bio-energy barely changes baseline emissions.

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Discussions

- GDP loss rate is largely affected by energy prices. Energy price is also affected by carbon price, energy demand change, electrification rate and the structure change in power mix. Carbon price on the other hand is related to mitigation target, BaU emissions, mitigation choices and so on.
  - The results show that low energy price, low BaU energy demand and emissions are the key factors of the low mitigation scenarios.
- Carbon prices can be seen as the mitigation cost to economic institutes, as well as mitigation policies. Carbon prices results mean that socio-economic condition would interact with climate polices when meeting with stringent climate target such as 1.5 degree and the impact would be obvious in the latter part of the century.
  - Socio-economic policies regarding bioenergy would have large effects on climate policies.

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Discussions

- To achieve 1.5 degree target, huge mitigation cost would occur if SSP2 socio-economic condition is maintained.
- Both supply side and demand side factors should be taken into account from SSP2 to a greener society.
  - The technology development, good management of energy use, the social acknowledgement of a greener society are important for the achievement of stringent climate targets.

Thank you!

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