IIASA POLICY BRIEF #34
OCTOBER 2022

Promising climate progress

Recent net-zero pledges could take the world a long way towards meeting the Paris climate goals, but an ambition gap remains.

The global climate goals of the Paris Agreement will have to be met through action at the national level. So how do existing national plans and pledges stack up?

One of the leading efforts to answer this question is through the Exploring National and Global Actions to Reduce Greenhouse Gas Emissions (ENGAGE) Project. Within ENGAGE, a collaboration of international groups is calculating how national policies would affect global emissions. Their main interim findings are:

→ **Neither current policies nor existing nationally determined contributions (NDCs) come close to the Paris goals.** At best, current policies stabilize greenhouse gas emissions, whereas a deep cut is needed.

→ **Recent net-zero targets are a big step forward.** These pledges, announced by several countries before and during COP26 in Glasgow, would bring global emissions down to a much lower level than current policies or NDCs.

→ **They are, however, still not enough to meet long-term climate goals.**

→ **To close the remaining gap we must cut fossil fuels sharply, and further extend the reach of renewables.**

→ **The optimum mix of mitigation approaches differs a lot for each country,** with varying combinations of solar, wind, biomass, hydro, geothermal, carbon capture, as well as wave and tide power.

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The Paris Agreement aims to limit the increase of global mean temperature to well below 2°C and preferably 1.5°C. It requires countries to set their own nationally determined contributions (NDCs) which include emissions targets to 2030, as well as plans of action to achieve those targets. Many nations have also set out longer-term goals, notably the net-zero targets for mid-century, proposed before and during the Conference of the Parties (COP26) in Glasgow in 2021.

The crucial question is, how close do these ambitions take us to the Paris goals? One aim of the ENGAGE project is to help answer this question.

The process is more complex than simply adding up promised emissions. For a start, many countries do not have targets beyond 2030. Even where mid-century net-zero pledges exist, they do not specify the emissions pathway that will be followed to reach that target. Integrated assessment models are therefore useful to calculate plausible emissions pathways, and show which technologies and other mitigation options are most likely to minimize cost.

To plot global emissions, the consortium uses several different integrated assessment models, which take into account economics, industry, land use, and other global systems. The models calculate likely emissions and climate effects over time, given a particular set of policies or other assumptions.

Five futures

Each global model in the project has tackled five broad scenarios:

2°C and 1.5°C scenarios: models calculate global cost-optimal ways of meeting these temperature goals in 2100, ignoring all stated policy.

Current policies: assuming all climate policies that are already implemented. Results show global emissions continuing to climb (Figure 1), with warming projected to be around 3.3°C at the end of the century.

NDC scenario: fully implementing all NDCs to 2030, with ambition levels remaining constant after that[1].

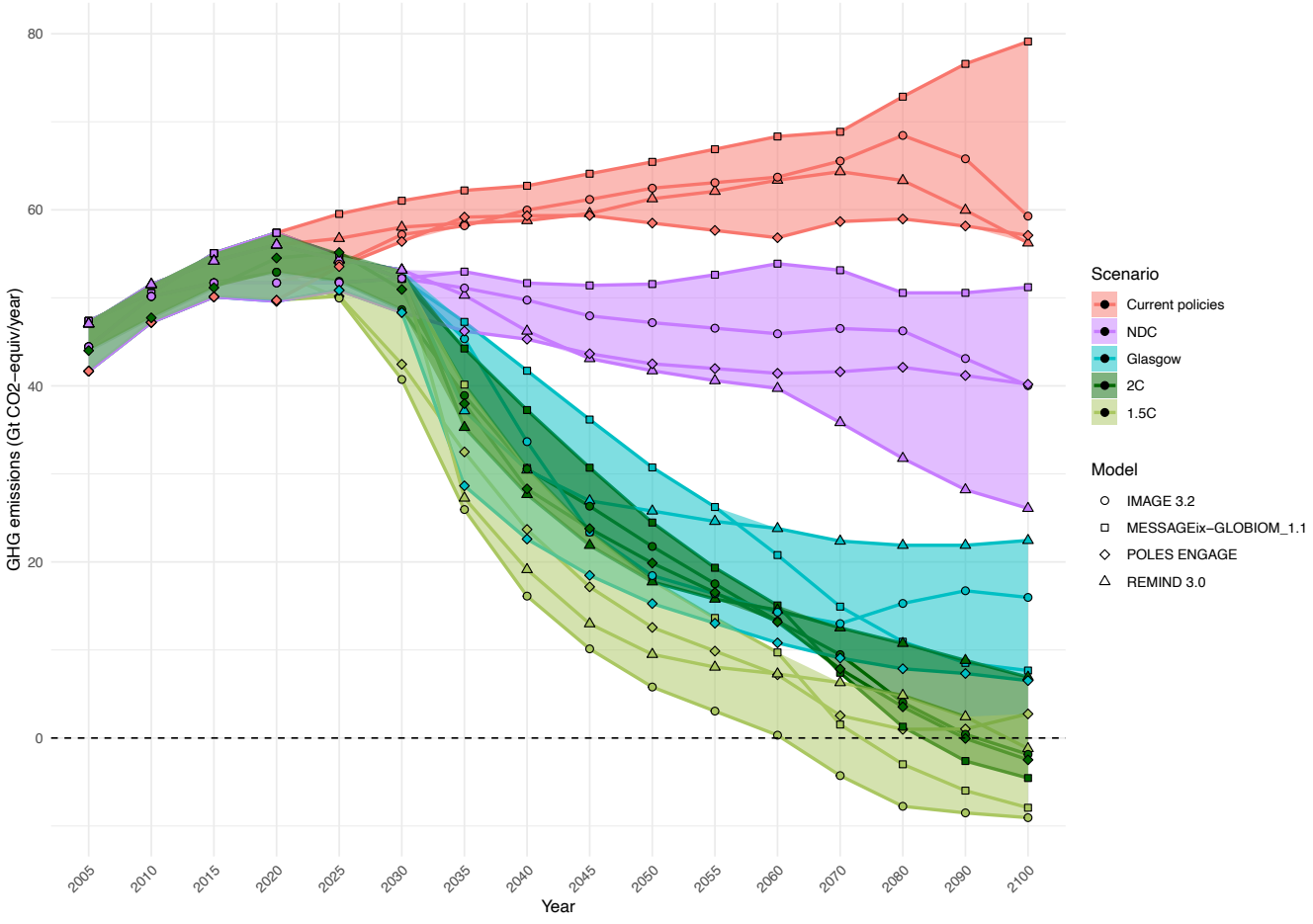

Figure 1. Global emissions pathways for the five scenarios, each according to four different models Greenhouse gas emissions are shown in billion tonnes of CO_2 equivalent per year.

[1] This is modeled by maintaining the 2030 carbon price, adjusted for projected GDP growth.

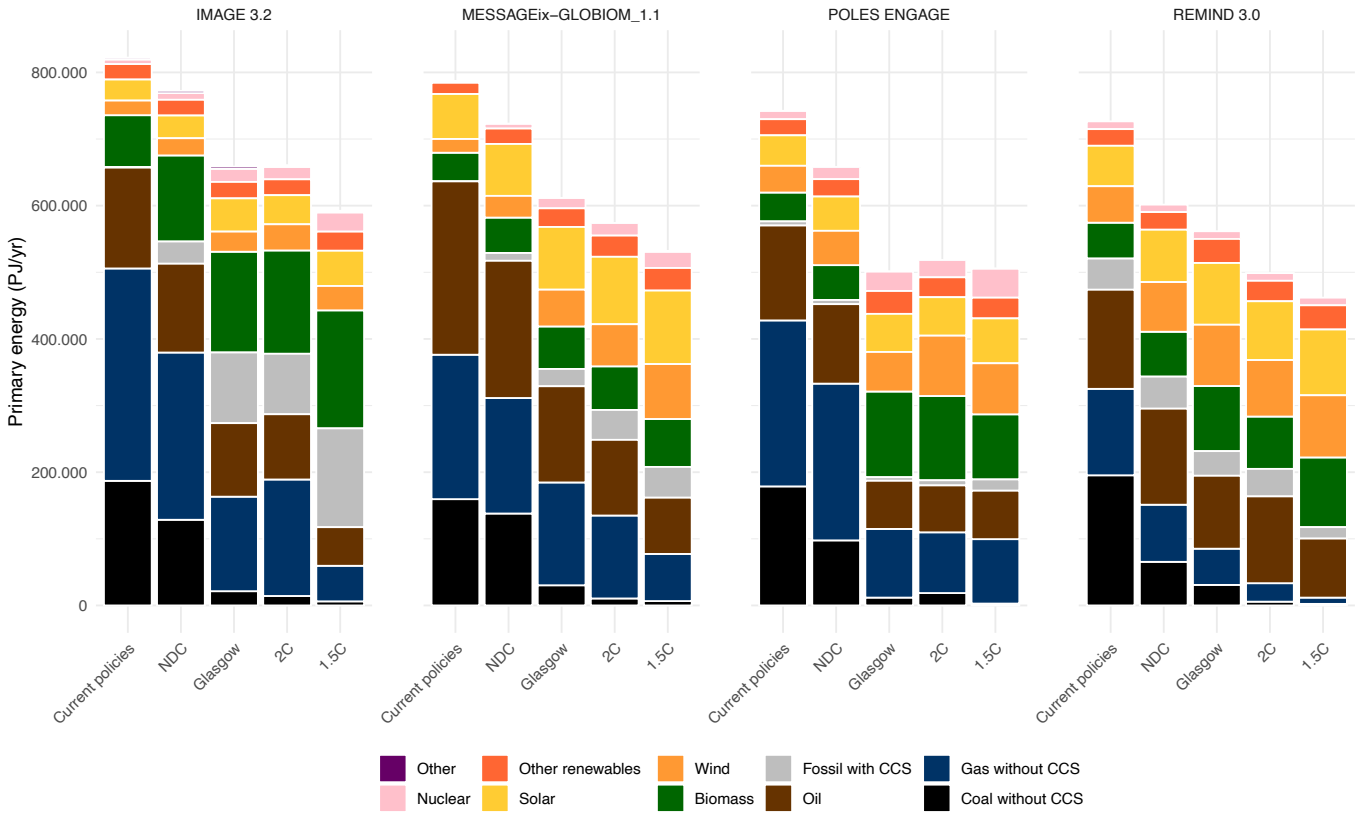

Figure 2. Global primary energy mix in 2050 for each scenario and models.

This leads to warming of around 2.7°C, still substantially above the Paris goals. Note that emissions under current policies are far above these NDC projections, revealing a clear implementation gap.

Glasgow scenario: fully implementing NDCs and the net-zero pledges announced by the end of COP26. All models show that this is more ambitious than NDCs, with a much lower global emissions pathway. However, this still doesn't meet the Paris goals, with models projecting end-of century warming in this scenario of around 2.1°C.

Closing the gap

The gap between the Glasgow scenario and 2°C is small, but bear in mind that the Paris goal is to limit warming to *well below* 2°C. The results show that it should be feasible to do this, closing the gap between Glasgow and 1.5°C.

The 1.5°C scenario modeled here would require phasing out coal, and a rapid cut in oil and gas, as well as further expanding the use of renewables. Existing net-zero pledges imply that renewables should meet around 40-45% of global primary energy in 2050. Meeting 1.5°C would require that share to grow to 50-75%.

Some models show other technologies playing a role, notably fossils with carbon capture and storage (CCS), wave and tidal power, and nuclear. Global projected energy balances are shown in Figure 2.

A crucial question is how to distribute this extra effort between countries. The ENGAGE project has also investigated various ethics-based schemes for effort-sharing (described in IIASA Policy Brief 35), and is investigating whether the gap to 1.5°C could be closed simply by more nations committing to net-zero.

Contrasting strategies

Actually achieving net-zero targets will require nations to move to more sustainable energy and land systems. ENGAGE has developed a standardized framework for national modeling to provide a fair assessment of each country's cost-optimal mitigation strategy.

These national models project very diverse approaches, depending on local economics and renewable resources. For instance, Japan combines large reductions in the use of oil and gas with strong investment in solar, biomass, and wind. China achieves net-zero emissions by heavily reducing coal use and spreading investments across a wide range of low-

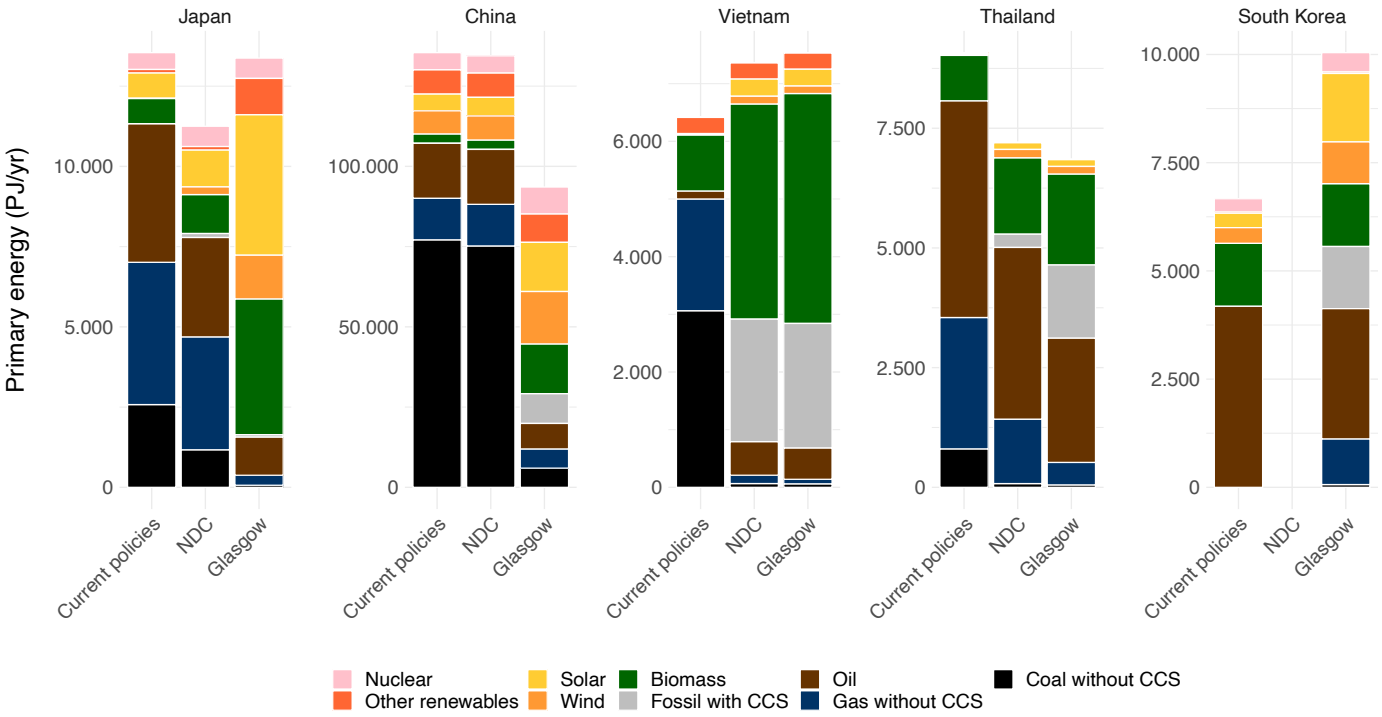

Figure 3. Primary energy mixes in 2050 for selected countries.

carbon solutions, including nuclear and CCS, as well as renewables. Vietnam and Thailand, with higher shares of land available, increase use of biomass. Thailand and Korea continue to use a lot of oil.

Stand and deliver

This work shows that recent net-zero pledges could be a big step towards meeting the Paris goals, as long as governments deliver the promised cuts.

To actually meet those climate goals, global ambition on fossils and renewables must be increased further – perhaps by more countries standing up to commit to net-zero.

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ENGAGE
FEASIBILITY OF CLIMATE PATHWAYS

The International Institute for Applied Systems Analysis (IIASA) is an independent, international research institute with National Member Organizations in Africa, the Americas, Asia, and Europe. Through its research programs and initiatives, the institute conducts policy-oriented research into issues that are too large or complex to be solved by a single country or academic discipline. This includes pressing concerns that affects the future of all of humanity, such as climate change, energy security, population aging, and sustainable development. The results of IIASA research and the expertise of its researchers are made available to policymakers in countries around the world to help them produce effective, science-based policies that will enable them to face these challenges.

PUBLICATIONS ON WHICH THIS POLICY BRIEF IS BASED

The research behind this brief will inform a report to be delivered to the European commission in June 2023. Results will then be published in open-source academic papers.

REFERENCES AND USEFUL RESOURCES

ENGAGE: www.iiasa.ac.at/projects/engage

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