

# SUSTAINABLE AND RESILIENT TRANSPORT

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*The transport sector is one of the fastest growing sources of emissions in Türkiye. This set to continue as motorization rates and population grow. At the same time, extreme weather events from a warming climate can impair transport infrastructure, disrupting logistics and supply chains with real economic impacts. This article investigates approaches to decarbonizing transport in Türkiye and improving the resilience of transport infrastructure.*

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As one of the 195 states that have ratified the Paris Agreement, Türkiye has set itself a target of achieving net zero carbon emissions by 2053. Achieving this goal is not only crucial for global climate-related objectives but can simultaneously offer co-benefits for the country by tackling underlying structural obstacles for growth and development from economic, social, and environmental perspectives.

### ***Introduction and Context:***

#### ***Decarbonizing Transport Will be Key for Enabling Green Growth***

Türkiye is working from a strong baseline and a demonstrated commitment to achieving its goals. While the energy sector, which includes transportation, accounts for three-quarters of the country's greenhouse gas emissions, the full sector overall is less carbon-intensive compared to the EU average.<sup>1</sup> This is primarily due to an existing large penetration of renewable energy in the power system and low motorization rates. However, the transport sector is undergoing two momentous transitions that will shape its impact on green growth. These include (i) accommodating personal mobility for a country of 84 million people predicted to reach 107 million by 2060; and (ii) modernizing the logistics sector of an intensely trading nation with global aspirations. Accommodating these transitions while significantly reducing carbon emissions, ideally on an eventual long-term trajectory to carbon neutrality, is within Türkiye's reach given the right combination of investments and sectoral policy that focus on (1) electrification and decarbonization of transport, (2) a modal shift, and (3) energy efficiency. The policies proposed in this article will help explain how to strengthen this baseline further to achieve the goal of achieving net-zero carbon emissions by 2053.

Economically, the net fiscal impact of following a resilient and net zero pathway as defined by the World Bank Group (WBG) in the Country Climate and Development Report (CCDR) for Türkiye<sup>2</sup> is positive and, in fact, increases when considering longer-term horizons. Adopting a resilient and net zero pathway plan, such as the plan outlined by the WBG in the CCDR, leads to a net US\$ 15 billion gain over 2022–30 and a US\$ 146 billion gain over 2022–40, largely due to reduced fuel imports and health benefits from decreasing air pollution.<sup>3</sup> Furthermore, working towards this zero-emissions goal facilitates growth of industry, jobs and export opportunities offered by green technologies and sectors and protects the economy against longer-term risks such as carbon lock-in and corresponding lack of economic competitiveness as the world transitions towards reduced greenhouse gas

1) Türkiye's CCDR, (2022): 7.

2) Türkiye's CCDR, (2022).

3) Türkiye's CCDR, (2022): 9.

emissions. From a social perspective, achieving these goals can facilitate growth and employment within newly evolving sectors which poses great opportunity, if jobs in exposed sectors are adequately protected.

The path towards a net zero-carbon economy will increase GDP growth and employment, thanks to large investments and energy efficiency. This shift is likely to result in increased consumer consumption due to technological upgrading and reduced fuel costs.<sup>4</sup> Furthermore, by adopting a new structure of operation, Türkiye can intentionally and proactively support a just and inclusive transition.

Finally, there are also environmental benefits associated with transitioning to a decarbonized transportation future. Proactive mitigation and adaptation within industries allow for concerns of high vulnerability to the impacts of climate change to be addressed. Türkiye's road, rail, airport, and port infrastructure are highly exposed to the impacts of climate change, which namely include more frequent and more severe flooding, wildfire, and heatwave events. World Bank modeling shows that Türkiye's road network is significantly less resilient to disruption than that of Germany and Serbia and is about on par with that of Mexico. At the sub-national level, the road networks of the Adana, Izmir, and Black Sea regions are less resilient than those in the Ankara and Istanbul areas. Nationally, the rail network is much less resilient than the road network. The co-benefits associated with achieving a net-zero future not only justify the importance of such an environmentally important transition but also highlight the wider set of benefits associated with such a transition.

Next, we present the three main intervention pillars for decarbonized transport identified in Türkiye's CCDR, along with discussions on the key issues associated with each topic, key policy intervention areas and potential implementation strategies. It is important to note that this article does not provide a comprehensive list of recommended policies for green transport in Türkiye, but rather highlights the need for progress on multiple axes to achieve decarbonization and climate resilience. It also aims to suggest a well-rounded approach that includes a broad spectrum of policy options, including placing greater focus on electrification, public transport, multimodality, and freight efficiency gains.

### *PILLAR 1: Decarbonization, Supported by Electrification*

**Key Issue:** While significant progress has been made on electrification within the Turkish context, electric mobility and electric vehicles (EVs) alone will not be enough to reach net zero in Türkiye by the target year. An electrified approach must be combined with significant investments in public transport and other, low-carbon

<sup>4</sup> Türkiye's CCDR, (2022): 11.

modes that will help keep the motorization rate low while still offering citizens better overall mobility.

*Key Policies:*

- Electrifying 12 percent of cars and 19 percent of buses (both of these measures were at 0 percent in 2020) (CCDR – p. 68);
- Investment in research and development and pilot projects to make technologies to decarbonize heavy industries available and cost-competitive by 2030;
- Government actions and support to ensure institutional readiness for the adoption of zero-carbon fuel aircraft and vessels in domestic transportation;
- Implementing public policies, infrastructure interventions, and behavioral dynamics to achieve long-term transport decarbonization pathways;
- Prioritizing measures to decarbonize and increase the efficiency of trucking operations, as the trucking sector is likely to remain the dominant mode of freight transport;
- Taking steps towards enhancing readiness for the decarbonization of aviation and maritime transport, such as public-private collaboration and research;

On the passenger side, decarbonization will primarily be about managing the transition of car ownership and use.

Implementation Strategy: Deep decarbonization of transport of the kind anticipated under the resilient and net zero pathway (RNZP) scenario outlined by the World Bank, the most recent CCDR (2022) is not significantly more expensive over the 2022–60 timeframe compared with the business as usual scenario in terms of infrastructure investments and is associated with sizable savings in the outyears through reduced oil consumption and the economic value of avoided carbon emissions. The RNZP scenario results in estimated savings of US\$ 114 billion in avoided fossil fuel consumption, without counting the benefits from energy security and reduced exposure to global oil price volatility, and US\$ 639 billion in avoided road transport externalities, all in present value terms cumulative through 2060.<sup>5</sup>

Public policy support would be critical for EV production and adoption. A mandate to increase the percentage of zero and low-emission vehicles, for example, would foster greater EV market penetration by creating incentives for charging infrastructure development and investments in EV and battery manufacturing. However, considering the need to balance EV transition with a focus on decarbonization, the key is to promote conversion to EVs on one hand, and to promote investments in decarbonized public transport on the other. The goal therefore is to green the existing vehicle fleet by converting it to EVs as much as possible, while at the same time resisting an increase in the motorization rate. The latter is accomplished by offering

5) Türkiye's CCDR, (2022): 44.

sustainable mobility options not centered on private vehicle ownership (e.g., mass transit, micro-mobility, active mobility, intercity passenger rail, etc.)

### *PILLAR 2: Multimodality and Public Transport*

**Key Issue:** In 2019 exactly 50 percent of Turkey’s 82.4 MtCO<sub>2</sub>e from transportation came from passenger transport, while the other half from freight transport (CCDR Transport – p. 11). Surveys of Türkiye-based shippers show that a primary reason for the low adoption of rail freight is a generalized lack of last-mile rail connectivity to/from organized industrial zones, major manufacturing facilities, maritime ports, logistics centers, and other cargo-related logistics clusters.<sup>6</sup> At present, only 16 out of 210 ports in Türkiye have railway connections at the “last mile” (for a total length of 85 km). Nevertheless, even this small length accounts for 7.5 percent of the overall freight carried on the national rail network of over 13,000 km. A railway connection to Istanbul’s Ambarlı container port complex, which handled 3.2 million TEUs in 2022 (26 percent of national port throughput), is yet to be completed. Similarly, rail connections to the new Çandarlı (Izmir) and Gemlik (Bursa) ports are still pending.

**Key Policies:** Financial investment focused on infrastructure, paired with railway service delivery improvements can create a set of benefits including increasing rail freight modal share, reducing logistics costs, highway congestion and road infrastructure wear and tear, while also freeing up capital for firms to invest in productivity-inducing projects. This kind of approach would support the government in its national development plan objective of more than doubling the modal share of rail freight to achieve a 10 percent market share by 2023 (CCDR – p. 46). Furthermore, Türkiye’s commodity mix—intense in bulk and breakbulk goods like iron ore, steel products, and cement, as well as bulky products like passenger cars—and the relatively long distances per freight trip are compatible with greater use of bulk and intermodal rail (containers and trailers on rail). To achieve this, supportive, risk-informed urban planning with transit-oriented development to support a modal shift toward rail, public transit, and soft modes such as cycling and walking. Promoting compact and coordinated urban growth, mixed-use urban development, transit-oriented development, and walkable and well-connected streets can help to reduce transport-related emissions in Turkey’s cities. Furthermore, increasing the share of rail in total freight transport to 8 percent (which was at 4 percent in 2020) and achieving a public transit modal share of 49 percent for surface transport (compared to 47 percent in 2020) are good benchmark goals to help facilitate the multimodal shift.<sup>7</sup>

6) Türkiye’s CCDR, (2022): 47.

7) Türkiye’s CCDR, (2022): 68.

Implementation Strategies: Surveys of Türkiye-based shippers show that a primary reason for the low adoption of rail freight is a generalized lack of last-mile rail connectivity to/from organized industrial zones, major manufacturing facilities, maritime ports, logistics centers, and other cargo-related logistics clusters. Managing the transition to higher rates of car ownership proactively is a major development opportunity for Turkey. This will include considering facilitation of electric vehicle adoption with greater provision of public transport (bus services, Bus Rapid Transit services, and urban, suburban and inter-city rail services), shared mobility (such as carpooling services), and active mobility (such as micro-mobility and non-motorized transport) will determine much of Turkey's decarbonization pathway over the next 40 years.<sup>8</sup> Furthermore, Targeted infrastructure investment, complemented by improvements in service delivery on the part of railway undertakings—including private providers under Turkey's reformed railway market consistent with the EU acquis—can bring about sizable gains in rail freight modal share, which would in turn reduce logistics costs, reduce highway congestion and road infrastructure wear and tear, and free-up capital that firms can invest in productivity-inducing projects.<sup>9</sup>

*PILLAR 3: Efficiency Gains in Freight and Logistics Key Issue:* Türkiye's logistics sector is underperforming relative to potential. Logistics infrastructure and service delivery performance, which improved noticeably because of massive infrastructure investments in the 2000s, deteriorated through most of the 2010s, as evidenced by Türkiye's downgrading in the World Bank's Logistics Performance Index (LPI) from 27th place in 2012 to 47th place in 2018. Türkiye's most recent LPI rank—for 2022—improved to 38th in the world, thus showing gains in performance since 2018 and stemming the deteriorating trend, but this result is still below Türkiye's 2012 placement, suggesting untapped potential. Further, logistics in Türkiye are still highly dependent on trucking with little incidence of multimodality, even for long-distance movements. Rail freight captures only about 4 percent of all ton-km transported, significantly less than in relevant high- and middle-income comparator countries. Even if rail freight gained significant modal share in the coming years—an unlikely development without a concerted policy and private sector engagement effort, as evidenced by international experience—this would still leave the trucking sector as the likely dominant mode of freight transport in Türkiye for years to come.

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8) Türkiye's CCDR, "Transport," (2022): 12.

9) Türkiye's CCDR, "Transport," (2022): 12.

*Key Policies:*

- Improving energy efficiency in the transport sector, particularly in carbon- or energy-intensive sectors, to improve external competitiveness and productivity.
- Implementing efficiency-enhancing measures in logistics, such as cargo consolidation, equipment sharing and standardization, digitalization of corridors, and seamless inter-modal truck-rail transitions.
- Logistics modernization towards a more even modal distribution, higher efficiency, and widespread adoption of zero-carbon traction. This will require an “all-of-the-above” approach, of which electrification is only a part.

Implementation Strategies: Even if rail freight gained significant modal share in the coming years, trucking would likely remain the dominant mode of freight transport, as it is in most upper-middle income and high-income countries. Therefore, measures to decarbonize and increase the efficiency of trucking operations deserve policy priority. At current levels of battery technology, electrifying trucking—particularly heavy-duty trucks used for long-haul shipments—is challenging, while other promising technologies, such as hydrogen, are still under development. Complementary measures, such as wider cargo consolidation, equipment sharing and standardization, digitalizing corridors through technologies like intelligent highways and smart railway signaling systems, and more seamless intermodal truck-rail transitions for containerized freight, will therefore be needed to increase the efficiency of trucking and logistics.<sup>10</sup>

While battery technology is likely to evolve to accommodate long-haul trucking operations, no zero-carbon alternatives for long-haul trucking are as yet commercially available, whether in the form of battery technology, alternative (zero-carbon) fuels, or infrastructure solutions such as electrified highways (some of these approaches are being tested). Therefore, complementary measures will be needed, particularly in the short and medium term, to increase the efficiency of trucking and logistics. Electric trucks alone—even in instances where this is already possible, such as in the case of small commercial vehicles—are unlikely to deliver the modernization that Turkey’s logistics sector requires. Examples of efficiency-enhancing measures that can both reduce logistics costs and help decarbonize logistics include wider incidence of cargo consolidation, equipment sharing and standardization, digitalization of corridors through technologies like intelligent highways (ITS) and smart railway signaling systems (digital rail traffic management), and more seamless inter-modal truck-rail transitions for containerized freight.<sup>11</sup>

10) Türkiye’s CCDR, (2022): 46.

11) Türkiye’s CCDR, “Transport,” (2022): 13.

### ***What the World Bank Group is Doing to Support These Efforts***

#### **Priority 1: Logistics and the Middle Corridor (MC)**

Türkiye's position at the western terminus of the MC between China and Europe is of significant strategic importance to Türkiye's trade and growth prospects. For Türkiye, developing the MC is consistent with its aspiration to (1) boost trade and economic integration with the South Caucasus and Central Asia, as well as East Asia, and (2) promote rail freight adoption and reduce logistics costs. The International Rail Logistics and Network Resilience Project (IRREP), under preparation and co-financed by the World Bank, is a first step in turning this aspiration into reality but other links will be needed. Notably, establishing a freight rail link across the Bosphorus at Istanbul's Third Bridge is a crucial missing link for continuous railway connections from end to end along the MC at higher freight volumes. The World Bank can convene the donor community to make the case for and finance this link. Logistical centers are also suffering from underinvestment in Türkiye. A study on this subject could be a first step towards improving overall logistical performance in the country.

#### **Priority 2: Urban transportation and mobility for continued growth**

Essential to the decarbonization of Türkiye's economy, cities need to invest in mobility solutions that will allow them to remain the country's engines of growth and competitiveness. eMobility, public transit, transit-oriented development, use of all available modes of transport including ferries, micro mobility, and improved intermodal connectivity of urban transit all offer interesting possibilities for Türkiye to maintain and enhance mobility in its urban areas.

The World Bank suggests that Türkiye consider establishing a national eMobility platform to enable municipalities to procure eBuses under concession or leasing agreements from private providers. This method of pooling demand to help overcome the high capital cost of entry into the eBus market has been implemented with success in India where it is known as the Grand Challenge, and economic savings of more than 30 percent have been demonstrated for eBuses. Such a platform would require cooperation among municipalities and the Government of Türkiye to build capacity for procuring and managing such contracts and linking demand with eBus manufacturers who could supply the needed vehicles. From this perspective, manufacture of EVs in Türkiye is also an attractive possibility for private sector driven growth in a green industry with export potential.

#### **Priority 3: Ports and decarbonization of maritime transport**

Türkiye is a maritime shipping power of regional significance, and its trade footprint is amplified by its position as a transshipment hub and the western terminus of the



MC. Further development of the ports sector to improve governance, last-mile and hinterland connectivity, efficiency, and readiness for low- and zero-carbon bunker fuels (LZCBF) will be necessary to maintain the sector's ability to serve Türkiye's growing exports and meet the low-carbon regulations emerging from its main trading partners in the EU. At the same time, the World Bank is helping Türkiye explore its potential to produce or distribute LZCBF as a source of growth and jobs that also support international efforts to decarbonize global shipping. The intention would be to use shipping as a possible anchor customer for green methanol, hydrogen, and/or ammonia to be produced in Türkiye from renewable sources.

#### Priority 4: Network resilience

A national-level assessment of the vulnerability of Türkiye's transport infrastructure and services is needed but has never been conducted. This would be a good time to fill this gap, and the WBG is bringing resources to aid in doing so. A high-level assessment conducted for the Türkiye CCDR showed that there are significant risks to the road and rail networks, and that at least two of Türkiye's main airports and seaports are exposed to flooding risks. A detailed, national study modeling impacts across the whole Turkish transport network will permit the government to understand specific systems or locations that are vulnerable to climate-related threats (e.g., flooding, precipitation, landslides, and wildfires) and other natural hazards (e.g., earthquakes). This in turn makes it possible to begin identifying asset management and investment priorities in both hard infrastructure and softer systems to help manage disaster risk in the network and around the country as a way of increasing resilience in mobility and logistics. A resilient transport system is itself a critical element of overall societal resilience because it is essential to moving disaster-affected people out of danger zones and moving needed relief or reconstruction supplies to the danger zones. Türkiye should begin to study its options in this domain.