

How do climate policies impact multiple SDGs in China?

Jing-Yu Liu, Shinichiro Fujimori, Kiyoshi Takahashi, Tomoko Hasegawa, Xuanming Su and Toshihiko Masui
National Institute for Environmental Studies

1 Background

- The 2015 Paris agreement was a key milestone in the United National climate negotiations. Meanwhile, the 17 sustainable development goals (SDGs) of the 2030 Agenda for Sustainable Development were adopted also in 2015. The achievement of SDGs would be strongly impacted by the measures of combating climate change and vice versa.
- We intend to answer the following research questions:
 1. What is the **trade-offs** and **co-benefits** of **climate policies** on **SDGs** in **China**, such as **energy security, food security, water scarcity, air quality, land management**? (We summarized the co-impacts in section 3 and provided detailed analysis on key SDGs indicators in section 4.)
 2. How does different **mitigation measures** influence the effects on SDGs? (Section 5)

2 Methodology

- Model: AIM/CGE, recursive dynamic model, China single country model, 42 sectors.
- Scenario settings, see table below

Scenarios	Description
BaU	historical trend (see Figure 1 for emission pathways) China's emission pathway is consistent with global 2 degree target following the same method as Mittal (2017)
2Deg	Emission constraint follow China INDC before 2030. From 2015 to 2100, emission budget is the same as 2Deg. Emissions are assumed gradual declining.
INDC	From 2015 to 2100, emission budget is the same as 2Deg. Emissions are assumed gradual declining.
Additional mitigation strategy scenarios in section 5	
INDC_LimCoal	Emission constraint same as INDC. Coal power is limited.
INDC_Lowtrns	Emission constraint same as INDC. Low transportation need.
INDC_NoCCS	Emission constraint same as INDC. No CCS.
INDC_HighEE	Emission constraint same as INDC. High energy efficiency.

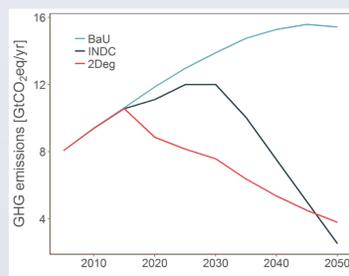


Figure emissions pathways for BaU, INDC and 2Deg scenarios

- We select 9 indicators for 5 sustainable development goals

Indicator selections			
SDGs	indicators	SDGs	indicators
Energy security	Energy supply (TPES) diversity	Air quality	SO2 emissions
Energy security	Oil trade dependency	Air quality	NOx emissions
Energy security	Oil price	Water scarcity	Industry water withdrawal
Food security	People at risk of hunger	Land management	Deforestation risk
Food security	Food price		

3 Results: trade-off and co-benefits of climate policies on SDGs

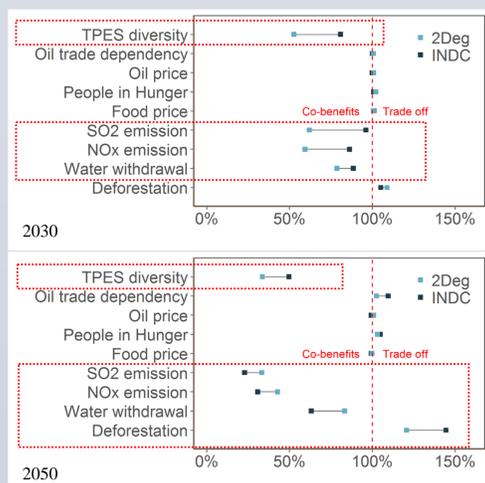
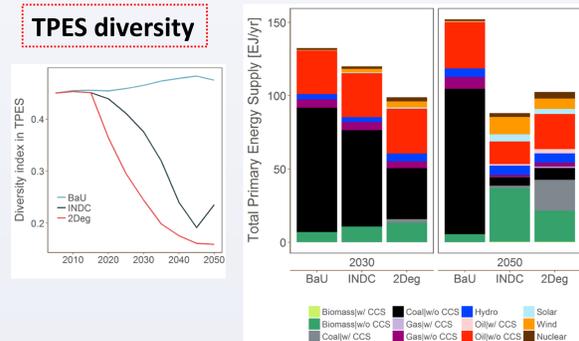


Figure percentage risks of sustainable development achievement in mitigation scenarios in relative to BaU.

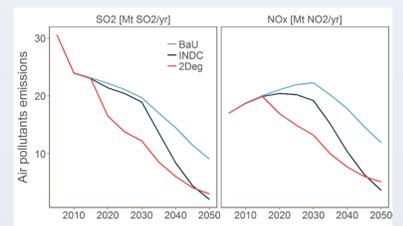
- Energy diversity, air pollution, industrial water withdrawal has largest co-benefits in 2030 and 2050.
- Compared to 2Deg, INDC scenario does not show enough co-benefits in 2030 because of the weak emission target but larger co-benefits in 2050 if follow 2-degree pathway after 2030.
- Among all the indicators of SDGs, the trade-off exists mostly in deforestation risks in the mid-term but not in the near-term.

4 Results: detailed analysis in key SDGs indicators



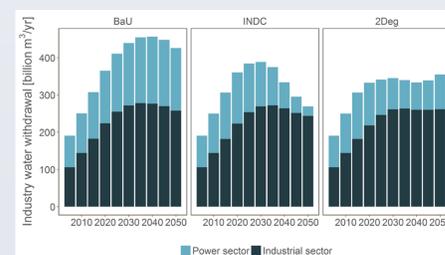
- The diversity index is $\sum(P_i^2)$, P_i is the share in TEPEs: the lower, the better.
- 2Deg shows better diversity.
- INDC scenario shows a turning point around 2045 because of the large dependency on biomass.

Air pollution



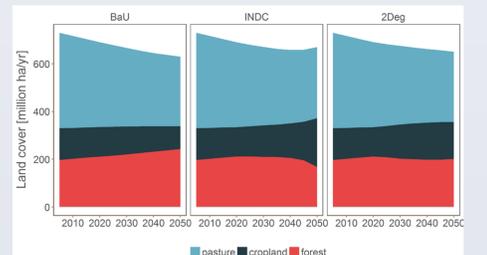
- In the near-term around 2030, INDC scenario shows little progress in SO2 emissions reduction compared with 2Deg.
- NOx emission reduces more than SO2 in INDC scenario in 2030.

Water scarcity



- The change in industry water withdrawal mostly comes from the water demand reduction in power sector in INDC and 2Deg.

Deforestation



- Deforestation risk occurs in the mid-term.
- The risk is larger in INDC in comparison with 2Deg scenario.

5 Results: how do different mitigation strategies make a difference?



Figure percentage risks of sustainable development achievement in additional mitigation strategy scenarios in relative to INDC scenario in 2030 and 2050

- Different mitigation strategies mostly affect water withdrawal, TPES diversity and air pollutant emissions.
- The change in SDGs indicators in different mitigation scenarios shows larger differences in 2050 than 2030.
- Demand side measures such as energy efficiency improvement and low transportation demand are essential to increase some co-benefits between climate policies and SDGs without harm other goals.

6 Conclusions and next steps

- Due to the weak near term pledges and stringent mid-term emission reduction in 2050, compared with 2Deg, INDC shows less co-benefits in air pollution reduction, water withdrawal but larger risks in deforestation and a bounce of energy diversity risk around 2050.
- The findings in this study indicates the necessity of the inclusion of SDGs agenda in climate policies making and a careful selection of mitigation measures.
- Future steps include municipal and agriculture water consumption and withdrawal modelling and more selections of mitigation measures in section 5.