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BEYOND FOSSIL FUELS: CHARTING A SUSTAINABLE TRANSPORT PATHWAY FOR BANGLADESH

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Beyond Fossil Fuels: Charting a Sustainable Transport Pathway for Bangladesh

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Executive Summary

Bangladesh's transport sector stands at a critical turning point. It is indispensable for economic growth, employment, trade, market access, and mobility. At the same time, it is increasingly exposed to climate risks and is becoming a growing source of greenhouse gas emissions. The sector employed around 6.71 million people in 2022 and accounts for about 15% of Bangladesh's total emissions, making it the second-largest source of domestic energy-related emissions. Emissions from the sector have also increased rapidly over time, reflecting rising urbanisation, economic expansion, road dependence, and fossil fuel use. This paper argues that Bangladesh can no longer treat transport merely as an infrastructure issue. It must be placed at the centre of the country's climate, energy, industrial, urban, and development strategies.

Bangladesh's transport infrastructure is highly vulnerable to climate change. Floods, cyclones, storm surges, salinity intrusion, landslides, erratic rainfall, and heat stress are already affecting roads, bridges, culverts, and communication networks. Rural roads, many of which fall under the Local Government Engineering Department, are particularly exposed because of poor conditions and limited technical and financial capacity for climate-resilient maintenance. In 2023, climatic hazards caused an estimated annual loss of USD 179 million to road and rail infrastructure. The risks are also socially uneven. By 2050, up to 50.4% of women could risk losing access to transport infrastructure. The paper therefore highlights that climate resilience must be a central part of transport planning, not an afterthought.

The emissions profile of the sector shows two closely related problems: road dominance and fossil fuel dependence. Road transport has become the dominant mode of mobility, while rail and inland waterways remain underutilised despite their potential for lower-carbon movement of people and goods. Transport-related CO2 emissions have been rising, with a sharper increase after 2005. Road vehicles are also growing rapidly, with the Integrated Power and Energy Master Plan 2023 indicating an annual rise of 12.4% in the number of road vehicles. Although the share of natural gas in road transport increased after 2000, oil products still carry the main fuel burden. Rail and navigation remain fully dependent on oil products. This creates a serious challenge: if Bangladesh continues on a business-as-usual pathway, transport emissions, energy imports, congestion, and air pollution will continue to rise together.

The paper situates Bangladesh's transport transition within the broader climate policy context. Under NDC 3.0, Bangladesh has set transport-sector mitigation targets up to 2035, including emission reductions under both unconditional and conditional scenarios. The transport priorities include improving fuel efficiency, promoting low-carbon transport systems, and supporting modal shifts. Specific actions include the expansion of MRT and BRT systems, promotion of electric vehicles, electrification of railway routes, installation of solar-equipped railway stations, and modernisation of rolling stock and signalling systems. Bangladesh's inclusion of an explicit transport mitigation target in its third-generation NDC is important. Yet the paper also notes a central concern: many climate finance commitments remain voluntary and non-binding, which creates uncertainty about implementation, especially for countries with large infrastructure and financing needs.

Bangladesh already has several relevant policies for a greener transport sector, including the Automobile Industry Development Policy 2021, the Electric Vehicle Registration and Operation Policy 2023, the Electric Vehicle Charging Guideline, the National Integrated Multimodal Transport Policy, the National Air Quality Management Plan, and the Bangladesh Climate Prosperity Plan 2022-2041. These policies contain important commitments on electric mobility, charging infrastructure, multimodal transport, railway expansion, inland waterways, cleaner buses, vehicle standards, public transport, walking, cycling, and climate-resilient infrastructure. However, the policy landscape remains fragmented. The paper identifies major gaps in policy coherence, financing, implementation capacity, monitoring, compliance, and institutional coordination. In some cases, policies set ambitious targets but do not provide adequate financial or operational mechanisms. In others, existing transport laws do not sufficiently address electric mobility or sustainability. As a result, Bangladesh has many policy signals, but not yet a fully integrated implementation framework.

To assess the economy-wide effects of green transport strategies, the paper uses a recursive dynamic Computable General Equilibrium model for Bangladesh. The model is calibrated with a 2022 Social Accounting Matrix and captures linkages across sectors, households, government, factor markets, product markets, investment, trade, and the rest of the world. It also includes a household survey module, allowing impacts to be assessed across different household groups. This is important because transport reform affects not only emissions, but also GDP, employment, household income, poverty, productivity, fuel use, and structural transformation. The baseline scenario assumes Bangladesh's GDP at factor cost grows by 6.10% annually during 2023-24 to 2035-36, broadly maintaining the country's historical growth momentum.

The modelling exercise considers four transport-sector decarbonisation scenarios and one combined scenario. The first promotes electric buses, assuming that 25% of buses will be electric by 2035. The second considers private electric car adoption, assuming that 30% of passenger cars will be electric. The third focuses on rapid transit and road infrastructure improvements to reduce travel time, increasing average traffic speed from 7 km per hour to 10 km per hour. The fourth covers railway electrification and metro rail expansion, including a 142 km operational metro rail network and 348 km of electrified railway by 2035. The combined scenario brings all these interventions together. These scenarios are not just emissions-reduction exercises. They also test how cleaner and more efficient transport systems can improve productivity, reduce congestion, support labour mobility, and generate wider economic gains.

The simulation results show that transport-sector decarbonisation can deliver substantial development benefits. Under the combined transport scenario, GDP growth rises from the baseline rate of 6.10% to 6.54%. GDP in 2035 becomes 4.1% higher than the baseline. The strongest individual impact comes from the rapid transit scenario, which raises GDP by 2.6% above the baseline and increases GDP growth to 6.39%. This reflects a simple but powerful point: congestion is not only a transport problem. It is a macroeconomic constraint. In 2023, slow traffic caused an estimated loss of 3.2 million work hours per day, equivalent to USD 4.38 billion in GDP. If the trend continues, the loss could rise to around 6 million work hours per day, equivalent to USD 9 billion in GDP. By contrast, private electric car adoption has almost no meaningful GDP effect because it

mainly changes the consumption pattern of richer households rather than expanding productive transport services.

The employment and welfare results are also important. The combined transport package creates 2.02 million additional jobs by 2035 compared with the baseline. Rapid transit alone creates 1.24 million additional jobs, while electric buses create 0.45 million and railway electrification and metro expansion create 0.20 million. The combined transport package also raises household income by 3.8% for the bottom 30%, 3.1% for the middle 50%, and 2.1% for the richest 20%. This means the gains are relatively stronger for poorer households. The poverty impact follows the same pattern: the full transport package lifts an additional 0.8 million people out of poverty by 2035, with rapid transit contributing the largest poverty-reducing effect among the individual interventions.

The policy message is clear. Bangladesh's low-carbon transport strategy should not be narrowly centred on private electric vehicles. Electrification is important, but its development impact depends on where it is applied. Electric buses, rapid transit, metro rail, railway electrification, and better road infrastructure deliver much larger economic and social gains because they affect a wider share of the population and improve productivity. Public and mass transport should therefore receive priority. Private electric cars can still contribute to emissions reduction, especially in the long term, but they should not dominate public policy, fiscal incentives, or infrastructure planning.

The paper concludes that Bangladesh needs a comprehensive and realistic transport transition strategy. This should include climate-resilient infrastructure, investment in public transport, expansion of multimodal systems, stronger rail and inland waterway services, cleaner vehicle standards, reliable EV charging infrastructure, and a credible financing plan. Policy implementation must be backed by clear institutional mandates, monitoring systems, compliance mechanisms, and coordination across ministries and agencies. Without addressing financing and implementation barriers, even well-designed policies will remain on paper. With the right choices, however, Bangladesh can use transport-sector transformation not only to reduce emissions, but also to raise growth, create jobs, reduce poverty, lower congestion costs, improve air quality, and support a more inclusive development pathway.

1. Introduction

The transport system is an essential element of the economic development of any country, given its role in improving market efficiency and reducing costs by ensuring access to markets, labour, and services. The transport sector not only creates direct employment but also has indirect effects by boosting the economy through increased income and added demand (Rodrigue and Notteboom, 2013). However, it is also one of the major contributors to greenhouse gas (GHG) emissions, responsible for about 23% of man-made CO2 emissions worldwide. From 1990 to 2022, transport emissions grew at an average annual rate of 1.7%, which is higher than in any other sector except industry (IEA, 2023). It is also one of the largest consumers of fossil fuels.

Bangladesh is the thirteenth most climate risk-affected country (Adil et al., 2025). The consequence of a changing climate is no longer an issue of the distant future, but a present reality. Between 2000 and 2019, there were 185 extreme events, resulting in 0.38 fatalities per 100,000 people (Eckstein et al., 2021). The consequences of climate change are estimated to result in 13.3 million internal climate migrants by 2050 (World Bank, 2018).

Bangladesh's contribution to climate change has been negligible, accounting for only 0.4% of global emissions. However, rapid economic growth and urbanisation have resulted in higher GHG emissions. GHG emissions from energy and fuel combustion surpassed emissions from the agriculture sector in 2017 (World Bank, 2022). While the transport sector employed 6.71 million people in Bangladesh in 2022 (ILO, 2023), it is also responsible for 15% of the country's total emissions, making it the second-highest source of domestic energy-related emissions. Emissions from the sector have increased annually by 9% since 1971 (World Bank, 2022).

COP30, held in Belém, Brazil, in November 2025, was a landmark moment for the green transition in the transport sector. In this round, a dedicated Transport Pavilion was established in the COP Blue Zone, reflecting growing recognition of the sector's centrality to climate action (SLOCAT, 2025). Additionally, a Declaration on Low-Emission Transport, launched by Chile, was endorsed by ten additional countries. The Declaration committed to bringing down the transport sector's energy demand by 25% by 2035, with one-third of the fuel demand to be supplied through renewable sources and/or sustainable biofuels (GIZ and SLOCAT, 2026). The conference concluded with 195 Parties adopting the Belém Package, a set of 29 decisions covering just transition, adaptation finance, trade, gender, and technology. Notable decisions include the commitment to mobilise USD 1.3 trillion annually by 2035 for climate action and triple adaptation finance (UN News, 2025).

Despite the wide range of commitments, the success of the Conference in bringing countries together to tackle the changing climate remains questionable. According to the UNEP Emissions Gap Report 2025, even the full implementation of all third-generation NDCs would result in global warming of 2.3–2.5°C by the end of the century. Furthermore, the Belém Package has explicitly deferred the question of phasing out the use of fossil fuels (UN News, 2025). The transport sector, accounting for 15.9% of global GHG emissions in 2024, remains mostly dependent on fossil fuels (UNEP, 2025; GIZ & SLOCAT, 2026). For fossil-fuel-dependent sectors such as transport, this omission may lead to

long-term negative consequences. In addition, the ability to fulfil the commitments is likely to be constrained by financing gaps, especially for countries such as Bangladesh. The country submitted its NDC 3.0 within this cycle, placing it among the only six Asian countries to include an explicit transport GHG mitigation target in their third-generation NDC (MoEFCC, 2025; GIZ & SLOCAT, 2026). With the financial commitments outlined in COP30 being non-binding and voluntary, the extent of the implementation of the country's commitments remains a central concern.

Bangladesh's vulnerability to climate change will put development progress at risk in the coming decades. To sustain three decades of economic growth and poverty reduction trends, Bangladesh must identify key climate-related vulnerabilities and contributing sectors and take proactive measures for both mitigation and adaptation. The centrality of the transport sector in the economy, as well as its role as a primary emitter, underscores the need for Bangladesh to address the vulnerability of the sector while exploring pathways to reduce its carbon footprint. Building on this, this paper aims to provide a comprehensive analysis of Bangladesh's transport sector, highlighting the sector's vulnerabilities to climate change, existing measures in place, and identifying successful pathways for a sustainable, low-carbon transport future.

By bringing into focus the current challenges and opportunities for creating change within the sector, the paper generates valuable insights for Bangladesh's climate policy development. Existing transport sector policies have been reviewed to determine the gaps in policy coherence. Additionally, through an economy-wide modelling exercise, the overall macroeconomic impact of various green transport strategies has been evaluated. Thus, this paper will contribute to the Government's ongoing efforts to reform Bangladesh's transport sector in alignment with its climate goals.

This paper is structured as follows: the next section assesses the risks posed by climate change to the country's infrastructure, identifying area-specific vulnerabilities. The third section synthesises emission-relevant information on the transport sector, disaggregated by different modes. It also provides a regional comparison to assess Bangladesh's relative position in the emissions profile. The fourth section outlines Bangladesh's commitments and the pathways for transforming the transport sector. The following section further elaborates on the policy framework of the sector and positions existing policies against climate needs. Section 6 presents the results of a Computable General Equilibrium (CGE) model analysis that compares different scenarios in the transport sector and their impacts on different macroeconomic and environmental indicators, thereby generating quantitative evidence on the benefits of green transport strategies. Based on the discussion in the previous sections, the following section highlights the barriers and enabling conditions for a sustainable transport transition in Bangladesh. The paper concludes with a synthesis of key findings and recommendations for policy action.

2. Climate Change and Infrastructure Vulnerability

Climate change will increasingly expose Bangladesh to natural hazards. In 2023, Bangladesh ranked 191 out of 208 countries in the National Road Vulnerability Index (Koks et al., 2023). Increasing climate change risks impact the entire transport sector value chain, with the road sector being the major mode of transportation. Most of the roads are in poor condition, and the rural roads, under the authority of the Local

Government Engineering Department, are particularly vulnerable due to technological and resource constraints. In 2023, there was an annual loss of 179 million USD to the road and rail infrastructure due to climatic hazards (Climate Disaster Resilience Initiative, 2023). By 2050, up to 50.4% of women risk losing access to transport infrastructure (Global Centre on Adaptation, 2022).

Three types of challenges make the road sector vulnerable to climate change: sea level rise leading to salinity, storms and cyclones, and excess rainfall causing flash floods and riverine floods. The areas of north-central Sherpur, Jamalpur, and Gaibandha districts, as well as southwest Satkhira, Barisal, and Pirojpur districts, are the most vulnerable in this regard. Different regions in the country face different challenges from climate change. Table 1 outlines the potential area-specific impacts of climate change on the transport sector (Goosen et al., 2018).

Table 1: Potential impacts of climate change on the transport sector based on area

Area	Potential impacts
Haor region	• Damage to roads due to inundation and erratic rainfall
Coastal areas	• Damage to the road crust due to salinity, concrete roads are not salinity-tolerant • Damage to local roads due to cyclones/ storm surges, and floods
Flood-prone areas	• Damage to bituminous road crust due to floods, high temperatures, and erratic rainfall • Damage to bridges, culverts, and roads • Damage to local roads due to floods
Chittagong Hill Tracts and Coasts	• Damage to the road and communication infrastructure due to landslides • Damage to roads due to loose topsoil in hilly areas • Damage to bridges/culverts due to erratic rainfall

Source: Adapted from Goosen et al. (2018)

The transport sector is one of the largest contributors to air pollution in Bangladesh. Air pollution has been ranked as the second-highest risk factor for deaths and disability in the country (Raza et al., 2022). Particulate Matter 2.5 (PM2.5), a key pollutant linked to transport pollution, has significant negative health impacts. The lack of vehicular fitness is largely responsible for the increased air pollution in urban areas. An analysis of vehicle performance in Dhaka City in 2018 indicated relatively better performance of CNG/Octane vehicles (Table 2). However, diesel vehicles, regardless of their category, performed poorly. Buses were found to be the highest polluters: 84% of buses and minibuses were found to be emitting more than the permitted value (Department of Environment, 2019).

Table 2: Performance of different categories of vehicles

CNG/Octane vehicles			Diesel Vehicles		
Category	**Total Vehicles tested**	**% of vehicles passed**	**Category**	**Total Vehicles tested**	**% of vehicles passed**
Auto Rickshaw	144	92.3	Bus	158	16
Bus	67	74.5	LDV	203	41.4
Car	243	87.8	Truck	1411	31
Light Duty Vehicles	118	76.7			
Motorcycle	243	22.2			

Source: Compiled by Authors from the Department of Environment (2019)

3. Emissions Profile of the Transport Sector

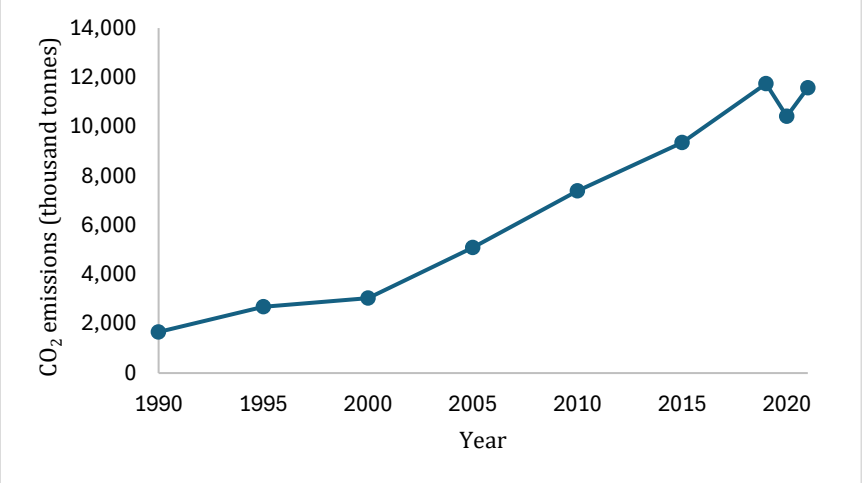
In 2022, Bangladesh emitted 252.04 million tonnes of CO_2 equivalent ($MtCO_2eq$) (MoEFCC, 2025). The transport sector in Bangladesh is a key contributor to the country's overall GHG emissions. It is necessary to dissect the emission profile to effectively design strategies for reduction. This section provides an overview of the sector's emission trends over the years. It also highlights the road dominance in mobility through increasing vehicle numbers and the sector's reliance on fossil fuels.

3.1. Sectoral CO_2 Emission Trends

The transport sector has played an important role in the economic development of Bangladesh. Driven by rapid urbanisation and economic growth, the demand for personal and private transportation has been rising. It is estimated that 3.2 million two- and three-wheelers will be added between 2020 and 2050 (Gota & Huizenga, 2022). The sector, being heavily reliant on fossil fuels, is one of the major contributors to greenhouse gas emissions and air pollution in Bangladesh, responsible for 14% of the GHG emissions from fuel combustion in the country. The increasing number of vehicles is putting significant pressure on the energy consumption and GHG emissions in Bangladesh (Raza et al., 2022). Furthermore, transportation infrastructure, such as land, water, and air, emits CO_2 during the construction and maintenance phases as a result of the consumption of raw materials and energy.

Figure 1 shows the rising trend in CO_2 emissions by fossil-fuel-dependent transport. Although it has been gradually increasing since 1990, from 2005, the rise has been steeper.

Figure 1: Fossil fuel transport CO_2 emissions (thousand tonnes)



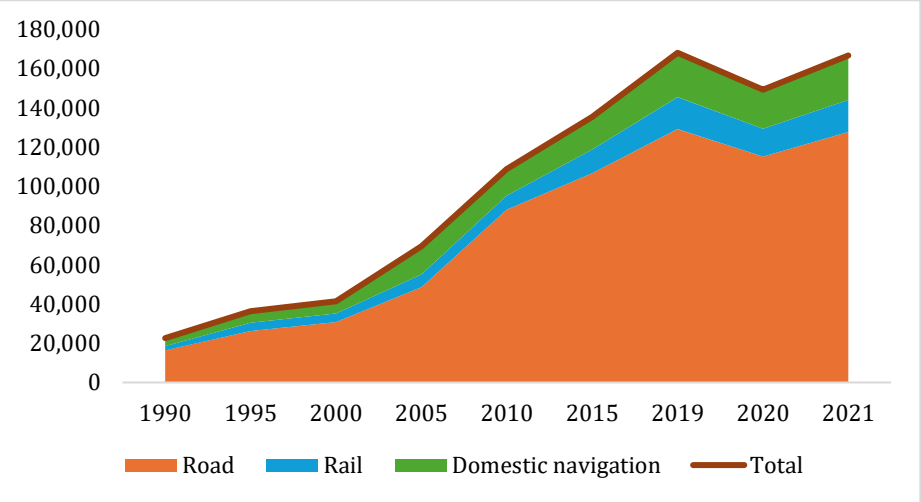
Source: Emissions Database for Global Atmospheric Research

3.2. Road Dominance and the Reliance on Fossil Fuels as an Energy Source

Figure 2 shows the energy consumption by different transport modes. Road transport has dominated the sector among the different modes in recent years. Although the fuel consumption for navigation has steadily increased owing to abundant river transport, demand for automobiles has been increasing as the economy grows. According to the

Integrated Power and Energy Master Plan 2023, the number of road vehicles has been rising at an annual rate of 12.4%.

Figure 2 Transport sector energy consumption (TJ)



Source: UN Energy Statistics Database

Table 3 illustrates the reliance on fossil fuel sources by all modes (road, rail, navigation) since 1990. The road sector had been completely dependent on oil products up until 2000, after which the share had been gradually declining over the years, with natural gas replacing oil. However, the lion's share of the burden is still borne by the oil products. On the other hand, both the rail and navigation sectors are completely reliant on oil as the primary source of fuel.

Table 3: Energy consumption sources (different modes)

	Road			Rail	Navigation
	Oil products	**Natural gas**	**Electricity**	**Oil products**	**Oil products**
1990	100%	0	0	100%	100%
1995	100%	0	0	100%	100%
2000	100%	0	0	100%	100%
2005	93%	7%	0	100%	100%
2010	56%	44%	0	100%	100%
2015	60%	40%	0	100%	100%
2019	67%	33%	0	100%	100%
2020	68%	32%	0	100%	100%
2021	71%	28%	1%	100%	100%

Source: UN Energy Statistics Database

Responsible for only 0.4% of the global emissions, Bangladesh has a negligible impact on the overall climate change. However, with a large population and economic growth, if the country follows a "business-as-usual" (BAU) pathway, GHG emissions will rise significantly. With the number of road vehicles rising at an annual rate of 12.4%, the size of the transport sector has been experiencing rapid growth (Ministry of Power, Energy and Mineral Resources, 2023). Under the BAU scenario, total GHG emissions in Bangladesh will increase from 169.02 Mt CO_2e to 409.4 Mt CO_2e in 2030 (MoEFCC, 2021). Under the Paris Agreement adopted in COP21 in 2015, countries pledged to move towards a sustainable development pathway by limiting global warming within 1.5-2 degrees Celsius above pre-industrial levels. As a signatory to the Agreement, Bangladesh has been doing its part by taking proactive measures to bring down its emission levels as

well as build resilience to a changing climate. The country has been formulating its Nationally Determined Contributions (NDCs) since 2015 and has prepared the latest version in 2025, a key element of the Paris Agreement. The transport sector is a key part of the NDC. The critical issues of the sector- the road dominance and fossil fuel dependence- have been targeted through various measures. The next section outlines the key priority areas and the proposed actions.

4. Nationally Determined Contributions and Sectoral Mitigation Goals

The transport sector in Bangladesh is responsible for fuel combustion from the road, rail, and inland water transport systems. The time period considered in the NDC 3.0, published in 2025, is up to 2035. It goes beyond the INDC in 2015 and the Updated NDC in 2021, though setting more ambitious targets for 2035. From the transport sector, 7.74% and 14.03% emission reduction has been promised in the unconditional and conditional scenarios, respectively. Table 4 provides a comparison of the targets set in NDC 2021 and 3.0.

Table 4: GHG emission mitigation targets in the transport sector in 2030 and 2035 under NDC 2.0 and NDC 3.0

	NDC 2021 (updated)			NDC 3.0		
	BAU Emission	**Reduction in $MtCO_2eq$**	**%**	**BAU Emission**	**Reduction in $MtCO_2eq$**	**%**
Unconditional	36.28	3.39	12.3	30	2.32	7.74
Conditional		6.33	10.23		4.21	14.03

Source: Compiled by Authors from NDC 2021 (MoEFCC, 2021) and NDC 3.0 (MoEFCC, 2025)

The NDC 3.0 has put forward targets for GHG emission reduction for different sectors. In this light, several mitigation actions have been proposed in the document. The specific priorities include the improvement of fuel efficiency, the improved use of a less carbon-emitting transport system, and a modal shift. Table 5 outlines the priorities and mitigation actions proposed in the NDC 3.0 under unconditional and conditional scenarios.

Table 5: Mitigation actions for the transport sector under conditional and unconditional scenarios in NDC 3.0

Sub-sector	**Priority actions**	**Actions by 2035**	
		Unconditional	**Conditional**
Road	Modal shift to MRT/BRT		Construction of the following MRT lines in Dhaka: MRT-1 MRT-2 MRT-4 MRT-5N MRT-5S Construction of BRTs in major cities
	Promotion of Electric Vehicles in the public vehicle fleet	30% of passenger cars will be EVs	25% of buses in Dhaka city area will be EVs

Sub-sector	Priority actions	Actions by 2035	
		Unconditional	Conditional
Rail	Improving fuel efficiency and electrification	Implementation of solar-equipped railway stations and installation of solar energy plants on at least 30% of railway-owned vacant land. 20% of this target will be unconditional Electrification of a 348 km railway route, of which 20% will be unconditional Purchase of modern rolling stock Introduction of the colour light signalling system	Implementation of solar-equipped railway stations and installation of solar energy plants on at least 30% of railway-owned vacant land. 80% of this target will be conditional Electrification of a 348 km railway route, of which 80% will be unconditional

Source: Compiled by Authors from NDC 3.0 (MoEFCC, 2025)

5. Policy Landscape and Institutional Architecture

NDC 3.0 outlines the new commitments for aligning the development of a sustainable transport system with Bangladesh's climate goals. It focuses on the promotion of e-mobility, rail electrification, expansion of mass transport, strengthening inland waterways, and the integration of environmentally friendly mobility such as walking and cycling. To achieve these objectives, the NDC outlines the necessary policy measures, as discussed in Table 6.

Table 6: Policy measures in transport

Sub-sector	Priority Measures
Road	• Develop a national e-mobility roadmap with clear milestones • Enforcing vehicle and battery standards and offering fiscal incentives, raising consumer awareness • Expanding EV charging and parking infrastructure • Developing skilling and certification programs for EV operators, mechanics and technicians
Rail	• Expansion of the rail network to ease pressure on roads • Electrification of priority sectors and digitalisation of signalling systems
Water	• Promotion of inland waterways • Promotion of low-carbon vessels and green transport hubs
Urban transport	• Expansion of MRT and BRT systems • Electrification of the bus fleet in Dhaka • Developing the EV charging infrastructure and safety standards to reach the set goal • Encouraging walking and cycling with public transport through multimodal hubs
Cross-cutting measures	• Ensuring environmentally sound sustainable management of battery recycling and e-waste

Source: Compiled by Authors from NDC 3.0 (MoEFCC, 2025)

There is a robust domestic climate policy framework in Bangladesh focused on building resilience. Most of the existing policies in the transport sector in recent years have a climate focus, fostering efficiency through a sustainable process. An overview of the policies presents their alignment with Bangladesh's climate goals in the NDC. Existing policies prioritise the adoption of electric vehicles, the creation of multimodal transport options, maintaining vehicle standards, and providing the necessary infrastructural support.

5.1 Electric Mobility as a Green Transport Option

Globally, the transport sector is responsible for 20% of the total carbon emissions (World Economic Forum, 2022). Ensuring net-zero emissions requires that sectoral emissions be reduced by a quarter by 2030. In this circumstance, electrification of the transport sector is, therefore, an unavoidable measure.

Electric mobility consists of Electric Vehicles (EVs), which are a broad term for vehicles with at least one electric motor and an electric energy supply system, which can be an on-vehicle storage system (i.e., a battery) or an off-vehicle power system (power grid). There are a number of subsets of EVs (Eisenmann et al., 2021). The most conventional ones are listed below:

- Fuel cell electric vehicle: additional on-vehicle electricity generation system (fuel cell or solar cell)
- Hybrid electric vehicles (HEV): vehicles containing an additional energy source, such as combustion engines and an energy supply system (additional fuel)
- Battery electric vehicle (BEV): EVs with a battery as an electric storage system on the vehicle
- Plug-in hybrid electric vehicle (PHEV): Hybrid electric vehicles with a large capacity and a high-voltage electric storage system. These can be charged from the grid.

5.2. Policy Support for EV Rollout

Bangladesh is moving towards EV adoption in its transport sector. However, the progress has been slow with various infrastructural and financial barriers. Faster electric vehicle rollout in Bangladesh requires policy support. A number of policies and guidelines are already in place, which are reviewed in the following section.

Automobile Industry Development Policy, 2021

The objective of this policy is to establish Bangladesh as a regional hub for automobile production by 2030, which will contribute to its economic growth, technological advancements, and sustainable development. The policy prioritises innovation and research to promote local production of auto parts and addresses environmental concerns through the development of energy-efficient and eco-friendly vehicles (Ministry of Industries, 2021).

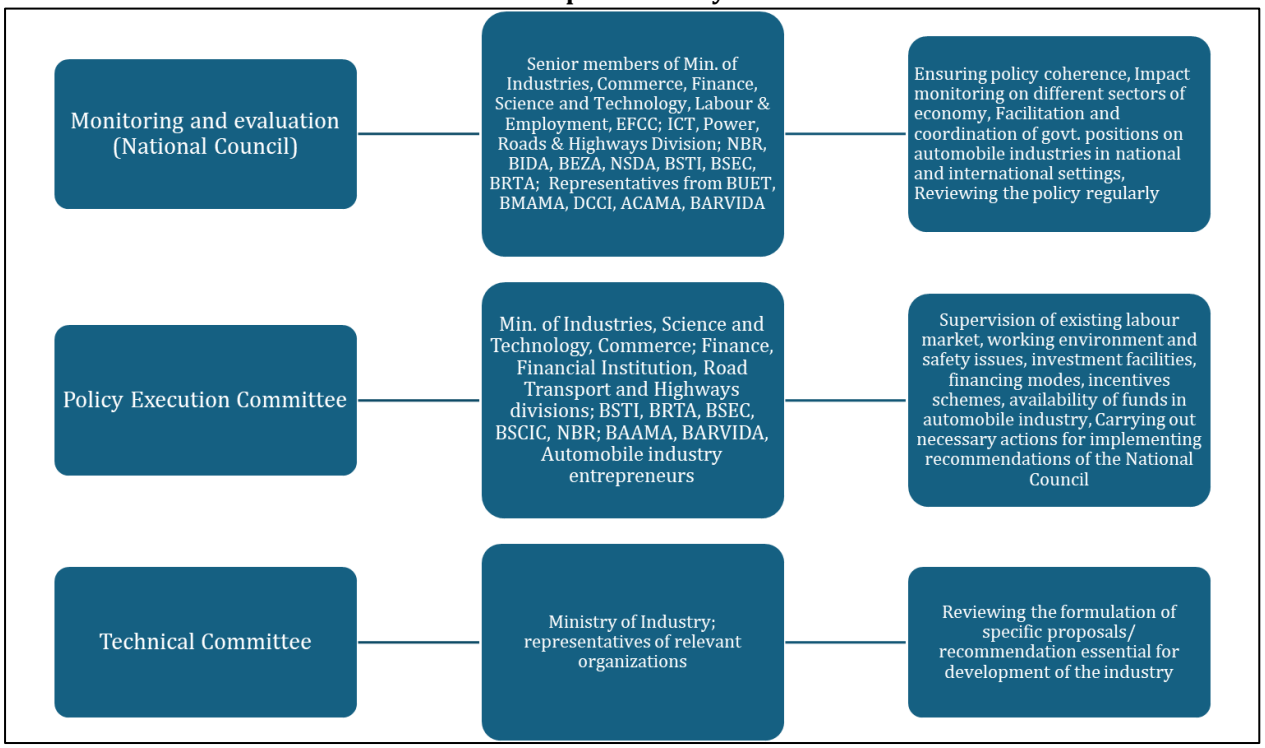
The policy aims to expand the automobile industry, increase foreign investment, set emission and safety standards, and encourage local production through several

strategies, as discussed in the next section. The strategies to develop the automobile industry are as follows:

- **Promotion and development of the local automobile industry:** The government prioritises the local production of both commercial and passenger vehicles. Incentives will be provided based on the level of local value addition, technology transfer, expertise improvement, foreign earnings, strengthening of the manufacturing value chain, linkage creation within the industry, and R&D investment. A phased incubation approach will be adopted to promote continued growth and efficiency of the local investors. As part of the financial incentives, the incidence of the Total Import Tariff will be fixed in a way to facilitate the actual development capabilities of the local automobile industry, rather than limit them to assembling factories. A tax incentive system will also be introduced to support the subcontracting of local SME industries with large and already established automobile industries. Anti-dumping duties will also be implemented to check dumping and unfair trade practices.
- **Development of the Automobile Market:** To encourage domestic and international demand, local manufacturers will be prioritised in public procurement. Furthermore, the policy supports the usage of micro-dot technologies like proof marking and coding to help identify locally produced vehicles, aiding market expansion and improving brand visibility.
- **Production of local auto parts:** The government will provide necessary training to local manufacturers to produce Original Equipment Manufacturer (OEM) standard parts. A tax exemption facility will be provided based on the level of investment in the automobile manufacturing sector. Furthermore, factories that will produce import-substituted parts will be provided with tax holiday facilities, while buyers of locally produced/assembled vehicles will also enjoy a percentage of income tax relief proportionate to the value of the purchased vehicle.
- **Progressive manufacturing plan:** Local manufacturers will be encouraged to increase local value addition. To promote sustainable usage, guidelines on reconditioned car management and automobile scrapping will also be formulated.

The implementation and monitoring of the policy will involve a wide range of stakeholders from both the public and private sectors. Ministry of Industry will take the lead role in all three areas- execution, monitoring, and evaluation- and provide technical expertise. Figure 3 summarises the institutional architecture for the policy.

Figure 3: Institutional architecture for the implementation of the Automobile Industry Development Policy



Source: Compiled by Authors from Automobile Industry Development Policy (Ministry of Industries, 2021)

Electric Vehicle Registration and Operation Policy 2023

A landmark step toward promoting sustainable transportation, this policy outlines the registration and operational framework for electric vehicles. It aims to achieve the target of having 30% of electric vehicles on the road by 2030. In addition to a clear definition of electric vehicles, it provides guidelines for registration processes and for determining the economic life of the vehicles in order to ensure a cleaner environment (BRTA, 2023). According to this policy, special incentives will be provided through reduced import duties, tax benefits, and subsidies for local manufacturers and importers to encourage EV adoption.

To minimise the environmental impact of the vehicles, registration for the EVs will be granted for a specific period aligned with their economic life. The registration will be cancelled once the period expires, and the vehicle will be scrapped.

The Electric Vehicle Charging Guideline

The guideline primarily aims to prepare practical plans for integrating EV charging infrastructure into urban design, ensuring accessible, affordable, and effectively positioned infrastructure to meet the needs of the whole population (Power Division, 2022). The development of these infrastructures will facilitate the broader market for EVs and promote uptake among consumers and significantly contribute to reducing emissions in the long term. Additionally, it also has the aim to integrate small businesses into the EV charging market. The strategies for implementation are as follows:

- **Private charging stations**: A key strategy within the guideline, private charging stations can be built by individuals or companies on their premises by adhering to

safety and operational standards. The tariff system for private stations will be based on the type of charging equipment used and the operational costs associated with the provision of the service, while the pricing structure for charging will be based on standards ensuring secure and reliable charging services, with clear pricing guidelines provided for both small and large fleets.

- **Public charging stations**: Pivotal for making EVs accessible to the general population, public charging stations will be constructed in several phases. In the first phase, priority will be given to the centre points in divisional towns, important highways, and strategic locations, while the second phase will cover additional areas and establish charging stations with specific power capacities. The service charges for these stations will be based on established pricing standards and will be reviewed periodically to ensure the competitiveness of the electric vehicles.

5.3. Policy Support for an Integrated Approach

For the transport sector, the NDC identifies improving fuel efficiency and the condition of the inland water transportation system, and increasing the usage of less emissions-based transport systems as key priorities. Given the current level of preparedness, solely relying on electric vehicles will not be sufficient. Bangladesh needs to adopt an integrated approach covering all modes of transportation. This will allow for the reduction in road sector dominance and thereby result in a low-emission scenario. The following policies provide the framework for achieving this:

The National Integrated Multimodal Transport Policy

Approved in 2013, the primary goal of the policy is to create a sustainable, integrated and efficient transport system catering to the requirements of both passengers and freight, that is economically feasible, environment-friendly, and has the capacity to support Bangladesh's growing economy and regional trade. The policy highlights a paradigm shift by focusing on reducing road dependence and emphasising railway and inland water transport development. It also prioritises the improvement of transport infrastructure, particularly through a public-private partnership model. The policy places special emphasis on ensuring the best utilisation and maintenance of existing assets and infrastructure. Within this policy framework, separate policies have been set out for each sector (Ministry of Communication, 2013). The sub-sectoral policies are discussed as follows:

- **Railways**: It is intended to develop the Bangladesh railway to meet the needs of passengers and freight customers through specific mechanisms. These include:
  - Reducing road pressure by enhancing service quality for passengers.
  - The policy emphasises the development of multimodal corridors between major economic centres.
  - Expanding the rail network in all regions of the country to make the rail service more accessible
  - Modernising the system through the introduction of electric traction, ticket punching, chord line, monorail, etc.
  - Corporatisation of the Bangladesh railway to introduce efficient business practices and planning for financing the measures needed to achieve the objectives.

- **Inland Water Transport:** In addition to an emphasis on dredging activities for improving navigability, the policy also focuses on investing in new ports to better serve increasing passenger and bulk cargo needs. It calls for strengthening research into more fuel-efficient vessels. It seeks to digitise the sector and introduce water buses to provide door-to-door services.
- **Road transport:** The policy places the highest priority on improved road maintenance. One unique feature of the policy is the focus on reducing road congestion through measures such as introducing user charges, improving traffic management measures, and promoting capacity building for addressing existing network congestion. The policy addresses the environmental concern for the road networks by emphasising the need for conducting full social and environmental appraisals of road projects with sustainable action plans to mitigate the adverse effects of road projects.
- **Environment-friendly, efficient transport:** The policy prioritises greener, cleaner vehicles with less environmental impact, as well as better public transport and measures that assist non-motorised transport and walking. But it also acknowledges that these measures are insufficient to control the pollution and congestion caused by road traffic. Therefore, the policy emphasises the need for taking measures that reduce the rate of road traffic growth through the following measures:
  - The policy calls for the promotion of innovative measures for more accessible, comfortable, and cleaner bus services to reduce car usage, establishing it as an attractive alternative to cars.
  - Encouraging CNG-driven vehicles
  - Introducing and promoting solar-powered refrigeration units for trucks carrying perishable items
- **Transport and land use:** Given the close interrelation between transport and land use, the policy calls for the need to undertake scientific research to assess the special impact of transport on land use for the adoption of land use policies that encourage the usage of local services in addition to reducing the need to travel. The policy emphasised the need for integrating land use policies with transport policies.

National Air Quality Management Plan

The transport sector is the largest consumer of petroleum products in Bangladesh (World Bank, 2022). On the other hand, the number of different types of vehicles on the roads has been rising. This reliance on the road sector, combined with the transport sector's high share in liquid fuel consumption, makes it a major contributor to air pollution in Bangladesh. The National Air Quality Management Plan provides useful guidelines for a greener transport sector (MoEFCC, 2024). Although the primary aim of the policy is to improve the air quality in the country, the policies, if translated into action, can contribute to major steps towards a sustainable transport sector. The strategies are as follows:

- **Controlling emissions from heavy-duty vehicles:**
  - Implementation of strict emission standards and regulations for heavy-duty vehicles
  - Incentivising the modernisation of heavy-duty vehicles by promoting the adoption of newer and more fuel-efficient vehicles
  - Promoting the transition to multimodal transport initiatives

- **Controlling emissions from light-duty vehicles:**
  - The policy promotes a shift from private passenger vehicles to public transport through the adoption of buses, expansion of metro rail services, and increased operational costs of private cars and parking services
  - Creating an optimal urban layout strategy and an incentive for moving towards a sustainable multimodal public transport system. The policy provides examples of green corridors, pedestrian bridges, and exclusive lanes for buses and non-motorised vehicles.
  - Introduction of a road pricing mechanism to manage and control vehicle usage
- **Promotion of public transport and electric vehicles:**
  - Expansion of metro rail services as per schedule
  - Strengthening the city bus system for better connectivity through the installation of bus queue shelters, post signs, electronic payment, and bus-tracking systems for users
  - Providing fiscal incentives for manufacturers, importers and owners of electric vehicles. For example, creating provisions for rebates of customs duty and VAT, discounts in electric tariff, road tax, and vehicle registration fee. The plan also prioritises the expansion of the installation for public and private charging stations.
  - Generalised measures include conducting regular mandatory vehicle inspection and maintenance procedures to ensure they meet the emission standards set by Schedule 2 of the APCR as a condition of receiving a fitness certificate. Additionally, it prohibits high-emission vehicles from the roads by adopting phase-out programs and restricting high-emission vehicles from priority area roads.

Bangladesh Climate Prosperity Plan 2022-2041

As a crosscutting and comprehensive policy, the Bangladesh Climate Prosperity Plan consists of a number of key priority areas for transitioning to a sustainable future. In terms of the transport sector, the policy prioritises moving to modern mobility solutions for both rural and urban areas. The policy aims to shift at least 30% of the newly registered transportation fleet to electric by 2030 (MoEFCC, 2022). To achieve this, it sets the following specific targets:

- **Electric/green mobility focused:**
- Ensuring 50% and 80% of the rideshare fleet is green/electric by 2025 and 2030, respectively
- Enabling EV manufacturing to contribute up to 10% of GDP by 2030
- Creating an enabling environment for manufacturing mobility solutions such as inland waterway transportation, green electric buses, e-bikes, etc., by 2022. Furthermore, by 2024, establish a hub for manufacturing energy-efficient vehicles through strategic investments and the adaptation of high technology.
- **Efficiency-focused:**
- By 2030, upgrade 1500 km of national highways to 4/6 lanes to handle the growing traffic.
- Ensuring at least 30% of the railway infrastructure is climate-resilient and energy-efficient by 2030.

The plan outlines the following key measures to create a green and climate-resilient transport system in Bangladesh:

- Electrification of 10000 km of internal waterways transportation
- Restoration of all canals and box culverts
- Construction of 10000 km of bike lanes
- Construction of 10000 km of footpaths
- Electrification of transportation, including rideshare, e-scooters, e-bikes, and e-baby taxis
- Upgrading of 1500 km of national highways and 4000 km of regional highways
- Retrofitting 13000 km of zilla and upazila (farm-to-market) roads

For this undertaking, the policy outlined the need for mobilising at least USD 5 billion of green financing from international investors. It further stated the need for support from international partners for the creation of special leasing facility windows and credit enhancement. Additional resources for the implementation of this policy will come from government subsidies for green and electric vehicles, as well as public-private partnerships for construction and electrification projects.

5.4. A Critical Review of the Existing Policy Framework

As is apparent from the above section, there is no dearth of policies. However, the policy landscape in Bangladesh is characterised by large inconsistencies, a lack of coherence, and implementation gaps. With respect to the transport sector, many of the policies are forward-looking, set clear targets, and provide pathways for achieving them. However, some gaps remain.

The **Automobile Industry Development Policy, 2021,** focuses on using trade policies like anti-dumping, rules of origin, elimination of non-tariff barriers, and bilateral and multilateral trade agreements to facilitate the growth of automotive industries. This remains largely unimplemented, although the policy was formulated in 2021. Furthermore, there is no guidance on what the import duties and tax rates should be.

While the **Electric Vehicle Charging Guideline** mentions the integration of small businesses in the EV charging market, it does not provide specific support mechanisms or incentives for them. Additionally, the construction of charging stations needs to be aligned with existing urban development and land use policies to avoid any inconsistencies.

The National Integrated Multimodal Transport Policy emphasises creating a greener environment through multi-pronged approaches, promoting a multimodal transport system, reducing road congestion through encouraging the usage of public transport, non-motorised transport, and improved mobility. It also provides a guideline for the necessary actions to achieve the stated objectives. In line with its name, the policy indeed provides an integrated approach for achieving a green and sustainable transport sector. However, one deficit of the policy is the lack of clear financing mechanisms for achieving these goals.

Despite being a comprehensive and clearly defined plan, the **Bangladesh Climate Prosperity Plan**, in some cases, is overly ambitious without considering the limitations

in technical and infrastructural capacity as well as the financial barriers for the implementation of an undertaking of this scale. Bangladesh has already missed the milestones between 2022 and 2024, as well as lacking the resources necessary to meet the targets of 2025. Without substantial improvements, the targets for 2030 will also be missed.

Most of the policies emphasise the need for maintaining safety and environmental standards. However, none of them includes any clear mechanisms for monitoring compliance, penalties for non-compliance, or reporting systems.

In addition, the transport system of Bangladesh is predominantly road-based. The existing policy to help guide the road system is the Road Transport Act 2022. In the almost 200-page document, however, it neither provides any directives on the usage of EVs nor has any focus on creating a greener, more sustainable transport sector. Although the policy has a separate section on environmental pollution, it lacks substantive provisions or strategies to promote sustainability in the transport sector.

6. Economy-wide Impacts of a Green Transport Transition: CGE Model Analysis

6.1. The Methodology of the Economy-wide Modelling

This study examines how Bangladesh's climate commitments, particularly the targets under NDC 3.0, can contribute to the country's broader development objectives. The central question is straightforward but important: how would achieving the NDC 3.0 targets help Bangladesh attain its national economic development goals? To answer this, the study applies an economy-wide recursive dynamic Computable General Equilibrium (CGE) model to compare Bangladesh's business-as-usual growth path with alternative scenarios in which NDC 3.0 targets are achieved. The comparison allows the study to estimate the incremental economic, social, and environmental benefits of climate action up to 2035.

The analytical approach begins with a business-as-usual baseline. This baseline tracks the likely evolution of the Bangladesh economy to 2035 without additional policy interventions linked to NDC 3.0. The study then introduces sector-specific climate actions and compares the resulting development outcomes with the baseline. In this way, the model does not simply ask whether climate action reduces emissions. It asks a broader development question: what additional gains could Bangladesh achieve in terms of GDP, employment, poverty reduction, undernourishment, household income, and structural transformation if it implements its NDC 3.0 commitments?

In this paper, the modelling exercise focuses on the transport sector. This sector was selected through a review of the NDC 3.0 document, with particular attention to which targets could be translated into model-based scenarios. The selection was also informed by a review of relevant literature, expert consultations, policy engagement, and stakeholder discussions. In the transport sector, the model considers pathways such as increased electric vehicle use and rapid transport systems.

The core modelling framework is built around a 2022 Social Accounting Matrix (SAM) for Bangladesh. The SAM provides a consistent economy-wide database that captures the flow of income and expenditure across producers, households, government, investors, and the rest of the world. It allows the model to trace how changes in one part of the economy affect other sectors and institutions. This is particularly important for climate policy analysis because climate action in transport can generate effects far beyond the targeted sector.

The SAM for the Bangladesh economy has 80 sectors in the database. This level of sectoral detail allows the analysis to capture production patterns and supply-chain linkages with considerable precision. Agriculture is represented through 27 primary products and 17 processed products. The energy sector distinguishes between solar and hydropower, while the transport sector differentiates between internal combustion vehicles and electric vehicles. This sectoral structure is important because the transition to a low-carbon economy is not uniform across the economy. Different sectors face different constraints, technologies, emissions profiles, and adjustment costs. A detailed sectoral framework, therefore, helps identify where the largest gains, risks, and trade-offs may arise.

The model also includes a household survey module. The population is divided into 20 household groups based on rural and urban per capita expenditure quintiles. This makes it possible to assess how climate policies affect different types of households. Such distributional analysis is particularly important for Bangladesh, where climate risks, poverty, food insecurity, and employment vulnerabilities are unevenly distributed across regions and social groups. A policy that raises aggregate GDP may still have unequal effects across households. The household module, therefore, helps the study assess not only the macroeconomic effects of climate action but also its implications for poverty, undernourishment, and household welfare.

Labour markets are also disaggregated by education levels. This feature allows the model to capture the employment implications of climate-related policy shifts. Green transport may create new jobs, but the type of jobs created will depend on the skill composition of labour demand. At the same time, some sectors may face adjustment pressures as production technologies and energy systems change. By separating labour by education levels, the model can examine how climate action affects different categories of workers and whether the transition may require complementary investments in skills, training, and labour-market support.

The recursive dynamic structure of the CGE model allows the analysis to move beyond a one-period static comparison. The model tracks the economy over time, linking current outcomes to future economic conditions. Population growth and urbanisation are introduced exogenously, affecting labour supply and household demand. Sectoral capital accumulation is determined endogenously, based on past investment patterns. This means that policy shocks introduced in one period can influence future production capacity, investment, employment, and income. The dynamic structure is therefore well-suited to assessing Bangladesh's development trajectory up to 2035.

A key strength of the CGE framework is that it captures economic linkages across sectors, factor markets, product markets, institutions, and the external sector. Producers use

factors such as land, labour, and capital, along with intermediate inputs, to produce goods and services. These goods and services are then sold to households, the government, investors, other producers, or foreign buyers. Some goods are exported, while imported goods enter domestic markets and compete with domestic production. Prices adjust to ensure that supply equals demand across markets. This equilibrium-based structure allows the model to capture both direct and indirect effects of policy changes.

The model also maintains macroeconomic consistency. It keeps track of government revenue and expenditure, savings and investment, and the current account or foreign exchange balance. This is essential for climate policy analysis. Many green transition measures require investment, subsidies, public spending, or changes in imports of capital goods and technologies. These measures may affect fiscal balances, external balances, and investment flows. The CGE model ensures that these economy-wide constraints are reflected in the results rather than treated as external assumptions.

Data reconciliation is a central part of the methodology. The modelling database brings together information from national accounts, balance of payments data, household surveys, labour force surveys, government accounts, public finance studies, firm and industry studies, programme evaluation studies, and firm surveys. Each source contributes a specific element. National accounts provide GDP by sector, product supply and use, and transaction costs. Balance of payments data provide information on trade flows, remittances, foreign investment, and development assistance. Household surveys provide data on consumption, diets, labour income, land and enterprise earnings, taxes, and transfers. Labour force surveys provide information on employment and earnings by sector. These different data sources are reconciled into a coherent SAM and then used to calibrate the CGE model.

The SAM structure links production, income generation, income distribution, consumption, investment, government finance, and external transactions. Activities receive income from marketed output. Commodities are used for intermediate demand, private consumption, public consumption, investment demand, and exports. Factors receive value-added payments, which are then distributed to households as factor incomes. Households also receive transfers and remittances and allocate their income across consumption, savings, and direct taxes. The government receives revenue from producer taxes, tariffs, VAT, excise taxes, direct taxes, and foreign aid, while also spending on consumption, transfers, savings, and investment. The rest of the world account records imports, exports, foreign payments, remittances, grants, and foreign savings.

The supply-chain structure of the model is also important. Activities combine labour, land, capital, and intermediate inputs to produce output. This output is then transformed into commodities, which may be sold domestically, exported, or combined with imports to form a composite supply. Composite supply is then used by households, government, investors, and producers. The model allows price-driven substitution in selected parts of the system, while assuming no substitution in others. This structure reflects the fact that producers and consumers can adjust their behaviour when relative prices change, but only within technological and institutional limits.

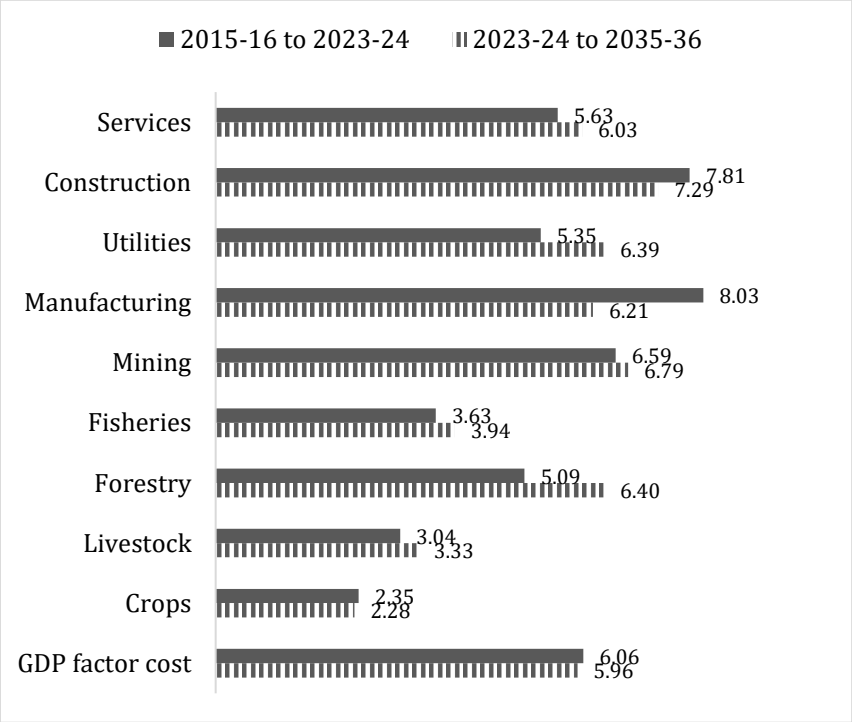
Through this framework, the study can simulate how specific NDC-related interventions affect the broader economy. The study's outcome indicators include GDP gains, job

creation, household income, and poverty. This is important because Bangladesh's climate transition cannot be assessed only through emissions reductions. The central issue is whether climate action can support a wider development strategy. If well designed, decarbonisation can reduce vulnerability, improve productivity, create jobs, lower future economic losses, strengthen food security, and support more inclusive growth.

6.2. Baseline scenario

The baseline scenario provides the reference path against which the transport-sector decarbonisation scenarios are assessed. It represents Bangladesh's projected economic trajectory up to 2035 in the absence of additional NDC 3.0-related interventions. Under this baseline, GDP at factor cost is projected to grow at an annual average rate of 6.10% during 2023-24 to 2035-36, broadly maintaining the country's historical growth momentum (Figure 4). The baseline is driven by population growth, productivity growth, and changes in cropped area. Productivity is introduced through the shift parameter in the production function, while labour is assumed to be mobile across activities. Low-skilled workers are allowed to remain unemployed, while high-skilled workers are assumed to be fully employed. Capital, however, is assumed to be immobile across activities.

Figure 4: Baseline and historical growth rate



Source: Dynamic recursive CGE model of Bangladesh

The macroeconomic closure assumptions also shape the baseline. The exchange rate is fixed, and foreign savings adjust to clear the external market. Given the tax rate, the government budget deficit adjusts to balance government accounts. The savings rate is also scaled so that aggregate savings equal aggregate investment. These assumptions provide a consistent economy-wide framework for assessing how transport-sector interventions affect GDP, employment, income, and poverty relative to the business-as-usual path.

6.3. Transport Sector Decarbonisation Scenarios

The decarbonisation scenarios are designed around Bangladesh's NDC 3.0 targets for 2035. The broader modelling exercise covers energy, transport, and agriculture, but the transport-sector scenarios are especially important because transport is both a major enabler of economic activity and a growing source of emissions. The NDC 3.0 transport targets include electrifying part of the road vehicle fleet, improving rapid transit systems, expanding metro rail, and electrifying part of the railway network. More specifically, the targets include making 25% of buses and 30% of passenger cars electric by 2035, developing rapid transit through improved road infrastructure, expanding the operational metro rail network to 142 km, and electrifying 348 km of railway.

These scenarios are not only environmental interventions. They are also productivity and structural transformation scenarios. Faster, cleaner, and more efficient transport can reduce travel time, lower fuel dependence, improve labour productivity, and support agglomeration economies in urban and peri-urban areas. However, the scale and nature of the impact depend on the type of intervention. Public transport reforms and rapid transit systems affect a large number of workers and commuters, while private electric cars mainly affect the consumption pattern of richer households. This distinction is important for interpreting the model results.

Scenario building for the transport sector

The transport-sector simulations are built around four individual scenarios and one combined scenario (Table 7). The first is TR_BUS, which promotes electric buses. This scenario assumes that 25% of buses will be electric by 2035. Since passenger transport accounts for a large share of road transport revenue, this intervention has the potential to influence both the transport service sector and the wider economy. However, the starting point is very low, as electric vehicle-based transport services account for less than 1% of total transport services. To reach the 25% electric bus target, the model assumes that the transport sector would need to grow at around 14% annually.

The second scenario is TR_CAR, which represents the adoption of private electric cars. It assumes that 30% of passenger cars will be electric by 2035. As of 2023, private electric cars were not present in the baseline. The scenario assumes that electric cars are consumed only by richer households. While fuel costs fall sharply, with petroleum expenditure declining and electricity expenditure rising, electric vehicle costs are assumed to be 50% higher than those of internal combustion engine vehicles. As a result, this scenario mainly changes household expenditure patterns rather than expanding productive transport services.

Table 7: Scenario building: Transport sector

Scenarios	Descriptions	Assumptions

TR_BUS (Promote Electric Bus)	• 25% of buses will be electric by 2035
	  • 53% of total road transport revenue comes from passenger transport
		• Transport service with electric vehicles occupies less than 1% of the total transport service.
		  • The transport sector needs to grow @14% annually to achieve the target of 25% electric bus transport.

TR_CAR (Adoption of private electric car)	• 30% of passenger (private) cars will be electric
	  • As of 2023, no private car is electric
		• Only rich households consume electric vehicles
		  • Expenditure on electricity will increase, and petroleum will fall – fuel cost savings are 92%
		  • Transport equipment cost will increase – EV cost is 50% higher than an ICE vehicle

TR_RAP (Rapid transit to reduce traffic time)	• Bus Rapid Transit System (BRT) and improve road infrastructure to reduce travel time
	  • As of 2023, average traffic speed is 7km/hr.
	  • 3.2 million work hours are lost daily
		• Increase average speed to 10km/hr
		• Productivity of workers in the non-agriculture sector will increase
		• The transport sector will grow faster than other non-agriculture sectors

TR_RLY (Railway electrification and metro rail expansion)	• 142km operational Metro Rail network & electrified 348 km railway network • As of 2026, metro rail is operating for 22 km	• Completion of 142 Km metro project by 2035 • The electric vehicle transport sector will grow • Labor productivity will increase due to time savings
TR_ALL	Above all scenarios combined	

Source: Model scenario building based on NDC 3.0

The third scenario is TR_RAP, which focuses on rapid transit and improved road infrastructure to reduce travel time. This is one of the most important scenarios from a productivity perspective. The baseline condition is severe: average traffic speed is only 7 km per hour, and slow traffic causes a loss of 3.2 million work hours per day. The scenario assumes that the average speed increases to 10 km per hour. This raises worker productivity in the non-agriculture sector and allows the transport sector to grow faster than other non-agriculture sectors.

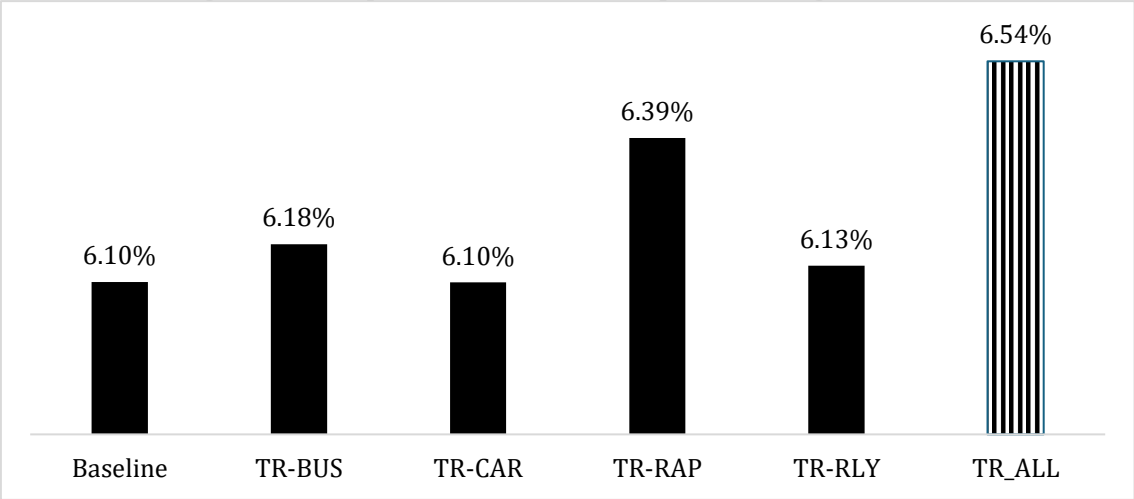
The fourth scenario is TR_RLY, which covers railway electrification and metro rail expansion. It assumes a 142 km operational metro rail network and 348 km of electrified railway network by 2035. Since metro rail was operating for only 22 km as of 2026, this scenario implies a major expansion of urban mass transit infrastructure. The model assumes that this will expand the electric vehicle transport sector and raise labour productivity through time savings. The final scenario, TR_ALL, combines all four transport-sector interventions.

6.4. Simulation Results

Impact on GDP growth

The transport-sector results show that decarbonisation and transport modernisation can raise Bangladesh's growth trajectory above the baseline (Figure 5). Under the baseline, Bangladesh's GDP is projected to grow at 6.10% per year. When all transport-sector targets are achieved under TR_ALL, GDP growth rises to 6.54%. This suggests that transport-sector transformation can generate economy-wide gains by improving mobility, reducing congestion costs, and increasing productivity.

Figure 5: Transport sector scenario: Impact on GDP growth rate



Source: Dynamic recursive CGE model of Bangladesh

Among the individual transport interventions, the rapid transit scenario has the largest effect on GDP growth. Under TR_RAP, GDP growth rises to 6.39%, reflecting the gains from reduced travel time and improved road infrastructure. This result is intuitive. In a congested economy, time lost in traffic is effectively lost productive capacity. When workers spend less time in traffic, productivity improves, especially in non-agricultural sectors where commuting, logistics, and service delivery are closely tied to transport efficiency.

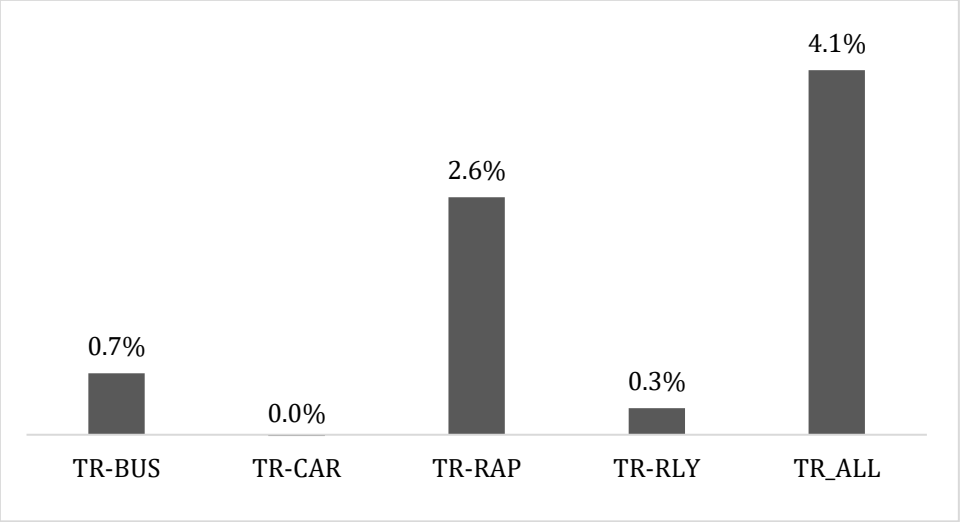
By contrast, the private electric car scenario does not raise GDP growth in a meaningful way. This is because private electric cars do not expand public transport services or significantly improve economy-wide productivity. They reduce petroleum use for richer households and increase electricity consumption, but their broader value-added impact is limited. This finding is important from a policy perspective. It suggests that public transport electrification and mass transit expansion are likely to generate larger development gains than a narrow focus on private electric vehicle adoption.

Impact on GDP under transport-sector interventions

The GDP deviation results provide a clearer picture of the size of the transport-sector impact in 2035 (Figure 6). Under the combined TR_ALL scenario, GDP is projected to be 4.1% higher than the baseline in 2035. This is a sizeable gain, particularly because the

transport package works largely through productivity, service expansion, and reduced time losses rather than through a direct increase in conventional output alone.

Figure 6: Transport sector scenario: GDP in 2035: % deviations from baseline



Source: Dynamic recursive CGE model of Bangladesh

The largest individual GDP effect comes from TR_RAP, which raises GDP by 2.6% above the baseline. This confirms that reducing traffic congestion and improving average travel speed can generate strong economy-wide benefits. The model estimates that Bangladesh lost 3.2 million work hours per day in 2023 due to slow traffic, equivalent to USD 4.38 billion in GDP. If the same trend continues, work-hour losses could rise to around 6 million hours per day, equivalent to around USD 9 billion in GDP. These figures show that congestion is not simply an urban inconvenience. It is a macroeconomic constraint.

The TR_BUS scenario raises GDP by 0.7% above the baseline. This reflects the gains from expanding electric bus services, especially because buses are part of productive passenger transport. The TR_RLY scenario raises GDP by 0.3%, suggesting that metro rail expansion and railway electrification also generate positive effects, although the estimated impact is smaller than that of rapid transit. The TR_CAR scenario shows no meaningful GDP gain, reinforcing the point that private vehicle electrification has limited macroeconomic benefits unless it is part of a broader transport-system transformation.

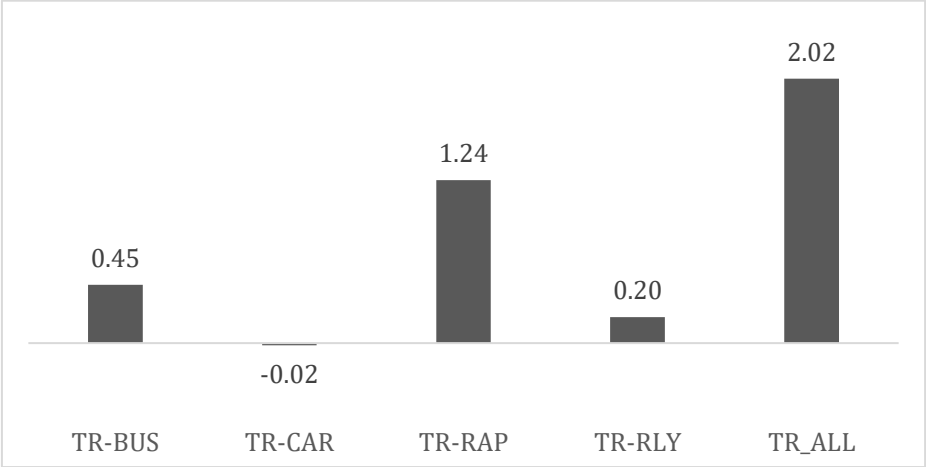
Impact on employment

Transport-sector transformation also produces positive employment effects (Figure 7). The combined TR_ALL scenario creates 2.02 million additional jobs in 2035 compared with the baseline. This employment gain comes from the expansion of transport services, infrastructure-related activities, improved mobility, and the wider productivity effects that stimulate production in other sectors.

Again, TR_RAP is the strongest individual intervention. It creates 1.24 million additional jobs, reflecting its large effect on productivity and economic activity. Improved road infrastructure and rapid transit systems reduce the cost of movement for workers and firms. This can support higher output, stronger service-sector activity, and increased labour demand. TR_BUS creates 0.45 million additional jobs, as the expansion of electric

bus services generates demand in transport operations, maintenance, equipment, and related services. TR_RLY creates 0.20 million additional jobs, largely through metro rail expansion, railway electrification, and associated transport services.

Figure 7: Transforming the transport sector: Additional jobs created in 2035 compared to baseline (million persons)



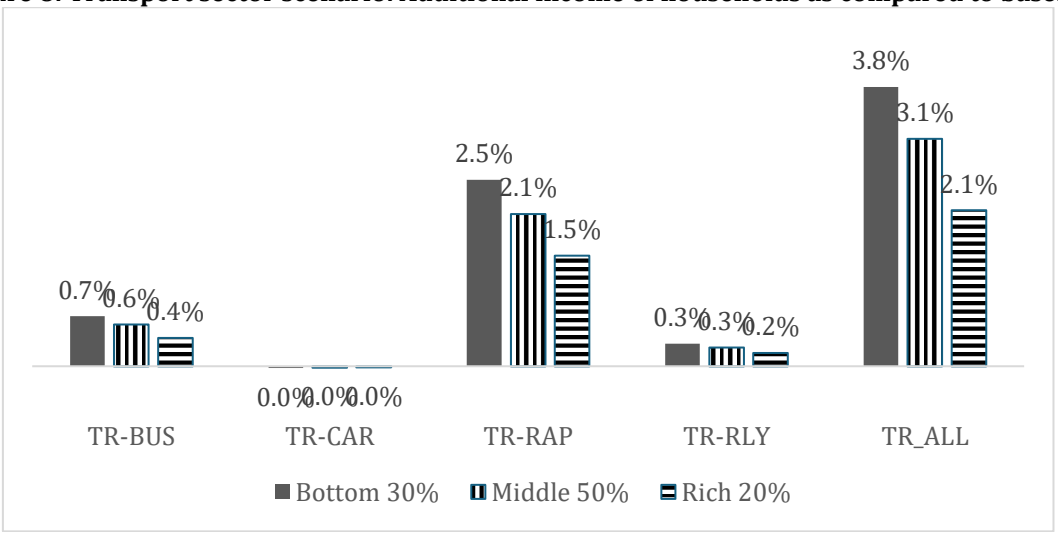
Source: Dynamic recursive CGE model of Bangladesh

The TR_CAR scenario has a very small negative employment effect of 0.02 million jobs. This does not mean that electric cars are undesirable from an emissions perspective. Rather, it suggests that private electric car adoption alone does not generate broad employment gains. Since it is assumed to be consumed mainly by rich households and involves higher equipment costs, the macroeconomic employment effect remains limited.

Impact on household income

The transport-sector scenarios also generate important distributional effects (Figure 8). Under the combined TR_ALL scenario, household income rises by 3.8% for the bottom 30%, 3.1% for the middle 50%, and 2.1% for the rich 20%, relative to the baseline. The income gains are therefore progressive: poorer households benefit proportionately more than richer households.

Figure 8: Transport sector scenario: Additional income of households as compared to baseline



Source: Dynamic recursive CGE model of Bangladesh

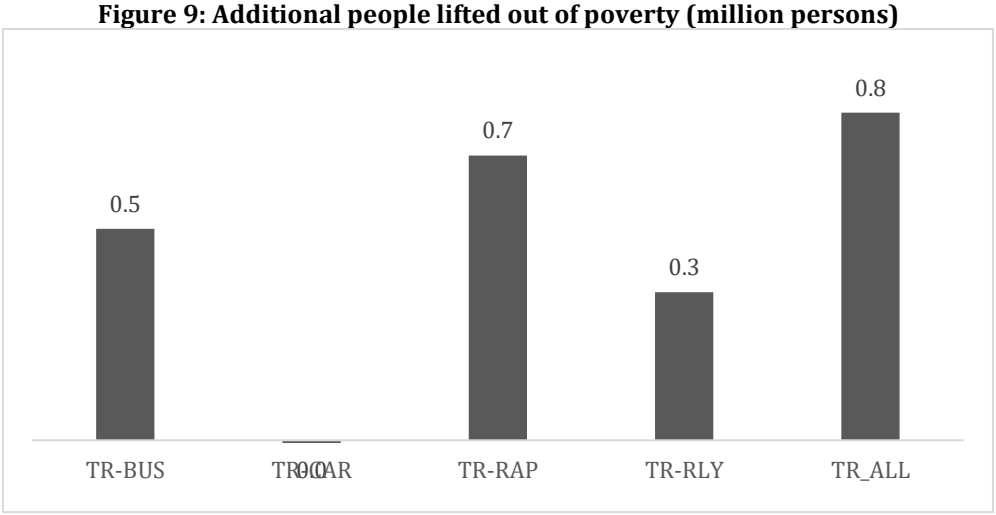
This result is significant. Poor and lower-middle-income households are more dependent on public transport and more exposed to time losses, unreliable mobility, and high commuting burdens. Improvements in rapid transit, bus systems, and rail connectivity can reduce these constraints. They can also improve access to jobs, services, and markets. As a result, transport-sector reform can become a direct instrument of inclusive growth, not only an infrastructure or emissions policy.

Among the individual scenarios, TR_RAP again has the largest effect on household income. It raises income by 2.5% for the bottom 30%, 2.1% for the middle 50%, and 1.5% for the rich 20%. TR_BUS also has a positive effect, raising income by 0.7% for the bottom 30%, 0.6% for the middle 50%, and 0.4% for the rich 20%. TR_RLY generates smaller but positive gains across all household groups. In contrast, TR_CAR has almost no effect on household income, which is consistent with its limited impact on GDP and employment.

Impact on poverty

The poverty results further confirm the inclusive potential of transport-sector transformation (Figure 9). Under the combined TR_ALL scenario, an additional 0.8 million people are lifted out of poverty by 2035 compared with the baseline. This is not a marginal outcome. It shows that transport investments can have poverty-reducing effects when they improve productivity, expand employment, and raise incomes for poorer households.

Figure 9: Additional people lifted out of poverty (million persons)



Source: Dynamic recursive CGE model of Bangladesh

The largest poverty impact comes from TR_RAP, which lifts 0.7 million people out of poverty. This reflects the strong connection between reduced travel time, labour productivity, and household income. TR_BUS lifts 0.5 million people out of poverty, while TR_RLY lifts 0.3 million. The private electric car scenario has no poverty reduction effect. This pattern is important for policy design. It suggests that public and mass transport investments are more effective for inclusive decarbonisation than policies centred mainly on private vehicle adoption.

The key message is that transport-sector decarbonisation should not be treated narrowly as a shift from fossil-fuel vehicles to electric vehicles. The larger development gains come

from transforming the transport system itself. Electric buses, rapid transit, metro rail, and railway electrification can reduce emissions, but they can also reduce congestion, save time, increase productivity, create jobs, and improve household welfare. For Bangladesh, the priority should therefore be an integrated transport strategy that combines electrification with public transport expansion, road infrastructure improvement, and urban mobility reform.

7. Challenges and Opportunities for a Low-Carbon Transport Future

Bangladesh has undertaken significant steps towards integrating a climate-resilient focus into the transport policy landscape, key to fostering effective change through a sustainable process. The previous section has provided a detailed overview of the existing transport policies. The discussion revealed that while the policies have a clear climatic focus, either directly or indirectly, the outcomes, if implemented, will significantly assist in achieving the targets set out in the NDC. The existing policy landscape provides opportunities for transforming the transport sector. However, there are significant barriers preventing the smooth transition to green transport options, which need to be addressed to ensure effective implementation and long-term impact.

Addressing financing gaps through prioritisation

Bangladesh has created its own funding mechanism, "Bangladesh Climate Change Trust Fund (BCCTF)", using its national resources, allocating $480 million so far, which supports the implementation of 800 projects. However, there remains a significant deficit for the full implementation of the NDC 3. One of the international sources of funding is the Green Climate Fund. The Fund has been designed to improve developing countries' adaptation capacities by limiting or reducing GHG emissions. Although Bangladesh has received funding from GCF through multilateral organisations, the government has been mostly unsuccessful in managing direct funds. The main challenge lies in the inconsistency of the international standards required for receiving funds with the domestic methods (Ministry of Finance, 2025).

In the face of an unstable global economic and political environment, Bangladesh needs to be innovative in securing financing for achieving its climate goals. Transition to EVs and HEVs requires a large one-off investment for building charging stations and then long-term investments for their maintenance. On the other hand, the construction of a multimodal transport system and a well-connected public transport network also requires a significant amount of investment. Given financial and institutional constraints, the most impactful and urgent actions to achieve climate resilience in the sector must be prioritised. A combination of transport policies dedicated to infrastructure investment in addition to introducing a carbon price is more effective in reducing the required level of carbon tax to reach a particular target, compared to a "carbon price only" strategy, since a transition to public transport leads to reductions in GHG emissions, thus requiring a lower carbon tax (Waisman et al., 2013).

A coherent fiscal policy framework for EV transition

It is crucial to take necessary measures to enhance the competitiveness and acceptability of EVs. The current national transport policy documents outline provisions for

incentivising local EV manufacturing, assembling, and acquisition through financial incentives, subsidies, and waivers. However, the high import cost, supplementary duty, and massive registration cost of EVs have been reducing their competitiveness in the market. For example, the registration cost of a small 150 KW EV was similar to that of high-end cars. Additionally, the one-off income tax payable for EVs is at least BDT 150,000. The existing policy has been such that EV buyers who already owned another car were subject to an annual surcharge of BDT 100,000 for the EV (Shitu, 2024; Chakma, 2024).

Moreover, industry experts in a sectoral Expert Group Meeting (EGM) revealed that there is no separate tax and duty structure for electric vehicles with different capacities. For example, both EVs and HEVs face the same amount of duty, although the hybrid cars, in most cases, are used, whereas the electric cars are brand new. To make the EVs affordable, a clear breakdown of taxes should be in place based on the price and KW of the cars.

However, some changes have been brought about in the latest budget for FY26. To accelerate the shift to cleaner transport, the interim government has announced a series of tax benefits. Broadly, key shifts include exemption of value-added tax (VAT) for five years, customs and other duty reductions for up to 60%. In particular, all VAT on e-bikes has been reduced to 5%, while the entire VAT for the manufacturing stage for lithium and graphene batteries has been reduced until June 2027. Additionally, all import taxes on key raw materials have been limited to 1%. Furthermore, in case of multiple vehicle ownership, there is a provision of tax exemption in case of the electric vehicle (NBR, 2025a; NBR, 2025b; NBR, 2025c).

Providing these financial incentives is a step in the right direction. Removing the financial constraints to promote the EV industry, however, also comes with its own challenges, as listed below:

- Historically, the provision for financial incentives has contributed to the development of specific companies, rather than encouraging a competitive environment. When local production of the product parts is a mandatory requirement, industry growth is often stifled by restricting the entry of smaller manufacturers.
- Often, the benefits are subject to companies meeting specific conditions such as the attainment of ISO certifications, meeting environmental and safety standards, submission of a declaration for NBR vetting, obtaining approval from the Bangladesh Road Transport Authority, and setting up dedicated manufacturing units with advanced machinery (NBR, 2025a; NBR, 2025c). While these criteria are important for maintaining factory standards, it is necessary to ensure the transparency of the process. The government must provide clear guidelines for streamlining the approval process, reducing bureaucratic delays, and offering technical assistance to smaller companies that may struggle to meet the requirements.
- Furthermore, in reality, providing financial incentives in the form of lowering taxes or increasing subsidies on the components for constructing charging stations can be difficult, given the current economic context as well as international pressure for subsidy reform. Within this backdrop, the government

is currently focusing on "tariff rationalisation" rather than reduction, according to insights from the EGM.

Ensuring adequate charging facilities

One of the biggest challenges of transitioning to electric mobility is the lack of charging stations. As of now, there are only 14 officially approved public charging stations in Bangladesh (Shitu, 2024). Although this covers the big cities such as Dhaka, Comilla, and Chittagong, most of the country remains neglected. If EVs are to be widely adopted, a sufficient number of charging stations across the country needs to be built, and users will be disincentivised given the added cost and inconvenience of travelling long distances for fuel. Furthermore, a reliable electricity supply is essential to ensure a smooth transition to green mobility.

Climate-smart transport planning and infrastructure resilience

While focusing on the transition to electric mobility, it is crucial to ensure sustainable battery disposal systems. The EGM with sector experts revealed that the average lifetime of an electric vehicle battery is 8000 cycles, equivalent to 20 years, after which the batteries need to be disposed of. Now, at the early stages of moving to an electric transport system, it is essential to plan for constructing an efficient disposal system.

On the other hand, embedding climate resilience into the planning of the transport infrastructure is a critical step forward. With increasing climate vulnerability, it is necessary to incorporate the infrastructural concerns into future policymaking. Extreme climate has become a reality rather than a problem of the distant future. Therefore, all plans for the infrastructural development of the transport sector must integrate climate risk assessments, utilise resilient materials, and ensure regular maintenance to withstand its effects.

Introducing transport sector adaptation measures in national and international policies and commitments

It is necessary to link the national transport priorities with the long-term climate strategies. The emphasis of the current NDC for the transport sector is mostly on mitigation measures. Although mitigation and adaptation actions often coexist, the NDC does not outline any specific adaptation actions for the transport sector. However, as mentioned in the previous chapters, transport infrastructures are at significant risk of climate vulnerabilities. Therefore, the government must go beyond emission reduction and include context-specific adaptation and resilience measures.

Scientific assessment of EV feasibility and energy demand

A strategic and methodically grounded assessment of the effect of EV adoption on electricity demand, along with proactive planning to address any potential issues, is essential. While Bangladesh focuses on transitioning to renewable sources of energy, the prioritisation of EVs gives rise to new challenges. As the adoption of EVs may create greater demand for electricity, we may need to consider alternative sources of energy. The electricity generation in Bangladesh is predominantly reliant on fossil fuels. In

addition to potentially implicating the electricity supply, it will also have consequences from an environmental lens through increased fossil-fuel usage. Although there are possibilities of shifting to hybrid vehicles, the scarcity of charging stations means the continued usage of fossil fuels. Unaddressed in the existing policies, this potential contradiction requires attention in future endeavours.

Analysing the good practices of countries adopting electric mobility while focusing on renewable energy sources may prove beneficial in this regard. For example, India opened its first solar-powered electric bus depot in Surat in 2025. The solar power plant will supply the electric bus depot with 100,000 kWh of clean energy annually. The solar panels, their inverters, and the second-life batteries required a small investment of 15 million rupees (approximately 155,000 euros). Of the city's 1100 buses, 450 are now electric (Parikh, 2025). On the other hand, Nepal is leveraging its wealth of hydropower to boost the EV sector. The swift transition within a short period of time is the result of government policies leveraging Nepal's abundant hydropower and a reduction in dependence on imported fossil fuels, as well as enhanced collaboration with China, the world's largest manufacturer of electric vehicles (DePillis and Sharma, 2025)

For a shift to electric mobility to truly yield effective results in emission reduction, it is essential that Bangladesh also focuses on reducing its dependency on fossil fuels for electricity generation.

Addressing data gaps in transport-climate-energy modelling

Bangladesh needs to address the significant lack of context-specific research in the transition to green energy in the transport sector. Currently, there is limited data and research on the technical, economic, environmental, and institutional feasibility of transitioning to alternative fuel sources. It is necessary to conduct comprehensive research to generate evidence not only for making informed policy decisions but also for building a robust and compelling case for attracting private investment and foreign direct investment for switching to alternative sources such as solar, biogas, and biomass.

Increased focus on alternative transport modes

Bangladesh also needs to diversify its transportation modes to ensure swift and sustainable mobility. As shown in the previous sections, the transport sector is road-dominated- the focus needs to shift towards a multimodal system. However, challenges in the rail, waterways, and aviation sectors remain. Bangladesh Railway has been facing significant losses in recent years (Bangladesh Bureau of Statistics, 2023). These sectors need to be revamped and modernised to ensure transparency and accountability and to provide the support necessary to move away from the current level of road sector reliance.

8. Conclusion

The transport sector in Bangladesh faces both profound challenges and significant opportunities in the face of climate change. As a country with one of the highest vulnerabilities to climate change, the transport infrastructure faces risks arising from increasingly extreme weather patterns, ranging from flash floods, cyclones, and salinity

to heatwaves. These challenges, made even more complex by the sector's dependence on fossil fuels and contribution to the country's CO_2 emissions, highlight the need for a comprehensive and planned shift toward low-carbon alternatives. The findings from the CGE model provide a detailed account of the potential economic and social impacts of such a transition, indicating not only the feasibility but also the benefits of a green transport pathway in terms of long-term economic growth, employment generation, and poverty reduction.

Existing policies provide the pathways for ensuring sustainability in the sector. However, many policies remain on paper while the timeframe for implementation passes by. It is imperative that the policies not only align with the broad development agenda of the country but also consider the implementation barriers to ensure feasibility. Furthermore, future new policies or amendments to the existing ones need to lay out clear financing mechanisms that can fulfil the current gaps in infrastructure and technology. Without addressing these financial and implementation barriers, even the most well-intentioned policies will fail to achieve their envisioned outcomes. Moreover, aligning the sector's policy with international climate commitments is also crucial.

The transport-sector simulations show that Bangladesh's NDC 3.0 transport targets can produce meaningful economic and social benefits by 2035. The combined transport package raises GDP growth above the baseline, increases GDP by 4.1% relative to the baseline level in 2035, creates 2.02 million additional jobs, raises household income across all income groups, and lifts 0.8 million people out of poverty. The results also point to a clear hierarchy of impacts. Rapid transit and road infrastructure improvements generate the largest gains, followed by electric buses and railway electrification. Private electric car adoption has limited macroeconomic, employment, income, and poverty impacts.

From a policy perspective, the implication is clear. Bangladesh's transport-sector decarbonisation agenda should focus first on public transport, rapid transit, and productivity-enhancing infrastructure. Electrification matters, but its development impact depends on where it is applied. Electric buses and rail-based systems can support both low-carbon mobility and inclusive growth. Private electric cars may still contribute to emissions reduction, but they should not dominate the policy agenda. A successful transport transition must therefore combine climate ambition with economic efficiency, social inclusion, and urban productivity.

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