Electrification in 1.5°C Scenarios
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Background
- Electrification, which is a process that involves increasing the share of electricity in the total final energy consumption (electrification rate), plays a pivotal role in realizing lowering carbon dioxide emissions. The IPCC 1.5°C special report (SR15) shows an increasing electrification rate in 1.5°C scenarios throughout this century (SR15 Chapter2).
- However, the extent to which mitigation measures must increase the electrification rate is still not made clear because SR15 does not clearly show differences in electrification rates between 1.5°C and baseline scenarios.
- Besides, we cannot understand how much the additional electrification measures are required to limit the rising temperature to below 1.5 °C compared to that below 2 °C because the SR15 show any difference in the electrification rate between the 1.5 °C and 2 °C scenarios which have the same baseline scenarios.

Aim
This study aims to clarify the additional electrification measures required to reduce carbon dioxide emissions by analyzing differences in the electrification rates among the 1.5 °C, 2 °C and baseline scenarios using the SR15 scenario database. This study uses a total of 67 1.5 °C scenarios ("Below 1.5 °C", "1.5 °C low overshoot", and "1.5 °C high overshoot") and 120 2 °C scenarios ("Lower 2 °C" and "Higher 2 °C").

Result
- The median of the electrification rate in the 1.5 °C scenario is 44% in 2050 and 62% in 2100.
- The median of the electrification rate in the 2 °C scenario is 36% by 2050 and 58% by 2100.
- Although the range of the predicted electrification rate was wide, electricity is expected to be a major energy carrier in the end-use sector at 1.5 °C and 2 °C scenarios.
- However, because the electrification rate ranges in 1.5 °C and 2 °C scenarios overlap with that of the baseline scenario, it is obvious that additional electrification measures are required for all decarbonization scenarios.
- Only a few 1.5 °C and 2 °C scenarios exhibited a negative difference compared to the baseline scenario.
- Thus, this figure shows that the additional electrification measures are required to decarbonize because the electrification rates are larger than that of the baseline scenario for almost all 1.5 °C scenarios.

Figure 1. Electrification rates in 1.5 °C, 2 °C, and baseline scenarios
Figure 2. Differences in the electrification rate compared to that of the baseline scenarios
Figure 3. Differences in the electrification rate compared to baseline scenarios for IAMs
Figure 4. Differences in the electrification rate compared to baseline scenarios for IAMs

- Figure 3 shows the differences in the electrification rates of the 1.5 °C and 2 °C scenarios compared to that of baseline scenarios by IAM. This figure shows that the differences in the electrification rate for different IAMs.
- In contrast, the medians of differences in the electrification rate of the 1.5 °C scenarios are larger than those of the 2 °C scenarios by IAM without REMIND-MagPIE 1.7-3.0 (Figure4.).
- Thus, compared to 2 °C scenarios, 1.5 °C scenarios showed a common trend of increasing the electrification rate in almost all IAMs, although the change values of the electrification rate from baseline scenarios varied by IAM.