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How to assess the soundness of carbon neutrality commitments in specific national contexts?

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After COP26, climate change policy will be at a crossroads. Most important countries and many important stakeholder groups have committed in front of the international community to reach carbon neutrality by mid-century or soon after, consistently with the requirements identified by science to keep the global temperature goal well below 2°C. But short-term targets and actions remain in most cases misaligned with

this long-term objective, reflecting the challenges of implementation. These challenges notably come from the nature of the measures proposed to reduce greenhouse gas emissions on human activities, and, most importantly, from their heterogeneous effects, according to national circumstances and differential impacts on various activities and categories of households. Climate mitigation, like many other environmental issues, is therefore not a question of pure economics but of political economy, involving the resolution of conflicts of interest. Acknowledging this characteristic, a recent handbook presents the state of the art of the discipline that considers ecological issues and crises from a political economy perspective. In particular, its [chapter 20](#) discusses how to analyse the political economy of energy and climate transitions and the associated methodological challenges, which are related to modelling tools and pathways design frameworks that have to inform the real-world transition towards carbon neutrality.

Model-based scenarios allow exploring different transition pathways, analysing the interplays between systemic transformations and quantifying the impacts to provide orders of magnitude. As such, they play an important role to inform actionable low-emission development strategies and to guide the selection of concrete policy instruments and measures. The bottom-up paradigm of the Paris Climate Agreement, later framed by the global carbon neutrality objective, strays away from the pure economic theory schemes and reintroduces the political economy dimension of transformative scenarios. Therefore, it calls for revisiting the approach to scenario design, beyond the conventional use of integrated assessment models, which have been structuring tools to elaborate an international climate regime from Kyoto (1997) onwards. Scenario design must notably allow considering the specificities of country circumstances, while analysing complex policy packages beyond carbon pricing, opening the box of deep structural transformations and capturing the complexity of social and economic effects, including redistributive effects. These requirements lead to reconsider the status of models, which fail to capture all these components and must therefore be embedded in a broader framework to support an effective design of strategies and actions towards global carbon neutrality.

This new perspective defines a change in the role of models, which are no longer an instrument to provide a normative expert view of policy solutions, but rather a tool to inform policy discussions among stakeholders. By ensuring the reintroduction of the political economy dimensions of energy and climate transitions, it can serve to characterize the effects of the carbon neutrality transformations, the areas of choices and their consequences. This provides a way to organize and structure the policy discussion framed by the different interests. In this new approach, modelling is only one component of a broader [pathways design framework](#), which serves to translate detailed, qualitative narratives expressed in the language of stakeholders into a synthetic set of quantitative indicators that are needed to characterize the transformations according to consistent metrics.

Two examples where this framework allowing the integration of different considerations of political economy in the definition of climate and energy strategies are: the French experience of the National Debate on Energy Transition (DNTE) in 2013 and the international [Deep Decarbonization Pathways \(DDP\) initiative](#). The [DNTE](#) did not produce new scenarios but assessed pre-existing scenarios, stemming from contrasting visions of the future, and eventually grouped in four trajectories representing different perspectives on the low-carbon transition. Models were not systematically used to produce the individual scenarios, but the four trajectories were described in a coherent way in tables of standardized results, revealing the main points of convergences and divergences in the content of the considered transformations, as a key input into stakeholder consultations and eventually policy decision. The DDP initiative adopted a similar approach, transposed internationally in number of country-driven exercises and investigating the pathways towards deep reductions of greenhouse gas emissions. Cross-cutting analyses of national DDP scenarios indicate that ambitious mitigation requires simultaneous strong action on four pillars of systems transformation—energy efficiency and conservation; decarbonization of energy carriers like electricity, biofuels and hydrogen; fuel switching of end uses to these decarbonized energy carriers; maximisation of natural and

technological sustainable carbon sinks. They also show that these common features will be achieved very differently in different country contexts. But if enabling conditions are met and adequate policy packages are introduced, deep decarbonization can be performed in a way that provides multiple economic, social and environmental benefits and opportunities for raising living standards everywhere. These include improved air quality, enhanced energy security, reduced energy poverty, improved employment, income distribution and macroeconomic performance.

Investigating the accelerated and profound transitions required by carbon neutrality raises specific political economy questions that challenge standard analytical paradigms. To be relevant for the carbon neutrality issues, scenario frameworks should be able to analyse radical transformation of socio-technical systems and the interconnections at the heart of these systems' change, which require in turn to adopt a detailed representation of the main drivers of changes. They should also represent **changing lifestyles** to allow consideration of a combination of technological and societal changes. Addressing social justice in the ecological transition requires adopting a holistic approach to policy packages, beyond carbon pricing, which in turn imposes going beyond conventional economic modelling exercises.

Finally, the carbon neutrality objective requires abandoning the idea of a burden-sharing allocation of efforts among countries and considering instead that, in the long term, each country must face the challenge of reaching very low emission levels in its own boundaries. It remains clear, however, that the nature of the domestic transformation—including the political economy aspects of the transition—will in any case depend on the nature of the global transition. A major challenge will therefore lie in the possibility to capture deep decarbonization narratives in country analyses at a level of detail sufficient to inform international cooperation priorities from each country's perspective.

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