

Contribution from the National Confederation of Transport (CNT) to the Roadmap for a Just and Planned Energy Transition

Introduction

The transport sector plays a strategic role in the Brazilian economy, as it is essential for territorial integration, the functioning of supply chains, and the mobility of people and goods. In Brazil, although the emissions profile is strongly influenced by land use and agriculture, the transport sector represents a significant share of emissions associated with energy consumption. Its high dependence on fossil fuels, particularly petroleum-based fuels, positions it as part of the solution in the energy transition agenda.

From the perspective of the National Confederation of Transport (CNT), it is important to highlight that the discussion on the energy transition in the transport sector must take into account its specificities, balancing decarbonization objectives with competitiveness, energy security, economic viability, and the continuity of essential services provided to society.

According to the CNT Greenhouse Gas Emissions Inventory for the Transport Sector, the national transport mix is predominantly road-based, which is reflected in its higher share of sectoral emissions. This structural configuration concentrates transport demand in a system largely based on liquid fuels, particularly diesel, reinforcing its central role in the functioning of the sector and in the dynamics of energy consumption.

Additionally, the analyses developed by the Transport Decarbonization Coalition indicate that, under a continuation of current trends, the growth in transport demand is expected to increase the sector's energy consumption over the coming decades, reinforcing the need to establish consistent pathways to reduce dependence on fossil fuels. At the same time, the study indicates that viable alternatives exist to support this transition, provided they are implemented in an integrated manner and aligned with the operational specificities of each transport mode.

In this context, the transition in the transport sector should not be characterized as an immediate substitution process, but rather as a gradual transformation involving a combination of different solutions, including diversification of the energy matrix, expansion of the use of lower-carbon fuels, the incorporation of new technologies, and improvements in the efficiency of transport systems.

The Brazilian experience, through sectoral articulation and the development of technical studies, demonstrates that building transition pathways depends on evidence-based approaches capable of reconciling climate ambition with economic and operational feasibility. This understanding is essential to contribute to the construction of a global Roadmap applicable to different national realities.

Thus, the present contribution seeks to present, from the perspective of the transport sector, the main challenges, levers, experiences, and recommendations for the transition away from fossil fuels, considering the sector's specificities and the need to promote a just, orderly, and equitable transition.

The information presented in this contribution derives from the study developed by the Transport Decarbonization Coalition, entitled “*How to Make the Transport Sector an Active Contributor to Reducing Brazilian Emissions*”, submitted as an annex. The document brings together technical analyses and identifies decarbonization levers, serving as a reference for the construction of viable pathways for the energy transition in the transport sector.

1. Key barriers to the transition away from fossil fuels

The transition away from fossil fuels is shaped by a set of structural barriers related to the configuration of the transport mix, the dynamics of demand growth, and the viability conditions of alternative energy solutions.

One of the main barriers is associated with the structure of Brazil’s transport mix, characterized by the predominance of road transport, which plays a central role in territorial integration and in the functioning of logistics chains. This configuration results in a high dependence on liquid fuels, particularly diesel, reflecting a well-established and widely distributed system, which makes the transition more complex.

This dynamic is reinforced by projected growth in transport demand, which is expected to increase energy consumption over time. Even with efficiency gains and technological progress, increased activity places pressure on energy demand, requiring that the transition be conducted in a way that ensures service provision without compromising reliability and efficiency.

From a technological perspective, not all transport modes currently have fully mature, scalable, and economically competitive solutions to replace fossil fuels. Segments such as long-haul road transport, maritime transport, and aviation still require the development and consolidation of alternatives, as well as the demonstration of their operational reliability under real-world conditions.

Another relevant barrier relates to the need to develop infrastructure for new fuels and technologies. The adoption of alternatives such as advanced biofuels, electrification, and hydrogen depends on expanding production capacity, establishing refueling, recharging, and distribution networks, as well as adapting logistics and operational systems. The lack of such infrastructure limits the large-scale deployment of these solutions and requires long-term investments.

In this context, it is also essential to ensure that new fuels and technologies meet criteria of quality, reliability, and economic, technical, and operational sustainability, so as not to generate negative impacts for the main end user of the system: the transport operator. The adoption of new solutions must ensure cost predictability, adequate performance, and compatibility with existing operations.

From an economic perspective, the high cost of the transition and the limited investment capacity of a significant share of operators—particularly those with tighter financial

margins—represent a relevant barrier to the adoption of new technologies and fuels in a sector that is highly sensitive to operating costs.

In this context, it is important to recognize that the transition away from fossil fuels is likely to occur gradually and should not be interpreted as a constraint, but rather as part of a strategy to diversify the energy matrix. This approach contributes to energy security and operational stability, while enabling the progressive development of new solutions.

In addition, the transition depends on structural enablers such as regulatory evolution, financial incentives, an enabling innovation environment, partnerships, and workforce capacity building. The absence or weakness of these elements, including the lack of regulatory predictability, hinders the implementation of solutions and increases perceived risk among sector stakeholders.

Limited availability of data, metrics, and monitoring instruments also represents a significant barrier, as these elements are essential to inform public policies, assess results, and prioritize interventions with the greatest potential impact.

In summary, the main barriers to the transition are related to the current configuration of the transport system, technological and infrastructure constraints, the economic viability of alternatives, and the absence of fully consolidated enabling conditions, requiring a gradual, integrated, and energy diversification-oriented approach.

2. Key levers to enable the transition away from fossil fuels

Based on the analyses developed by the Transport Decarbonization Coalition, the transition towards an energy matrix that is progressively less intensive in fossil fuels is structured around an integrated set of levers acting on the energy matrix, the transport mix, and system efficiency. The study identified and assessed around 90 levers, highlighting that the transformation of the sector depends on the coordinated and complementary implementation of multiple solutions.

These levers can be organized into three main pillars, which account for most of the potential to reduce dependence on fossil fuels in the sector.

The first pillar refers to the reconfiguration of the transport mix, with the expansion of more energy-efficient modes, such as rail and waterways. Rebalancing freight transport reduces the energy intensity of the system, lowering demand for fossil fuels per unit transported.

The second pillar corresponds to the expansion of lower-carbon fuels, particularly biofuels. Increasing the share of fuels derived from biomass, such as ethanol, biomethane, and renewable diesel, represents a central lever, especially in the short and medium term, as it enables the use of existing infrastructure and supports a gradual substitution process that is operationally compatible with the sector.

The third pillar involves electrification and the development of new technological pathways, including solutions based on hydrogen and power-to-X. Electrification, particularly in light-duty and urban transport, has strong potential to reduce fossil fuel use, while emerging technologies are expected to play a relevant role in hard-to-abate segments.

In addition to these main pillars, the study highlights a set of complementary levers focused on energy and operational efficiency. These include fleet renewal and modernization, the expansion of urban public transport, the optimization of air routes, improvements in road and rail infrastructure, and enhanced port operations management. Although their individual impact tends to be more incremental, their high feasibility makes them essential for achieving immediate gains.

The effectiveness of these levers is directly conditioned by the existence of structural enablers, such as regulatory evolution, financial incentives, support for innovation, public-private partnerships, and workforce capacity building. These elements are critical to enabling large-scale adoption and reducing barriers associated with the transition.

In summary, the transition in the transport sector does not rely on a single solution, but rather on an integrated combination of strategies that act on energy demand, the energy matrix, and system efficiency in a complementary manner. This approach enables gradual and structural progress, reconciling emissions reduction with economic viability and operational security.

3. Experiences, best practices and lessons learned applicable to the development of transition roadmaps

The Transport Decarbonization Coalition stands out as a relevant sectoral best practice in building pathways for the energy transition, by conducting a technical and collaborative process to map the main decarbonization levers in the transport sector. Based on data, modelling, and forward-looking analyses up to 2050, the initiative enabled the identification of a comprehensive set of solutions, organized in an integrated manner, and adapted to the specificities of different transport modes.

One of the main distinguishing features of this experience is its multi-stakeholder articulation, which fostered structured dialogue among operating companies, policymakers, and technical institutions. This approach made it possible to align the operational feasibility of solutions with climate objectives, reducing the gap between ambition and implementation. As a result, the recommendations produced by the Coalition have contributed to strengthening public debate and supporting the formulation of public policies, including relevant inputs to the development of Brazil's National Climate Change Plan (Plano Clima).

A key lesson learned is that the development of effective roadmaps for the energy transition in the transport sector depends on processes that are simultaneously evidence-based, collaborative, and implementation-oriented. The active participation of the productive

sector allows for the incorporation of real constraints related to cost, technology, and operations, while the involvement of the public sector ensures alignment with national strategies and regulatory instruments.

The experience also highlights the importance of adopting a multi-technology and progressive approach, recognizing that the transition away from fossil fuels in transport does not occur through a single substitution pathway, but rather through the combination of different solutions over time. The structured identification of levers, combined with the assessment of their feasibility, contributes to prioritizing actions and guiding investments more efficiently.

Another relevant lesson concerns the role of collaborative governance, which proves essential for the success of sectoral roadmaps by enabling consensus-building, continuous updating of strategies, and adaptation to technological and market developments. This model has strong potential for replication across different national and regional contexts, contributing to accelerating the energy transition in a pragmatic manner aligned with local realities.

In addition, the Brazilian experience highlights the relevance of technical and operational instruments to support the transition in the transport sector. In this context, initiatives developed by the Transport System—such as the *Despolluir* Program, which provides direct support to operators and promotes improvements in fleet environmental performance, and the CNT Greenhouse Gas Emissions Inventory for the Transport Sector, which reinforces the role of data and metrics as a basis for diagnostics and prioritization—stand out. Complementarily, the promotion of energy diversification approaches based on the combination of different technological pathways, such as biofuels, electrification, and hydrogen, is also noteworthy.

Finally, it can be observed that the existence of structured, evidence-based guidelines has contributed to increasing engagement by transport sector companies in the national decarbonization agenda. This movement is reflected in the adoption of innovative solutions, pilot projects, and initiatives focused on energy efficiency and the use of lower-carbon fuels, demonstrating the capacity of the productive sector to translate strategic guidelines into concrete actions and to contribute to the development of viable and scalable pathways for the energy transition.

4. A just, orderly, and equitable transition in the context of diverse national circumstances

In the transport sector, a just, orderly, and equitable transition must be grounded in the recognition that countries have very different logistics structures, transport systems, demand profiles, energy availability, and institutional capacities. For this reason, the transition away from fossil fuels cannot be treated as a uniform process, with a single technological pathway or a single pace of implementation applicable to all.

In the Brazilian case, this need is particularly evident. Brazil is a country of continental dimensions, with a strong dependence on road transport for the movement of freight and passengers, significant regional heterogeneity, and different levels of technological maturity across transport modes. In this context, a just transition requires that pathways consider not only climate ambition, but also energy security, territorial integration, economic competitiveness, and the operational viability of the transport system.

This entails, first, recognizing that the transition in the transport sector must occur progressively and be based on a combination of different solutions. In hard-to-abate segments, the complete and immediate replacement of fossil fuels is not technically feasible. Therefore, an equitable approach should allow countries and sectors to adopt trajectories consistent with their specific conditions, combining biofuels, electrification, hydrogen, advanced fuels, energy efficiency gains, and modal rebalancing. In this context, international cooperation, access to finance, technology transfer, and capacity building are essential, particularly for developing countries.

Second, a just transition must reflect the different levels of dependence on fossil fuels across modes, regions, and value chains. In transport, this dependence is directly linked to the predominance of diesel- and gasoline-powered fleets, existing infrastructure, and the long lifespan of assets. Therefore, an orderly transition must include mechanisms that reduce the risks of operational disruption, avoid abrupt cost increases, and ensure predictability for operators, companies, and users.

In addition, equity in the transition requires attention to its economic and social impacts. In the transport sector, changes in the energy matrix may affect logistics costs, consumer prices, employment, and supply chains. At the same time, the transition to a low-carbon economy represents an opportunity for socioeconomic development, with potential for green job creation, strengthening of value chains, and workforce development, particularly in countries of the Global South. For this reason, roadmaps should incorporate policies to support productive adaptation, financial instruments for fleet renewal and infrastructure development, as well as training and capacity-building measures.

Another key element is that an equitable transition must recognize the role of developing countries in building solutions aligned with their comparative advantages and national circumstances. In Brazil's case, this includes the potential for expanding lower-carbon energy sources, the high share of renewable sources in the electricity matrix, and opportunities to improve efficiency in the transport system and existing infrastructure. Thus, the principle of equity should not be understood as lower ambition, but rather as the ability to build realistic, implementable trajectories aligned with national capacities.

Finally, a just and orderly transition in the transport sector depends on collaborative governance and coordination between the public and private sectors. The experience of the sector shows that articulation among companies, sectoral entities, technical institutions, and policymakers is essential to identify viable pathways and translate diagnostics into concrete actions. This lesson is particularly relevant for the development of global roadmaps: participatory processes that are technically grounded and sensitive to national

realities tend to produce more effective, socially legitimate, and economically sustainable strategies.

Final considerations

The transport sector plays a central role in the global transition away from fossil fuels, not only due to its relevance to supply chains and territorial integration, but also because of the technical and operational complexity that characterizes its activities. In this context, building viable decarbonization pathways requires approaches that reconcile climate ambition with economic, technological, and logistical realism.

The Brazilian experience, particularly through the Transport Decarbonization Coalition, demonstrates that it is possible to structure consistent pathways based on collaborative, evidence-based, and implementation-oriented processes. The mapping of levers, long-term scenario analysis, and the articulation between the public and private sectors make it possible not only to identify solutions, but also to assess their feasibility and prioritization.

The contributions presented highlight that the transition in the transport sector will not occur through a single solution, but rather through a combination of strategies, including diversification of the energy matrix, the promotion of lower-carbon fuels, electrification, the development of new technological pathways, and improvements in system efficiency. This integrated approach is essential to ensure a consistent reduction in dependence on fossil fuels over time.

At the same time, this transition must be conducted in a just, orderly, and equitable manner, recognizing different national realities, varying levels of technological maturity, and the diversity of transport systems. Regulatory predictability, financial instruments, infrastructure investments, and workforce capacity building are essential elements to enable this transformation in a sustainable way.

Therefore, it is essential that the roadmap proposed under COP30 incorporates flexible, multi-technology, and evidence-based approaches capable of accommodating different national trajectories, while promoting convergence towards shared climate objectives. The transport sector, as part of the solution, is committed to actively contributing to the development of an energy transition that is environmentally effective, economically viable, and socially inclusive.