PBL Netherlands Environmental Assessment Agency

Low-Emission Pathways in 11 Major Economies: Comparison of Optimal Pathways and the INDCs

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Introduction

- Success Paris Agreement depends on implementation of the Intended Nationally Determined Contributions (INDCs) at the national level.
- We assess emission trajectories and the energy system transition of 11 major economies projected by integrated assessment models (IAMs) for baseline and cost-optimal 450 ppm CO_2eq mitigation scenarios, and compare the results with the INDCs.
- We present various policy relevant indicators, adding more national detail to the literature describing global model scenarios.

MILES project: Modelling and Informing Low-Emission Strategies

- IAM scenarios from AMPERE, LIMITS, EMF27, and MILES projects:
  - Scenarios: Baseline and cost-optimal 450 ppm CO_2eq (~2°C)
  - Models: DNE21+, GCAM, GEM-E3, IMAGE, MESSAGE, POLES, REMIND, and WITCH.
- Model results compared with INDCs (Den Elzen et al., 2016, Emmerling et al., 2016). Three types of INDC ranges:
  - Range in reduction targets as defined in the INDCs (Russia, USA)
  - Range unconditional and conditional reduction targets (Mexico)
  - Range resulting from various model studies (China, India)

Conclusions

- The national carbon budgets (2010 – 2100) showed on average a 79% reduction between baseline and mitigation scenario; largest reductions projected for Brazil, Canada, and Turkey.
- In general, the INDCs are insufficient to reach the mitigation level of the optimal 2°C scenarios.
- However, the INDCs of Brazil, Canada, the EU, Mexico (conditional INDC), South Korea, and the USA are projected to be relatively close to optimal 2°C pathways.
- Shares of low-carbon primary energy reach over 50% in 2050 in the optimal 2°C scenario.

Greenhouse gas emissions

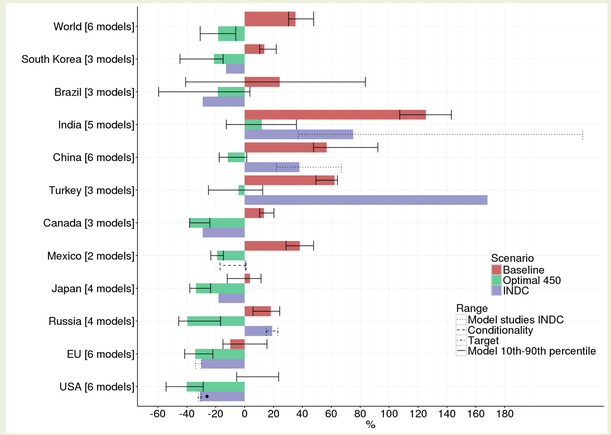

Fig. 1: Kyoto gas emissions in 2030 (relative to 2010) for Baseline and Optimal 450 ppm CO_2eq scenarios (10^{th}, 50^{th}, 90^{th} percentiles), and INDCs

Carbon budgets

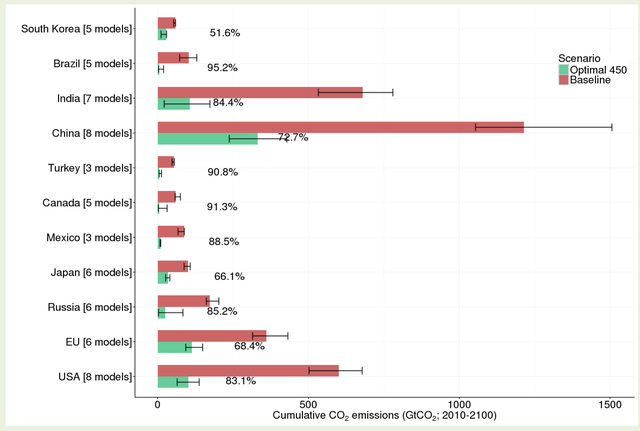

Fig. 2: Regional carbon budgets (Gt CO_2) between 2010 and 2100 for Baseline and Optimal 450 ppm CO_2eq scenarios (10^{th}, 50^{th}, 90^{th} percentiles)

Peak years

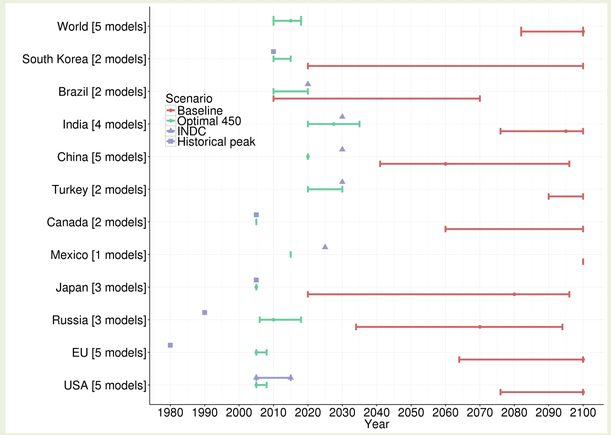

Fig. 3: Peak years of Kyoto gas emissions projected by models (10^{th}, 50^{th}, 90^{th} percentiles) and for INDCs (triangles)

Share low-carbon energy

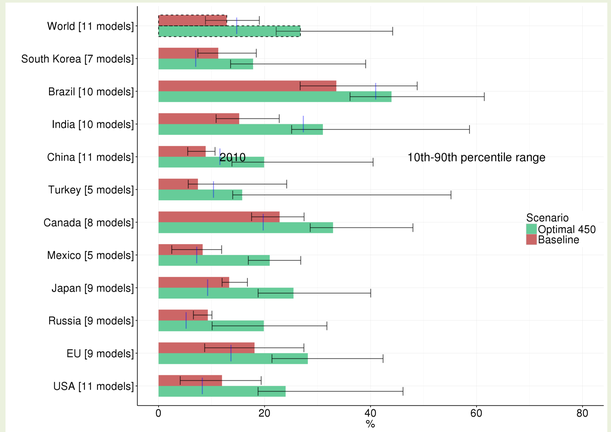

Fig. 4: Share of low-carbon energy sources (all except fossil fuels without CCS) in primary energy supply in 2030 (10^{th}, 50^{th}, 90^{th} percentiles; blue line: 2010)

References

- Den Elzen M, et al. (2016) Contribution of the G20 economies to the global impact of the Paris agreement climate proposals. Climatic Change:1-11.
- Emmerling J, et al. (2016) The WITCH 2016 Model: Documentation and Implementation of the Shared Socioeconomic Pathways, FEEM Nota di Lavoro 42.2016. FEEM, Venice.

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