

A harmonized scenario framework can help to align national climate policies with global goals. Pathways for Asia

For exploring national and global actions to reduce greenhouse gas emissions, a new set of standardized national scenarios were developed by the ENGAGE project. The systematic exploration of the national GHG emissions reduction efforts permits direct comparison between the climate targets of different countries. This reveals gaps in the global effort, measure the fairness of national targets, and identifies related challenges. The study finds that:

- **National short-term targets do not match long-term targets or meet global goals.**
- **Economic burdens vary widely.** A 30% emissions cut in one nation may have more economic impact than a 100% cut in another. This can inform fair national targets and reveal where nations need assistance, or could pay others to make cuts on their behalf.
- **Government support is needed** to help more national modeling teams join coordinated efforts.

Reaching global goals requires national action

- Meeting the global climate goals of the Paris Agreement requires action at a national level. Tailor-made national scenarios are valuable for informing climate policies, but they are difficult to compare. They all have different assumptions, and are rarely published in open academic papers.
- A new set of standardized national scenarios were developed. According to this framework, each country ran one business-as-usual scenario plus a set of climate mitigation scenarios spanning a wide range of cuts in 2050 – 10% to 100% (reductions relative to emissions in 2010).
- Using such standardized scenarios enables a fair comparison of each nation's energy and land-use systems under a given level of mitigation, which brings several benefits.

Falling short

- The ENGAGE project compares a standardized sets of scenarios from different countries. Here we focus on six countries in Asia.
- For each country a **deep mitigation scenario** consistent with the country's published long-term mitigation strategy is used. If that strategy does not exist a target based on income was developed (100% emissions cuts by 2050 for high-income countries, 80% for middle income, and 50% for low-income).
- The pathways were selected by the country teams so that long-term global emissions would be low enough to meet the Paris goal of keeping warming to well below 2°C.
- For each country, the national teams also developed a scenario that follows its short-term climate commitments up to 2030: the unconditional nationally determined contributions (NDCs). In most countries, these NDCs are clearly inconsistent with the deep mitigation pathways, in some cases with a very large emissions gap. If every country follows its existing unconditional NDCs, that would lead to global emissions far above the trajectory required for 2°C (Figure 1).

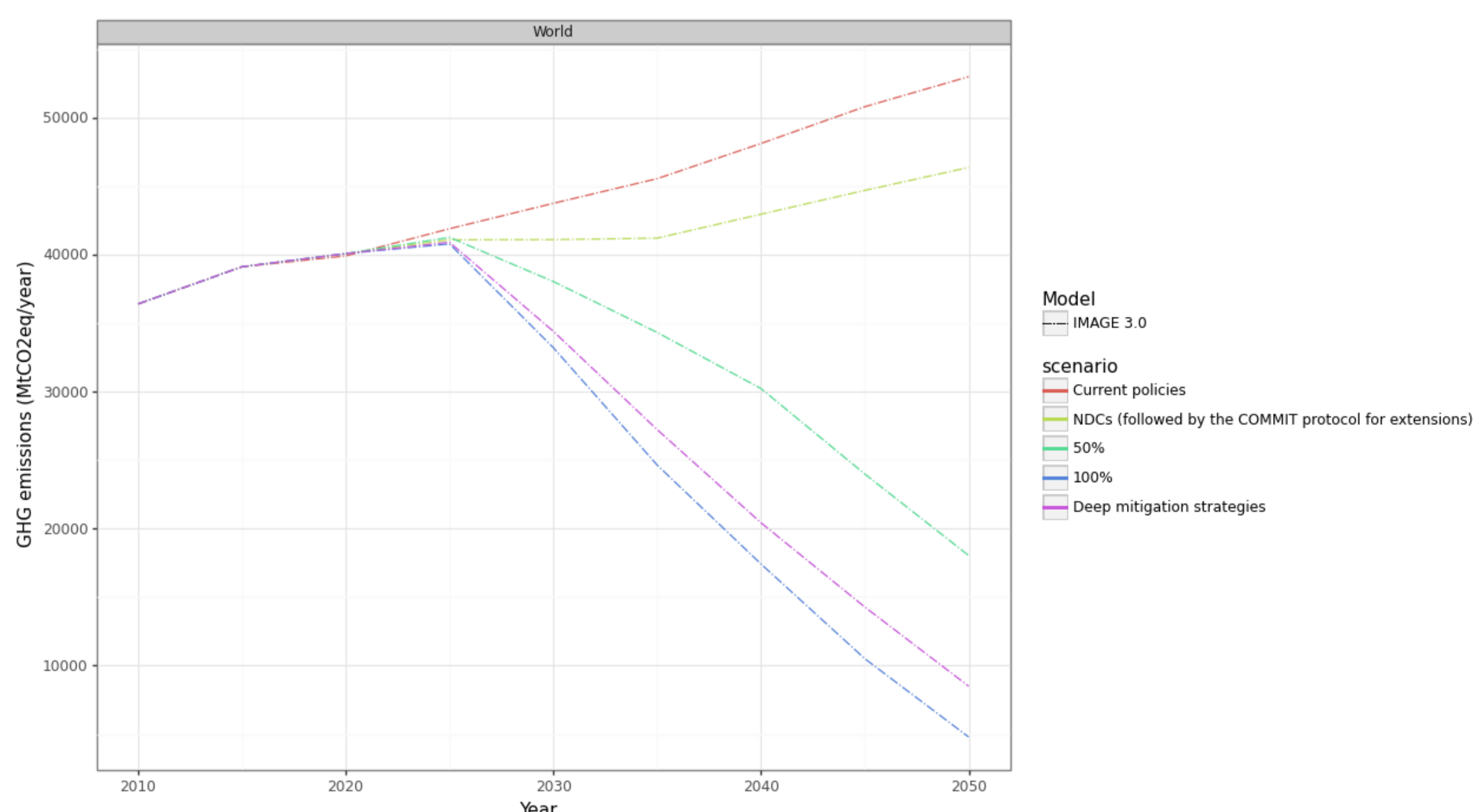


Figure 1. Modeled emissions following some of the scenarios specified in the new standardized framework.

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 FEASIBILITY OF CLIMATE PATHWAYS
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Economic imbalances across Asian countries

- A given level of mitigation has very different economic impacts in different countries.
- The effect of mitigation on GDP for six countries are explored: **China, India, Japan, Korea, Thailand, and Vietnam**. The differences are stark. For example, India is projected to face a higher GDP loss to reach a target of only 30% than Korea faces to reach 100% (Figure 2). This could be used to evaluate **economic fairness**, exploring which level of reduction in a developing nation would be economically equivalent to carbon neutrality in today's wealthier countries.
- The systematic assessment also reveals where special solutions are needed. E.g., some countries see high GDP impact for even modest levels of mitigation. We are also able to see more broader range of aspects as Figure 2.

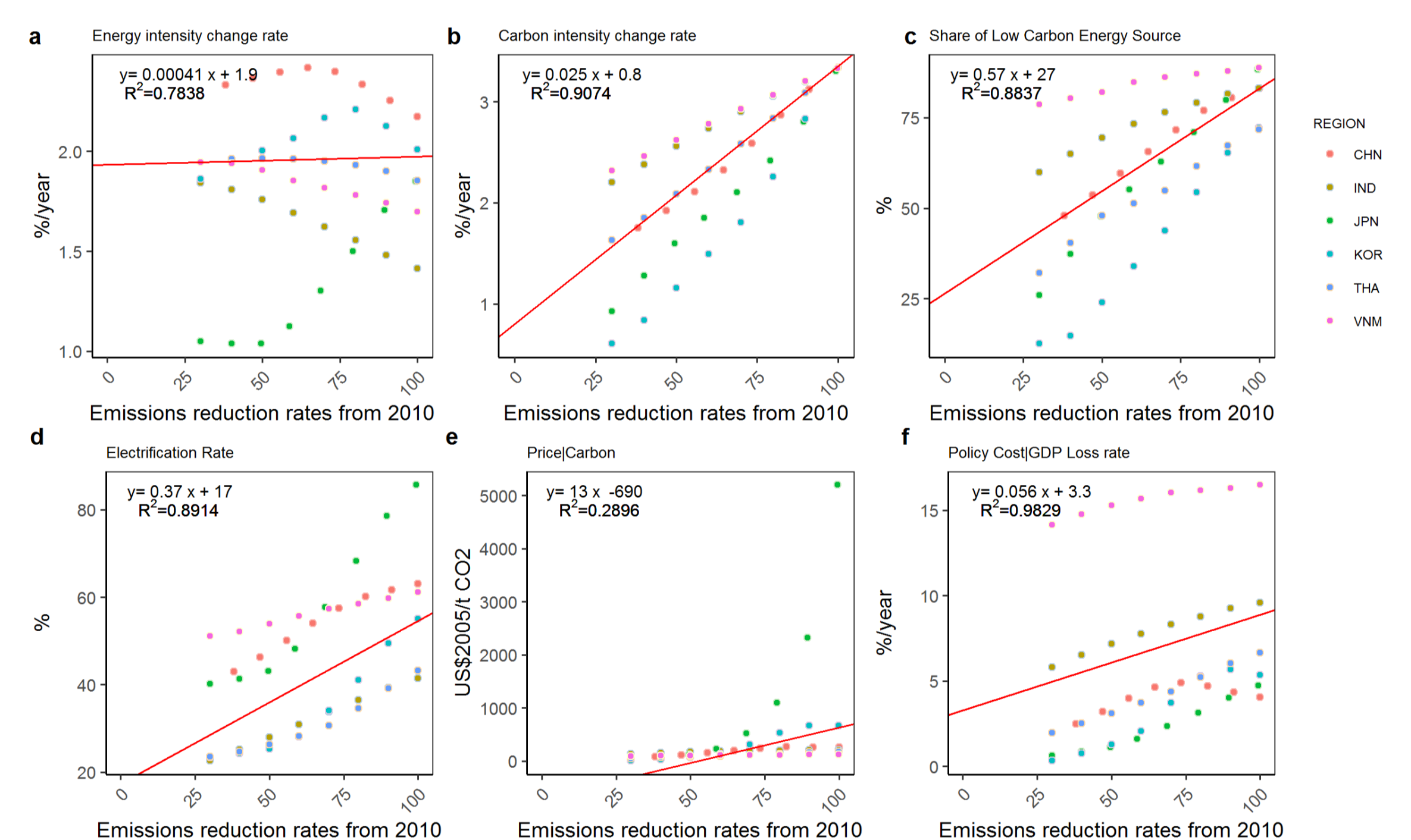


Figure 2. Cross-national comparison of national long-term scenarios (NLPs). Six scenario indicators for 2050 are plotted against reduction targets. Panels a, b, c, d, e, and f represent mean annual rate of energy intensity change (%), mean annual rate of carbon intensity change (%), share of low carbon energy sources in primary energy supply (%), electrification rates in final energy consumption (%), carbon prices (\$/tCO₂) and GDP loss rates (%). The solid lines indicate regression results using the derived slope and intercept + mean of dummy country results

Decarbonization challenges may exist also in today's industrialized countries

- Full decarbonization might also be challenging in some of today's industrialized countries. E.g. Japan has comparatively limited potential for solar and wind power making targets close to 100% very difficult to achieve with projected carbon prices reaching US\$500 (Figure 3). It would be economic thus for Japan to outsource its mitigation efforts and provide financial support to other countries to make more cost-effective emission cuts outside the country.
- Results show that the most cost-effective approach to mitigation will vary across countries. Pathways for the six Asian countries have very different projected energy mixes in 2050, some relying more on biomass, nuclear, or hydropower while others favoring more solar and wind.

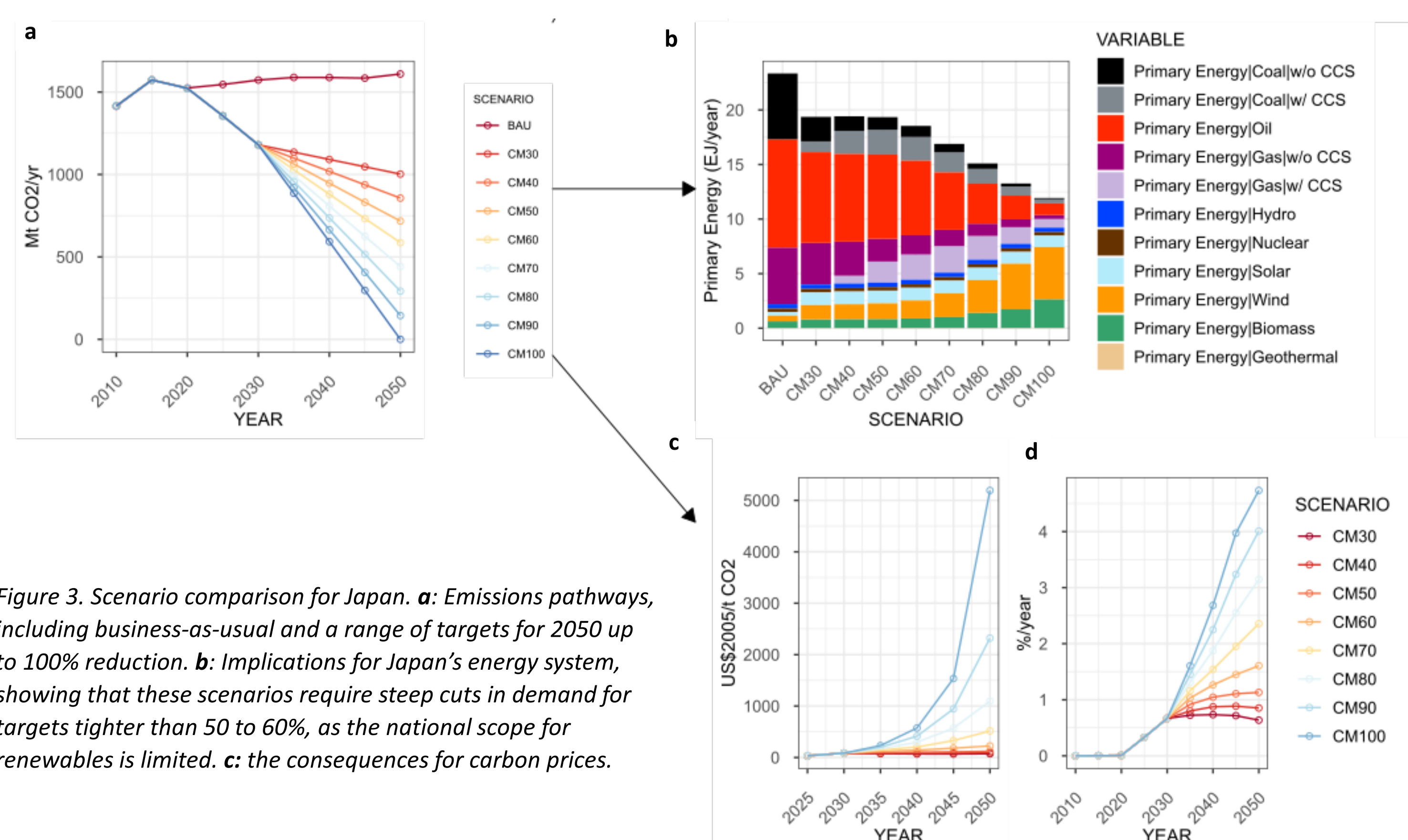


Figure 3. Scenario comparison for Japan. a: Emissions pathways, including business-as-usual and a range of targets for 2050 up to 100% reduction. b: Implications for Japan's energy system, showing that these scenarios require steep cuts in demand for renewables is limited. c: the consequences for carbon prices.