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

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Introduction

- Paris Agreement has confirmed that we'll hold the increase in the global average temperature to well below 2 ° C above pre-industrial levels. At the same time, we will be pursuing efforts to limit the increase to 1.5 ° C.. 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 are combined with RCPs to frame scenario architecture. S
  - 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.
- 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?

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

Results

1 Mitigation costs

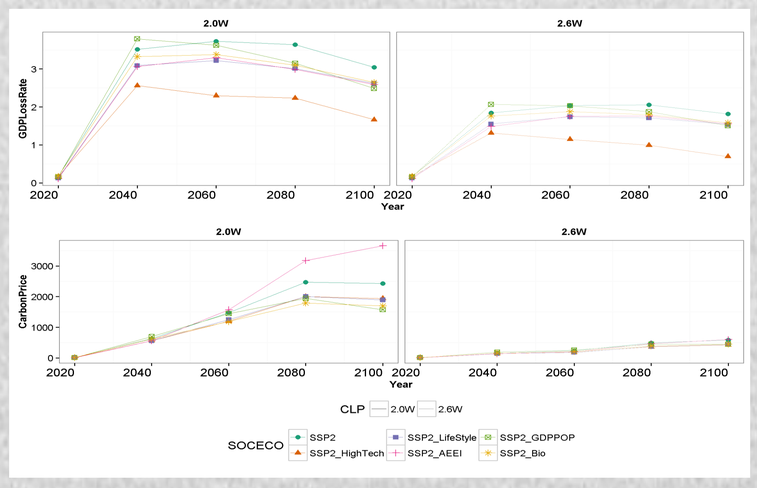

Figure1 Mitigation cost

- 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.

Results

2 Energy price results

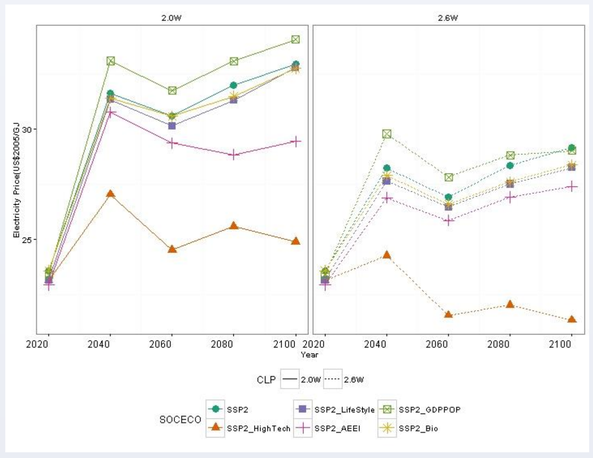

Figure2 Energy price in 2100

- 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

3 Energy demand and GHG emission results

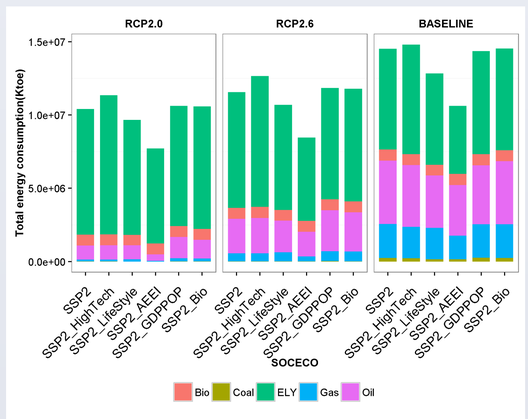

Figure3 Energy demand in 2100

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

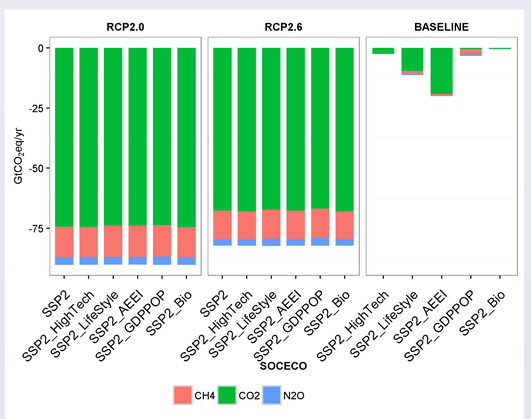

Figure4 GHG emission (SSPs-SSP2_BaU)

- 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.

3 Land cover results

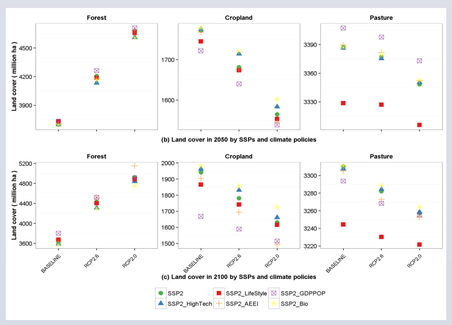

Figure5 land cover

- AEEI also has the lowest cropland need and highest forest land and then highest land use change emission reduction
- Bioenergy scenario has the highest cropland and pasture land cover. Lowest forest.
- Energy efficiency improvement means less biomass primary energy , so least cropland for bioenergy. More forest land is available for CO2 emission absorption.

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 Bio or CCS would have large effects on climate policies.