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Deep Decarbonization Pathways for national development consistent with carbon neutrality

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The global carbon neutrality goal set by the Paris Climate Agreement requires pro-active national climate action guided by socially, economically and politically actionable strategies to reach net zero greenhouse gas (GHG) emissions at national levels. These strategies must be informed by robust evidence on long-term sectoral transitions to [net zero](#) ensuring adequate representation of national circumstances and strong ownership by key domestic stakeholders. [Climate Policy's special issue published today](#) presents recent progress from this topic as emerging from the research conducted by the [Deep Decarbonization Pathways \(DDP\) initiative](#) in Argentina, Brazil, China, India, Indonesia, Mexico and South Africa. It presents methodological advancements required to integrate the key features of trajectories compatible with carbon neutrality. It also discusses key policy lessons emerging from the analysis, notably the necessity for wide ranging sector-focused policy packages supported by adequate international cooperation, in order to simultaneously address multiple objectives in a consistent policy framework at national level. These detailed policy insights provide concrete benchmarks against which progress of countries towards carbon neutrality can be assessed.

Formation of policies to reach emissions levels consistent with the Paris Agreement goal requires a detailed understanding by stakeholders and decisionmakers of country-driven transformations consistent with a low-GHG emissions future, of the short-term actions and policies which are required to put and keep a country on track with its long term objectives and of the conditions for a country to align its broad security, development, and climate objectives.

Since its launch in 2013, the Deep Decarbonization Pathways (DDP) initiative has focused on [developing analysis to inform these policy questions](#).

The investigation of national carbon neutrality requires methodological advancements on pathways analysis

The investigation of carbon neutrality at national level has led the DDP to promote specific methodological evolutions to make the pathways analysis relevant to this depth of ambition.

This includes the detailed representation of [the Agriculture, Forest and Other Land Uses \(AFOLU\) sector](#) as a key source of negative emissions, which are critical to compensate for residual emissions in other sectors. It requires specific accounting of all related drivers and constraints affecting this sector at the national level, such as land-use competition, changes in agricultural practices, and trade-offs with biodiversity or socio-economic impacts.

A detailed sectoral approach is also required to capture all opportunities and enablers for deep emission reductions across transport (distinguishing [passenger transport](#) and [freight transport](#)), [industry](#) and [power generation](#). This requires considering a broad range of mitigation options including technological options as well as structural and organizational changes, with a particular focus on ambitious efforts towards reductions of energy and material demand

Finally, to be policy-relevant in these contexts, carbon neutrality analyses need to demonstrate explicitly the compatibility of the required deep transformations in all sectors with socio-economic development priorities as defined by each country. In practice, this means that [pathways analyses](#) must go beyond the aggregate representation conventionally limited to economic growth and GDP, to capture explicitly narratives related to the key socio-economic issues relevant to each country context, such as, eg, as energy access, inequality, poverty or employment.

Carbon neutrality requires wide ranging sector-focused policy packages supported by adequate international cooperation

The analysis conducted in the special issue stresses that carbon neutrality transition is about addressing multiple objectives in a consistent policy framework.

Carbon neutrality requires accelerating immediate emission reductions in sectors where technical solutions are already available and economically competitive as compared to carbon-intensive options. This is notably the case in power generation, passenger transport and the land use sector.

But carbon neutrality also requires preparing today the conditions enabling long-term deep emission reductions by taking actions on technological progress, infrastructure development and behavioral change. These actions do not necessarily deliver immediate emission reductions but are essential to make innovative zero emission technology options available and affordable in all sectors, to build adequate infrastructure which will favor the adoption of low-carbon solutions and to support changes in lifestyles compatible with less carbon intensive ways of consuming and producing.

Carbon neutrality also requires strengthening synergies between climate, industrial and economic agendas and managing the social impacts of the transition, notably with regards to the most vulnerable.

From a policy standpoint, addressing these multiple objectives in a balanced way calls for the adoption of [comprehensive policy packages](#) that combine complementary actions in a consistent policy framework

The analysis conducted in this special issue provides concrete examples of such a holistic approach to policy and provides concrete recommendations for the adoption of policies and measures which capture the specificities of each of the key sectors that matter for deep decarbonization: power generation, passenger transport, freight transport, energy-intensive industry and AFOLU. In addition, the special issue proposes a deep dive in the diversity of economic policy tools suited to support freight transport decarbonization, highlighting notably the importance to complement conventional pricing instruments with non-economic and regulatory policies combined with strategic investments in infrastructure and planning. The special issue also highlights global governance as a critical lever to enable the sectoral transformations of energy-intensive industries required by carbon neutrality. More generally, the analysis stresses the key role of international cooperation to create conditions required by national transitions in all key sectors

A benchmark to assess national climate action and guide future steps of ambition and implementation in support of the Paris Agreement objectives

A [recent analysis on the last decade of national climate action](#) by the DDP Initiative highlights concrete policy gaps with respect to key policy insights from this Special issue on the requirements for carbon neutrality. It shows notably that too little proactive action has been taken to prepare for the longer-term evolution of infrastructure and behaviors needed to reach carbon neutrality. Also, the emergence of consistent policy packages coherently and consistently addressing climate along with social and industrial concerns is still largely missing.

These two critical gaps highlight that, despite noteworthy progress since the signature of the Paris Agreement, there is critical necessity to anchor even more the design of policy at national level on a robust, evidence-based national strategy, which can provide guidance to short-term decisions within the broad context of sustained longer term economic development.

