Mobility and Transport Connectivity Series

Financing Climate Action for **TRANSPORTATION in Developing Countries**

WORLD BANK GROUP

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Acknowledgments

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Foreword

Binyam Reja, Ph.D.

Global Practice Manager,
Transport Infrastructure Vice Presidency,
World Bank

Transport plays a vital role in the economic and social development of nations, yet it is also one of the largest contributors to greenhouse gas emissions. Developing countries face a dual challenge: expanding transport infrastructure to support inclusive growth while transitioning to sustainable, low-carbon systems. Bridging this gap requires innovative and substantial climate finance solutions.

This report, a product of the World Bank's Transport Global Department, reflects our mission to eliminate extreme poverty and promote shared prosperity in a livable planet. It delves into the critical nexus of climate finance and transport, offering insights into how innovative financial solutions and climate finance can be catalyzed to attract private and public investments to decarbonize transport while ensuring accessibility, affordability, and resilience. By aligning climate goals with development objectives, we can unlock the potential of sustainable transport to drive inclusive growth while safeguarding our environment for future generations.

We hope this report serves as a resource and inspiration to policymakers, development practitioners, and the global community to collaborate and act boldly, leveraging climate finance to create transport systems that not only connect people but also build a more sustainable and inclusive communities.

Binyam Reja is the Global Practice Manager for Transport at the World Bank. He leads transformative programs that focus on climate action, decarbonization, inclusive mobility, logistics, and innovative infrastructure financing solutions. He has been instrumental in establishing the World Bank's Global Facility to Decarbonize Transport (GFDT) and the Transport Global Knowledge Unit, where he leads a team of technical expertise and economist in pioneering new approaches for e-mobility, disruptive transport technologies, and climate and innovative financing for decarbonization. Dr. Reja previously served as the Regional Practice Manager for China, Central Asia, Mongolia, and Korea, where he managed a portfolio totaling US$10 billion, and promoted sector reforms and private sector mobilization to support sustainable and resilient infrastructure development. Dr. Reja holds a Ph.D. in Economics from the University of California, Irvine, and a B.A. (Honors) in Economics from the University of California, Santa Barbara. He also completed the Executive Education Program at Harvard University's Kennedy School of Government.

About the Authors

Daniel Benitez is a Global Lead at the Transport Global Practice of the World Bank. Daniel coordinates the strategy on Maximizing Finance for Development. Since 2006, his work at the World Bank involves both analytical and advisory services on infrastructure economics, policy, and financing. Daniel has led large institutional reforms to deliver Public-Private Partnerships in LAC and ECA. More recently, he is working on innovative financial instruments to support the transition to low-carbon mobility. He also worked on computable general equilibrium analysis and regulation of infrastructure utilities. Daniel holds a Ph.D. in Economics from the University of Toulouse, France.

Jyoti Bisbey is a Global Sustainable Development Finance Expert with more than 20 years of experience in leading green and resilient infrastructure finance and public-private partnerships (PPPs) in developing countries. Jyoti has been staff at the World Bank Group and the United Nations, and currently an Executive Committee member of the World Association of PPP Units and PPP Professionals (WAPPP) and Climate Advisor to the International Sustainable Resilience Center (ISRC). Jyoti has led the establishment of two global benchmarks on private investment in developing countries Certified PPP Professional (CP3P), Private Capital Mobilization (PCM), and currently serves on the Executive Advisory Committee for FAST-Infra Sustainable Infrastructure® Label. Jyoti holds an Executive Certificate from Harvard University, MBA from George Washington University, USA and BA in mathematics (Honors) from St. Stephens College, Delhi, India.

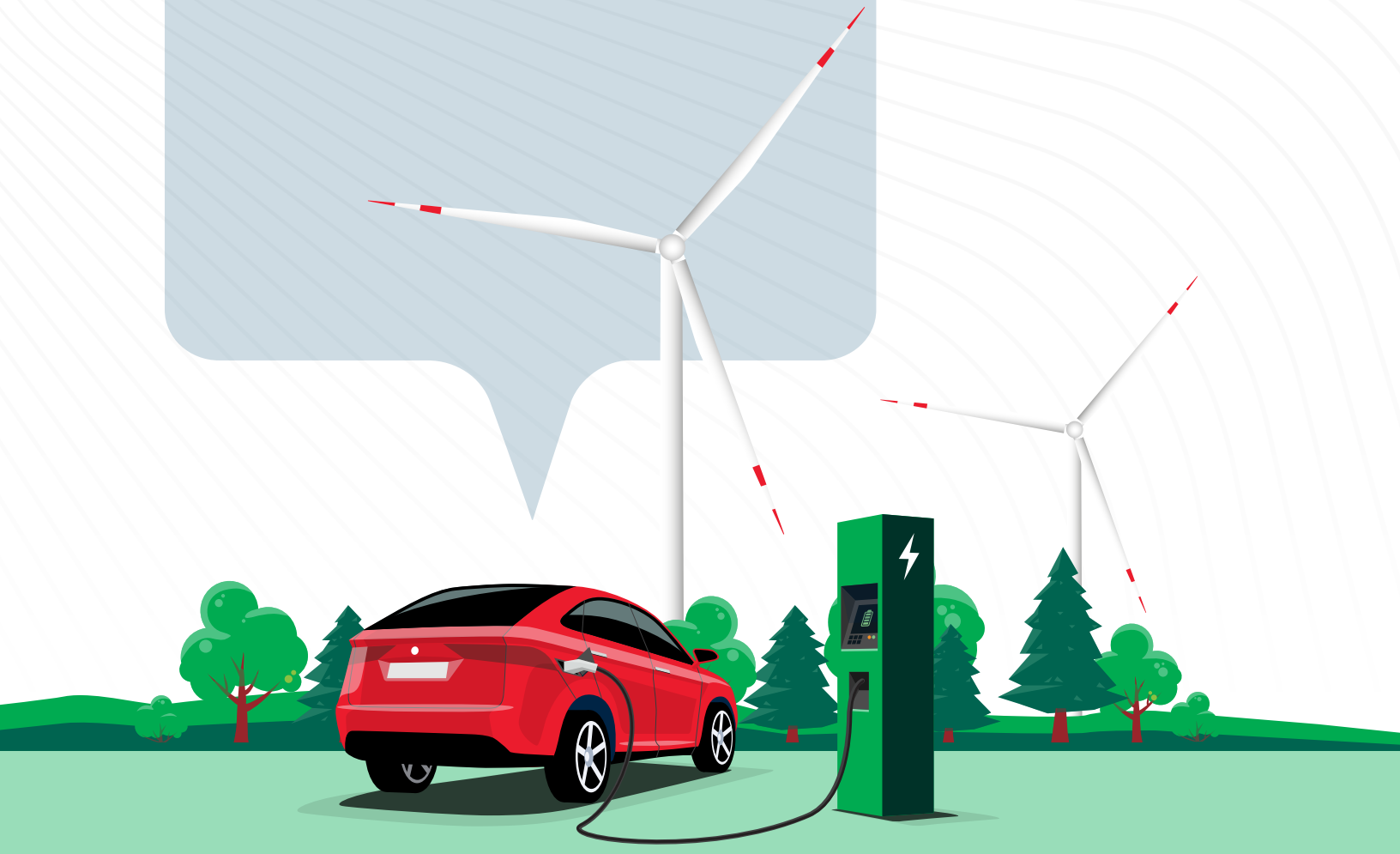
Abbreviations

ADB	Asian Development Bank
AfDB	African Development Bank
AIIB	Asian Infrastructure Investment Bank
ASI	Avoid, Shift, Improve
BRT	Bus Rapid Transport
CapEx	Capital Expenditure
CCAP	Climate Change Action Plan
CCDR	Country Climate and Development Report
COP	Conference of the Parties
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CPI	Climate Policy Initiative
CRR	Climate-related Risk
DFI	Development Finance Institution
EAP	East Asia and Pacific
EBRD	European Bank for Reconstruction and Development
ECA	Export Credit Agency
ECA	Europe and Central Asia
ECR	Effective Carbon Rate
EIB	European Investment Bank
EMDEs	Emerging Markets and Developing Economies
ESG	Environment, Social, and Governance
ETS	Electronic Trading System
EU	European Union
EV-RSP	Electric Vehicle Risk-sharing Program
EVs	Electric Vehicles
GCF	Green Climate Fund
GDP	Gross Domestic Product

GFTD	World Bank Global Facility for Transport Decarbonization
GGRF	Greenhouse Gas Reduction Fund
GHG	Greenhouse Gas
Gt	Gigaton
HIC	High-income Country
IADB	Inter-American Development Bank Group
IBRD	International Bank for Reconstruction and Development
ICAO	International Civil Aviation Organization
ICCT	International Council on Clean Transportation
ICEV	Internal Combustion Engine Vehicle
ICT	Information and Communication Technology
IDBG	Inter-American Development Bank Group
IEA	International Energy Agency
IFI	International Finance Institutions
IMF	International Monetary Fund
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
ITF	International Transport Forum
LAC	Latin America and the Caribbean
LDV	Light Duty Vehicle
LEZ	Low Emission Zone
LMICs	Low- and Middle-income Countries
LRT	Light Rail Transit
LVC	Land Value Capture
MDB	Multilateral Development Bank
MENA	Middle East and North Africa
MM	Motorization Management
MoU	Memorandum of Understanding
MRV	Measurement, Reporting, and Verification

MUL	Multi-use Lane
NDCs	Nationally Determined Contributions
NMT	Non-motorized Transport
O&M	Operations and Maintenance
ODA	Official Development Assistance
OECD	Organization for Economic Cooperation and Development
OEM	Original Equipment Manufacturer
OHD	Off hour Delivery
OPEC	Organization of Petroleum Exporting Countries
PFI	Private Finance Initiative
PIC	Private, Institutional, and Commercial Capital
PM	Particulate Matter
PPIAF	Public-private Infrastructure Advisory Facility
PPP	Public-Private Partnerships
QMG	Qingdao Municipal Government
SAR	South Asia Region
SGDF	Shandong Green Development Fund
SLOCAT	Partnership on Sustainable, Low Carbon Transport
SOE	State-owned Enterprise
SSA	Sub-Saharan Africa
TCO	Total Cost Ownership
TDI	Transport Decarbonization Investment Series
TDM	Transport Demand Management
TOD	Transit-oriented Development
UNECA	United Nations Economic Commission for Africa
UNFCCC	United Nations Framework Convention on Climate Change
VCM	Voluntary Carbon Market
WB	World Bank Group
WRI	World Resources Institute
ZEV	Zero-emission Vehicle

Executive Summary



Executive Summary

The climate change crisis makes Paris Alignment of the transport sector one of the most pressing development challenges of our time. Transport emissions are rising at a higher rate in low- and middle-income countries (LMICs) than in high-income countries. Transport emissions are closely linked to road-based transport and rates of motorization. With lack of public transit solutions and longer distances to markets, the developing world is likely to be the main contributor to transport carbon dioxide (CO_2) emissions in the coming decades. Doing nothing will be catastrophic to the planet and humanity. LMICs may risk getting locked into the wrong technology, which would bring higher switching costs in the future. However, green and electrified technologies will bring benefit from reduced congestion, firm competitiveness, road safety, and increased livability in cities and the quality of life. The public and private sectors must act urgently to significantly mitigate the climate risks and build on the advantages offered by the present low rates of motorization and high active travel patterns.

Green and resilient transport investments must increase to meet the 1.5°C pathway. Rozenberg and Fay (2019) provides a quantification of the estimated increased investment required to pursue a climate action pathway for LMICs. Under the preferred scenario—ambitious goals, high efficiency—the overall investment in transport infrastructure per year is estimated at $417 billion between 2015 and 2030 – or an annualized increase equivalent to 1.3 percent of the GDP. A similar degree of urgency is necessary to make the existing assets and services climate resilient. The same report estimates maintenance expenditures at 2.6 percent of GDP. The enormity of the challenge to retrofit, maintain and build new investments to withstand the climate change is increasing exponentially each day. According to Hallegatte, Rentschler, and Rozenberg (2019), the net benefit of building more resilient infrastructure in low- and middle-income countries would be $4.2 trillion, with $4 in benefit for each $1 invested.

However, the current climate finance landscape for developing economies may be insufficient to support the challenge. Recent estimates place worldwide climate financing flows for transport at $336 billion as average of 2021-2022, which occurred mostly in developed countries. Certainly, increasing and using resources wisely to mobilize other sources is quite significant and an urgent need to fulfill climate action in transport in developing countries. Developed economies are the largest recipients when it comes to climate finance. Energy investments are also receiving a sizable climate financing share. Worldwide climate financing flows are estimated at $1.27 trillion each year. East Asia and the Pacific, the US and Canada, and Western Europe account for a combined 84 percent of total climate finance. Flows continued to fall short of needs, particularly in developing and low-income economies. Less than 3 percent of the global total ($30 billion) went to or within least developed countries (LDCs), while 15 percent went to or within EMDEs excluding China. The ten countries most affected by climate change between 2000 and 2019 received just $23 billion, which is less than two percent of total climate finance.

Much of the financing for low-carbon transport in countries originates from the private sector. Majority of this financing is devoted to electrification of vehicles in developed countries. In developing countries, the majority financing continues to come from development finance institutions (DFIs). Climate funds and capital markets are expanding their green transport portfolio although they continue focusing largely on the energy sector. While thematic investing is accelerating, driven by regulatory changes, including the integration of environment-social-governance (ESG) preferences in investor choices, there is not much focus on green transport, beyond e-vehicles. There are many reasons behind this fact. First, there is a lack of bankable projects. In many cases, these projects fail to monetize revenues to repay loans and thus rely on limited government funding to make them financially viable. This could be the case for public transport, investments on active mobility, and infrastructure resilience. Second, many markets do not have the demand to mobilize capital at a larger sectoral/country scale, and thus, their focus is at project level and often disconnected from other potential investments that can maximize climate action. Third, it is crucial to expand financing sources, and it requires allocating risks as per the capacity of each actor to efficiently handle it. However, when it comes to public sponsored projects, many governments lack access to and/or a track record of commercial borrowing without DFI involvement backstopping some risk. There are also limited opportunities to diversify risk for private sector sponsored projects. DFIs have mostly focused on hard infrastructure, given the connectivity needs in developing countries.

While more climate finance can play an important role in reducing the investment gap, the transport sector has some limitation to generate revenues from users and thus, on the capacity to mobilize finance. First, transport as a sector encompasses multiple infrastructure and transportation services for passengers and freight. In many cases political, economic, and technological barriers do not allow users to be charged. Second, even when some pricing is possible, often, it is not done correctly to include externalities and thus, it could lead to over investment (i.e., private cars running on poor roads) and under investment (i.e., sidewalks, bike lines, public transport)—the use of carbon taxes to correct for climate externalities is limited in developed economies. Third, transport services (and their infrastructure) can complement when they provide multimodality, or they can be substitutes when there is competition in the market or redundancy for resilience. From a policy perspective, getting the right bundle of transport services is challenging and, in most cases, it leads to higher costs and lower revenues. These issues underpin the challenges of greening the transport system. When it comes to the implementation of greener policies in the sector, decentralization efforts have assigned tasks to local governments, but they usually lack the funding and technical capacity to undertake such investments. Even with the increasing shift toward municipal financing, creditworthiness and the smaller scale of projects are barriers in many cities. Reducing the funding gap needs an ecosystem approach where capacity building, regulations, and innovation are important pillars, and they are integrated in planning, design, and execution in a whole-of-government approach.

Can governments mobilize much-needed resources to finance the transport climate action transition? In principle, the answer for developing countries is not straightforward. Financing the transition to low-carbon transport requires complex decisions on moving people and freight, land use, pricing, and taxation. It requires prioritization of climate action policies to set the path during the transition. There are opportunities to create revenue streams for financing select projects and fund key policies. Carbon taxes, fees reflecting the true cost of road usage, land use taxes, and other instruments can create a pool of resources linked to a specific target, with proper governance

structure. Yet, capturing these externalities in prices and taxes should come along with investments and policies to facilitate the transition—taxation, by itself, should not be the path to low-carbon goals. Prioritizing and assessing how resources are allocated is equally important, which improves the quality and efficiency of public spending. The three emerging messages are: (a) removing perverse subsidies is an essential first step toward transport decarbonization; (b) users of private motorized transport1 must pay their full social costs, and it also applies to air transport and shipping; and (c) tax revenues from transport externality pricing, accompanied by increased public spending, need to be recycled into green and resilient investments, and investments that deliver the highest impact.

An integrated financing approach is needed as proposed in this report. Governments need to address the fundamental bankability issues in projects, which are reinforced even more in green transport projects. Incorporating transport-specific climate action targets with a comprehensive understanding of what is "green" by establishing a green transport taxonomy and standards to package transport projects can be a starting point for many public agencies. By ensuring a portfolio of bankable green projects, agencies can harness new financiers and capital markets investors that are focused on transport sustainability. In parallel, DFIs need to scale up their financing to climate mitigation and adaptation in transport, beyond lending, to play a larger role in derisking instruments to mobilize private capital and scaling up small projects in cities. A cohesive set of concrete recommendations is presented in the report to combine funding, financing, policy interventions, and stakeholder engagement:

- set transport-specific climate action goals,
- establish green transport–specific regulation and institutional frameworks,
- incorporate GHG analysis in transport planning to prioritize policies and investments,
- optimize funding mechanisms to incentivize greening actions,
- ensure efficiency of public spending,
- focus on research and development by leveraging the private sector's ability to innovate, and
- develop a financing strategy including blended financing and credit enhancements to leverage sustainable finance into the Paris Aligned transition.

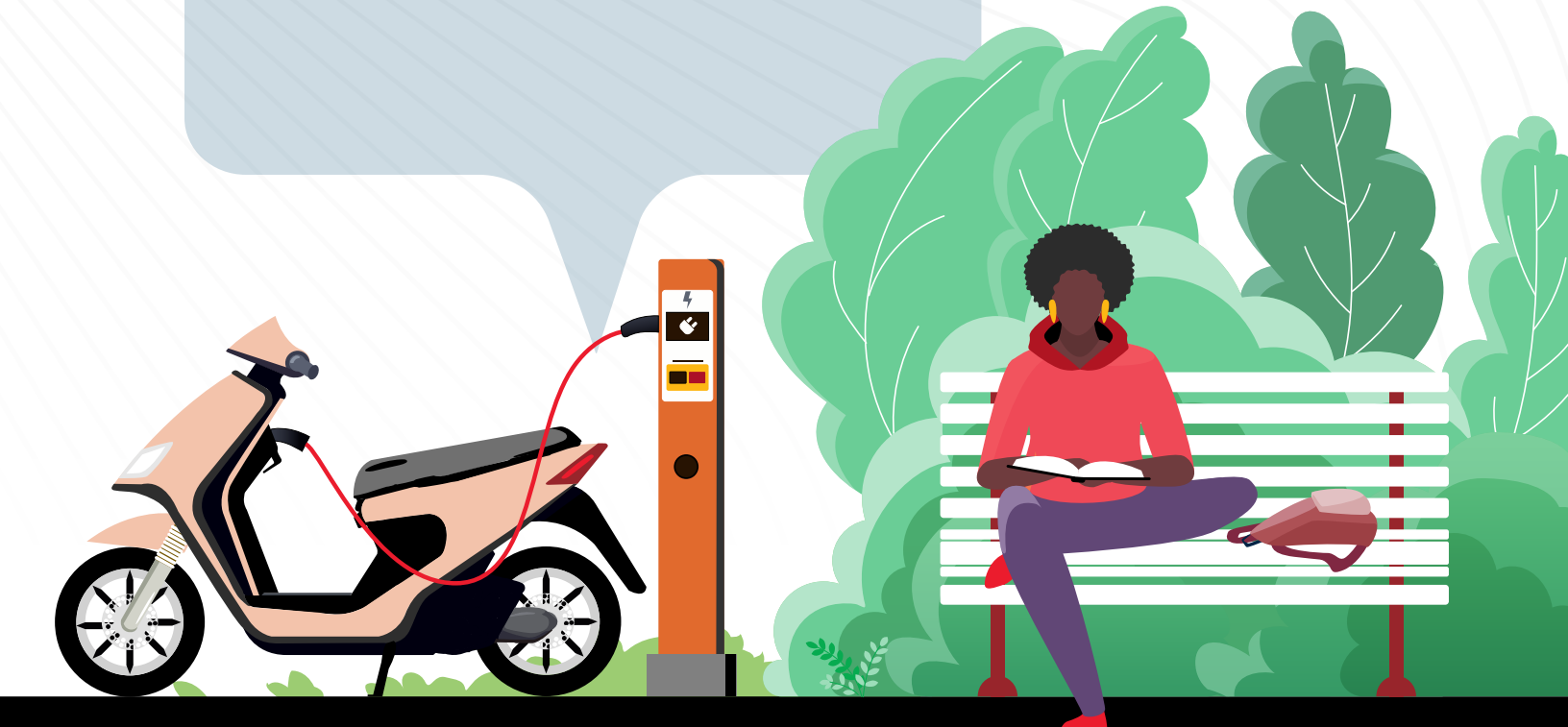
Beyond the need to strengthen policy, regulation, and governance, the report discusses innovative approaches to affordable finance in developing countries for greener mobility. For instance, through the ongoing projects in India to address public transport and 2-3 wheelers, or through wholesale approach to support clean mobility, blended financing can bring scale, diversify risks, reduce transaction costs, and provide greater flexibility in regions such as Sub-Saharan Africa.

[1] However, the distributional impacts of subsidy reform and externality pricing cannot be neglected. It clearly creates some challenges, especially for the lower middle-class. Any subsidy reform should address the vulnerability of the poor and lower middle-class. Moreover, the political economy can make such reforms impossible and thus government should work with relevant stakeholders. See Hallegatte et al. 2023.

Many countries are expanding their programs to finance two and three wheelers, e-buses, and active mobility projects with a combination of public financing through budget and issuing thematic bonds. Carbon pricing schemes can be explored in more advanced developing economies in addition to a global and voluntary carbon market to finance the transition, for instance in maritime shipping.

In conclusion, a paradigm shift is required in the way transport services and the built environment interact to align with the Paris Agreement. Transport is an essential service that facilitates the movement of people and goods to foster economic growth locally, nationally, and internationally, productivity growth, industrial competitiveness, and the quality of life. Decoupling transport demand from GHG emissions without constraining economic development, particularly in developing nations, requires a paradigm change from traditional solely road expansion infrastructure investments, which subsidize private vehicle owners and induce demand, to a more holistic approach that captures the various social and economic intricacies of how transport users interact with the built environment. The time is now, especially for LMICs, to prioritize transport as a lever to achieve their climate goals.

1 Introduction



Introduction

A climate orientation of the transport sector is urgent to meet the targets established in the Paris Agreement. Continued enhancements and innovations in climate-friendly technologies are creating opportunities to decarbonize the transport sector, unlock investments, and scale up action. Electric vehicles (EVs) are a prime example, with the number of units sold doubling in 2021 to 6.7 million, accounting for 9 percent of global vehicle sales. Despite this progress, the transport sector's climate action trajectory is insufficient to achieve the Paris Agreement. As an indication of the magnitude of action required, the International Energy Agency (IEA) forecast that to achieve net zero by 2050, a 1.5 Gt reduction in transport emissions is needed by 2030 compared to 2020 levels (7.2 Gt). This will require targeted and significant investment across the transport sector at a time when central and subnational governments have limited fiscal resources following containment measures implemented during the COVID-19 pandemic. Equally, transport service providers are heavily in debt following a steep loss of revenue due to demand shock, with many requiring bailout support. Further, rising levels of inflation are eroding purchasing power, making investments in critical infrastructure and service more challenging.

Estimates of worldwide climate-related investment ranks climate financing flows across all sectors in 2021–22 at $1.270 trillion on average each year.[2] The vast majority, or 90 percent, of climate finance flows were for mitigation. East Asia and the Pacific, the US and Canada, and Western Europe account for a combined 84 percent of total climate finance. Current global financial flows for adaptation are insufficient for, and constrain implementation of adaptation options, especially in developing countries (IPCC 6th Assessment Report, March 2023).[3] The financing of low-carbon transport accounted for $336 billion or 29 percent of that investment, making transport the second largest beneficiary of climate finance after the renewable energy sector, which accounted for 44 percent of all financing.

There is growing momentum and public pressure to drive action in transport and accelerate the transition to zero- or low-carbon transport. The two headline outcomes from the 2021 United Nations Climate Change Conference (COP26) were the signing of the Glasgow Climate Pact, which sets out what needs to be done to tackle climate change, and the Paris Rulebook, which provides guidelines on how the Paris Agreement is delivered. Yet, there was also the landmark pledge between 30 countries and six leading car manufacturers to move to 100 percent zero-emission cars and vans in leading markets by 2035, and 2040 globally. Within many segments of the transport domain, climate-smart solutions are becoming increasingly attractive from a total cost of ownership perspective; however, inducing market uptake and subsequent investment at scale are low and often markets fail to mature beyond pilot projects and niche markets, with a notable exception of EVs in several advanced markets.

[2] Preliminary estimates from Climate Policy Initiative (CPI).

[3] See https://www.ipcc.ch/.

In the recent COP28 in Dubai, the same message was reinforced, where the United Nations Climate Change Conference closed with an agreement that signals the "beginning of the end" of the fossil fuel era. These messages laid the ground for a swift, just, and equitable transition, underpinned by deep emissions cuts and scaled-up finance. During the conference, negotiators from nearly 200 parties came together with a decision on the world's first 'global stocktake' to ratchet up climate action before the end of the decade – with the overarching aim to keep the global temperature limit of 1.5°C within reach. The stocktake recognizes the science that indicates global greenhouse gas emissions need to be cut 43 percent by 2030, compared to 2019 levels, to limit global warming to 1.5°C. But it notes that parties are off track when it comes to meeting their Paris Agreement goals.[4]

To achieve the objectives of COP28 declaration a paradigm shift is required in the way transport services and the built environment interact. Transport is an essential service that facilitates the movement of people and goods, creates markets and business opportunities, and fosters economic growth. Decoupling transport demand from GHG emissions without constraining economic activity, particularly in developing nations, requires a paradigm change from traditional road expansion infrastructure investments, which subsidize private vehicle owners and induce demand. Still, many countries need to develop their transport network to support territorial development, and roads will continue playing an important role. However, planning transportation cannot be centered on vehicle use but on a broad approach that captures the various social and economic intricacies of how transport users interact with the built environment. Beyond the need to strengthen policy, regulation, and governance, which can underpin an enabling environment, investments in low-carbon transport and digital infrastructure are a necessity. There are calls for improving the international community's understanding of how investments and innovative finance solutions can create the conditions for the uptake of climate-smart solutions across transport sectors.

While the experience in more advanced economies can be useful, there is no one-size-fits-all approach to transforming the transport sector—each country must develop its own approach. Each country has its own unique challenges to overcome when decarbonizing the transport sector. An approach that works well in one nation may not be successful in another. However, there are core principles and frameworks that can support the development of a viable pathway that accounts for the local context.

The need and urgency to accelerate climate action of the transport sector and maintain the targets established in the Paris Agreement is evident. While climate-friendly technologies and access to innovative financing are still limited to facilitate low-carbon pathways, a paradigm shift from investment in private vehicle infrastructure to mass transit and active mobility is growing. However, the implementation and management of these components is critical to ensure a low-carbon pathway is achieved. To support national and subnational governments in developing tailored approaches, this document provides a set of recommendations that is sufficiently flexible and adaptable to each country context to support an effective transition to a climate-resilient pathway.

[4] UN Climate Press Release of December 13, 2023.

Attracting private capital to bridge the infrastructure gap is critical to accelerating climate action in the transport sector. With national and subnational governments fiscally constrained, attracting private capital to bridge the infrastructure gap, which the Intergovernmental Panel on Climate Change (IPCC) estimates to be between $1.6 trillion and $3.8 trillion annually, is essential to delivering low-carbon alternatives.[5] Historically, transport has been less successful than other sectors in attracting private capital but it is catching up on climate finance with 62 percent of total transport climate finance coming from the private sector in 2021-2022.

However, majority of private climate finance occurred in developed countries. The onus, therefore, for developing countries must be on boosting investment and financial instruments, deepening the understanding of the barriers that hamper scaled-up investments, introducing innovative finance solutions, and harnessing private sector and institutional investors.

To provide a holistic view of the challenges and solutions, this document is organized into these chapters:

- Chapter 2 describes the trends on climate action in transportation sector.
- Chapter 3 describes the architecture of finance for transport climate action.
- Chapter 4 discusses the trends in funding public investments and climate action policies in the transportation sector.
- Chapter 5 presents innovative, scalable, and replicable financial approaches on climate action in transport.
- Chapter 6 presents a series of recommendations for a transition to a low-carbon and resilient pathway in transport.

[5] A new report by ICCP (2023) does include a new update on the infrastructure gap: https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_Chapter_15.pdf. See also section 5.1 for different estimation of the infrastructure gap in Africa.

2

Sizing the Climate Action Challenge

Sizing the Climate Action Challenge

The climate change crisis makes transformation of the transport sector one of the most pressing development challenges of our time. Any scenario to stabilize climate change around the 1.5°C target above preindustrial temperatures is feasible only with an aggressive approach to decarbonizing transport,[6] which requires mitigation and adaptation. The demand for mobility continues to grow as economies develop and urbanize, and as populations and incomes increase. With the world population projected to reach 8.5 billion by 2030, annual passenger traffic (all modes) is expected to grow by 50 percent, and the global freight volume by 70 percent over the same period. Emissions from the transport sector comprised approximately 17 percent of GHG emissions in 2018. Transport sector emissions have also grown faster than those of almost any other sector over the past 50 years. These emissions are forecast to increase by 60 percent by 2050, if adequate action is not taken - see table 2.1.

Table 2.1 Estimated Transport Emissions from Multiple Sources (% of Total Emissions)

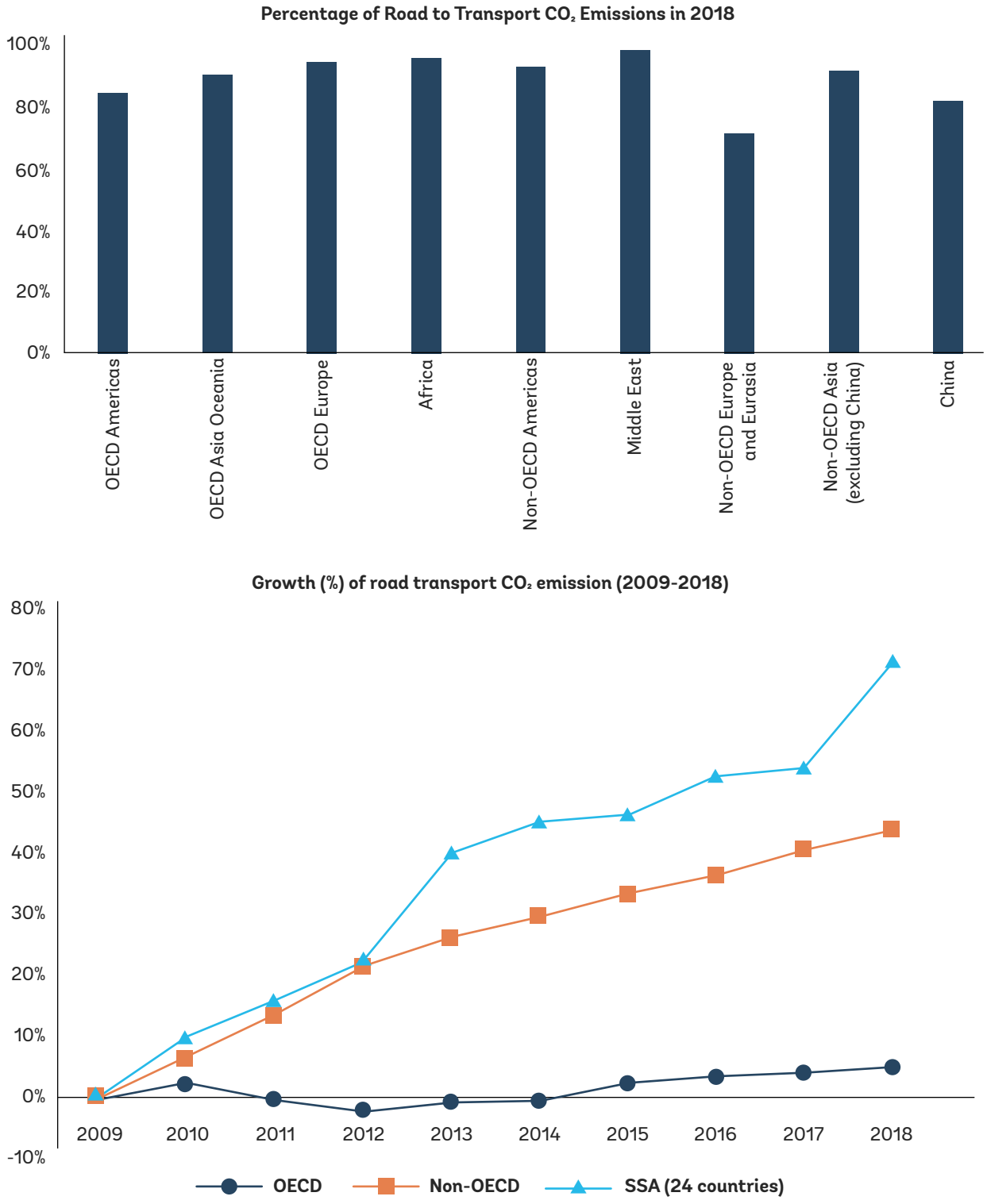
Source	2030	2040	2050
Global Calculator (2019)	12.8%	15.3%	17.9%
IEA (2017)	11.9%	14.2%	16.3%
ITF (2019)	8.8%	10.2%	11.6%
ICCT (2020)	13.8%	17.2%	21.0%
IRENA (2020)	8.2%	8.5%	8.8%
Shell (2020)	10.6%	11.8%	11.5%
SLOCAT (BAU) (2019)	11.0%	12.6%	14.5%
Average	**11.0%**	**12.8%**	**14.5%**

Source: Authors' adaptation based on SLOCAT—Transport Knowledge Base.
Note: ICCT = International Council on Clean Transportation; IEA = International Energy Agency; IRENA = International Renewable Energy Agency; ITF = International Transport Forum; SLOCAT = Partnership on Sustainable, Low Carbon Transport

While energy generation contributes the most GHG emissions, transport emissions are growing faster than those in energy. The ratio of transport to power emissions was 61 percent in 2011 but increased to 67 percent by 2018 (IEA 2021). While there is still a long way to go, the effort to decarbonize the power sector is paying off in most developed economies. It is driven by policy actions along with the capacity of these economies to fund the transition while leveraging innovative climate finance solutions. On the other hand, Emerging Markets and Developing Economies (EMDEs) as well as larger economies in South and East Asia are experiencing an increase in power demand, which is accelerating GHG emissions even as investments are being made in renewables and clear energies. Transport emissions, however, continue to grow worldwide for different reasons in each country – see Figure 2.1. An increase in the motorization rate, partially explained by the lack of public transport, along with unplanned urban sprawl, is likely to drive emissions in most EMDEs in the next decade. Worldwide, road transport is largely accountable for the total transport emissions—74 percent in 2018 (IEA 2021).

[6] Per IPCC research reflecting the consensus views of 830 scientists, engineers, and economists from more than 80 countries. This was formally endorsed by the governments of 194 countries, which, together, identified many possible pathways to reach carbon neutrality by the end of the century.

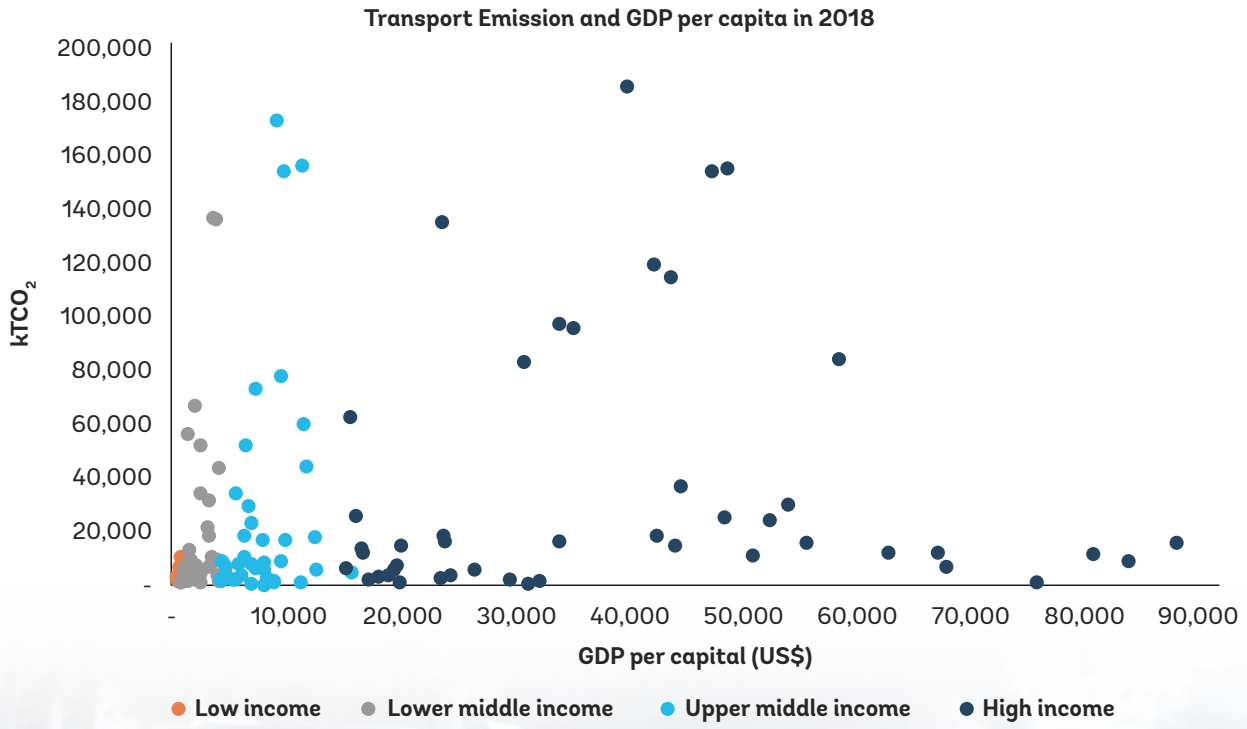
Figure 2.1 Transport CO_2 Emissions



Source: Reprinted from IEA 2021.
Note: IEA = International Energy Agency; OECD = Organization for Economic Cooperation and Development; SSA = Sub-Saharan Africa

Transport emissions from EMDEs are not negligible. These countries contributed as much to transport-related emissions as those in higher-income economies in 2018 (IEA 2021; see figure 2.2). Some LMICs show emission levels like those observed in higher-income countries. However, emissions per capita in higher-income economies are more than five times the emissions per capita in EMDEs. While all emissions matter, countries of high-, middle- and low-income economies are likely to differ in their transition path in policy actions and investment to achieve a Paris-aligned transport sector, as their capacity and development aspirations require different solutions.

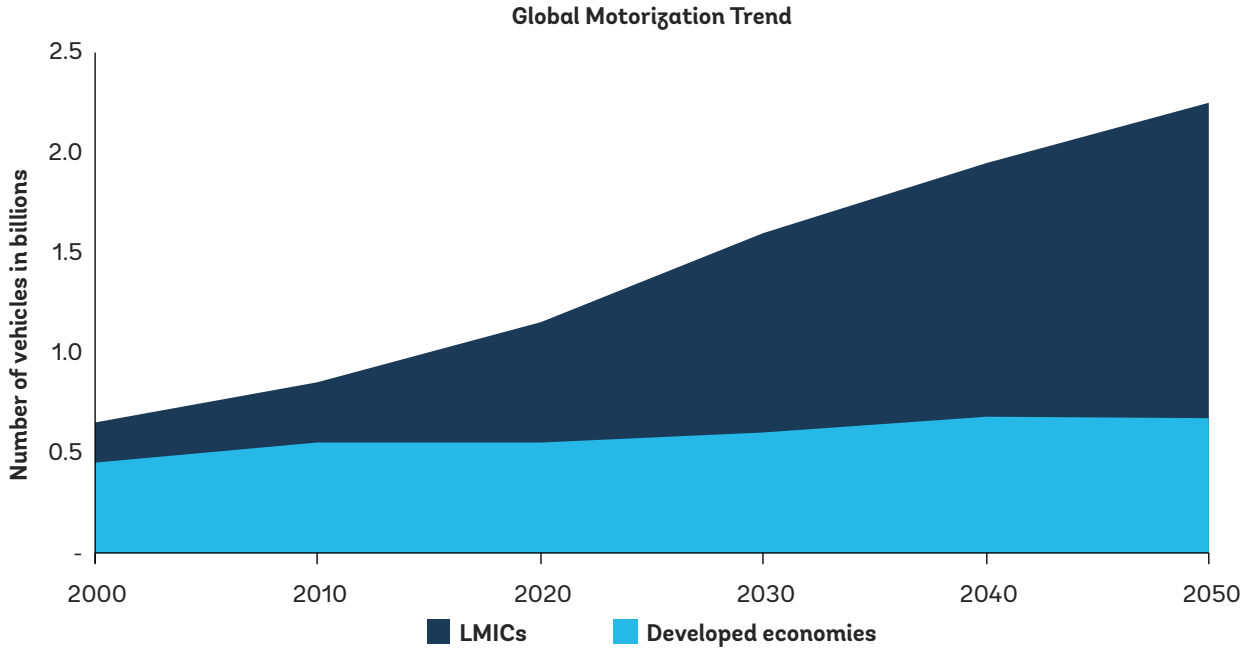
Figure 2.2 Transport CO_2 Emissions and Income Classification



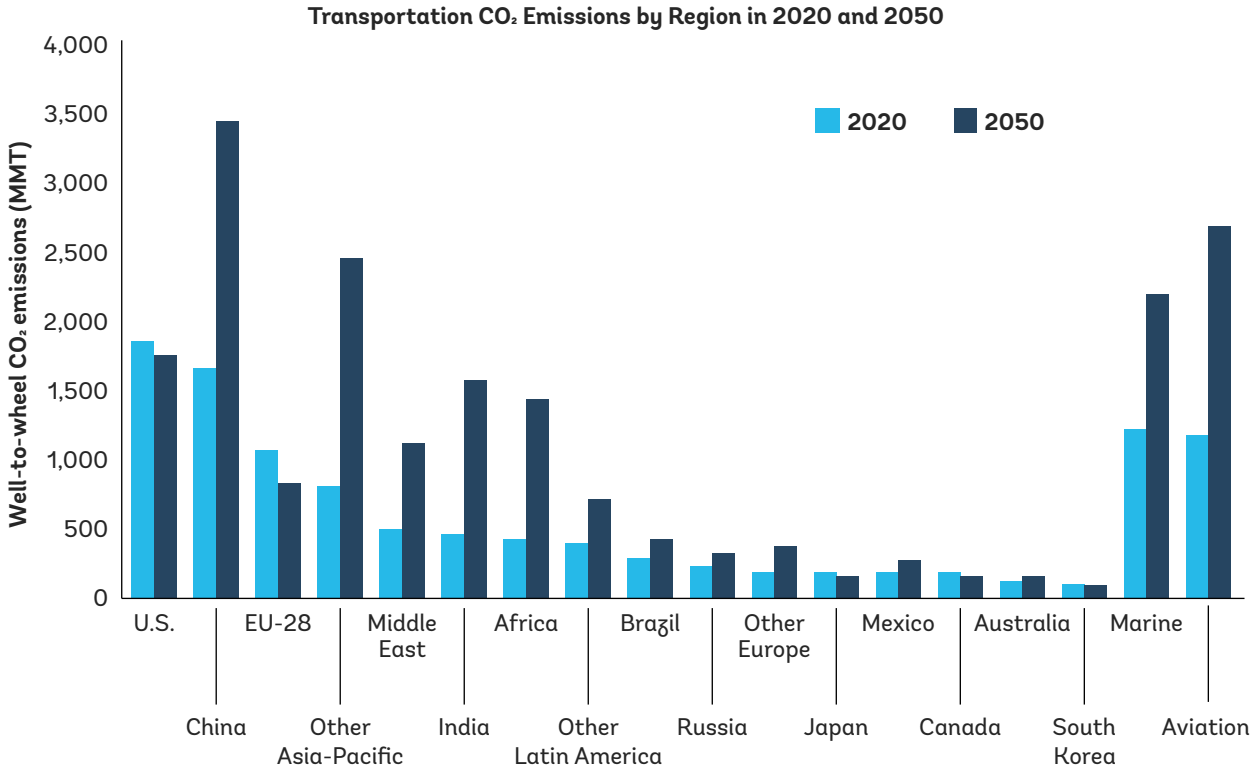
Source: Reprinted from IEA and WDI 2021.
Notes: Some countries with larger CO_2 emission, such as China and the United States, are not included for visualization purpose. Countries with lower emissions but higher GDP per capita or large populations are also omitted for the same reason.
GDP = gross domestic product; IEA = International Energy Agency; WDI = World Development Indicators

Without rapid, deep, and sustained mitigation and accelerated adaptation actions, losses and damages will continue to increase, including projected adverse impacts in LMICs, and will disproportionately affect the most vulnerable populations. Undoubtedly, developed economies are better suited to address the challenges and apply much-needed technological innovations. On the other hand, many LMICs have some mobility and aspirational needs that are not necessarily aligned with their capacity to implement and finance clean infrastructure and mobility solutions, with a higher risk of locking into not-so-clean technologies. Transport emissions are closely linked to the rates of motorization. Projections on growth in the global vehicle fleet show that future growth will primarily be driven by the increasing numbers of vehicles in LMICs. Motorization rates in developed countries have reached saturation and vehicle stock is projected to remain broadly stable (see figure 2.3). With rapidly growing motorization rates, the developing world is likely to be the main driver of increasing transport GHG emissions in the coming decades unless governments act to significantly mitigate the risks and build on the advantage that the present low rates of motorization and high active travel and public transportation rates offer.

Figure 2.3 Future Projections: Growth in Motorization Rate and Transport CO_2 Emissions



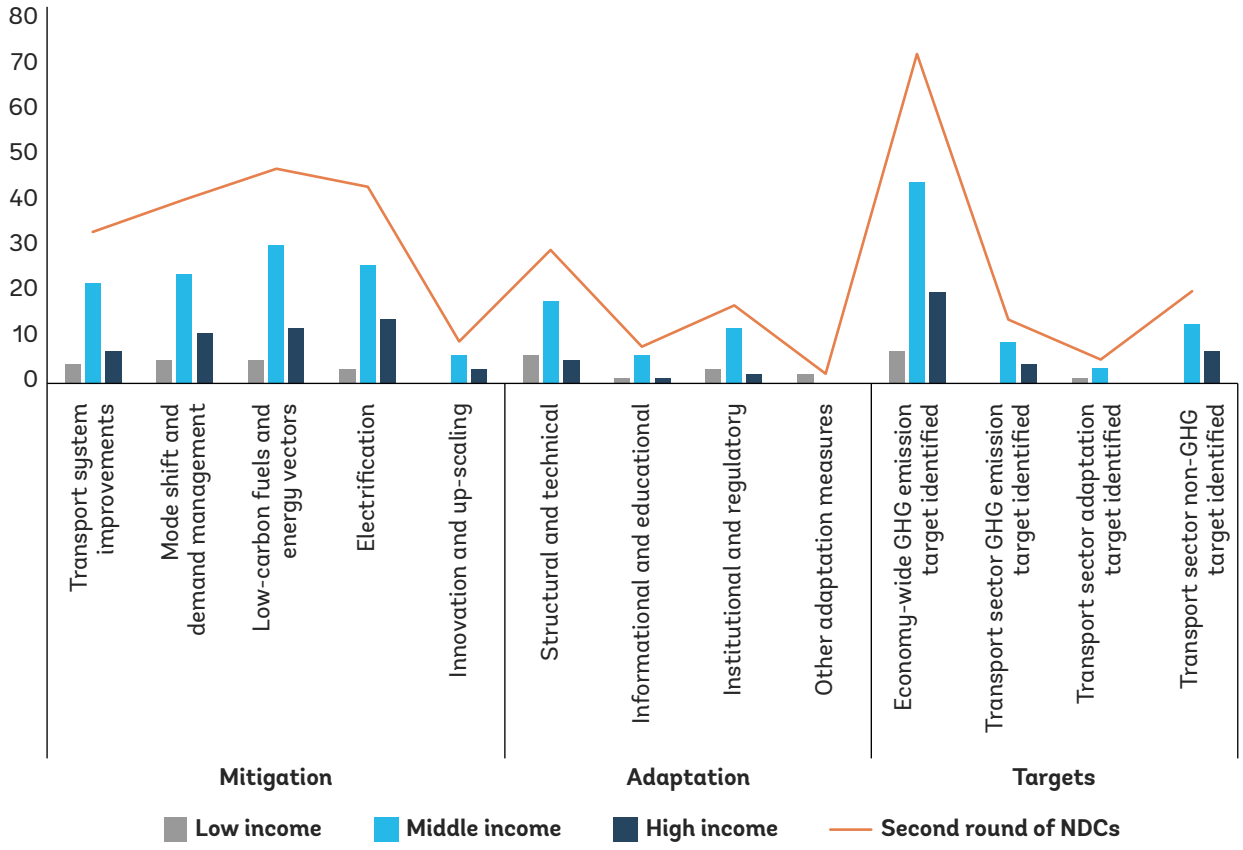
Source: Reprinted from UNDP 2020.



Source: Reprinted from ICCT Vision 2050.
Note: ICCT = International Council on Clean Transportation; LMIC = low- and middle-income countries; MMT = million metric ton; UNDP = United Nations Development Program

Achieving the Paris Agreement targets requires coordinated policy actions and strong political commitment. The Agreement requests each country to outline and communicate their post-2020 climate actions through their nationally determined contributions (NDCs). These are non-binding national plans describing targets for GHG emission reductions along with climate policies and measures. The first version of the NDCs highlighted efforts to decarbonize transport but the second version went further with more concrete actions. Nonetheless, 84 countries submitted their second version, out of 197 countries that signed the Agreement (SLOCAT 2021). Middle-income countries led the effort by proposing mitigation and adaptation measures in the transport sector. However, fewer countries have set targeted emission reductions (see figure 2.4). There are gaps between projected emissions from implemented policies and those from NDCs, and finance flows fall short of the levels needed to meet climate goals across all sectors and regions (IPCC 6th Assessment Report, March 2023).[7]

Figure 2.4 Number of Countries Tracking Climate Strategies for Transport



Source: Reprinted from SLOCAT 2021.
Notes: GHG = greenhouse gas; NDCs = nationally determined contributions; SLOCAT = Partnership on Sustainable, Low Carbon Transport

[7] https://www.ipcc.ch/.

The COVID-19 pandemic brought many lessons on how to reorganize some economic activities. The pandemic affected the way people moved and could change transport patterns in the long term in every part of the world. During its worst phase, there was a significant shift to home-based work, but many people who were required to continue traveling to work faced reduced transport options—the impact in LICs is less evident. Demand for public transport and air travel plunged. Walking and cycling rates surged on reconfigured streets. Global maritime trade dropped as large numbers of container fleets idled at the peak of initial lockdowns. On a positive note, these changes translated to a decline in fossil fuel consumption and GHG emissions. Moreover, if telecommuting trends continue post–pandemic, the reduced growth rate of transport might ease GHG emissions. Globally, governments implemented stimulus and recovery fiscal packages as COVID-19 surged, in some cases, with considerable resources channeled to fossil fuel–related companies rather than in clean energy.[8] Moreover, stabilization measures did not emphasize green transport measures, but as countries turn to longer term recovery, investing in sustainable mobility is of utmost importance.

2.1 Identifying the Need to Take Climate Action in Transport

By most estimates, the scale of financing channeled toward meeting Paris Agreement targets and the 1.5°C pathway is falling far short of the required investment. The IPCC estimates that $1.6 trillion–$3.8 trillion is required annually for supply-side energy system investments alone (IPCC 2018). As of 2021–22, average annual climate financing flows were $1.3 trillion (Climate Policy Initiative 2023), leaving an investment gap to fill if the Paris Agreement targets are to be achieved. Rozenberg and Fay (2019) quantifies the estimated increased investment required to pursue a climate action pathway for LMICs. Climate finance flows were primarily driven by a significant acceleration in mitigation finance. Despite the growth in 2021-2022, climate flows represented about only 1 percent of global GDP[9] in 2022. Under the preferred scenario—ambitious goals, high efficiency—investment in infrastructure within the transport sector needs to increase by 1.3 percent of the GDP, with an overall investment per year of $417 billion between 2015 and 2030. Ongoing expenditure on maintenance is found to be of similar order, requiring an increased expenditure of 2.6 percent of the GDP overall. But these figures could be even higher if other investments and policies are included.[10]

There is clearly a large investment gap in the efforts to achieve Paris-aligned transport[11] but can governments mobilize the much-needed resources to finance the transition? In principle, the answer for developing countries is not straightforward. Climate-resilient development integrates adaptation and GHG mitigation to advance sustainable development for all.

[8] See Fried, Welle, and Avelleda (2021). See also SLOCAT 2021 and https://climateactiontracker.org/publications/global-update-pandemic-recovery-with-just-a-hint-of-green/.

[9] Global GDP was $100 trillion in 2022, according to the World Bank (https://data.worldbank.org).

[10] Such policies could be, for instance, on investments on activity mobility (sidewalks, bike lines, etc.) and transport decarbonization policies when including the costs on banning ICE vehicles or standards on used vehicles among others.

[11] In general, the different estimations of the investment gap to decarbonize transport focus on the fleet renewal and expansion (vehicles, aviation, maritime). On the contrary, when it comes to less-developed economies, the investment gap to provide connectivity is underestimated and consequently, the investment gap to decarbonize transport is related to the increased connectivity.

2.2 Climate Action Requires Climate Risk Management

Action on mitigation and adaptation starts with understanding both climatic and non-climate risks to transport. Risks and projected adverse impacts, and related losses and damages from climate change, escalate with every increment of global warming. Climatic and non-climate risks will increasingly interact, creating compound and cascading risks that are more complex and difficult to manage (IPCC 6th Assessment Report, March 2023). While mitigation measure will entail removal and avoidance solutions, adaptation will involve building resilient transport systems that can withstand climate change impact. Most observed adaptation responses are fragmented, incremental, sector-specific, and unequally distributed across regions. Despite progress, adaptation gaps exist across sectors and regions and will continue to grow under current levels of implementation, with the largest adaptation gaps among lower income groups (IPCC 6th Assessment Report, March 2023).[12]

Transport sector–specific climate and disaster risk management is needed. Climate change is anticipated to elevate the occurrence and severity of certain extreme weather events. In particular, heat waves are expected to intensify, and the rise in sea levels may exacerbate storm surges along coastal regions, while precipitation is predicted to become more intense. These alterations pose an augmented risk of delays, disruptions, damage, and failures within our terrestrial, aerial, and maritime transportation systems. Given that the majority of current transportation infrastructure is designed to endure for 50 years or more, it becomes crucial to grasp the potential impact of future climate conditions on these long-term investments in the forthcoming decades.[13] Financing gap estimates do not include costs linked to escalating risks associated with climate change, which are not yet fully incorporated into the maintenance of existing infrastructure and investments in new infrastructure (Minh, Leow, and Seiderer 2020). According to Hallegatte, Rentschler, and Rozenberg (2019), the net benefit of building more resilient infrastructure in low- and middle-income countries would be $4.2 trillion, with $4 in benefit for each $1 invested. Moreover, enhancing service delivery requires much more than increased capital expenditure; it also requires improvements in spending efficiency (Rozenberg and Fay 2019). These climate-related risks (CRR) can broadly be classified into two categories (Bisbey et al. 2022): physical risks and transition risks. For the transport sector, these two risks will transpire as shown in tables 2.2 and 2.3.

Physical risks: These are the immediate impacts of climate change that arise from climate-related disasters. For example, storms and floods could damage real property and raise maintenance costs, and extreme weather events such as droughts could disrupt the functions of water-intensive infrastructure involved in hydropower generation, mining, and wastewater treatment.

[12] See https://www.ipcc.ch/.

[13] United States Environmental Protection Agency – Climate Impacts on Transportation.

Table 2.2 Physical Risks in Transport

Chronic risks—Longer-term shifts in climate patterns	
Mean temperature change	• Asset damage, such as melting road surfaces and buckling railway lines
Sea-level rise	• Permanent inundation of assets
Change in precipitation patterns and extreme variability in weather patterns	• Damage to assets in increased frequency and severity • Longer and more frequent disruption of services • Decreased level of protection from adaptation measures • Increased need for storage capacity of resources for contingency uses
Acute risks—Event-driven hazards, including increased severity of extreme weather events	
Drought and heatwave	• Asset damage • Disruptions of inland marine traffic
Flood	• Asset damage
Wildfire	• Multimodal traffic disruptions
Hurricane, storm, typhoon, and tornado	

Source: Authors' adaptation based on Bisbey, Lee, and Ryan (2022).

Transition risks: These are risks that could result from the process of adjusting toward a low-carbon economy. For example, abrupt and unforeseen heavy fluctuations in fossil fuel prices or changes in carbon pricing policies can disrupt the business models of entire industries.

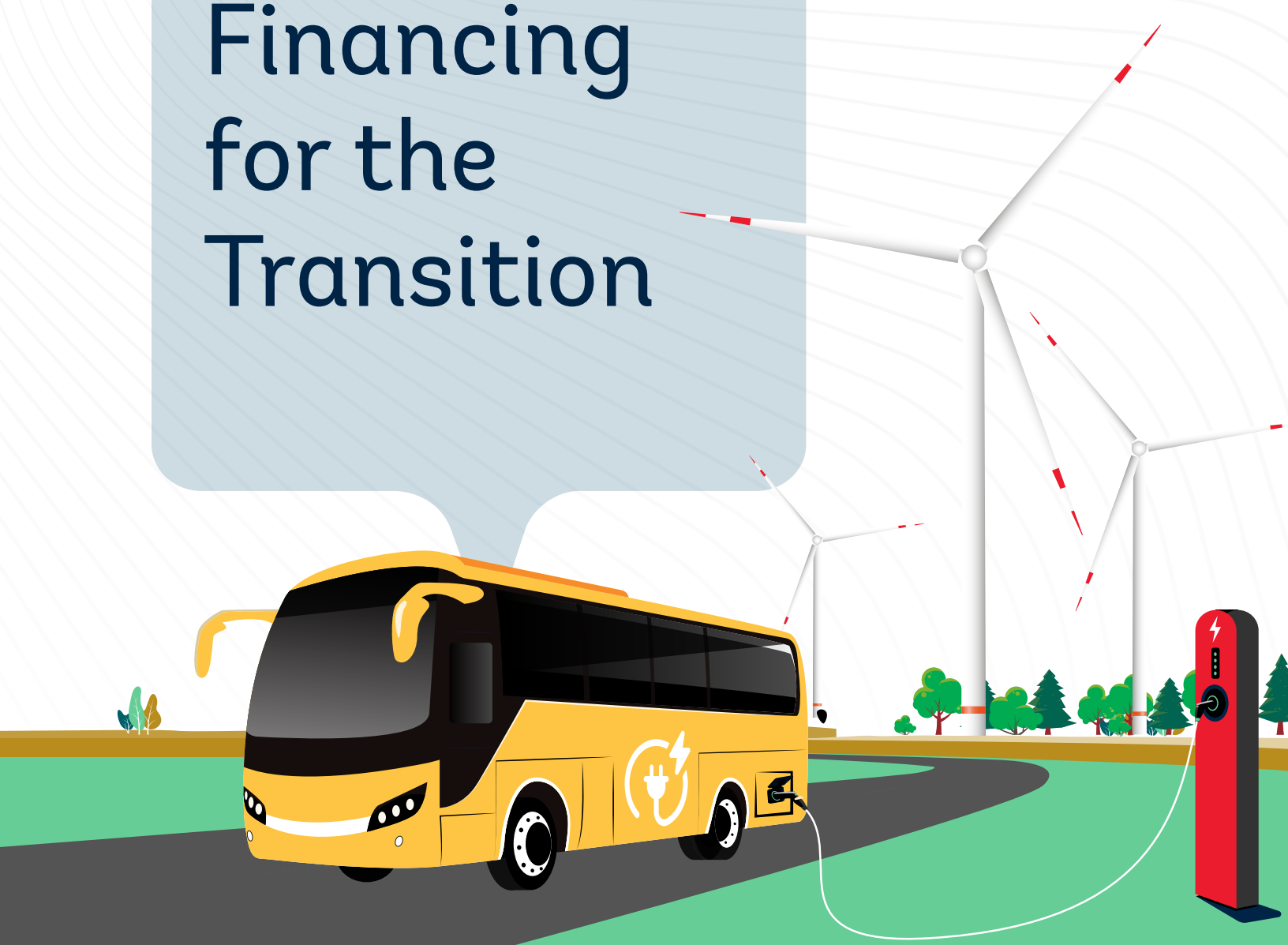
Table 2.3 Impact of Transition Risks on Transport Projects and Financing

Transition risks	Impact on transport projects	Impact on financing
Technology		
• Substitution of existing products and services with lower emissions options • Unsuccessful investment in new technologies • Costs to transition to lower emissions technology	• Write-offs and early retirement of existing assets • Reduced demand for products and services • Future capital investments in retrofitting new technology • Other costs to deploy new practices and processes	• Contractual provisions to encourage ongoing adoption of innovations and cost-sharing might be needed to promote technological upgrades • Investors may perceive higher financial risks from technological obsolescence accelerated by climate transition
Market		
• Changing customer behavior • Uncertainty in market signals • Increased cost of raw materials	• Higher uncertainties in economic demand and difficulty in pricing infrastructure services • Potential risks of cost overruns due to raw material price changes • Carbon pricing regime affecting input costs and output demand	• Private investors may demand additional financial support from the government to de-risk heightened climate-related market risks • The long-term financial viability of projects may be undermined if such market risks are not properly considered
Reputation		
• Shifts in consumer preferences • Stigmatization of sector • Increased stakeholder concern or negative stakeholder feedback	• Higher public scrutiny and political risks toward the approval of infrastructure proposals • Potential project delays and termination due to stakeholder protests	• Participatory processes may become increasingly important in PPP project planning and design
Policy and Legal		
• Increased pricing of GHG emissions • Enhanced emissions-reporting obligations • Mandates on and regulation of existing products and services	• Uncertainties in the obligations and sharing of financial costs from GHG pricing • Higher climate-related disclosure and other compliance costs on infrastructure operators • Write-offs, asset impairment, and early retirement of assets due to policy changes	• Project contracts may need either more flexibility for future revisions or forward-looking provisions to clarify how to manage the financial impact and regulatory challenges from new climate policy

Source: Authors' adaptation based on Bisbey, Lee, and Ryan (2022).
Note: GHG = greenhouse gas; PPP = public-private partnerships

3

Mobilizing Financing for the Transition

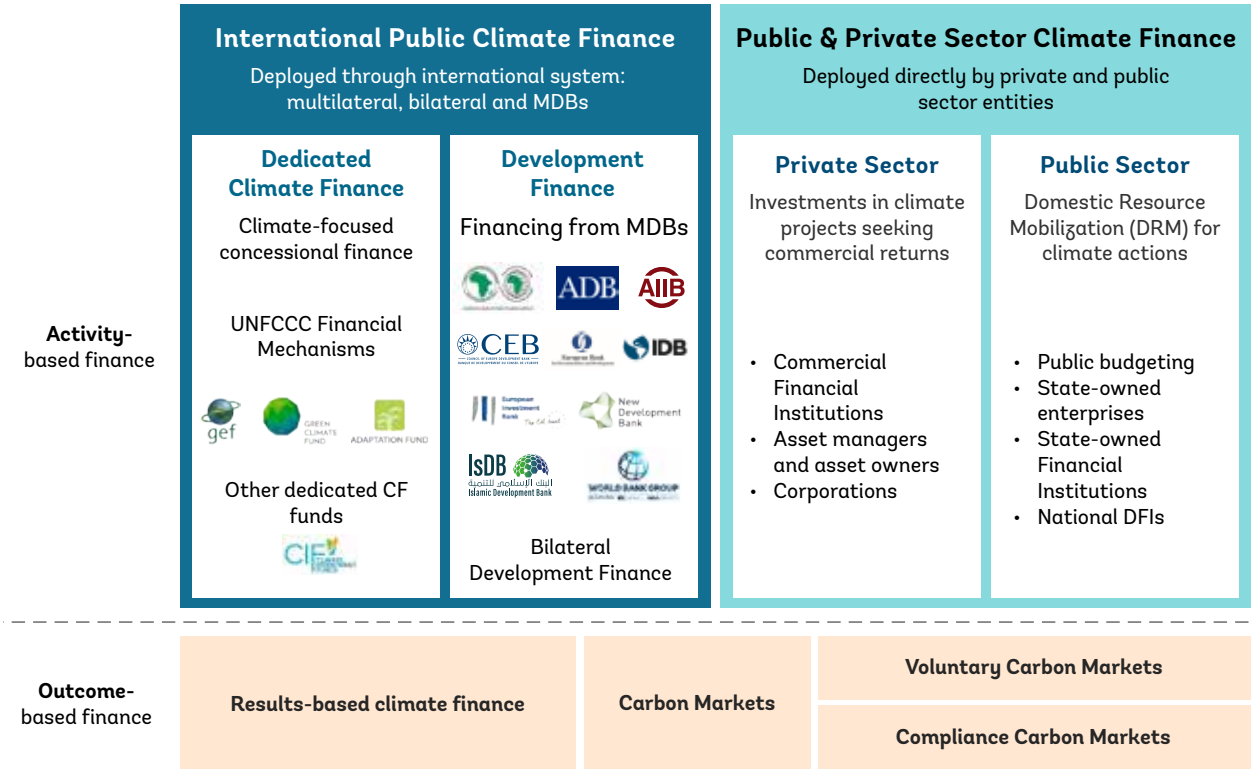


Mobilizing Financing for the Transition

As countries around the world are debating how they can strategize and deliver in line with their development path, the follow-up question is where will the financing for sustainable transport come from? As discussed below, most of the financing for low-carbon transport in developing countries originates from DFIs. At the same time, thematic funds, and instruments such as climate-related funds and bonds, have yet to leverage their support to the transport sector. This section discusses the global architecture of climate financing, the barriers, and limitations to mobilize different investors, and reviews some selected experiences toward the financing of green and resilient transport.

Virtually, most climate finance is in the form of activity-based climate finance. In most cases, this is channeled through loans, grants, equity, or guarantees to cover upfront costs. And outcome-based finance (result-based climate finance and carbon markets) can play an important role in channeling debt-free finance to project developers. Climate finance refers to local, national, or transnational financing that seeks to support mitigation and adaptation actions that will address climate change (United Nations Framework Convention on Climate Change). The investments for climate financing are complex and continually evolving. Distinguishing which flows of finance may be attributed to climate related investment is challenging. Several collated datasets provide insight into the scale of climate finance flows. However, reflecting the wide definition and wide range of potential sources of financing, accurate tracking of climate-related financing remains problematic. The next sections discuss the sources of climate finance, and some issues related to transport projects.

Figure 3.1 Sources of Climate Finance for Low-Carbon Transport



Source: World Bank.

3.1 What does the Climate Financing Landscape Look Like for Green Transport?

Estimates of worldwide climate-related investment ranks climate financing flows across all sectors in 2021–22 at $1.27 trillion on average each year.[14] The vast majority, or 90 percent, of climate finance flows were for mitigation. East Asia and the Pacific, the US and Canada, and Western Europe account for a combined 84 percent of total climate finance. Current global financial flows for adaptation are insufficient for, and constrain implementation of, adaptation options, especially in developing countries (IPCC 6th Assessment Report, March 2023).[15] The financing of low-carbon transport accounted for $336 billion or 29 percent of that investment, making transport the second largest beneficiary of climate finance after the renewable energy sector, which accounted for 44 percent of all financing.

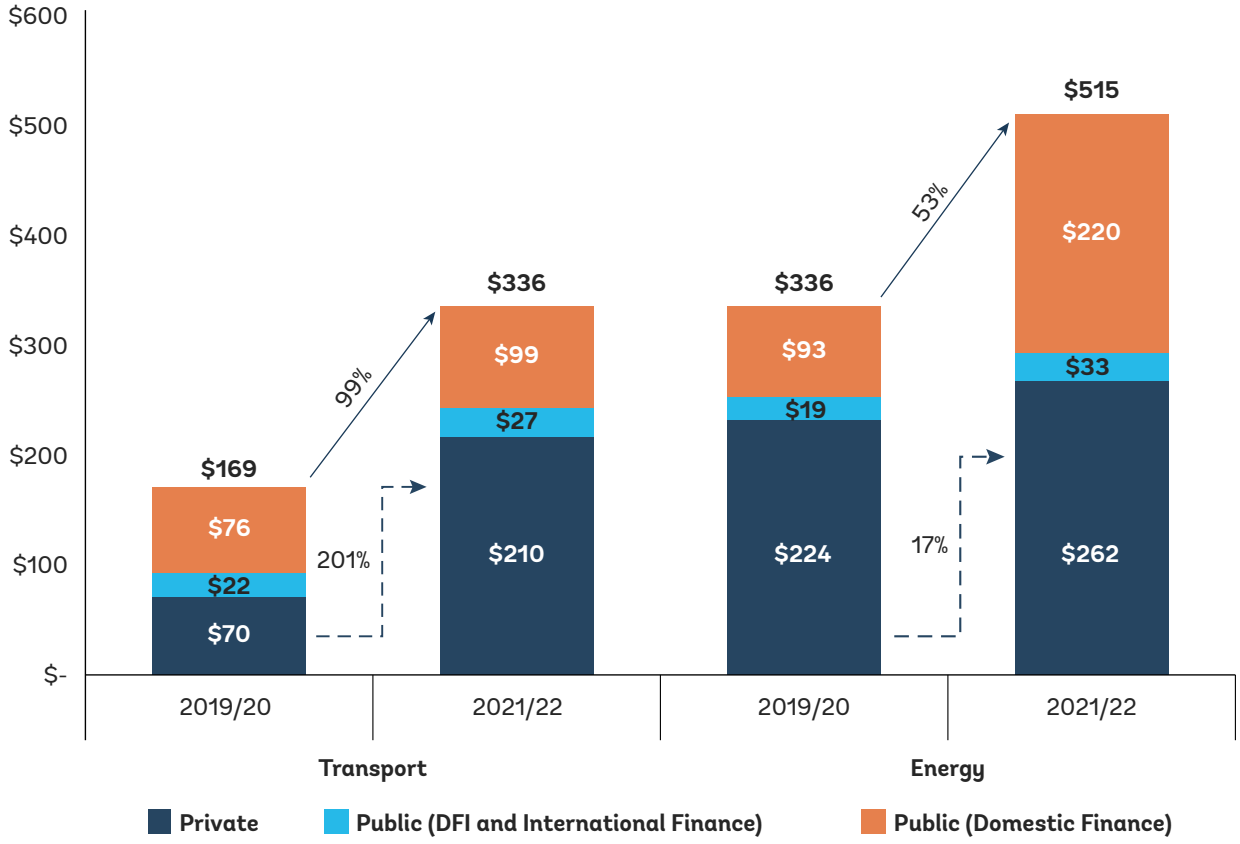
In a major shift in 2022, the source of low-carbon transport financing is primarily from the private sector worldwide with the majority coming from households. Commercial financial institutions, corporations, households, and individuals financing for low-carbon transport totaled $210 billion—about 62 percent, most of which was in developed countries—while domestic public

[14] Preliminary estimates from Climate Policy Initiative (CPI).

[15] See https://www.ipcc.ch/.

finance accounted for $99 billion or about 30 percent, and the rest came from the DFIs (Figure 3.1). This is a significant shift in the transport sector and in the year 2022, transport caught with the energy sector on sources of financing. While the energy sector attracts almost one and a half times the amount of climate-related financing, the proportion of private sector financing in energy (51 percent) is like the transport sector (62 percent). The role of financing from DFIs for both energy (6 percent) and low-carbon transport (8 percent) remains low.

Figure 3.2 Sources of Climate Finance for Low-Carbon Transport ($ billion)



Source: CPI 2022. Data derived from "Global Landscape of Climate Finance".
Notes: Private includes commercial financial institutions, corporation, funds, households/individuals, institutional investors, unknown; Public includes, government, public funds, national DFIs, SOEs, state-owned FIs; Public DFIs and International finance include multilateral DFI, bilateral DFIs, Export Credit Agency (ECAs), multilateral climate funds.
DFI = development finance institution; ECA = export credit agency; FI = finance institution; SOE = state-owned enterprise

Households and national development banks are taking the lead in transport. Average annual finance to transport projects rose by 99 percent from its 2019/20–20 level to $336 billion in 2021 and 2022. A breakdown of each of these three categories shows the evolution of domestic finance in clean transport from 2017 to 2022 (figure 3.2). National banks funding is consistently taking most of the financing, which makes sense in transport where both revenue generation and financing are local. In the private sector category, the largest share is from households with a growing share from commercial financial institutions and corporations. Private sector investment is increasing, but not

at the scale and speed necessary for the transition. Private sector actors, particularly financial institutions with trillions of assets under management, are committing to net zero and sustainable finance practices. Nonetheless, it is not clear how fast these commitments are translating into changes and investment on the ground (CPI 2023). The growth rate of private climate finance was 201 percent, as in Table 3.1. Multilateral climate funds, currently very low, must catch up if the low carbon transition is to be effective.

Table 3.1 Breakdown of Types of Financing Sources for Transport

	2017	2018	2019	2020	2021	2022
Private	**33,882**	**48,970**	**63,085**	**76,419**	**162,318**	**256,967**
Commercial FI	4,840	3,337	16,913	23,450	45,667	70,430
Corporation	2,969	1,838	20,028	26,004	7,305	11,071
Funds	586		3,355			
Households/Individuals	19,299	41,509	22,753	26,946	109,339	175,432
Institutional investors	4,468	2,286	22	19	7	34
Unknown	1,721		14			
Public (Domestic Finance)	**107,762**	**47,014**	**92,335**	**60,344**	**77,327**	**121,272**
Government	12,973	14,897	10,182	10,995	22,223	32,747
National DFI	92,150	31,085	82,128	49,139	55,065	88,525
Public Fund	21	67	26	211		
State-owned FI	585				39	
SOE	2,032	966				
Public (DFI and International Finance)	**15,081**	**19,513**	**19,684**	**25,295**	**22,977**	**31,604**
Multilateral DFI	12,382	10,810	15,657	15,705	17,561	20,171
Bilateral DFI	2,151	7,993	3,823	9,567	4,485	10,288
Export Credit Agency	548	710	203	23	649	649
Multilateral Climate Funds	44	49	34	141	283	496
Total	**156,725**	**115,497**	**175,104**	**162,059**	**262,622**	**409,843**

Source: CPI 2022. Data derived from "Global Landscape of Climate Finance".
Note: Private includes commercial financial institutions, corporation, funds, households/individuals, institutional investors, unknown; Public includes, government, public funds, national DFIs, SOEs, state-owned FIs; Public DFIs and International finance include multilateral DFI, bilateral DFIs, ECAs, multilateral climate funds. DFI = development finance institution; ECA = export credit agency; FI = finance institution; SOE = state-owned enterprise.

Road transport continues to dominate the demand for climate finance. Most (over 70 percent in 2022) of financing has gone towards electrification of vehicles and related infrastructure for charging and storage batteries (see Table 3.2). Rail and public transport stand at about 20 percent of total financing in 2022. The trend is consistent over the past four years. This is in proportion to a majority of financing coming from the private sector in electrification of private vehicles. Clearly, emphasis on modal shift to public transport is lagging and financiers must step up in making this happen.

Table 3.2 Breakdown of sub-sectors in Transport 2019-2022 in $ billions

Sector	2019	2020	2021	2022
Rail & Public Transport	17.0	10.0	68.0	88.0
Transport-oriented Urban Development and Infrastructure	1.0	1.0	-	0.0
Waterway	-	-	2.0	6.0
Aviation	-	-	0.2	0.1
Other/Unspecified	92.0	60.0	6.0	17.0
Policy & National Budget Support & Capacity building	2.0	-	2.0	3.0
Road Transport (EVs battery & chargers)	59.0	106.0	184.0	295.0
Total Transport	**171.0**	**177.0**	**262.2**	**409.1**

Source: CPI 2022. Data derived from "Global Landscape of Climate Finance".
Note: EVs= Electric vehicles.

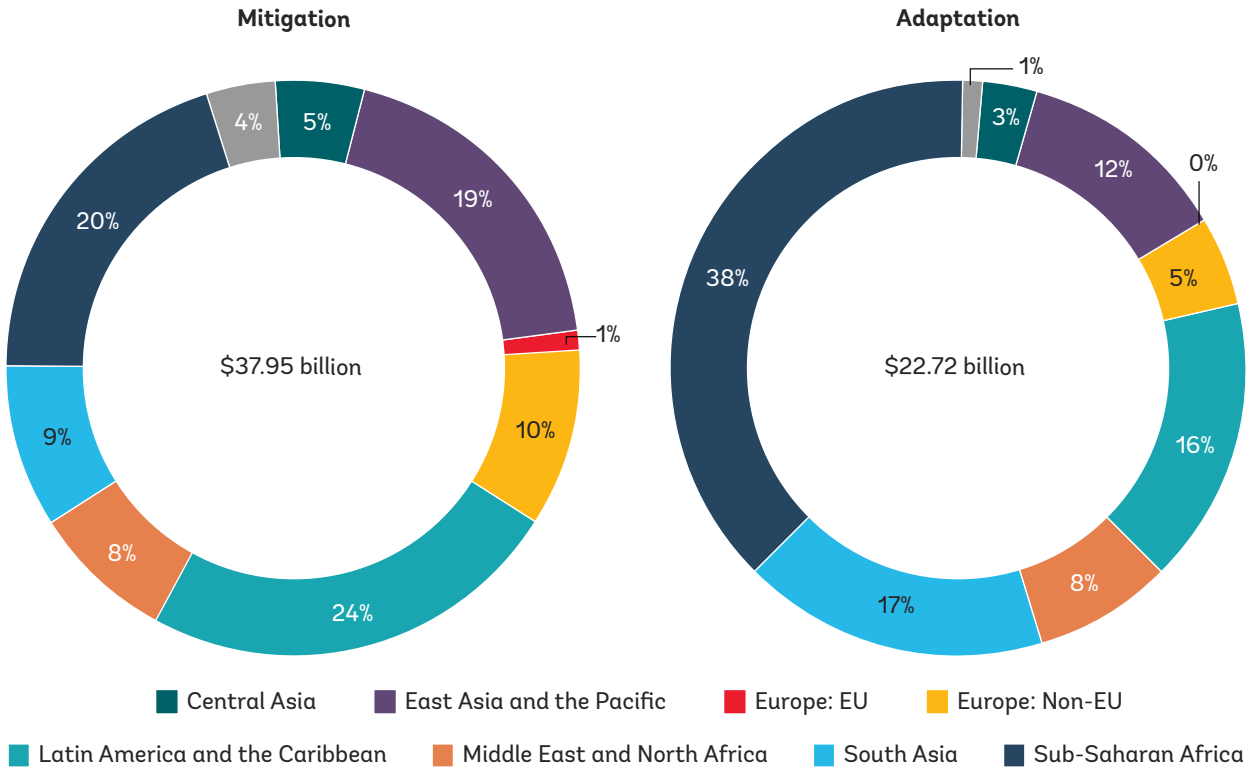
3.1.1. DFIs are leading financing on climate financing in transport

Among the DFIs, multilateral development banks[16] (MDBs) are taking an important role in supporting financing of low-carbon transport investments. They account for a quarter of the investment by DFIs and international finance for 2022 (see figure 3.3). The scale of transport sector financing extended by the MDBs collectively has averaged approximately $20 billion per year over the last decade. It exceeds the target set by the MDB working group on sustainable transport to provide more than $175 billion—$17.5 billion per year—of loans and grants for transport in developing countries between 2012 and 2022 under the Rio+ commitment.[17] Asian countries are the largest recipients of development financing flows to the transport sector, with just three countries—India, the Philippines, and Bangladesh—receiving more than half of the mobilized finance in 2017–18.

[16] The MDBs are African Development Bank (AfDB), the Asian Development Bank (ADB), the Asian Infrastructure Investment Bank (AIIB), the Council of Europe Development Bank (CEB), the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), the Inter-American Development Bank Group (IDBG), the Islamic Development Bank (IsDB), the New Development Bank (NDB) and the World Bank Group (WBG).

[17] The working group consists of the following banks: AfDB, ADB, Corporacion Andina de Fomento (CAF), EBRD, EIB, IADB, the Islamic Development Bank (IsDB), and WB.

Figure 3.3 Total Climate Finance from Multilateral Development Banks ($ millions) to LMICs in 2022



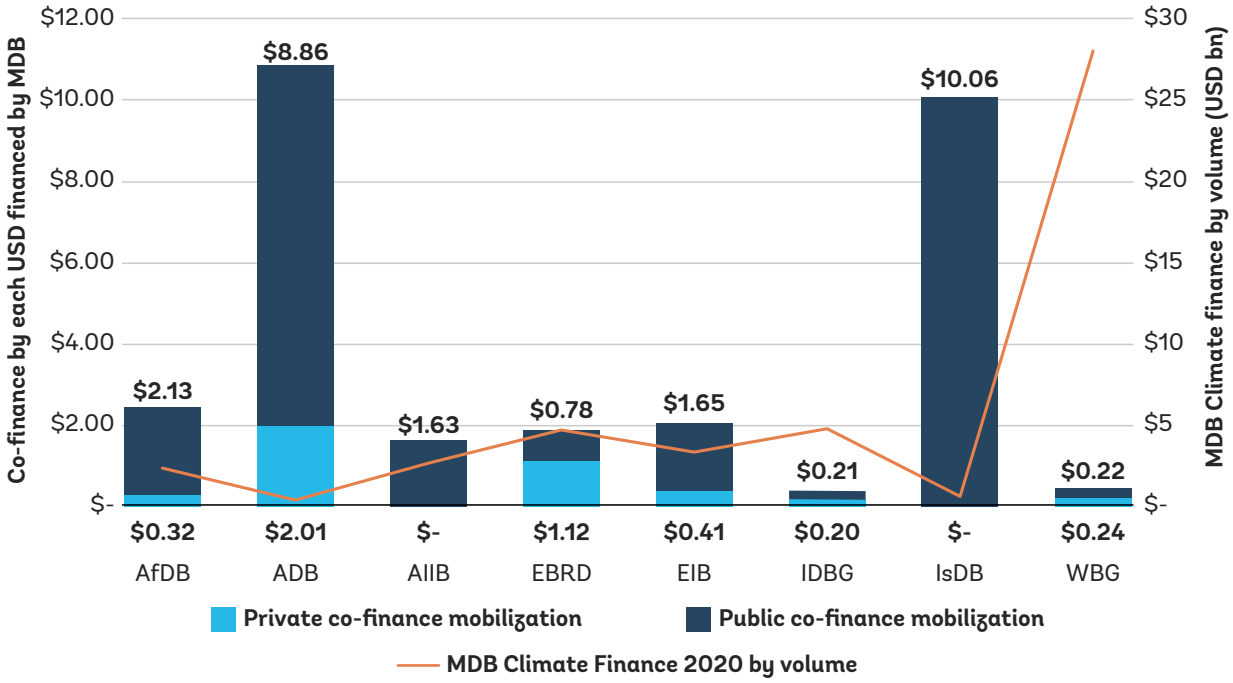
Source: 2022 Joint Report on Multilateral Development Banks' Climate Finance.
Note: MDB = multilateral development bank

The amount of climate finance from MDBs to all sectors in LMICs increased in 2022.[18] In 2022, $60.7 billion was for low-income and middle-income economies. Of this, $38 billion, or 63 percent, was for climate change mitigation finance and $22.7 billion, or 37 percent, was for climate change adaptation finance. In 2022, the MDBs reported $48.7 billion of their climate finance for public recipients and $12.0 billion for private recipients in low-and middle-income economies.

Mobilization of private finance decreased for the second consecutive year in 2020–21. In effect, for every dollar financed by each MDB in 2021, a smaller share was mobilized in co-financing from private sources. Even the most successful MDB for private cofinancing, the Inter-American Development Bank Group (IDBG), did not exceed one dollar in private capital for each dollar lent. The African Development Bank (AfDB) and the Asian Infrastructure Investment Bank (AIIB) reported more than $3 in other public cofinancing for each dollar financed through the country's government and aid agencies of developed countries (see figure 3.4).

[18] WBG et al. (2022).

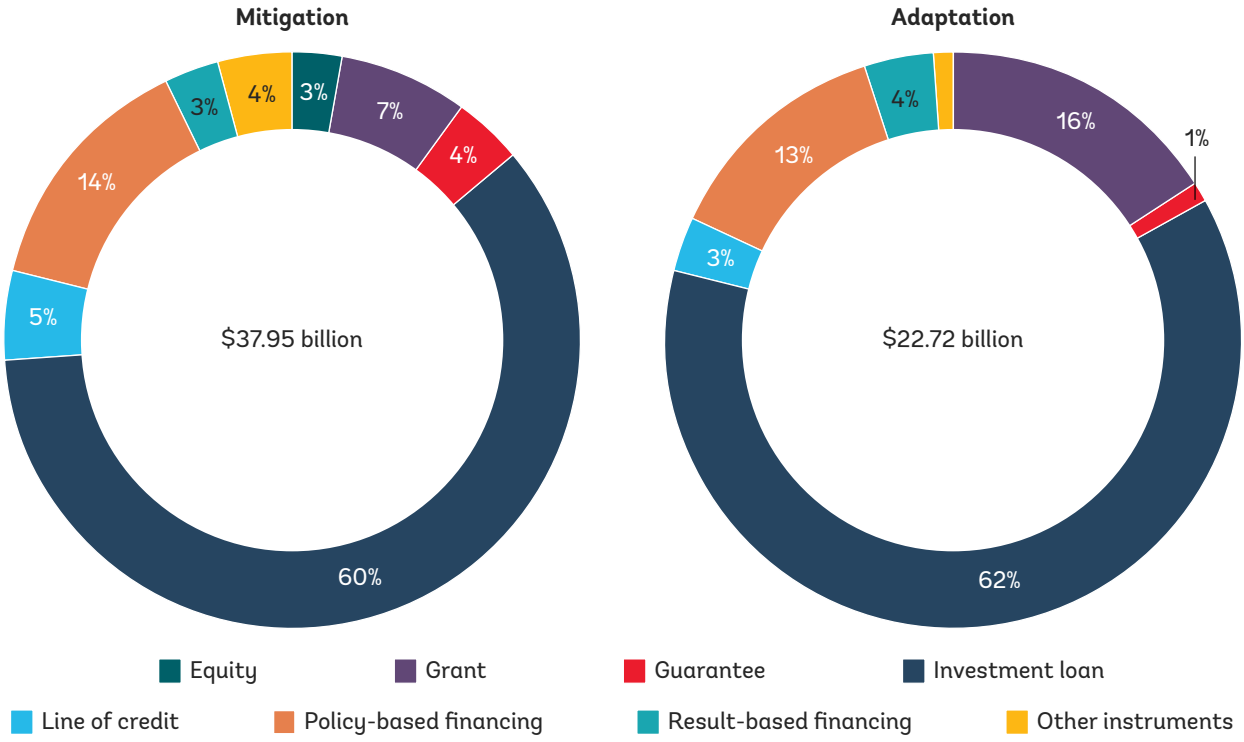
Figure 3.4 Cofinancing Mobilized for Each Dollar of MDB Climate Finance to all Sectors in LMIC (2022)



Source: Authors' adaptation from the 2022 Joint Report on Multilateral Development Banks' Climate Finance.
Note: LMIC = low- and middle-income countries; MDB = multilateral development bank.

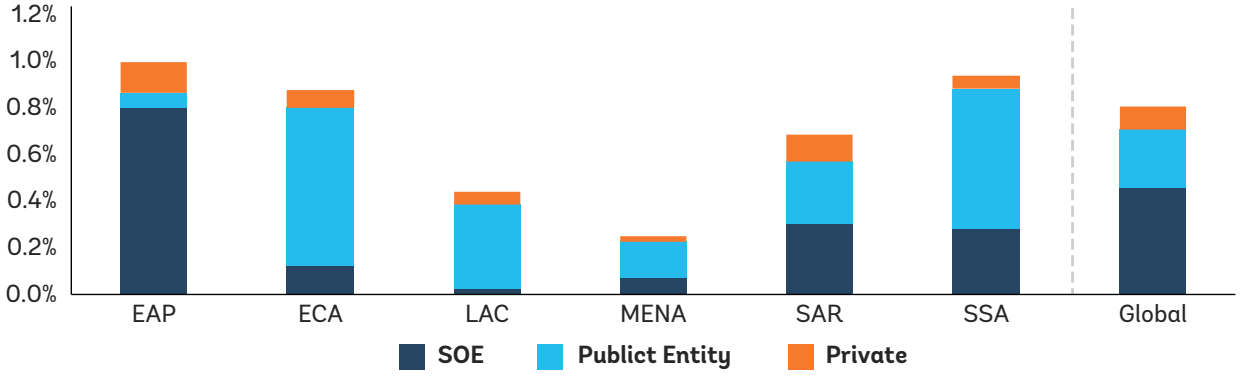
The limited mobilization of private finance in 2021 could be driven by the impact of the COVID-19 pandemic even when the figures were also low in the preceding years. Financing instruments that MDBs use most are loans, while guarantees and equity investment represent a minor share of climate finance in LMICs (see Figure 3.5). However, innovative solutions where the role of MDBs is focusing on derisking projects could be the right approach to mobilize more financing. It could eventually present opportunities for the private sector to offer some derisking instruments (guarantees and insurances) by pooling projects with different climate profiles. The experience of monoline companies, despite their collapse following the subprime crisis back in 2008, could bring some lessons learned on de-risking institutions. These companies provided insurance to fixed income (bonds) that have been useful to cover construction risks for greenfield projects. Maybe there are opportunities for MDBs, climate funds, and the private sector to leverage such type of instruments focusing on climate projects. At this urgent need of green financing, it is fully plausible that the private sector globally rises to accept green start-up financing and comes up with innovative mechanisms to leverage investments. It is worth mentioning that private monies in transport are channeled through PPP—project finance and regulatory asset-based models, state-owned enterprises (SOEs), public entities, and fully private infrastructure (see Figure 3.6). Thus, specific solutions should be crafted for each delivery mode.

Figure 3.5 MDB Climate Finance by Type of Instruments (2022)



Source: 2022 Joint Report on Multilateral Development Banks' Climate Finance.
Note: MDB = multilateral development bank.

Figure 3.6 Public and Private Investments in Transport Infrastructure[19]



*Based on 2016 GDP latest available at the time of analysis

Source: Public-Private Infrastructure Advisory Facility 2018.
Note: EAP = East Asia and Pacific; ECA = Europe and Central Asia; GDP= gross domestic product; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa; SAR = South Asia Region; SOE = state-owned enterprise; SSA = Sub-Saharan Africa.

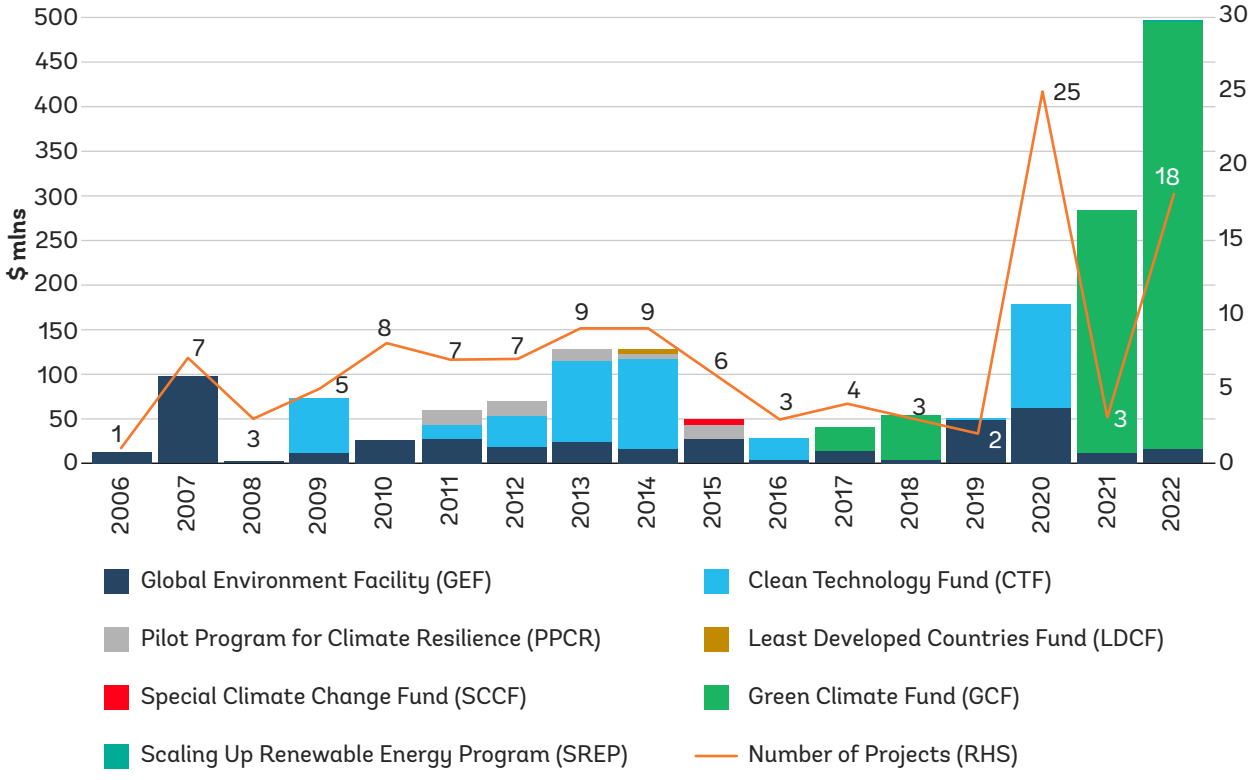
[19] These investments capture capital expenditure mostly in transport infrastructure and primarily in projects sponsored by the public sector. Investments in bus concession or investments in e-vehicles by households and private firms are not covered in this figure.

3.1.2. Climate funds are limited in their role to support green and resilient transport

Transport-related projects are securing limited climate funds to date. Climate funds were established under the United Nations Framework Convention on Climate Change (UNFCCC) as financing mechanisms designed to channel funding to climate-related mitigation and adaptation initiatives. A review of three of these funds—Green Climate Fund (GCF), Clean Technology Fund, and Global Environment Fund—concluded that transport-related projects have not featured significantly either by the number of projects or the investment volume in transport as compared with energy sector.

The number of transport projects financed is in single digits except in years 2020 and 2022. The volume of investments has been cyclical reflecting the trend, with GCF approving projects in Costa Rica, Light Rail; India, e-mobility; and Latin America and Caribbean, regional e-mobility - $200 million, the largest climate fund contributions to date. The downward trend reflects climate funds' focus on energy-related projects, which are readily packaged as green. Climate funds do not operate on fixed percentage allocation for any sector and consider finance proposals on a first-come basis. The upward trend in 2022 could be a good signal that climate funds are prioritizing the role of transport-based emissions in the overall climate action (figure 3.7).

Figure 3.7 Amount of Funding Approved by Climate Funds in LMICs for Transport by Year



Source: Authors' derivation from Climate Funds Update Data Dashboard.

3.1.3. Export credit agencies are supporting mobility in developing countries

Official export credit agencies (ECAs) play a crucial role in financing cross-border transactions for large-scale transactions denominated in a foreign currency in developing countries. ECAs arranged $53 billion in export credit in 2019, of which $15 billion was destined for LMICs. Transport and storage accounted for the largest share at 39 percent of total export credits in 2019. Transport-related activity by ECAs has supported developing countries to procure rail infrastructure and rolling stock.[20] Financing and guarantees have also been pivotal in procuring bus fleets for the bus rapid transit (BRT) systems. Such financing tools have enabled local commercial banks to extend finance to operating companies, which would not have been feasible without ECA financing guarantees and insurance against losses.

The scale of specific climate-related export credit remains small, between $1.5 billion and $2.5 billion per year between 2013 and 2018. The energy sector benefited with 81 percent of the credit, with only 7 percent of export credits going to climate-related projects in transport and storage activities between 2016 and 2018. Asia (36 percent) and Africa (32 percent) are the two largest beneficiaries (OECD 2019). The statistics are, however, constrained by data classification. The actual volume and share of export credits supporting climate-related transport activities are likely to be larger since different companies seeking ECA financing are classified under different categories.

[20] Rail transport is considered a green mode but ECA financing is not accounted as climate finance.

3.1.4. Private investment is catching up but only in developed countries

Private investment accounts for nearly 62 percent of overall investment in low-carbon transport. This figure is higher than the 51 percent of private investments in renewable energies.[21] However, the increase in private investment is mostly concentrated in developed countries. One reason for accelerated growth is the rapid increase in individual households' adoption of EVs and the fiscal incentives supporting these investments. Individual households' spending on EV purchases made up the largest portion at $175 billion—43 percent of the total climate finance in 2022.

This rapid growth in EV uptake can be largely ascribed to the impact of increasing public awareness and knowledge of the benefits of EVs. It has been aided by government-backed subsidy programs in many countries (IEA 2021). As governments continue to expand EV education programs, subsidy schemes, and charging infrastructure, and with forthcoming regulatory mandates on the discontinuation of ICE vehicle sales in many markets, EVs are primed for continued strong growth, with potential to become key contributors to global decarbonization of the transportation sector.

3.1.5. Institutional investors have been predominantly financing infrastructure assets

Pension funds, sovereign wealth funds, and other institutional investors have demonstrated keen appetite in financing major transport assets in the developed world, including high-speed rail lines, airports, and toll roads. Ideally, institutional and wholesale investors expect a thematic focus in their investments to improve the long-term performance. According to OECD (2021a), of the total amount tracked, institutional investment in infrastructure was $130 billion. Only 16 percent, or $21 billion, was allocated to green infrastructure in the G20 countries. The largest single subsector was roads with $42 billion. Roads (which include toll roads, bridges, tunnels, and highways), airports, and seaports are core infrastructure assets. Such assets generally offer steady revenue streams, often through concessions or availability payments.

3.1.6. Capital markets and thematic bonds have yet to become a major source of green transport financing in developing countries

The transport sector has made headway in channeling the proceeds from thematic bonds[22] and it is only a beginning. Tapping the capital markets through thematic bonds is a rapidly growing source of financing for projects, which demonstrate positive social or environmental impacts. Since the first green bond issued by the World Bank Group and European Investment Bank in 2007–08, the thematic bond market has grown significantly, covering all sectors, reaching total issuances of $5.3 trillion as of March 2024. While almost 84 percent of the issuance has been from advanced markets, more than $857 billion in thematic bonds were issued from emerging countries as of March 2024, as in Bloomberg (accessed April 2024).

[21] Climate Policy Initiative (CPI) (2023).

[22] Thematic bonds comprise green, social, sustainability, sustainability-linked (GSSS) bonds.

Transport-related investments account for nearly 20 percent of global green bond proceeds, garnering $52 billion in 2019 (SLOCAT 2021). This represents more than a 70 percent increase from 2018, highlighting the scale of growth in this form of financing. Within the transport sector, issuers have included automobile and auto parts manufacturers, railroad, and logistics companies. Vehicle manufacturers including Tesla, among others, have issued bonds to support investment into their EV programs.

Even though most thematic bond issuances have originated from private companies in developed countries, emerging market sovereigns are increasingly using these financial instruments to support the transport sector. Among emerging market sovereigns, most of the issuances financed railway, metro, and associated infrastructure (such as stations, grid connectivity, rolling stock, railway tracks) within the sustainable transport category. Two issuers allocated proceeds towards roadways: procurement of EV/hybrid buses, and associated infrastructure. For instance, from the THB30 billion sustainability bond issued by the Government of Thailand in 2020, about THB10 billion of the proceeds are designated to support the construction of the Bangkok Mass Rapid Transit (MRT) system. Other emerging countries which have successfully issued sovereign thematic bonds to invest in the transport sector include Chile, Egypt, Colombia, Indonesia, Mexico, India, Poland, Serbia, and Uzbekistan. (Bloomberg accessed April 2024).

Table 3.3 Sample of green bonds issued by EM Sovereigns (data collected by the World Bank Treasury)

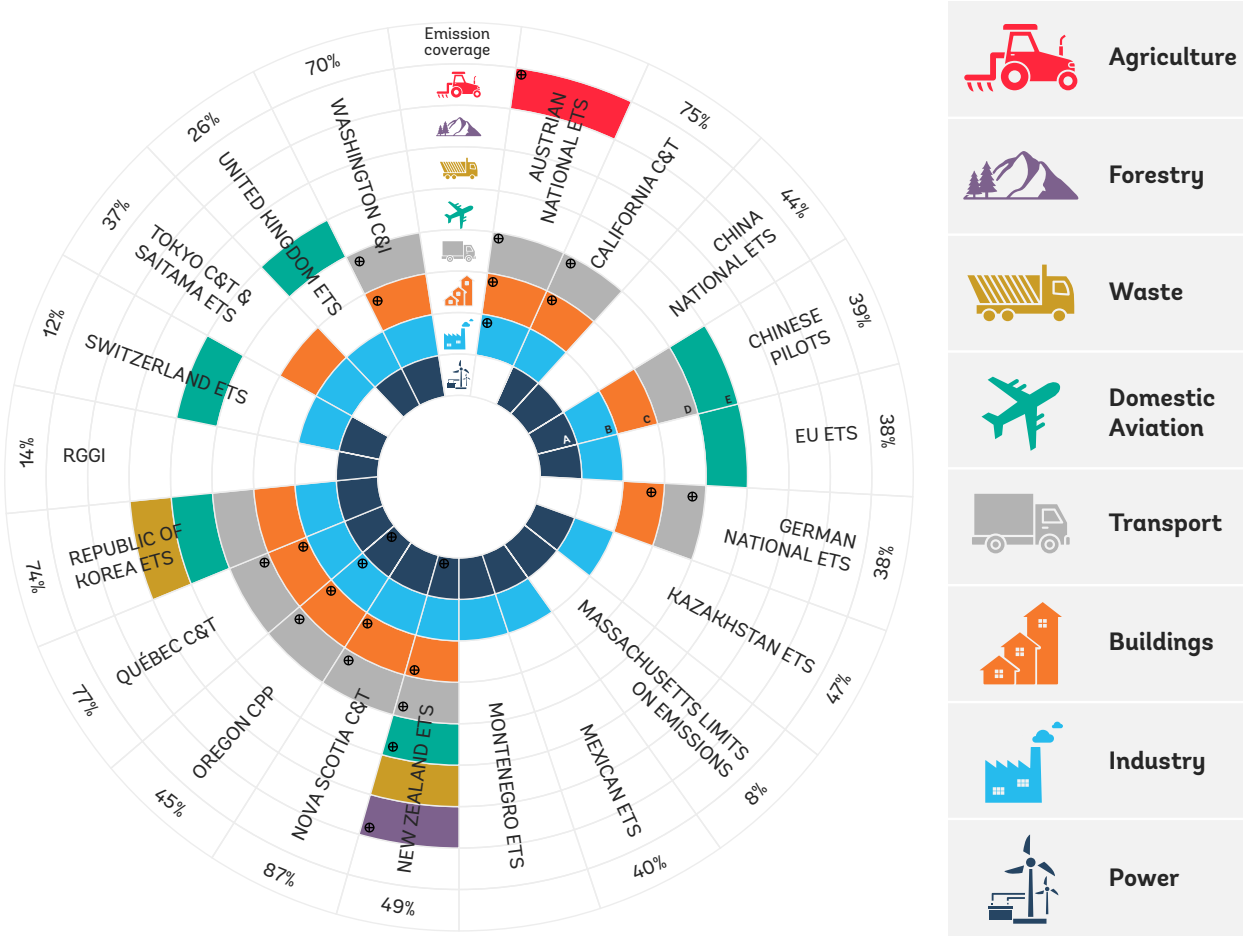
Country	Use of proceed (transport)
Chile	Rail and metro: 12 projects
	Electrification of buses: 4 projects
Colombia	Metros
	Mass transport and integration
Indonesia	Rail and metro: 29 projects
	Bus (Rapid Transit): 2 projects
	Vessel modernization: 1 project
Egypt	Metro (monorail)
Malaysia	Electrification of rail infrastructure
Mexico	Rail infrastructure (freight and passengers)
Poland	Electrification of rail infrastructure
Serbia	Rail infrastructure
Thailand	Metro infrastructure
Uzbekistan	Metro infrastructure

Source: World Bank.

3.1.7. Carbon market for transport is still in development

In the transport sector, the most common sectors active in carbon markets are domestic aviation and maritime sectors. The most common sectors are energy and industry (in blue in Figure 3.8). Many jurisdictions do not cover the transport sector. Even the ones that cover transport, mostly cover aviation and maritime. In December 2022, the European Parliament and the Council of the European Union (EU) reached a provisional agreement to apply the International Civil Aviation Organization's (ICAO) Carbon Offset¬ting and Reduction Scheme for International Aviation (CORSIA) to international flights from 2022 to 2027. In many jurisdictions, road-based transport emission markets are still in development, including in the EU, where the plan is to include the ETS2 from 2027 or 2028 onward. The graphic includes only sectors that are covered by at least one ETS.

Figure 3.8 Sectors Covered by Emissions Trading Systems Globally



Source: Reprinted from ICAP Status Report, 2023.
Note: C&T = Cap & Trade; CPP = Climate Protection Program; C&I = Commercial & Industrial; ETS = electronic trading system; EU = European Union; ICAP = International Carbon Action Partnership; RGGI = Regional Greenhouse Gas Initiative

Even in the Voluntary Carbon Market (VCM), the road-based transport sector emissions reporting methodologies are still developing. Two of the biggest organizations—Verra[23] and Gold Standard[24] —leading the VCM markets for measurements, reporting, and offsets are quickly developing transport carbon markets. For instance, Verra had a methodology for Electric Vehicle Charging Systems in 2018. In 2023, it opened a few more road transport–based methodologies for consultation, such as "Reducing Transportation Emissions in Cities," "Modal Shift in Transportation of Cargo from Road Transportation to Electricity Conveyor Belt," and "On- and Off-Road Mobile Electric Vehicle and Equipment Charging." Gold Standard has a methodology for "Lightweight two and three wheeled personal transportation." Both are focusing on electrification of vehicles.

3.2 What are the Barriers and Limitations to Mobilize for Financing Clean and Resilient Transport?

Climate action in transport adds a new layer of complexity when it comes to mobilizing climate mitigation and adaptation financing. While challenges are abundant, they also offer opportunities. The energy sector has been relatively successful, even when there is still much to do, in bringing green financing. Transport is yet to achieve the same success. Energy projects are closer to what investors and financiers call an asset class. On the other hand, in general, transport projects do not meet the same requirements to be considered as an asset class. The energy sector can be easily commoditized while transport is considered a public service. Another driver is the relatively low abatement cost of energy vis-à-vis transport, and consequently the capacity of clean energy projects to mobilize carbon finance. The question remains whether transport can achieve a similar trend and what needs to be done. Transport projects with a multimodality approach, for instance, by combining public transport and active mobility supported by a comprehensive land use policy and planning could achieve more GHG emission reduction and thus, drive the interest of climate finance. The role of MDBs and the development community is to support project preparation and the enabling conditions.

Barriers to mobilize financing for clean and resilient mobility are multiple and thus, there are opportunities for policy actions. For instance, consider those related to fleet purchase/renewal when it comes to public transport (buses) and freight (trucks, light duty vehicles (LDVs)) in developing countries. These barriers result from the commercial risk and the nature of business (freight, passenger transport), which can be difficult for domestic banks to characterize and offer specific lending products per industry. Creditworthiness and payment risk are well-known issues affecting governments, firms, and individual users asking for commercial financing. Such could be the case of a bus concession where local authorities fund the revenue gap. The capacity of the authorities to honor payments could be contested by commercial banks. In the logistics sector, a common pattern in many countries is the existence of freight firms operating with modern technologies while a large share of firms operates with a small and aged fleet with limited cashflows for investments.

[23] Verra manages the world's leading voluntary carbon markets program—the Verified Carbon Standard (VCS) Program. The VCS Program is the world's most widely used GHG crediting program. It drives finance toward activities that reduce and remove emissions, improve livelihoods, and protect nature.

[24] Gold Standard for the Global Sustainable Goals (SDGs) customizes safeguards, requirements, and methodologies to measure and verify impact on a wide range of activities—from climate protection projects seeking to issue carbon credits to corporate supply chain interventions to national or subnational programs looking for the most credible claims for their impact reporting.

Regulation (or lack of) is another barrier. For instance, on emissions control, scrapping incentives to reduce the funding gap and vehicle emissions checks (another factor to support fleet renewal) is a contributing factor to the limited supply of commercial finance. Motorization management studies also show some interesting findings in terms of access to finance, availability of used vehicles, the lack of scrapping programs, and high taxation on imported vehicles.[25] Some trucking regulations to protect the local industry can help in creating rents, and such revenue streams can be used to finance fleet renewal—in practice, there is limited evidence. Informality in public transport and freight is another factor limiting fair competition. Other factors include revenue generation for formal transport services and the capacity to access commercial loans or lease by those offering informal solutions. Another barrier is the access to and uncertainty in technology when it comes to hybrid or full electric mobility, as well as the availability/pricing of charging stations.[26] Some anecdotal evidence in Sub-Saharan Africa pointed also to the bank sector and the capacity to characterize these risks in loan products—for instance, by offering loans for fossil-fueled two–three wheelers but not when they run on electricity. Last, investments in active mobility (such as sidewalks, bike lines) could have a large impact in reducing emissions when they are articulated with public transport and land use planning. However, these investments are unlikely to generate revenues to make projects bankable and thus, they rely on the fiscal capacity or by real estate developers in the best scenario.

Governments are apprehensive of additional costs involved in making infrastructure resilient. The additional up-front cost of more resilient infrastructure assets ranges from negative to a doubling of the construction cost, depending on the asset and the hazard. Interventions to make assets more resilient include using alternative materials, digging deeper foundations, elevating assets, building flood protection around the asset, or adding redundant components (Hallegatte, Rentschler, Rozenberg 2019). In doing so, the returns on investments for making exposed infrastructure more resilient to natural disasters is not clear and difficult to estimate in terms of cost-benefit ratio, making it harder to convince the governments to make such changes.

3.2.1. MDBs need to shift from direct financing to mobilizing commercial finance

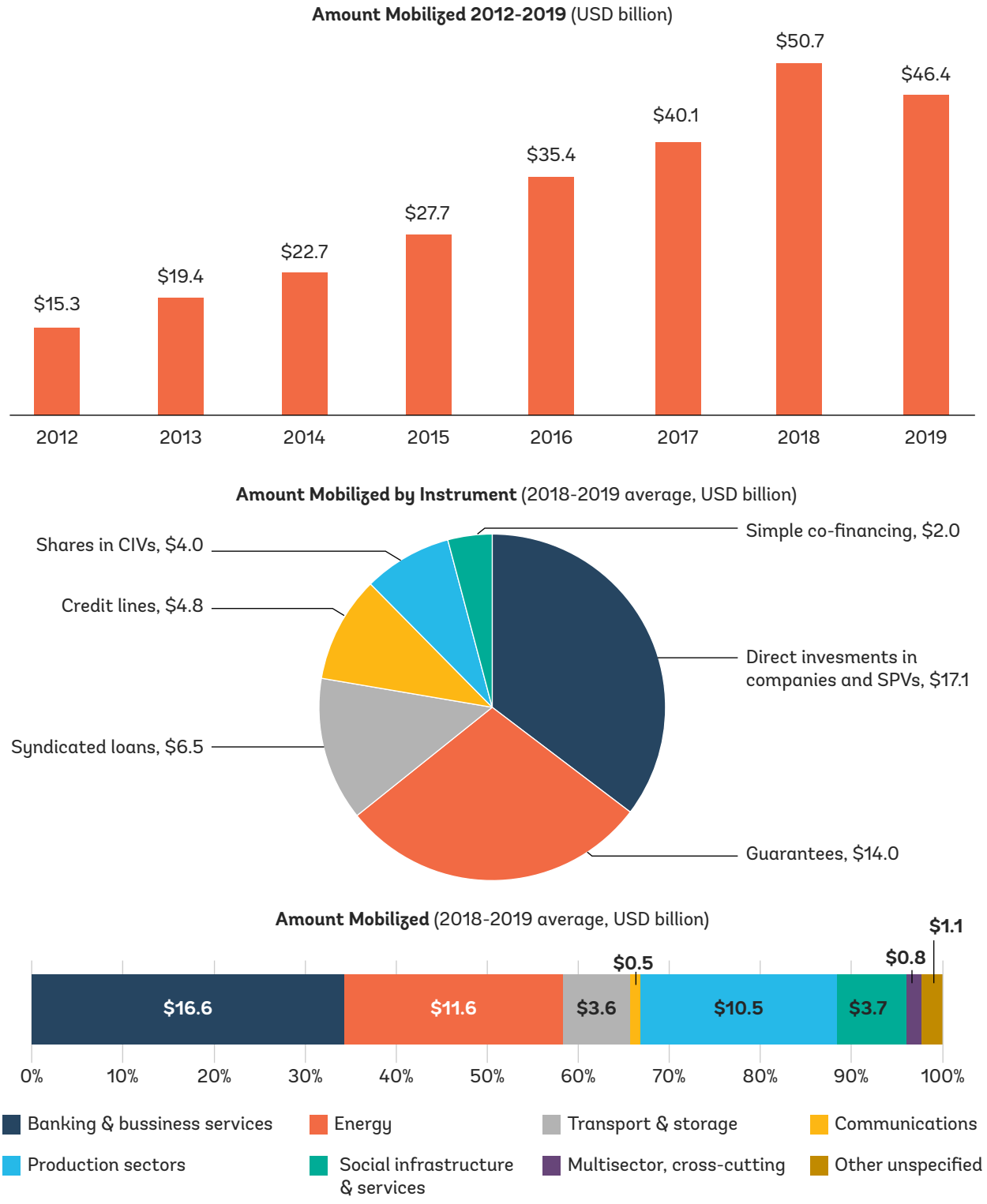
MDBs have agreed to expand the mobilization of private capital for infrastructure. The OECD tracks mobilization of private sector financing from Official Development Assistance (ODA) in multiple sectors.[27] In this context, transport and storage captured a 3.6 percent of the private finance (Figure 3.9). Mobilization of private climate cofinance is tracked as part of the climate finance commitment by MDBs (Figure 3.4). Private finance is mostly driven by the guarantees, lines of credit, and policy-based bond financing (Figure 3.7). MDBs should consider developing innovative solutions to mobilize commercial financing and private capital, adapted to each country's context. Some examples are presented in Section 5.

[25] See also The Global Fleet (2022).

[26] The manufacturing of automotive in SSA is limited, making imports of newer technologies complex and even prohibitive.

[27] The document does not distinguish whether these investments are focused on mitigation, adaptation, or resilience.

Figure 3.9 Worldwide Mobilization of Private Finance by Official Development Finance Interventions



Source: Reprinted from Organization for Economic Cooperation and Development 2021.
Note: CIV = Collective Investment Vehicles; SPV = Special Purpose Vehicle

3.2.2. Dedicated climate funds: Is the project eligible or green and resilient enough for funding?

Finding projects to fit project eligibility criteria presents a major challenge:

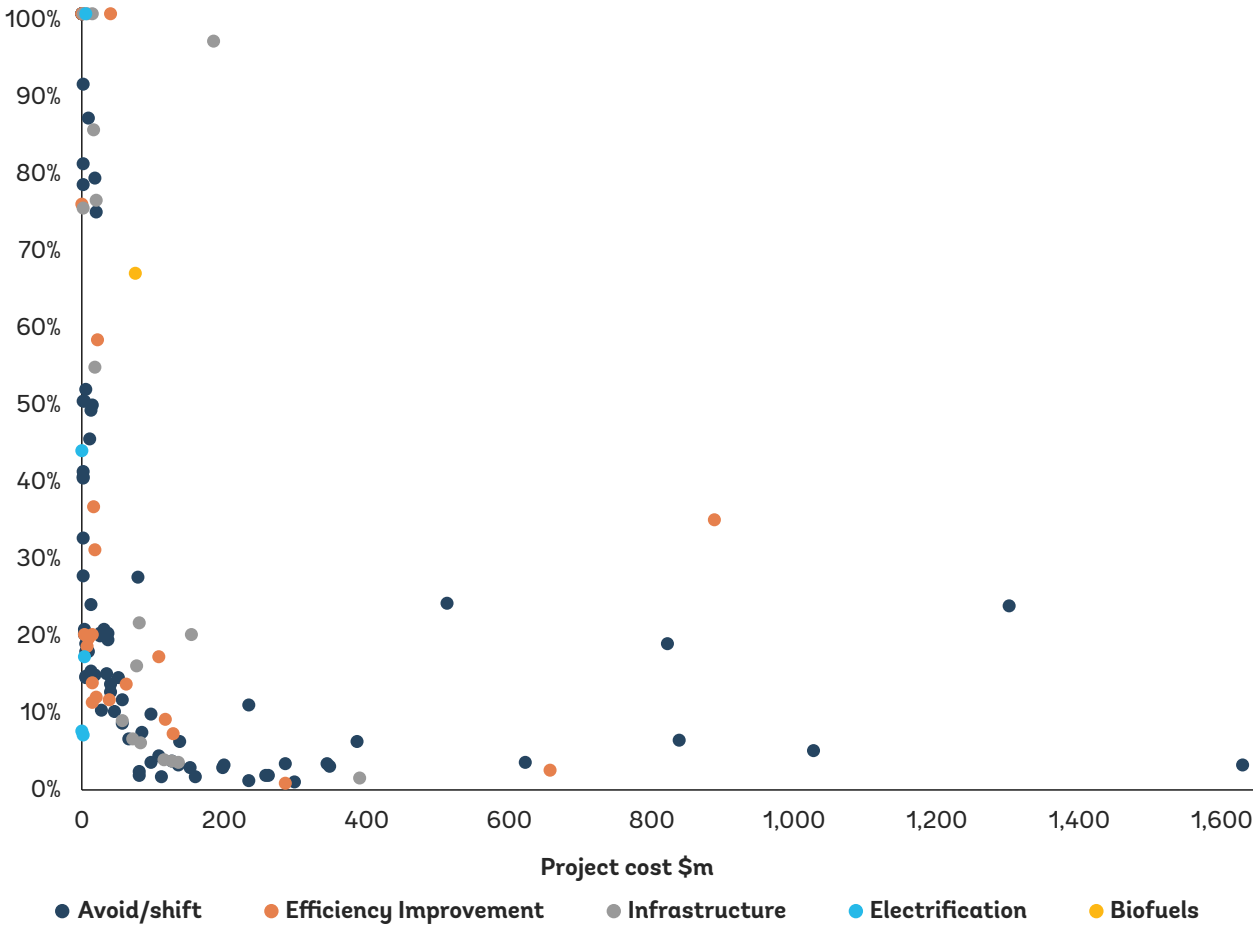
- Calculating the potential mitigation and adaptation impacts accurately is inherently complex. The impact of a transport scheme depends on the user's behavior; therefore, mitigation and adaptation projections have greater levels of uncertainty compared with other projects.
- Demonstrating additionality, in other words, that the scheme would not have taken place in the absence of support from the climate fund. Programs such as fleet renewal may arguably occur in any event although separated over a longer timeframe.
- Demonstrating that the scheme will facilitate a paradigm shift, perhaps using new and innovative forms of technology, which will transform the status quo.
- Synchronizing decarbonization efforts with the sectors involved in upstream activities, such as energy and power sectors. Fleet electrification should be coupled with clean energy sources to justify its mitigation impacts.

Institutional capacity presents additional hurdles to many developing countries. The process for accessing climate finance differs from fund to fund, and typically requires an accredited entity[28] to engage with the climate fund and to propose projects for investment, which are then considered by the climate fund governing board. Many countries gained accreditation for direct engagement with climate funds, so they are required to partner with a national or international accredited agency to submit proposals on their behalf.

Climate funds do not lead in financing sources, making them dependent on other DFIs. Even where projects succeed in gaining financing support from climate funds, the scale of financing support typically represents a small fraction of the project investment cost. Most climate funds focus on smaller projects and invest smaller amounts in larger projects (Figure 3.10).

[28] Accredited entities are defined by the Green Climate Fund (GCF) to implement projects. Accredited entities can be private, public, nongovernmental, subnational, national, regional, or international, as long as they meet the standards of the fund. Accredited entities carry out a range of activities that usually include the development of funding proposals and the management and monitoring of projects and programs.

Figure 3.10 Climate Fund Financing for Transport Schemes as a Proportion of Overall Project Cost



Source: Authors' derivation based on various climate fund project databases.

3.2.3. Private investment faces fundamental financial viability issues

Attracting commercial financing in green and resilient transport poses additional layers of challenges. First, services like public transport often involve a longer return on investment than transport projects, such as toll roads. Rail or metro systems are characterized by a greater upfront capital investment and often depend on government subsidies to be financially viable due to insufficient revenue streams. In many cities in LMICs, nonmotorized solutions may also require some infrastructure investments in sidewalks, bridges, bike lanes, and others, for which some large capital expenditure (capex) can challenge municipal balance sheets. This emphasizes the issue of the underfunding gap where essential infrastructure and services are often not financially sustainable as standalone projects without continued subsidy or grant support. Therefore, funding for transport infrastructure projects is often contingent on politically driven factors.

Second, because of poor policy support or economic disincentives such as fuel subsidies, the demand for sustainable transport options may be kept artificially low as opposed to private vehicles. The risk is related to the revenues—particularly the suppression of fares to a socially/politically acceptable level. There is a well-known policy trap leading to low-quality public transport supply. The trap is created by the need to keep fares low, with service deteriorating because of funding issues (lower frequency and coverage), and thus, more people turn to private transport solutions. Altogether, there are fewer fiscal resources to support public transport and more resources to cover road infrastructure. Good intentions, such as those looking to make public transport free, could be counterproductive if governments cannot ensure funding over time to maintain the service. The lack of prioritization of public transport over private transport, in relation to priority measures, leading to deteriorating financial viability is also a major commercial risk factor. Finally, the unfamiliarity of fewer low carbon-intensive transport modes may drive up the cost of capital. In the financial sector, a lack of certainty translates into greater perceived risk. Returns from sustainable or low-carbon transport are less well established, and therefore those transport modes are perceived as riskier investments.

Commercial finance for transport infrastructure has traditionally been successful mainly in investments that yield dependable future returns, including port and airport projects, toll roads, and parking. Public transport, while generating revenues through the farebox, in many cases does not collect sufficient returns to cover its investment costs. Therefore, commercial financing arrangements require significant cofinancing or ongoing subsidy support, as seen in the case of the rail operations in Addis Ababa and Manila, and the scale of public investment in the light rail transit (LRT) line under construction in Lagos.

Private investors are typically risk-averse and tend to prioritize investments that provide a high degree of certainty and stability. In transport projects, several factors can drive this risk aversion:

- Political and regulatory risks: Changes in government policies or regulations can significantly impact the profitability of transport projects. Private investors may be reluctant to invest in projects where the political or regulatory environment is uncertain or volatile.
- Construction and operational risks: Transport projects are often large and complex, with many variables that can impact construction timelines and operational performance. Private investors may be hesitant to invest in projects where the risk of delays or cost overruns is high.
- Market and demand risks: Transport projects are also subject to market and demand risks. Private investors may be concerned about investing in projects that rely heavily on uncertain market or demand projections, as these can impact the profitability of the project.
- Financial risks: Transport projects often require significant upfront capital investments, and private investors may be hesitant to invest if the financial risks are high. This includes risks such as currency fluctuations, interest rate changes, and credit risks associated with project financing.
- Environmental and social risks: Transport projects can have significant environmental and social impacts, and private investors may be hesitant to invest in projects that are perceived to have negative impacts on the environment or local communities.
- Climate-related risks: Lack of information regarding CRR makes it challenging to price the risks accurately and identify where investments are most required. This is compounded by the lack of clarity regarding the full environmental and social benefits of these investments.

Transport projects in many cases reflect the following common characteristics: (a) low rates of return on investment by comparison with other sectors, (b) long project lifecycles, and (c) higher levels of perceived risk by comparison with other sectors, with risks relating to project delivery, capital cost overrun, institutional risk, and traffic risk. Risks cannot always be diversified, and, in many cases, governments rely on risk-sharing schemes which are costly to enforce or lack credibility.

3.2.4. Carbon markets for private sector will remain fragmented in the transport sector

The level of ambition for transport needs to drastically increase in the second generation of NDCs. In 2015,[29] when countries first submitted their NDCs, of the 166 NDC submissions representing 193 countries, 76 percent highlighted the transport sector as a mitigation source, but only 8 percent included transport-specific GHG mitigation targets. In terms of Avoid-Shift-Improve strategies, the majority (65 percent) of mitigation measures mentioned in NDCs represented "Improve" strategies, whereas only 28 percent represented "Shift," and 7 percent represented "Avoid". Only 16 percent of NDCs included transport adaptation. NDCs also tended to focus more on passenger transport, and less than a quarter referenced freight transport.

[29] See SLOCAT (2022).

Today, the most common, and the largest share of the climate mitigation action is on aviation, maritime, and electrification of road-based passenger transport. Electric mobility (e-mobility) is the most common category of measures in second-generation NDCs. Seventy-four second-generation NDCs (52 percent) include e-mobility-related actions, representing 19 percent of all actions. Thirty-eight non-GHG transport targets in second-generation NDCs relate to vehicle electrification, and all are from middle and high-income countries. Most actions in second-generation NDCs do not specify the transport activity type to which they will apply.[30]

There is limited market understanding of carbon pricing, emissions measurement, and trading in transport sectors. Even the EU is expecting road transport to be part of ETS2 in 2027–28. The voluntary market is still catching up to the e-mobility market. Lack of standardization of methodologies, calculations, monitoring, reporting verification (measurement, reporting, and verification; MRV), and certification services in developing markets are the top barriers to entry. Many of the project owners neither have the knowledge nor the expertise to structure projects which will maximize emissions reduction and consequently earn credits. At the same time, governments, irrespective of whether they have included transport in their NDCs, are not equipped to work with project owners to capture emissions reductions benefits.

Political challenges remain to include transport in the NDCs and carbon pricing, more so in low-income countries (LICs), with none of them submitting a long-term strategy for level of transport climate action ambition and supporting plans in 2022.[31] Although the adoption of carbon pricing can spur investment in innovation and modernization that can lead to competitive advantages and economic gain, a common concern is that carbon pricing may threaten business competitiveness. Further, because the adoption of carbon pricing has yet to occur at a global level, there is the chance that firms operating in countries with a price on carbon may lose business, profits, or market share to competitors that do not have to account for a price on carbon. This unintended consequence of carbon pricing policies could result in "carbon leakage," where carbon-intensive industrial investments, operations, and related GHG emissions are shifted from carbon-limited markets to less stringent ones.

3.2.5. Institutional investment will take time to transition to green assets or finance projects in some noninvestment grade countries

First, green and resilient transport should be an investable asset for long-term investors such as pension funds and insurance companies. However, institutional investors face transition risks of existing portfolios and regulatory limitations. Their portfolio is usually affected by illiquid nature of their investments and by the uncertainty of the regulatory framework for clean infrastructure. There is some evidence to suggest that companies with large GHG emissions may also suffer from higher credit risk. For instance, research from the EDHEC Risk Institute[32] finds there is an increase in the probability of default for high-emitting companies after the passage of the Paris Agreement. This infers that exposure to climate risks in the face of stricter climate regulation is beginning to be priced into lending, especially those extended to fossil fuel companies.

[30] See SLOCAT (2022).

[31] See SLOCAT (2022).

[32] See https://www.edhec.edu/en/news/new-release-ipe-edhec-risk-research-insights-spring-2022.

Second, transport assets are particularly susceptible to demand shocks such as the one caused by the COVID-19 public health emergency. Historically, revenues from transport infrastructure have been comparatively stable, as revenues from concessions or availability payments are generally predictable, following broader economic activity trends. However, they may not be immune to large economic shocks. The demand shock caused some investors to devalue some transport assets in their portfolios, notably shares of airport operators.

Third, the lack of emission data for all assets, especially buildings included in the portfolios, makes it difficult to distinguish the share of green investments. Finally, institutional investors have some limitations to engage in noninvestment grade countries. Other investors may have the risk appetite, but such finance could jeopardize the affordability of these projects. Derisking instruments can help on that matter, along with blended finance mechanisms, but there are some limitations.

3.2.6. Thematic bond markets remain an untapped opportunity for green transport

These factors outline the key hurdles to exploring the potential of thematic bond markets:

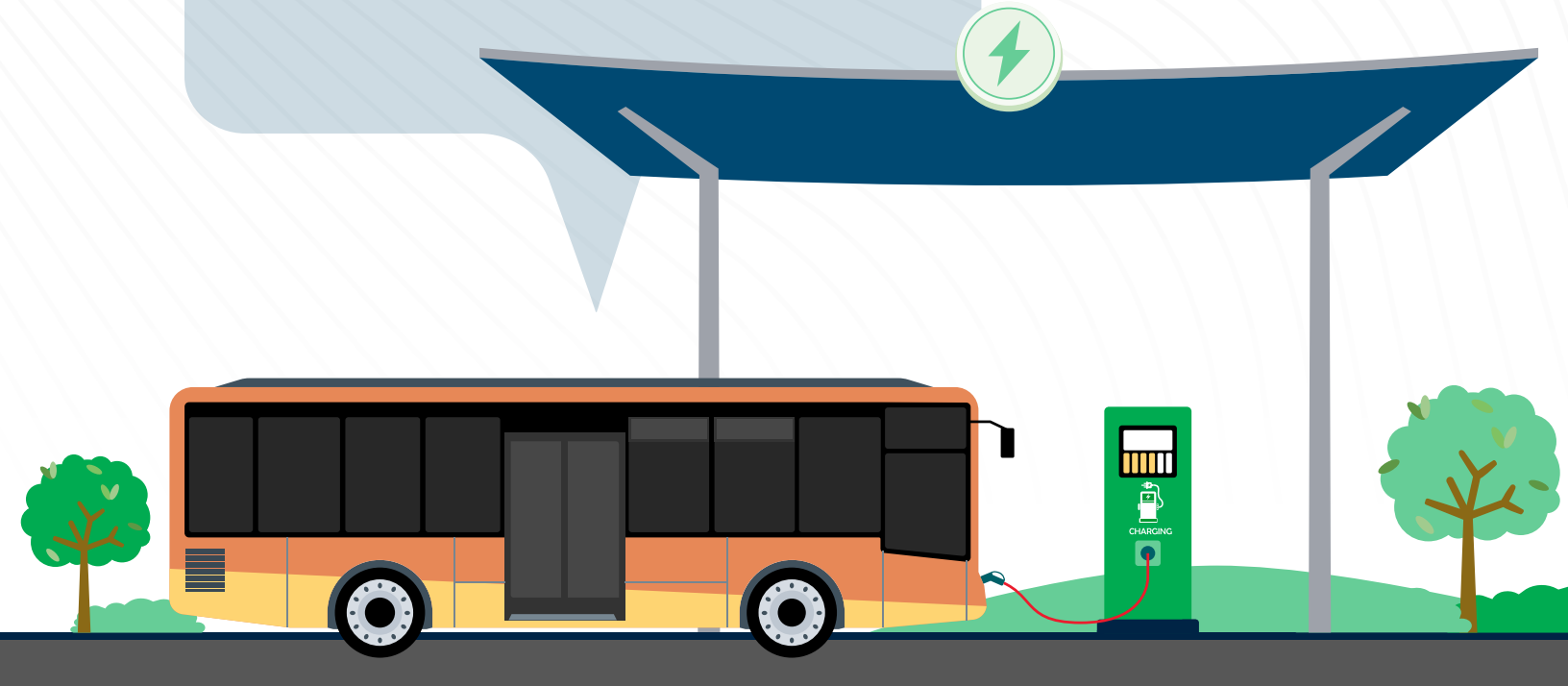
Limited evidence that the cost of finance sits marginally below that of traditional financing channels. The literature on green bonds and green debt more broadly is mostly empirical. On the pricing of green bonds relative to conventional bonds, the empirical literature has mixed results. MacAskill et al. (2021) review the literature from 2007 to 2019 and find a somewhat greater number of studies in favor of the existence of a small green premium, especially for green bonds that are government issued, are investment grade, and follow defined green bond governance and reporting procedures. Pricing of any kind of bonds is a gauge of default by the issuer, making traditional or brown bonds more expensive. In the case of traditional bonds, the issuer maybe be facing transition risks of carbon tax, ESG regulation, and generally increasing investors' appetite toward ESG-type of issues.

Institutional or corporate readiness to issue certified bonds. Credibility and transparency for investors improves by developing climate bond standards and certification processes. The list includes the Green Bond Principles, the Climate Bonds Standards, and the Green Financial Bond Directive. Certain public transport schemes, including BRT and rail electrification projects, are eligible under the climate bond standards.[33] Other projects that demonstrate delivery of passenger transport meeting thresholds can meet certification requirements for (a) per passenger kilometer direct emissions or (b) specific emission reduction thresholds.

[33] https://www.climatebonds.net/standard/transport.

4

Funding Climate Action in Transport



Funding Climate Action in Transport

Financing matters, but funding is crucial. In a nutshell, transport projects can be financed from multiple sources, while funding comes from user fees/charges and taxpayers' monies. Grants can be used as a financing instrument and as a funding instrument. Concessional financing can reduce financing costs, thus reducing the funding requirement. Financing climate action policies will require creating a predictable funding stream to meet their cost. Opportunities can present themselves to create revenue streams capable of financing selected investments and fund key policies. Even so, if the nationally determined contribution (NDC) commitments were to materialize, the transition will require some effort from users and taxpayers, and some prioritization of spending to reach the funding requirement side. In the capacity to generate direct revenues, the transport sector shows mixed results across the different modes and other infrastructure. A review of funding mechanisms used by most governments shows some stylized facts.

- General budgets are the main source of funding for large infrastructure investments:
  - The collection from transport fares, tolls, user charges, and fees in most cases provides limited revenues and their use varies across countries.
  - Projects with high traffic of passengers and/or freight have been concessioned and generate substantial revenues from users. Even so, such projects capable of covering the total project costs are limited.
  - When it comes to public transit systems, user-paid fares are in most cases insufficient to cover capital expenditures.
  - Fuel funds, when adopted, have financed a share of transport related policies. In many countries, there are still fuel subsidies. And the efficiency of modern ICE vehicles, the adoption of EVs, and a shift to public transport are reducing fuel tax collection.
  - Carbon taxes in LIMCs are not widely used – see discussion below.
  - Grants represent a minor portion of the transport capital expenditures in lower income countries.
- A larger tax collection from transport-related activities does not necessarily translate into more resources for the sector:
  - Budget laws determine a cap on resources that sectoral authorities can use to finance investments and policies. Disposable budgets could be lower depending on the treasury capacity during the year. Transport-related taxes collected do not equate to a similar amount of disposable budget for the transport sector.

- Earmarked funds and other schemes created may direct resources for some pre-established spending. Typical examples are fuel funds and carbon taxes,[34] but other revenue streams can be channeled to a dedicated fund such as toll revenues or royalties. These funds can be used as collateral for commercial loans in some cases. Governance and financial management issues—from a treasury perspective—are usual concerns when creating new earmarked funds. On the other hand, a specially dedicated fund contributes to a predictable revenue stream for specific investments and policies and could add more flexibility for planning and procurement when there is a lack of multiannual budgeting solutions.

- National and subnational treasuries collect different transport-related taxes.

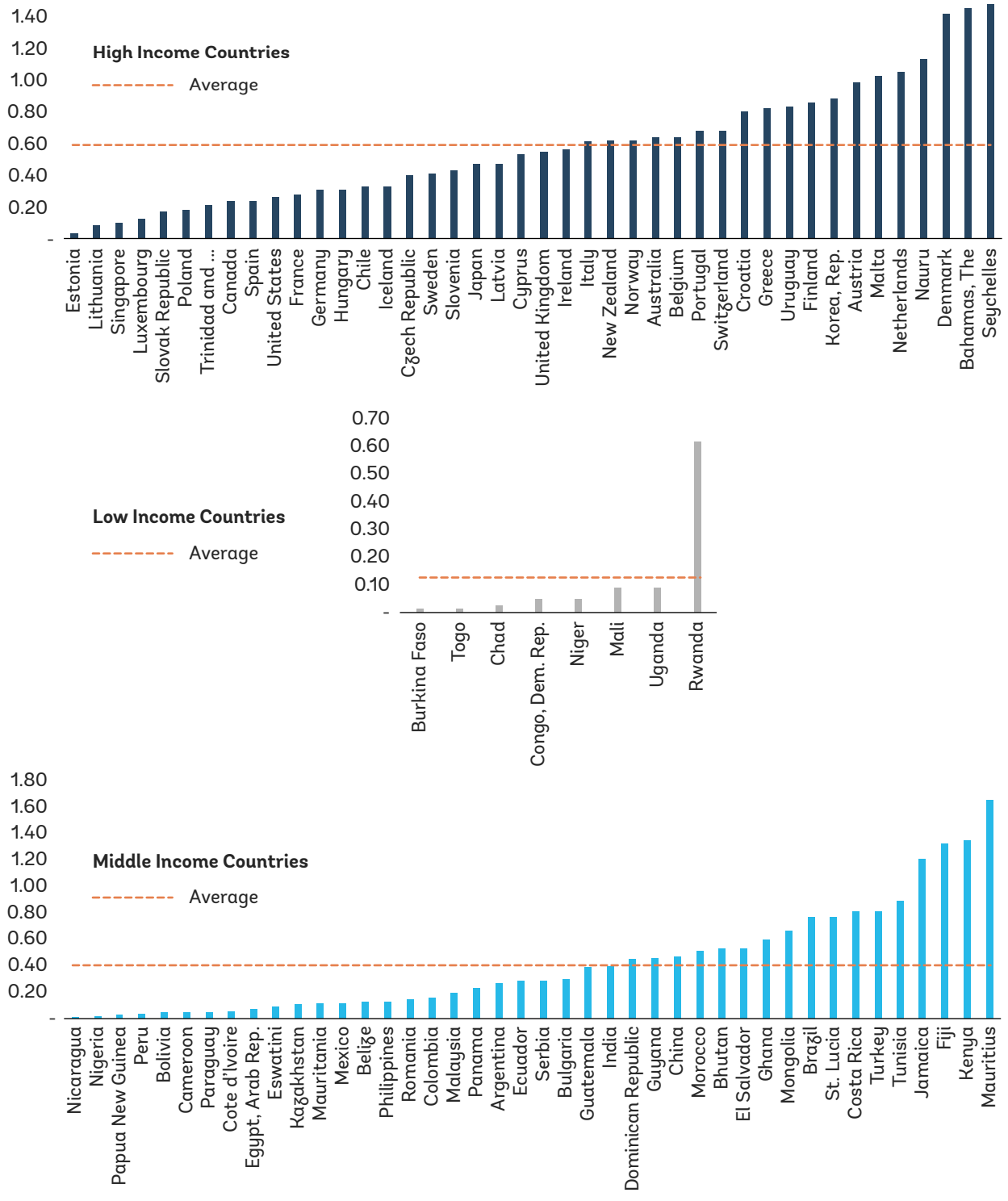
  - In general, national treasuries regulate the processing from fuel and carbon taxes, embedded in fuel prices, while subnationals generally manage taxes on vehicle ownership, licenses, and others.

  - Other taxes are being used to fund transport investments and policies. Examples include revenues from land value capture (LVC) and transport-oriented developments, royalties, and eventually, the profits from state-owned enterprises (SOEs) at ports and airports, for instance, or dividends from shares in private companies.

The full picture on the revenues generated by the collection of different transport-related taxes is incomplete. Figure 4.1 shows some figures on revenue collections from transport on capital spending, recurrent taxes on ownership, registration, and road use of motor vehicles and Figure 4.2 shows tax revenues from oil or fuel consumption—all types of usage. Expectedly, the average tax collection, as a percentage of gross domestic product (GDP), decreases with the level of country income. Tax revenues from oil or fuel are larger than the other transport-related taxes but the effect could be driven by the taxation of fossil fuels for power production. Unless these revenues are earmarked, the public treasury channels such resources and delinks them from the budget allocation to transport.

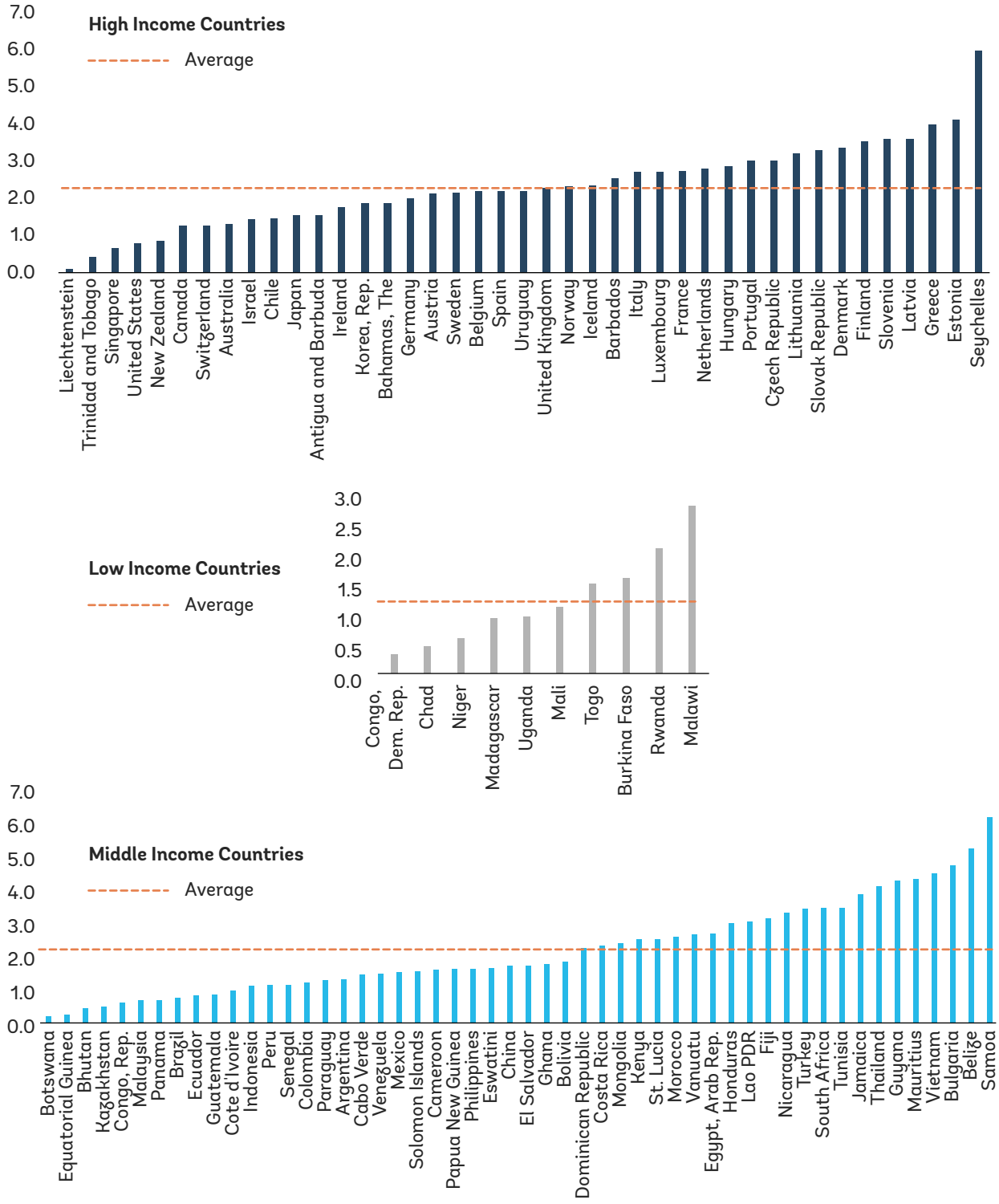
[34] Some countries are not able to channel the processing from carbon taxes into earmarked funds. Such is the case of South Africa.

Figure 4.1 Taxation in the Transport Sector as Percent of GDP in 2019 or Latest Available Information[a]



Source: Authors' adaptation based on Organization for Economic Cooperation and Development—Environmentally related tax revenue database (2019).
Note: GDP = gross domestic product.
a. One-off import or sales taxes on transport equipment, recurrent taxes on ownership, registration or road use of motor vehicles, and other transport-related taxes, excluding excise taxes on automotive fuels.

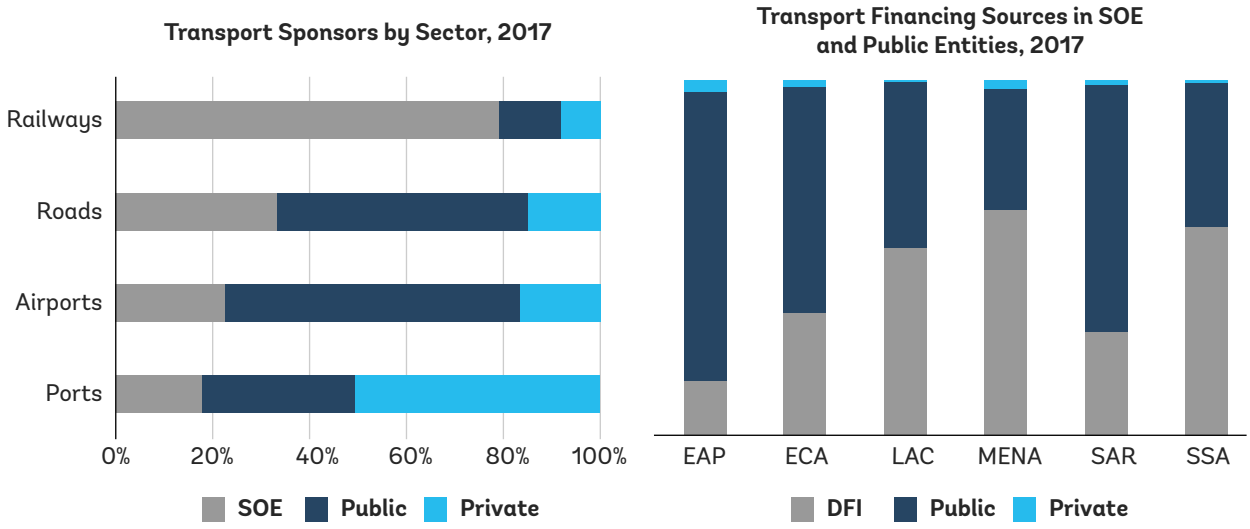
Figure 4.2 Oil and Fuel Taxes as Percent of GDP in 2019 or Latest Available Information[a]



Source: Authors' adaptation based on Organization for Economic Cooperation and Development Environmentally related tax revenue database (2019).
Note: GDP = gross domestic product.
a. These figures cover all taxes on oil and fuel consumption for transport and non-transport activities.

How much are governments spending on clean transport solutions? It is difficult to estimate. The information is scattered and limited in many cases to a few modes at the national level. The complexity of the transport governance with multiple modes and leading institutions, at national and subnational levels, makes data gathering difficult. The same difficulty applies to all transport investments, whether motorized or nonmotorized. Some of these capital expenditures are collected by the PPIAF (2017) for roads, ports, railways, and airports along with their delivery mode—state-owned enterprises (SOEs), public entities, and private.[35] However, these investments are not necessarily in low-carbon solutions and do not distinguish funding sources. Figure 4.3 (panel a) shows that SOEs and public entities in emerging markets and developing economies (EMDEs) deliver most of the investments. Financing sources for public sector delivery, SOEs, and other public entities are shown in Figure 4.3 (panel b). When it comes to public spending on policies (fuel subsidies, affordability, nonmotorized solutions), the information is more fragmented and limited.

Figure 4.3 Investments in Selected Transport Sector by Type of Sponsor—SOEs, Public Entities and Private (Concessions and PPPs) in EMDEs as Percentage of GDP in 2017



Source: Reprinted from Public-Private Infrastructure Advisory Facility 2017.
Note: DFI = development finance institution; EAP = East Asia and Pacific; ECA = Europe and Central Asia; EMDE = emerging markets and developing economies; GDP = gross domestic product; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa; PPP = public-private partnerships; SAR = Special Administrative Region; SOE = state-owned enterprise; SSA = Sub-Saharan Africa.

[35] Another source of information in the BOOST database (Open Budgets Portal) and more information can be obtained from Herrera Dappe, Matías; Foster, Vivien; Musacchio, Aldo; Ter-Minassian, Teresa; Turkgulu, Burak. 2023. Off the Books: Understanding and Mitigating the Fiscal Risks of the Power Sector. Live Wire; 2023/128. © World Bank, Washington DC. http://hdl.handle.net/10986/39752 License: CC BY-NC 3.0 IGO.

4.1 The Underfunding Trap in the Transport Space

The lack of funding and financing underpins the challenges of greening the transport system. Funding refers to the transport system's capacity to raise funds from its users, ranging from public transport passengers to car drivers, or use of public sector revenues. Financing refers to the capacity to access equity or loans to finance the large investments required, such as the construction of a metro line which has high upfront capital expenditure costs. Some infrastructure assets can monetize usage while others cannot. The streets and urban roads cannot be tolled with the prevailing technology; however, smartphones may disrupt this technological constraint as the phones can track individual movements, while tolling is feasible in some urban expressways. Car owners pay a registration fee that covers the cost of recording ownership, but it is insufficient to finance the expansion and maintenance of roads. Public transport fares partially cover the costs of providing public transport services, which are usually the costs associated with rolling stock, but not for the infrastructure. It is neither fair nor possible to exclude nonpayers, yet the governments must provide sidewalks and bike paths. Indeed, roads and sidewalks, public transport systems, and bike paths provide access to opportunities and therefore their benefits extend beyond the users themselves. A mix of funding sources and subsidies is necessary, recognizing the important social and economic role of mobility, beginning with property tax.

Many large cities in developing countries usually have ambitious plans for expanding the transport system, ranging from roads to mass transit. These cities need ambitious investments in the transport system because basic infrastructure is lacking or absent—sidewalks, cycle lands, bus rapid transit (BRT), intelligent transport systems, park and ride, and freight consolidation centers. However, their available resources represent just a fraction of the investment required. Cities therefore fall into an underfunding trap because actual expenditures for capacity expansion and maintenance of existing assets—a key aspect for sustainability—are insufficient. Primarily, four factors could explain why cities fall into this trap.[36]

- **First, the transport system and related infrastructure fail to collect enough revenues from users and become a political pawn when public budgets are defined.** It is unthinkable to charge pedestrians and cyclists a toll for walking on a sidewalk or for using a local street. Public transport fares do not typically recover the full cost of operations and maintenance, let alone the upfront capital costs for infrastructure. Hence, public transport often receives subsidies, which appear explicitly in the city budget and are frequently subject to politics. Moreover, public budgets are often biased toward the expansion of road infrastructure which ends up benefiting the wealthy owners of motorized transport. Not exclusive in EMDEs, these patterns occur even in more advanced economies.

- **Second, cars demand large infrastructure investments but contribute minimally, ultimately receiving implicit subsidies.** Registration fees cover mostly the cost of recording who owns the car or truck. Fuel taxes are an important source of funding, contributing to highway maintenance but also to highway capacity expansion which in turn encourages future car use. They contribute with a share of the collection to transport investments or are earmarked for capacity expansion, such as expressways, which in turn encourages further car use. A primary example of implicit subsidy for car use is free or underpriced parking, representing an undervaluation of public space, particularly in urban areas. In sum, users of private motorized transport need to be faced with their full social costs.

[36] The discussion borrows from Ardila-Gomez & Ortegon Sanchez (2016).

- **Third, in many countries, decentralization efforts have assigned responsibilities to local governments who lack the funding and expertise to deliver.** Roads that used to be national could be transferred to the municipality's responsibility for planning, and the oversight of public transport provision is devolved without the technical capacity or institutional framework to effectively meet this mandate. Yet, municipalities are ill equipped to perform this role. Another example is the property tax and the associated cadastre of properties. The property tax works better when the cadastre is updated annually to reflect the property value more accurately. However, national governments often retain the responsibility for cadastre management and updates. An outdated cadastre reflects lower property values and results in lower revenues from property tax.

- **Fourth, expanding transport infrastructure requires large, upfront capital investments, but creditworthiness is a barrier for many cities.** The available funding for many cities is insufficient to match required upfront investments. Cities must be able to gain access to financing—bonds, loans from banks, and guarantees. Yet many cities do not have credit ratings and cannot issue bonds or obtain a bank loan. Moreover, financing institutions often show their appetite to engage in large infrastructure projects that have a monetizable revenue stream rather than small public transport projects and investments in active mobility.

The underfunding trap leads to increased congestion at low levels of motorization. For instance, in many cases, the intersections of roads that are poorly operated lead to severe bottlenecks. This particularly affects the competitiveness of public transport operations as buses cannot navigate through congestion as well as cars, leading not only to less attractive service but also higher operational costs. Consequently, the majority that depend on and travel by public transport suffer longer delays, incentivizing car ownership, while the visibility of public transport operations suffers. Congestion is therefore a regressive tax, as it penalizes public transport users who are often from lower income groups, but it does not raise revenue.[37] Table 4.1 shows an assessment of selected funding schemes based on different characteristics. This table is not exhaustive; other tax and policy schemes can be also added. For instance, feebates for cleaner vehicles, energy efficiency standards for vehicles, a "cash-for-clunkers" program to retire high-emitting vehicles, fleet efficiency mandates, or differentiated import duties, all of which could drive individual financing toward greener transport.

4.2 Fiscal Measures to Fund Climate Alignment in Transport

Governments fund their policies and activities by collecting taxes and charges. Taxes are also being used to remedy negative externalities and redistribute income through the provision of public goods (and private ones). As discussed, there are taxes and charges connected to transport activities or land usage, for instance. These revenues are defined and/or collected by national, subnational authorities and agencies/SOEs. These instruments could be analyzed—whether they contribute to revenue generation and its predictability, acceptability, and implementation. Ardila-Gomez and Ortegon Sanchez (2016) discussed the characteristics as shown in Table 4.1. In practice, the composition of funding that governments raise in the transport sector varies by country and data on the collection of these taxes and charges are not systematically collected.

[37] See the following that measure the economic costs of urban traffic congestion: Victoria Transport Policy Institute (2020); World Bank (2010); Calatayud et al. (2021).

Table 4.1 Selected Funding Schemes and Their Characteristics

Funding Instrument	Government level involved	Resource Level	Stability	Political Acceptability	Administrative Ease	Efficiency	Equity	Environmental impact
Property taxes	Local/National		Lower	Medium	Medium	Lower	Medium	Lower
Parking charges	Local		Medium	Lower	Lower	Higher	Higher	Medium
Road Pricing	Local/National		Medium	Lower	Medium	Higher	Higher	Higher
Congestion charges	Local		Medium	Lower	Lower	Higher	Higher	Higher
Fuel taxes/surcharges	National		Higher	Lower	Lower	Higher	Higher	Higher
Vehicle Taxation	Local/National		Medium	Lower	Medium	Medium	Higher	Higher
Farebox revenue	Local/Private		Medium	Medium	Lower	Medium	Medium	Medium
Advertising	Local/Private		Higher	Higher	Medium	Lower	Lower	Medium
Tax on payrolls	Local		Higher	Medium	Medium	Medium	Medium	Medium
Land value tax	Local/National		Medium	Lower	Lower	Medium	Medium	Medium
Tax increment financing	Local		Medium	Medium	Lower	Medium	Lower	Medium
Special Assessment	Local		Lower	Medium	Lower	Medium	Lower	Lower
Transportation utility fees	Local		Lower	Lower	Lower	Medium	Lower	Medium
Development impact fees	Local/National		Lower	Medium	Medium	Medium	Medium	Lower
Negotiated exactions	Local		Medium	Medium	Lower	Medium	Medium	Medium
Air rights	Local/National		Medium	Medium	Lower	Medium	Lower	Medium

Legend Higher: Medium: Lower:

Source: Reprinted from Ardila-Gomez and Ortegon Sanchez (2016).

Another way to characterize these instruments is on their effects to decarbonize the sector. The nature of the fiscal arrangements and revenue-raising channels adopted can have important implications on the path toward decarbonizing the sector. Fiscal measures can fall into these categories:

- Pull factors—toward climate action
- Push factors—away from climate action
- Neutral—supportive to climate action

4.2.1. Pull factors—Toward climate action

Taxes and charges commonly levied on private vehicle users are vehicle import or registration tax, fuel duties, road user charges, and parking charges. These act as a pull factor toward climate action by discouraging the use of vehicles, particularly high-emitting vehicles. Many countries are using tax incentives to encourage electric vehicle (EV) adoption. One such example is Indonesia, which issued a government regulation in 2019 on luxury taxable goods for motor vehicles subject to sales tax, yet which gives tax reductions for plug-in hybrid, battery, and fuel cell vehicles (Nugraha 2020). Another example is Thailand, where the government is promoting EV investments through

tax incentives. The latest package approved in early 2021 covers a comprehensive range of electrical vehicles, namely passenger cars, buses, trucks, motorcycles, tricycles, and ships (BOI 2020). The structure of car taxes, or vehicle excise taxes, is emissions-based, ranging between 20 and 50 percent for internal combustion engine (ICE) vehicles and 10 percent for hybrid electric and fuel cell vehicles. The discussion also involved a restructuring of oil taxes, fuel excise taxes, and indexing the rates to emissions. In addition to these taxes, governments can strategically impose road user charges, congestion charges, or parking charges to discourage private car use in hotspot zones while increasing revenues for decarbonizing activities. While toll roads are prevalent in the developing world as a means of funding and financing new highway construction, the use of other forms of user charges have been less widely adopted in developing countries (see Table 4.1).

Carbon pricing instruments have increasingly drawn attention from policy makers as a mechanism for disincentivizing carbon-intensive activities. By putting a price on carbon emitted, the external costs of emissions can be internalized to encourage a low-carbon transition. The carbon pricing instruments that governments apply include carbon tax and emissions trading. Emitters are either required to pay a carbon tax at a fixed rate or are allocated emissions allowances, which can be further traded to keep the overall emissions of a system within the cap. Using the effective carbon rate (ECR), composed of emission permit price, carbon tax, and specific taxes on energy use to measure carbon prices of its member jurisdictions and G20 countries, the OECD (2018) found that taxes on fuels account for 99 percent of the ECR in road transport. The carbon pricing gap is the lowest for road transport—9 and 20 percent relative to the EUR30/tCO_2 and EUR60/tCO_2 benchmarks in 2021—compared with other sectors. However, the gap remains to be filled, and some studies find that the ECR should be raised to EUR50–100/tCO_2 in 2030 for countries to decarbonize in line with the Paris Agreement (OECD 2021b). In addition to acting as financial disincentives, revenues collected from the above-mentioned fiscal instruments can also be channeled toward decarbonizing activities. For example, the ENCON Fund in Thailand, set up in 1992 and capitalized by partial levies on petroleum products, has played a crucial role in providing funding support to the country's energy efficiency and renewable energy promotion initiatives.

Apart from carbon emissions, other external costs in road transport also occur from congestion and land use. Governments can therefore impose road user charges, congestion charges, or parking charges to discourage private car use in hotspot zones while increasing revenues for transport investment. A concern that may arise from the emissions-based tax regime is the erosion of the tax base in the long run. A mix of charges for the road user, or congestion, or parking based on different principles may help stabilize the inflow of fiscal revenues from road transport. Pull measures can also help in shifting investments toward more sustainable modes. For instance, local taxes to support public transport and general road fund maintenance budgets can support sustainable infrastructure such as cycling/footpaths (which are not expensive) and other active mobility solutions.

4.2.2. Push factors—away from climate action

An important push factor in public spending that hinders decarbonization is that of fuel subsidies. The International Monetary Fund (IMF) estimates that $305 billion or 0.4 percent of global GDP and $4.7 trillion or 6.3 percent of global GDP were spent on pre-tax and post-tax energy subsidies in 2015.[38] While pre-tax subsidies were estimated to decline to $295 billion—0.37 percent of global

[38] See https://www.imf.org/en/Topics/climate-change/energy-subsidies.

GDP—in 2017, post-tax subsidies were estimated to have increased to $5.2 trillion—6.5 percent of global GDP. Emerging economies in Asia account for about 40 percent of global post-tax subsidies. The highest post-tax subsidies in GDP share were observed in emerging and developing Asia, the Middle East, North Africa, Afghanistan, Pakistan, and the Commonwealth of Independent States, at more than 12 percent of regional GDP.

The phasing out of fossil fuel subsidies is an important policy to support decarbonization.[39] **Moreover, fuel subsidy reform has seen positive steps in recent times.** Revenue gains from such removal at a global level were estimated to be about $2.8 trillion—3.8 percent of global GDP—in 2015 and $3.2 trillion, or 4 percent of global GDP, in 2017. A reallocation of the savings from subsidy reform can be used to support clean energy transition, magnifying the impact of the subsidy removal. Indonesia, as a major producer of fossil fuels, has kept gasoline and diesel prices below market levels through heavy subsidies. Reform of the subsidy in January 2015 delivered savings of approximately IDR 211 trillion ($15.6 billion), or 10 percent of all government expenditure in 2015 (International Institute for Sustainable Development 2016). Also, Nigeria, as the largest oil producing country in Sub-Saharan Africa, is ending the era of fuel subsidy for the use of fossil fuel products in the country, which has cost as much as 120 billion naira ($294 million) per month as of March 2021.[40] The removal of subsidies, which are higher than average OECD subsidies, is aimed at addressing the negative net energy tax revenues. Nigeria has the potential to increase revenue by as much as 0.5 percent of GDP through a reformation of subsidies on fuel use which could further be channeled into transport decarbonization investments.[41]

Shifting fiscal support from brown infrastructure to fund low-carbon mobility. In many cases, the budget allocation for large infrastructure in the transport sector focusses on improving road usage or creating new urban developments without addressing mobility and GHG emissions. Large-scale investment in green transport infrastructure often focuses on high-speed rail lines which only serve a small proportion of travelers while not addressing the major growth areas in mobility demand. This statement is valid whether developed or developing economies even when the former has different mobility needs. A shift in fiscal support will lead to a double dividend by creating fiscal space for clean mobility and reduce GHG from grey infrastructure.

4.2.3. Neutral factors—other levies and revenues

More innovative solutions generate public revenues for funding transport, such as developer financial contributions to local sustainable transport infrastructure and services and LVC. This links to the general perception that transport infrastructure has positive impacts on local economic development, and therefore can be at least partially funded by private sector contributions (taxation). These sources of revenues are not new to some developed countries such as the United States and the United Kingdom. However, they represent a good opportunity for developing cities that have scarce public resources to crowd-in private funding for public goods.

[39] However, the distributional impacts of subsidy reform and externality pricing cannot be neglected. It clearly creates some challenges, especially for the lower middle-class. Any subsidy reform should address the vulnerability of the poor and lower middle-class. Moreover, the political economy can make such reforms impossible and thus government should work with relevant stakeholders.

[40] See https://www.bloomberg.com/news/articles/2021-03-25/nigeria-fuel-subsidy-hits-nearly-300-million-a-month-nnpc-says.

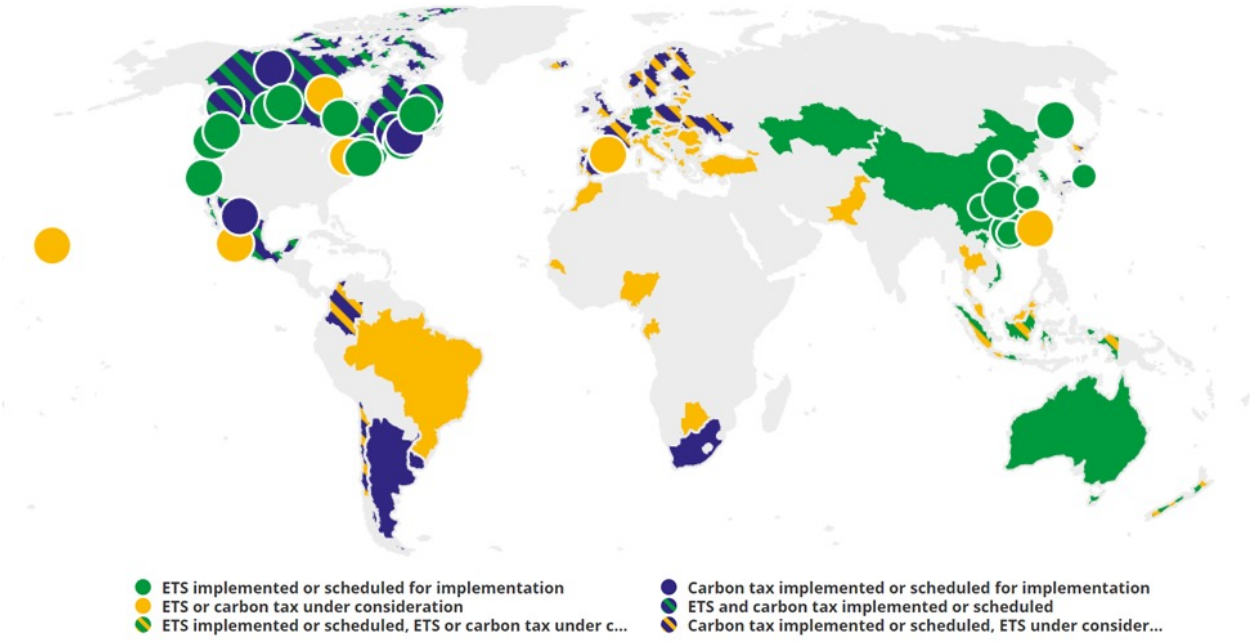
[41] See https://www.oecd.org/tax/tax-policy/taxing-energy-use-nigeria.pdf.

An example of raising alternative sources of public revenue to fund infrastructure investments in developing countries is São Paulo, Brazil. Applying the concept of LVC as a revenue-generating mechanism, the municipality of São Paulo introduced the charges for additional building rights—or Outorga Onerosa do Direito de Construir (OODC)—in the early 2000s, and later the certificates of additional construction potential (CEPACs), a form of charges based on land value and sold at auctions in the stock market. Revenue collected from the sale of CEPACs is used as a financing mechanism for local projects in urban operation areas. The first project CEPACs financed was the Água Espraiada Urban Operation (OUCAE), which involved a variety of investment and policy interventions. While about one-tenth of the total investments under the OUCAE between 2004 and January 2009 were for public transportation, nearly six times more funding was invested in road infrastructure (Mahendra et al. 2020). LVC therefore does not necessarily lead to decarbonizing investment activities unless authorities commit to the effort of decarbonizing the sector.

4.3 Fuel and Carbon Pricing

Carbon pricing initiatives around the world generated $53 billion in revenue in 2020 and covered 21.7 percent of global GHG emissions.[42] This is an increase of nearly $8 billion compared with 2019. However, potential for revenue generation from pricing transport emissions remains limited. While road transport has the smallest explicit inclusion of carbon tax in fuel excise rates compared with other sectors, 99 percent of the carbon price signal resulted from fuel taxes rather than carbon pricing initiatives. The difference is not trivial as carbon taxation often imposes some restriction on how the money can be used, which is often aligned with climate action objectives.

Figure 4.4 Summary of Regional, National and Subnational Carbon Pricing Initiatives



Source: https://carbonpricingdashboard.worldbank.org/.

[42] World Bank Carbon Pricing Dashboard—https://carbonpricingdashboard.worldbank.org/.

Among developing economies, Ukraine, South Africa, Mexico, Colombia, Chile, and Argentina have implemented a carbon tax scheme, but the tax rates are generally low. The size of revenues collected from carbon taxes ranges from less than $1 million in Argentina to $9,632 million in France.[43] A key question is how the revenues are used or recycled. In Colombia, carbon tax revenues are directed to the "Sustainable Colombia Fund" or later renamed "Colombia in Peace Fund," which is dedicated toward environmental protection activities. In Japan, Ireland, and Switzerland, carbon tax revenues are used to support energy efficiency or renewable energy activities. Meanwhile, some countries such as South Africa are prohibited from earmarking carbon revenues due to fiscal regulations. Most countries channeled carbon taxes (or revenues from ETS) to general budget and to a lesser extent, environmental spending (Parry et al. 2022).[44]

Several factors may have contributed to the limited uptake in carbon pricing for transportation: a) Governments are averse to additional taxation as several taxes on fuel use and vehicle ownership already exist, hence the reluctance from industry and households to see further taxation for carbon emissions; b) Concerns stem over social inequality, as in the absence of restructuring of taxation, carbon pricing would increase the cost of travel, and through increased logistics costs, also potentially feed through to commodity prices; c) While the higher income group is more financially capable of acting on the changing conditions, the lower income group risks being penalized by the rising prices due to the high proportion of income spent on fossil fuel–based travel;. and d) Establishing buy-in from relevant stakeholders and overcoming technical complexity in designing a cost-effective and socially equitable carbon pricing mechanism are keys to successful implementation.

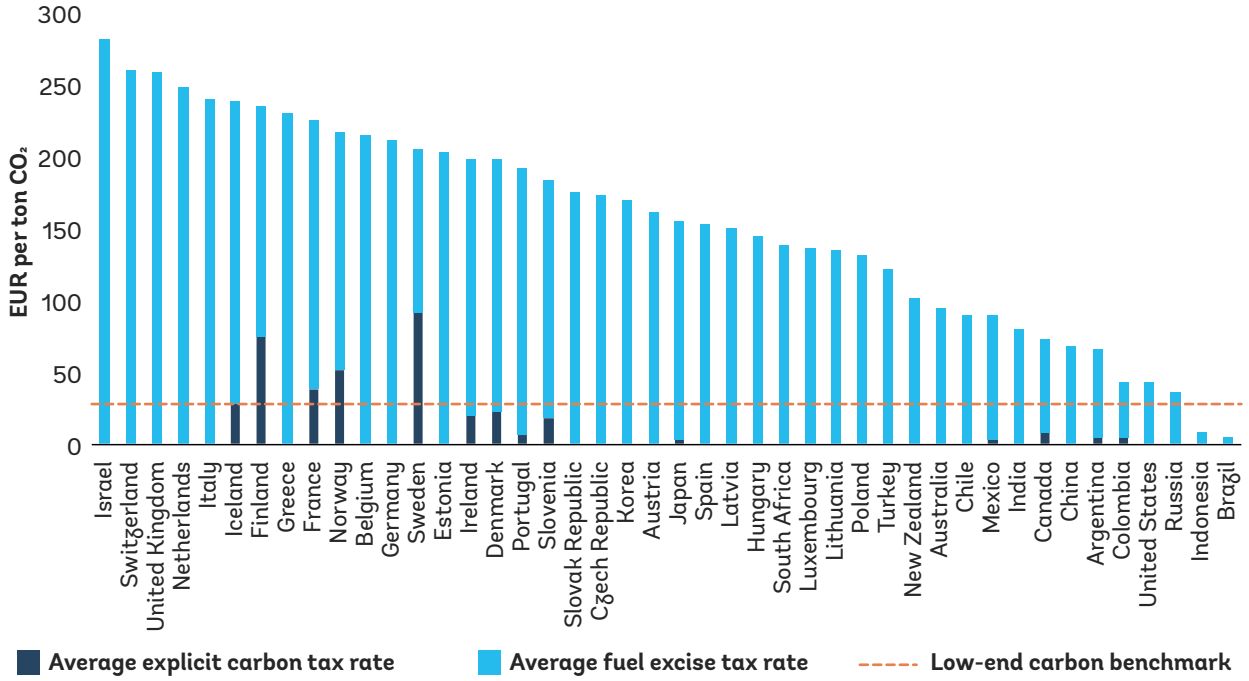
For many countries, the story is not about adding carbon pricing to fuel prices but to channel fuel tax revenues into climate-friendly actions. In fact, most countries have fuel taxes above a low end of carbon benchmarks and many above EUR100/tCO_2 (Figure 4.4). Carbon prices, however, have more impact when the collection is tied to specific uses and can be seen as a commitment to decarbonize transport mobilizing commercial finance. A survey of investors' perception on climate finance points highly to the role of carbon prices and subsidies for institutional investors.[45]

[43] Carbon Tax Implementation in the Energy Sector: A Comparative Study in G20 and ASEAN Member States, July 1, 2021.

[44] Ian Parry, Simon Black, and Karlygash Zhunussova. 2022. "Carbon Taxes or Emissions Trading Systems? Instrument Choice and Design" IMF Staff Climate Note 2022/006, International Monetary Fund, Washington, DC.

[45] IBID.

Figure 4.5 Effective Fossil Carbon Tax Rates by Country in 2018 (Low-End Carbon Benchmark 30 EUR per ton CO_2)



Source: Reprinted from OECD 2019.

Carbon pricing faces challenges in gaining public acceptance. This is particularly problematic for road transport, which is, in many countries, already heavily taxed. Carbon pricing may also disproportionately affect low-income households and negatively impact business competitiveness. These potential impacts need to be addressed. However, the role of carbon pricing in the road transport sector is not as clear as for other sectors such as power, where it is often used as the central mitigation mechanism. In the road transport sector, non-pricing policies can be better placed to incentivize specific actors. For example, vehicle efficiency standards provide a more direct signal for manufactures to innovate or fuel standards to promote development and uptake of low carbon or renewable fuels. While carbon pricing may not necessarily be the central mechanism to mitigate for the road transport sector, it does have a role to play:[46]

- It addresses imperfections in other policies—rebound effect in vehicle efficiency standards.
- It contributes to decarbonize supporting sectors such as electricity.
- It promotes equity across sectors allowing the market to determine whether or when road transport can offer least cost abatement.

On the other hand, a carbon tax has the potential to generate revenue. Unlike direct taxes, a carbon tax can be placed upstream on fuel producers or importers, which allows for a broad coverage of transport activities. This can reduce administrative costs, promote compliance, and reduce tax

[46] The role of a carbon price in tackling road transport emissions. Partnership for Market Discussion Paper. World Bank 2021.

evasion. Road transport needs a comprehensive policy suite to ensure mitigation opportunities are realized. It includes how best to design carbon pricing in road transportation to promote public acceptance and how to promote fuel tax reforms to help ensure the relative price of fuels accurately reflects their environmental and social damages.[47]

Decarbonizing the road sector would affect the tax structure and the financing of the governments. Oil and fuel taxes represented on average 6.8 percent of total taxation in high-income countries and 10.2 percent in middle-income countries in 2019.[48] In some countries, such as Thailand, more than a quarter of tax revenues comes from taxation on oil and fuel products. The progress on fossil fuel efficiency on new vehicles and the transition to clean energies will decrease tax collection. A study in Slovenia (OECD/ITF 2019) quantifies the effects and simulates some policy options. Under the existing policies, tax revenues from fossil fuels for transport are likely to decline substantially in the coming decades. The reduction in tax collection will be influenced by the rate of adoption of clean technologies, which by many estimations, is likely to be faster for cars and light duty vehicles, and slower for heavy duty ones. Technology permitting, as well as some improvements in the processing of information, a tax or levy scheme based on distance traveled can compensate for the missing revenues. The report concludes that gradual reforms of the tax system will allow for a smooth adaptation to technological changes in the vehicle fleet and the timely implementation of accompanying measures. Moreover, shifting from taxes on fuels to charges on distances driven can contribute to more sustainable tax policy over the long term, improving environmental and mobility outcomes.

Another effect of decarbonizing transport is the impact on fossil fuel exporting countries and their capacity to finance the governments along with clean energy programs. For instance, some estimations for the Middle East and North Africa (MENA) countries show that the effects could be dramatic if governments do not anticipate for such changes by diversifying their economy and tax base (Tagliapietra 2018). On the contrary, the large revenues collected in sovereign wealth funds can place these countries at the forefront of technological innovations while also ensuring some long-term cashflows.

Opportunities arise to create international voluntary carbon markets or other cooperative measures within industries. There are some proposals in the maritime sector (shipping), for instance, to include a voluntary carbon tax scheme to main transport companies and use the collection to help the sector with funding capacity to decarbonize the industry. Eventually, a similar approach can be used for aviation industries. Creating voluntary carbon markets has its advantages and challenges. But some industries, for instance, in the United States, are adopting implicit carbon pricing to facilitate their transition when mandatory carbon pricing or cross-border carbon taxes are implemented (Patnaik and Kennedy 2021).

Finally, there are some clear messages that emerge from this discussion: a) Removing perverse subsidies is an essential first step toward transport decarbonization; b) Users of private motorized transport need to be faced with their full social costs, although the transition to such objective will vary across countries; and c) Tax revenues from transport externality pricing need to be recycled into green investments to facilitate climate action. Moreover, the implementation of transport climate policies should be also assessed in the context of equity impact across countries and income groups.

[47] See also ITF (2023), Decarbonisation and the Pricing of Road Transport: Summary and Conclusions, ITF Roundtable Reports, No. 191, OECD Publishing, Paris 2021.

[48] See https://www.oecd-ilibrary.org/taxation/data/oecd-tax-statistics_tax-data-en.

4.4 Funding Matters but It is Not All Encompassing

Increasing funding to support climate action in transport activities is vital but how resources are allocated is equally important. Transport sector funding is overwhelmingly directed toward transport infrastructure as opposed to the provision of mobility services. Investment in increasing the transport infrastructure capital stock has primarily been channeled toward expanding the highway network through road construction, resulting in increasing motorization rates and motorized vehicle activity.

Sustained and dependable funding support for mobility services in the majority of developing countries is limited to national government subsidies. In most advanced developing economies, these funds are provided to rail systems or subsidy support and bailouts for publicly owned bus companies, despite much of the motorized travel being carried by informal public transport operators, who are typically nonsubsidized. Insufficient funding for public transport, alongside low regulated fares imposed on the private sector operators, leads to low quality and inefficient service provision. It also restricts the ability of the sector to invest in decarbonizing through fleet modernization or improving the efficiency of operations.

While a significant proportion of the population may be restricted in choice of mode of travel because of the cost, inadequate public transport inevitably encourages greater motorization. This is translated through the desire for private vehicle ownership due to the lack of attractive alternatives. Insufficient funding, public and private, undermines the power and effectiveness of regulations and vehicle standards as instruments to support climate action, as increasing standards typically comes at increased cost.

Even when new funding sources to support government policies can be identified, other actions on the spending side need to be addressed. Governments can revise tax structures to accommodate the arrival of clean technologies. New levies can be created, such as distance-based charges,[49] converting fuel taxes to carbon prices, adjusting vehicle ownership taxes to reflect the emission, and creating new taxes from transit-oriented development (TOD). However, it is unlikely that new revenues would be enough given the demand for clean transport solutions. First, governments can benefit from new information technologies to design better projects and work on the public investment management framework to improve the efficiency of their spending. Second, a review of spending priorities is likely necessary, for instance, when considering new land developments that contribute to urban sprawl instead of expanding highway capacities or providing more public transport solutions. On the other hand, increasing public transportation is necessary, but insufficient if other actions are not taken considering last mile connectivity and how economic activity is organized—housing, job and business opportunities, and supply chains. It is a weighty societal decision as to how far climate action can go.

[49] Ibid footnote 46.

5

Innovative Approaches to Finance Transport Climate Action

Innovative Approaches to Finance Transport Climate Action

This section presents a few selected approaches to finance transport climate action with a spotlight on the financing of clean mobility solutions.

5.1 Financing E-mobility in Sub-saharan Africa

Road transport emissions are growing faster in developing nations, with Sub-Saharan Africa (SSA) region showing the highest growth. Emissions are mainly driven by a rapid increase of motorization rates along with unplanned urbanization and the lack of public transport solutions. While road transport emissions in SSA are small relative to those on developed economies, the mobility needs and aspiration to own a vehicle have the potential to make the region a large polluter. These economies risk locking into unfriendly climate solutions, which bring higher costs to transition to more efficient and clean technology in the future.

The need for blended finance has been used in a limited fashion to support the transition to clean mobility in SSA. In general, concessional finance is available although insufficient to support the construction of transport infrastructures. While the evidence is scattered, concessional and climate finance have been less available when it comes to the provision of mobility (i.e., vehicles such as buses, trucks, light duty vehicles, two–three wheelers). Naturally, the question is whether these limited resources should be used to finance mobility instead of commercial finance (see figure 5.1). In advanced economies, commercial banks and other nonbanking financial institutions have been the main financiers **for fleet expansion and renewal.** Still, governments use different tax incentives, for instance, to support the transition to cleaner vehicles while the financing price and terms are defined in commercial terms. In **SSA, there are** multiple limitations for firms and individuals to gain access to commercial banks. **Moreover,** the domestic financial sector does not have enough capacity to finance clean/efficient technologies for a variety of reasons, such as the lack of bankable project opportunities, lower risk appetite, imperfect information, local-level/small-sized projects, high barriers to entry in new markets, and sector-specific challenges. Therefore, fiscal resources and concessional/climate finance could help the region transition to clean mobility.

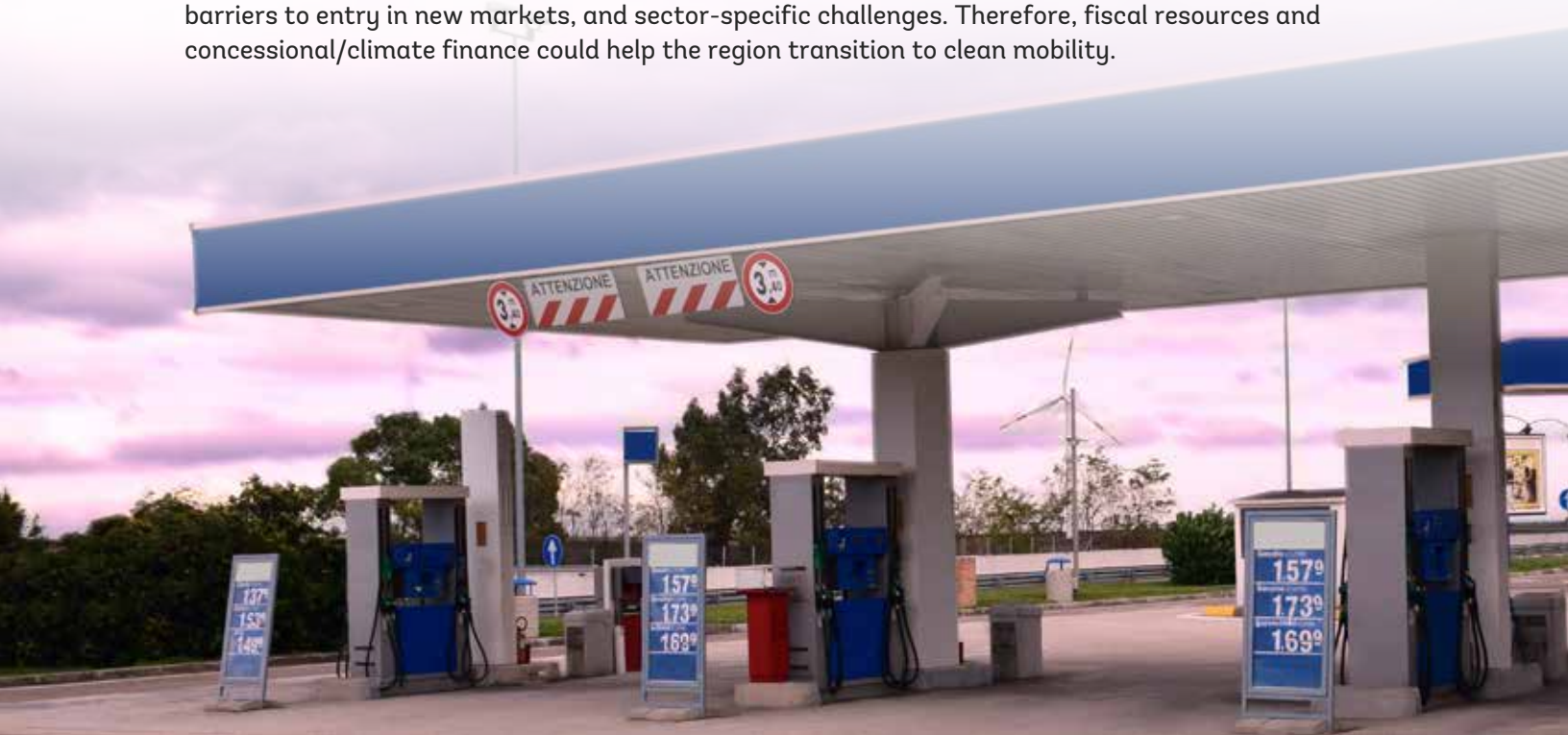
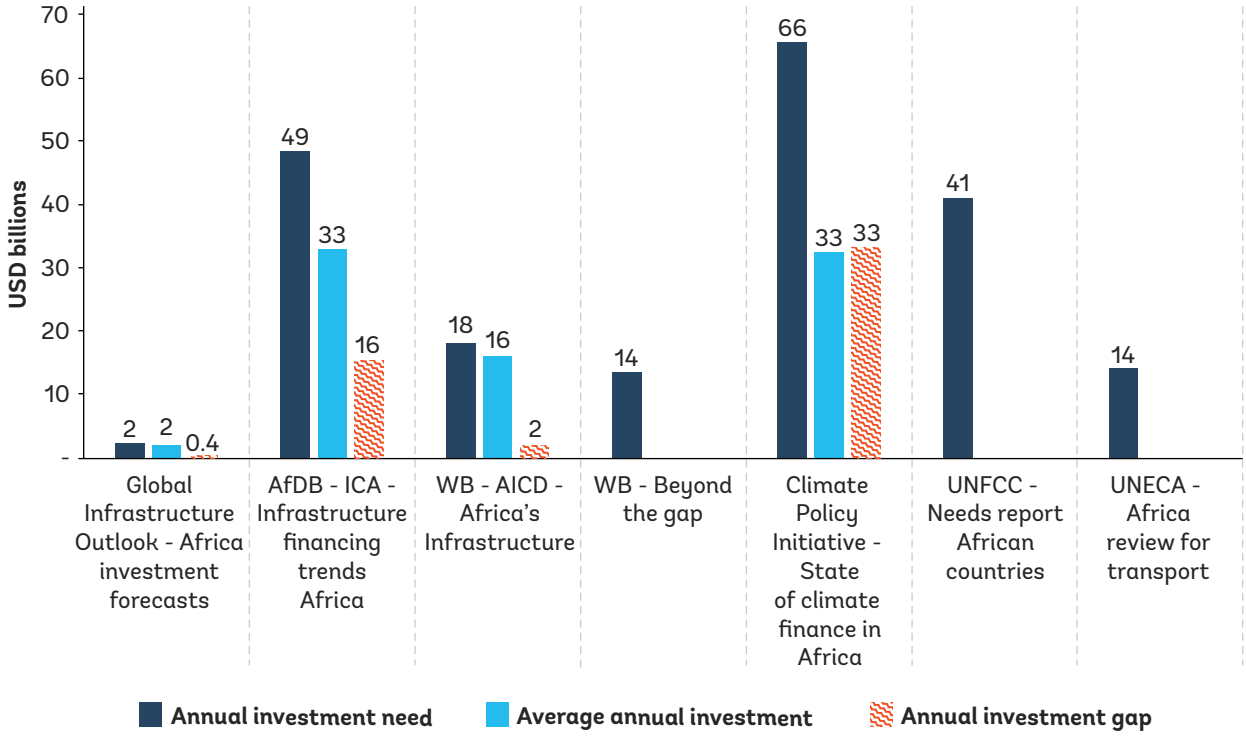


Figure 5.1 Financing Needs for Transport Infrastructure and Mobility in Africa—Annual Estimates (2020 – 2030)



Source: Authors' elaboration based on multiple sources.[50]
Note: AfDB = African Development Bank; AICD = Africa Infrastructure Country Diagnostic; ICA = Infrastructure Consortium for Africa; UNECA = United Nations Economic Commission for Africa; UNFCC = United Nations Framework Convention on Climate Change; WB = World Bank Group.

Unlocking finance for clean mobility still needs to address multiple barriers and thus, there are opportunities for policy actions – see discussion in Section 3.2. However, even when these issues are addressed, many markets in the SSA region do not have the requisite demand to provide economies of scale benefit at country level. In effect, most of the mobility projects are situated at a local level and are of smaller size and fragmented. For instance, a back-of-the-envelope estimation shows a capital expenditure of $50–100 million in (diesel) buses for a single Bus Rapid Transit (BRT) but figures could be much higher depending on the level of service and the needs of feeder buses.[51] E-buses will increase the ticket price, but they can bring benefits by reducing the total cost of ownership as shown in Garmendia et al. for many cities.[52] But the necessity of public transport

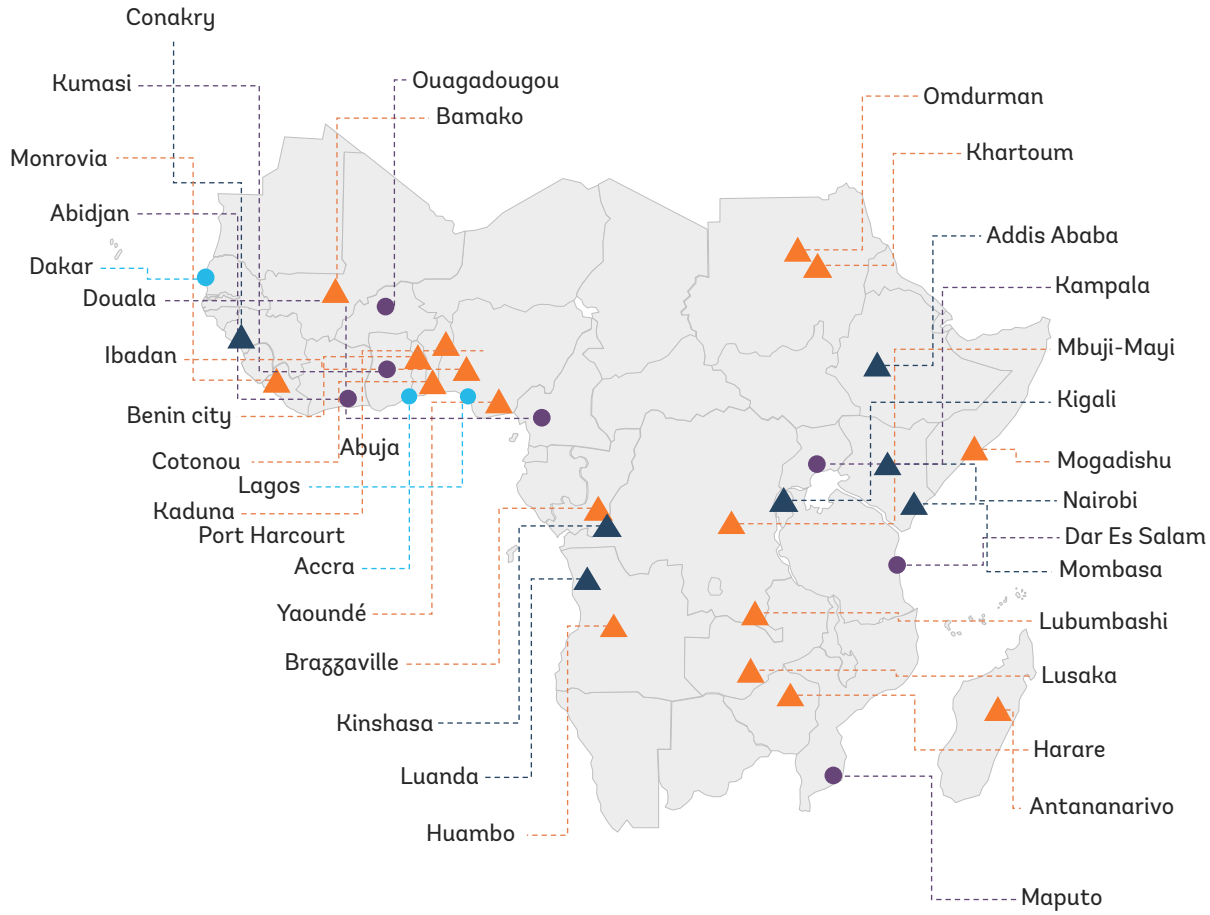
[50] GIO: https://outlook.gihub.org/region/Africa; AfDB: https://www.afdb.org/en/documents/infrastructure-financing-trends-africa-2019-2020; WB AICD: https://openknowledge.worldbank.org/handle/10986/2692; WB beyond the gap: https://www.worldbank.org/en/data/interactive/2019/02/19/data-table-infrastructure-investment-needs-in-low-and-middle-income-countries; Climate-Finance-Needs-of-African-Countries-1.pdf (climatepolicyinitiative.org) and Needs Report_African counties_AfDB_FINAL.pdf (unfccc.int).

[51] Assuming a BRT 15 km long, at productivity set at 10,000 pax/day/km. The investment needs may be higher depending on the technology (high-efficiency diesel technology or e-buses and battery provision/recycling) and if feeder buses are required.

[52] Briceno-Garmendia, Cecilia; Qiao, Wenxin; Foster, Vivien. 2022. The Economics of Electric Vehicles for Passenger Transportation (Draft). © Washington, DC: World Bank. http://hdl.handle.net/10986/38265.

solutions in most cities in SSA can scale up volume and attract new players providing financing, technology, and commercialization (dealers, lessors/fleet companies). A rapid estimation of the demand for buses in the region is shown in figure 5.2. A similar argument can be extrapolated to the trucking industry, light duty vehicles (LDV), and two–three wheelers. Opportunities exist to consolidate investment demand and promote new business models, such as leasing companies and/or offering a bundle of services. Governments have a role to step in by facilitating the creation of consolidated markets/aggregated demand to attract major commercial financiers. However, many governments lack access or the track record to mobilize long-term financing without development finance institution (DFI) involvement.

Figure 5.2 Estimated Demand for BRTs in Sub-Saharan Africa



8,000 buses

1,500 – World Bank projects
4,000 – Planned projects
2,500 – Prospective projects

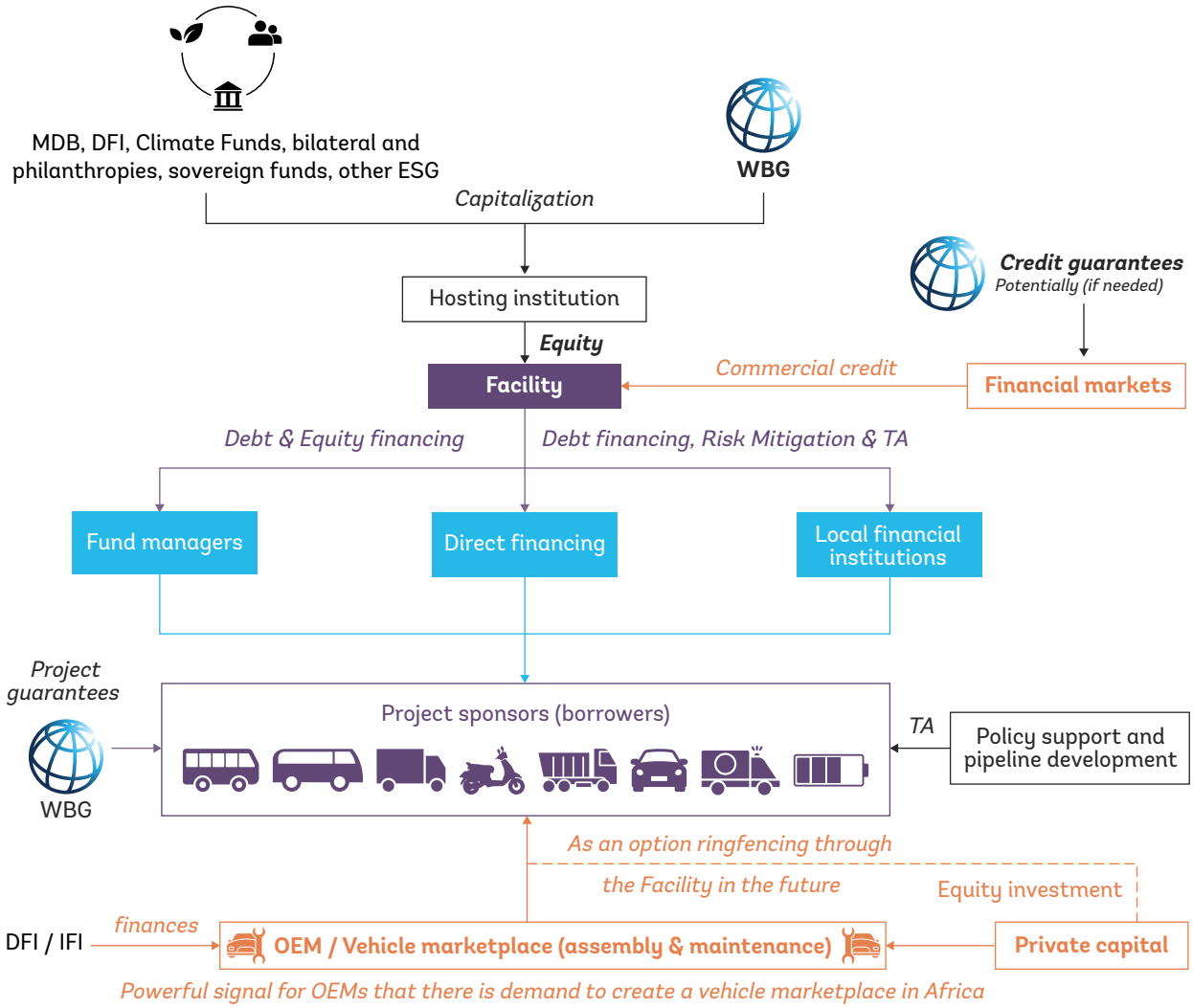
● WB BRT projects under preparation	▲ Cities with planned BRT systems
● WB funded BRT projects completed or under implementation	▲ Cities with >1 million population and no BRT systems planned

Source: World Bank estimation.
Note: BRT = Bus Rapid Transit; WB = World Bank Group.

Given the market gap and need to aggregate, the World Bank is exploring a concept for a regional financing facility to support the climate action in transport. The facility will mobilize MDB/DFI financing and concessional resources to leverage commercial finance to offer blended financing, credit enhancements, and technical assistance to support and accelerate development in a low-carbon transport sector (Figure 5.3). There will be a long-term agreement between the bus operator and the grantor regulating the service level, fares, and other revenues. Other assets are also envisaged such as modern trucks, light duty vehicles, or e-mobility and charging stations. The leasing model is just one of the possible solutions. Eligibility conditions will be based on commonly accepted principles: avoid, shift, and improve. Moreover, these investments should be consistent with the Paris Alignment even when some solutions still rely on (more) efficient fossil fuels. It is expected that road emissions will be offset, for instance, by shifting trips from cars to public transport or by more efficient trucks (less fuel consumption, less emissions from more efficient ICE). The facility could focus on implementable solutions that are context specific. Hard infrastructure (roads, railways, transit-oriented development, others) will continue to be financed by traditional instruments offered by DFIs.

A regional financing facility to support clean mobility can bring scale, diversify risks, reduce transaction costs, and address financing needs more flexibly at the country or asset level. Many markets in the region do not have the requisite demand for capital to mobilize financing at the country level. This is particularly relevant when it comes to financing large fleet acquisition or renewal for instance, of buses, vans, and heavy and light trucks running on more efficient technologies. These markets are traditionally financed by the private sector in more advanced economies. However, because of varying reasons such as risk appetite, imperfect information, fragmented market structure and sector-specific issues, these institutions are not capable to provide financing products focusing on clean mobility in most SSA countries. Governments can step in by facilitating the creation of these markets. At the same time, evidence shows that many governments lack access or the track record to mobilize commercial financing without DFI involvement. Also, it is expected that a regional solution can attract more original equipment manufacturers (OEMs) to compete for the market, making the financing of clean mobility more affordable.

Figure 5.3 An Illustrative Example of a Regional Financing Facility[53]



Source: World Bank – Regional Financing Facility.
Note: OEM = original equipment manufacturer; TA = technical assistance.

Recognizing that financing of climate-friendly transport solutions is one of the pillars to achieve a low-carbon transport, an ecosystem approach would be necessary to support policy reforms and technical capacity. Here are some levels of interventions to support innovative solutions and attract private sector investment simultaneously:

- An enabling environment at the policy level: to create a favorable transport Paris Alignment environment through policy, legal, and regulatory interventions such as World Bank country-level engagements.

[53] The example is only for illustrative purpose and does not assume any commitment from the World Bank Group or other institutions as shareholders in this ecosystem. See also "Financing the transition to electric vehicles in sub-Saharan Africa," Shell Foundation, January 2022.

- ASI (avoid, shift, improve) framework for transport climate friendly actions: to identify policies, investments, and a revenue plan to finance climate actions. As such, a transport vision and the implementation strategy would be the outcome. The World Bank Group's Country Climate and Development Reports (CCDRs) could be the starting point of a deep sectoral analysis connecting energy, territorial development, and land use.

- Technical capacity: it is necessary for public sector agencies and private sector. For the former, it is important to support capacity building to identify and prioritize investments, financing options, and implementation support. For the latter, it is important to become familiar with low carbon mobility solutions and options to invest and or adopt different transport solutions. For instance, commercial banks could be reluctant to offer financing for EVs given their concerns on the residual/secondhand value of EVs, battery performance, and others. In most cases, the concerns are due to a lack of information and some capacity building could be necessary.

- Funding and financing solutions to implement climate actions: It is important to develop targeted financial instruments to mobilize financing for transport climate investments by both public and private sectors.

A regional approach does not preclude the need to create an ecosystem at the country level to provide regulation, capacity building, and tax incentives to facilitate the transition. The experience in Dakar with a fleet renewal program for urban buses is a good example of the actions needed and lessons learned to materialize a program.[54]

The recently launched World Bank Global Facility for Transport Decarbonization (GFTD) will provide analytical support to the regional financing facility.[55] The GFTD works at both policy and technical levels to build an enabling environment and capacity to implement policies that pursue the greening of transport.

5.2. Financing Models in E-mobility

Electrifying transport requires a programmatic approach capable of dealing with the demand. It not only offers mass public transport systems that run on clean energies, but also facilitates the transition of large fleets of vehicles to these climate-friendly technologies. Such is the case of replacing two- and three- wheelers in India or Indonesia, among other countries with large fleets of ICE. The World Bank is analyzing some financial schemes to mitigate risks and facilitate the transition. Like the regional financing facility, a programmatic approach, reaching different markets, it is being explored in India. The approach can bring larger economies of scale in the OEM side as well as on the supply of financing—still, it is necessary to work with lenders on issues, such as lack of sector knowledge for credit appraisal and creditworthiness risk. Potential solutions encompass risk-sharing facilities and technical assistance to develop the ecosystem for EVs. Similarly, high-cost, and limited financing options are some of the main challenges for borrowers, along with resale value. For these challenges, fiscal and nonfiscal incentives should be identified,

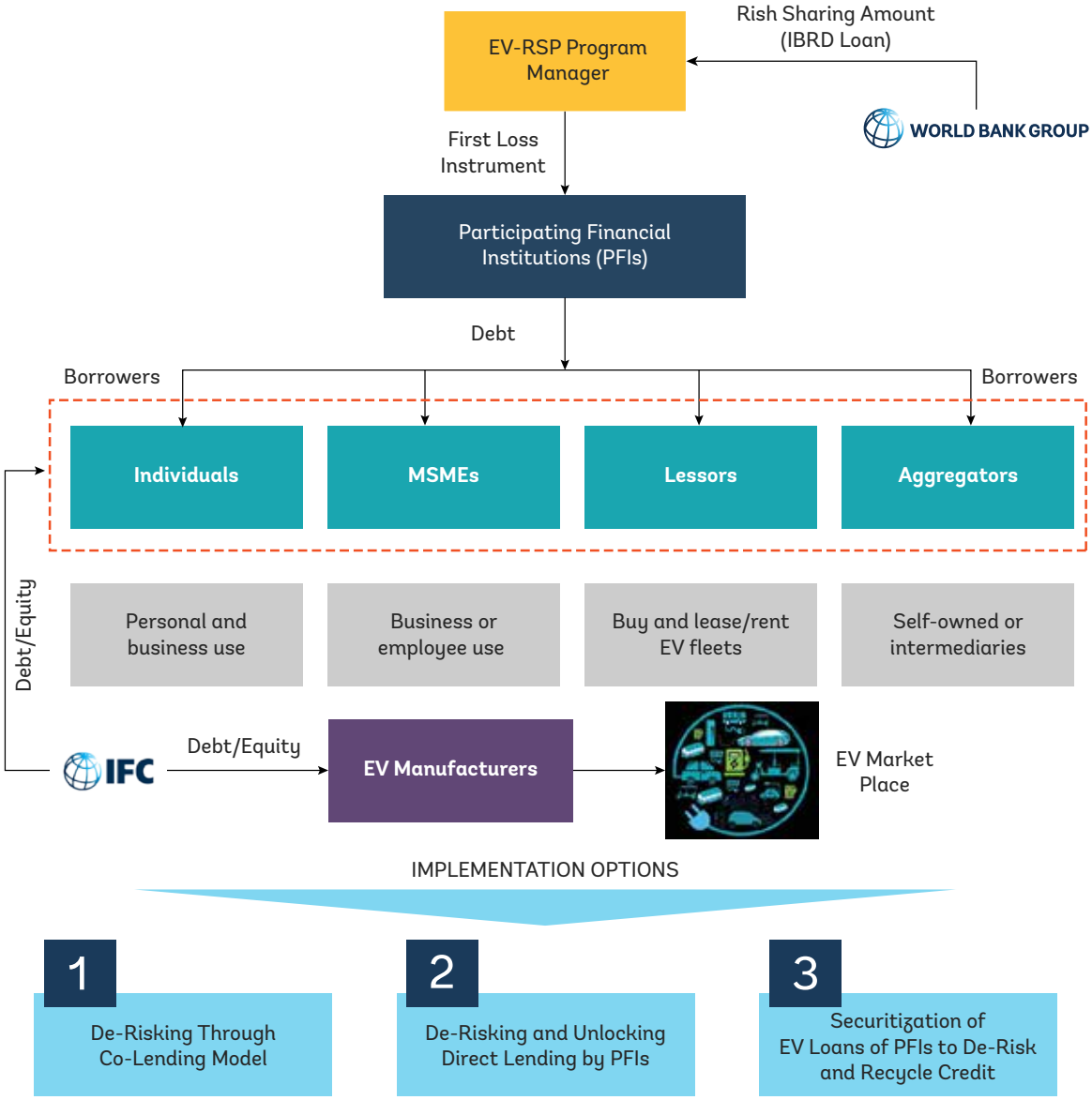
[54] Study About Vehicle Financing Options and PPP Framework for The Informal Sector in Africa. Africa Transport Policy Program, forthcoming SSATP publication (2023).

[55] See https://www.worldbank.org/en/topic/transport/brief/global-facility-to-decarbonize-transport.

as well as specific regulations covering the transport and energy sector. Some technical assistance to calibrate the fiscal incentives and define the necessary regulation should be part of the ecosystem. Finally, a programmatic approach should also bring manufacturers to develop the right product for each country, the capacity to supply the demand, and operation and maintenance (O&M) including battery recycling and warranty programs.

Three high-level options are considered within the overall EV risk-sharing program (EV-RSP) architecture for ease and speed of implementation. The approach can be designed to provide first loss partial credit guarantee to de-risk lending to two- or three-wheeler EV purchases. It should be capable to scale quickly in case of market demand. A structured approach in phases reduces lending rates and improves credit terms through the co-lending model or derisking of participating financial institutions (PFIs). A local development bank implements it as an intermediary for on-lending or as a program manager. It can incorporate structural mitigants in EV-RSP design, for instance, lending and underwriting requirements, single borrower limits, maximum tenor, minimum loan-to-value, among others. The risk-sharing instrument can be combined with technical assistance to develop an EV-lending ecosystem (Figure 5.4). It does not imply any financing commitment from the World Bank Group but just some possible options to support the project.

Figure 5.4 Financing Models for EVs



Source: Authors' adaptation based on ongoing World Bank projects.
Note: EV-RSP = electric vehicle risk-sharing program; IBRD = International Bank for Reconstruction and Development; PFI = private finance initiative.

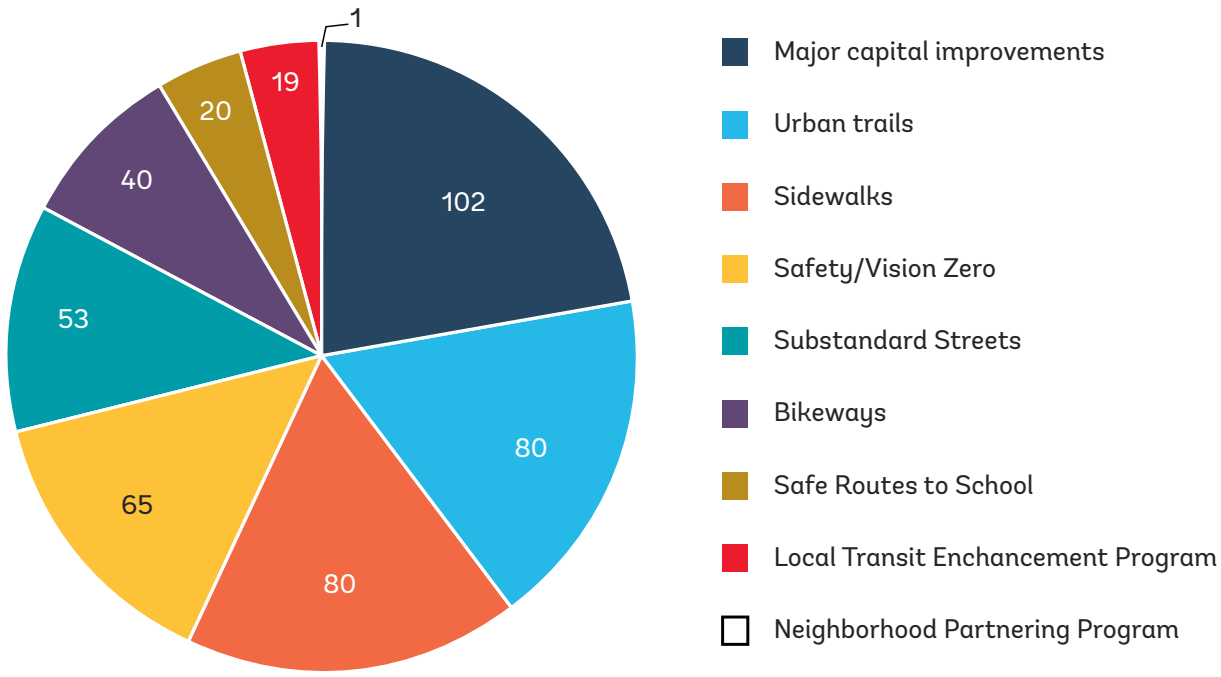
5.3 Accessing Bond Market Financing for Active Mobility

More cities are thinking of channeling investments in bike lanes, trails, sidewalks, and pedestrian safety to decouple increasing densification from rise in transport emissions. The City of Austin launched a $7.1 billion project in 2020 called the Project Connect System Plan. The city received overwhelming support for such investments from voters showing that people are willingly deciding to live in a greener, mobility-friendly city. The city plans to combine its funding and financing

mechanisms to undertake ambitious investments. The plan includes a zero-emissions fleet, a new rail system that travels belowground downtown, and an expanded bus system with more routes. While most of the funding for the plan comes from real estate taxes, the city is raising a thematic bond to finance active mobility. Bond financing will phase homeowners' tax bills over multiple years, decreasing the upfront liquidity crunch.

The plan includes $460 million in bond financing for transportation projects broken down into nine different categories. The largest category of funding will go toward major capital improvements, which include redesigning a major road and constructing a bridge to connect hiking and biking trails. Additionally, the bond provides a combined $200 million to fund bikeways, sidewalks, and urban trails (Figure 5.5).

Figure 5.5 Bond Financing ($ millions) for the City of Austin's Active Mobility Program



Source: City of Austin/Community Impact Newspaper.

Packaging active mobility as an asset to raise capital market financing is an innovative approach. The rise of an asset class based on people's choices can determine how countries can continue to densify cities but decouple rise in transport emissions by switching to active mobility and transport demand management (TDM) spatial planning and design. Significant investment is needed in all mobility options, including in reconfiguring existing roads, expanding rail system, buses, sidewalks, and bike paths. This will provide more options for people to travel around cities in an inclusive way.

5.4 Carbon Pricing Can Help Accelerate the Transition to Green Transport Targets

Environmental taxes, such as a carbon pricing, can be an efficient means for governments to mitigate negative externalities and collect funds to finance assistance and adaptation programs. They can have a lower marginal cost of public funds than direct taxes on labor and capital, for instance. They have a less distortionary effect on the economy, for example, through broadening the tax base and minimizing or avoiding distortions that result from higher tax rates on labor and capital (Barrios et al. 2013; Barrios et al. 2014). In addition, carbon pricing can be placed on a few large upstream points of regulation, which cover all downstream uses including the informal sector—representing 70 percent of all employment in developing and emerging economies (OECD and ILO 2019).[56] This can make the price of carbon more difficult to evade than direct taxes, increasing coverage and compliance (OECD 2021). Approximately $45 million was raised from carbon prices around the world in 2019. Carbon pricing as a potential source of revenue is particularly important in the prevailing context as it contributes to the sustainable macro fiscal frameworks needed for funding social assistance and post-COVID-19 crisis recovery programs.[57] Last, carbon taxes, which are generally under the purview of finance ministries, are easy to administer.

Alternatively, Emissions Trading Systems (ETS) are market-based mechanisms designed to reduce greenhouse gas emissions cost-effectively. They operate on the principle of setting an overall cap on emissions and allowing entities within the system to buy and sell emission allowances. Here are some key characteristics of ETS, particularly those that are administered downstream and often fall under the purview of environment ministries:

- Sophisticated Administration: ETS involves a complex administrative structure to monitor and enforce compliance with emission limits, allocate allowances, and oversee trading activities. This requires advanced systems for data collection, verification, and reporting.

- Limited Coverage: ETS may have limited coverage initially, focusing on specific sectors such as power generation and industrial activities. This allows for better management and gradual expansion as the system matures. Traditionally, ET) have not been widely used to directly address emissions from the transport sector, although, they can be implemented at the production of vehicles and batteries.

- Downstream Focus: This means that the regulation is applied to the final emitters, such as large stationary sources in the power and industrial sectors. This contrasts with upstream regulations that might target fuel producers or importers.

- Extension of Pre-existing Regulations: Downstream application of ETS often involves extending existing regulations to address local pollution. This integration can simplify implementation by building on established regulatory frameworks.

[56] This is quite different from direct taxes (which tend to be the default revenue source in many countries) which need to be collected from a vast number of individuals and struggle in covering the informal sector of economies.

[57] See, for instance, Burke, Fankhauser, and Bowen (2020).

- Pressure for Free Allowance Allocation: Downstream firms, especially in power and industrial sectors, may exert pressure for free allowance allocation. Free allowances are essentially a form of transitional assistance that helps industries adapt to the new carbon pricing system without causing abrupt economic disruptions.

- Addressing Local Pollution: ETS downstream can be a more targeted approach to address local pollution sources directly. By focusing on specific sectors, regulators can tailor emission reduction measures to local environmental conditions and challenges.

Two cases at the state and global level illustrate the revenue-drawing power of carbon pricing.

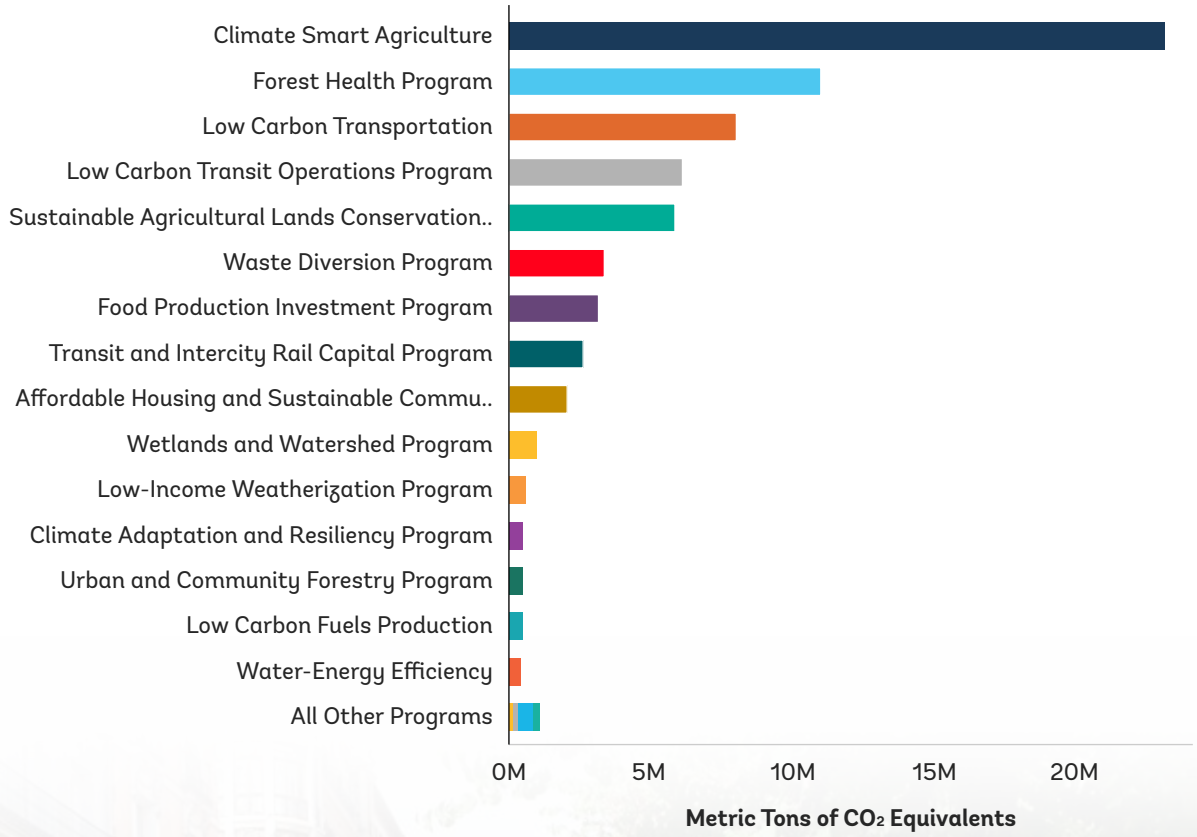
California has used the carbon pricing, specifically the Cap-and-Trade program, quite ambitiously to reduce GHG emissions and achieve carbon neutrality. The Cap-and-Trade program sets a cap or limit on total GHG emissions that declines over time. Large emitters, such as oil refineries and power plants, can buy, sell, and trade carbon allowances during quarterly auctions. The state's first two appropriations of Cap-and-Trade auction proceeds, in fiscal years 2013–14 and 2014–15, netted more than $900 million. The state's portion of the Cap-and-Trade auction proceeds are deposited in the Greenhouse Gas Reduction Fund (GGRF) and used to advance the objectives of the *California Global Warming Solutions Act* of 2006 (Assembly Bill No. 32; Núñez, Chapter 488, Statutes of 2006).[58] The Legislature has appropriated an excess of $15 billion as of May 31, 2021, to state agencies implementing GHG emission reduction programs and projects. California Climate Investments projects include affordable housing, renewable energy, public transportation, zero emission vehicles, environmental restoration, more sustainable agriculture, and recycling (Figure 5.6). At least 35 percent of these investments are made in disadvantaged and low-income communities and households. Communities where investments occur are realizing a wide range of benefits, including increased affordable housing opportunities; improved mobility options through transit, walking, and biking; cleaner air through zero emission vehicles; job creation, energy, and water savings; and greener, more vibrant communities.

[58] See http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf.

Figure 5.6 California Climate Investment Fund as of May 31, 2021

Estimated Greenhouse Gas (GHG) Reductions

Projects are expected to provide the estimated GHG reductions over time periods ranging up to 100 years. GHG reductions and funding amounts are displayed by default for all investments.



Source: Reprinted from California Climate Investments 2021.

A global carbon price on transport fuels can help finance the transition, as in the case of maritime transport. Initial estimates of possible carbon revenues from international maritime transport highlight the scale of potentially available financing, which offers a new set of additional climate actions.[59] To enable and accelerate an effective and equitable energy transition, the idea of carbon pricing for shipping has gained more traction. In the regional and national context, the European Union (EU),[60] the United States,[61] and China[62] have been taking first steps to charge shipping for its greenhouse gas emissions—with the EU being clearly most advanced by gradually including shipping in their EU Emissions Trading System (EU ETS) from 2024.[63] On a global level, governments at the International Maritime Organization (IMO) are seriously considering carbon pricing as a mid-term measure with recent submissions to the IMO making this policy option a keenly debated topic. Proposals by governments and industry range from a from a carbon levy on bunker fuel[64] to an emissions trading system (ETS) coupled with a fuel emissions standard[65] or a revenue-neutral feebate scheme.[66]

If the sector was to fully decarbonize by 2050, carbon revenues raised could range between $1 trillion to $2 trillion in one study.[67] According to another similar study, a flat carbon levy of $250 per tCO_2e could even raise $3.7 trillion by 2050.[68] Depending on different modelling assumptions, estimates for carbon revenues from international shipping could imply an average of around $40 billion to $60 billion of annual revenues (see Box 5.1). To put these numbers into perspective, global public climate finance—including through state-owned entities—amounted to $321 billion per year on average in 2019/20.[69] Thus, carbon revenues from shipping could change the landscape of additional climate finance significantly—to the benefit of shipping's own decarbonization and further enhanced climate action in terms of mitigation and adaptation. Taking important climate and equity considerations into account, the World Bank has already outlined a potential distribution framework for carbon revenues from international maritime transport.[70]

[59] Dominioni, G.; Englert, D.; Salgmann, R.; and Brown, J. 2022. Carbon Revenues from International Shipping: Enabling an Effective and Equitable Energy Transition – Summary for Policymakers. Washington, DC.

[60] European Commission. 2021. Proposal for Directive of the European Parliament and of the Council amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union, Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and Regulation (EU) 2015/757. COM (2021) 551 final. https://eurlex.europa.eu/resource.html?uri=cellar:618e6837-eec6-11eb-a71c-01aa75ed71a1.0001.02/DOC_1&format=PDF.

[61] US Congress. 2020.

[62] Chambers, S. 2021. China looks at adding shipping to the world's largest emissions trading scheme. https://splash247.com/china-looks-at-adding-shipping-to-the-worlds-largest-emissionstrading-scheme/.

[63] https://climate.ec.europa.eu/eu-action/transport-emissions/reducing-emissions-shipping-sector_en.

[64] Marshall Islands and Solomon Islands. 2021a.

[65] Norway. 2021b.

[66] Trafigura. 2020.

[67] Baresic, Domagoj, Isabelle Rojon, Alison Shaw, and Nishatabbas Rehmatulla. (2022).

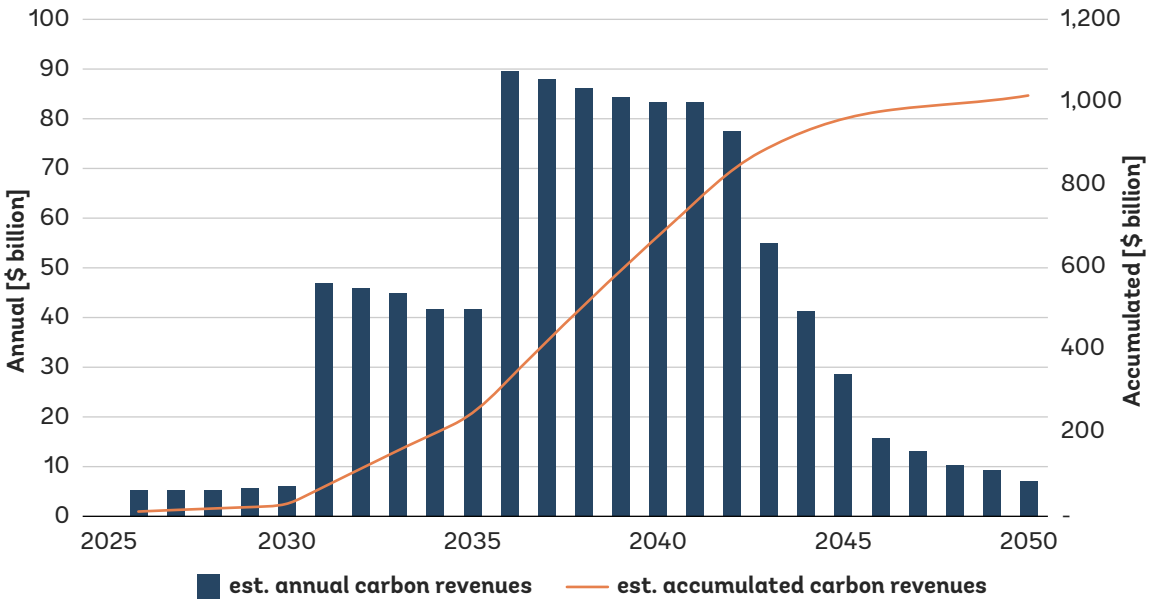
[68] Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping. 2021.

[69] Climate Policy Initiative. 2021.

[70] Dominioni, G.; Salgmann, R.; Rojon, I.; Englert, D.; Lagouvardou, S.; Gleeson, C. 2023.

Box 5.1 Potential Scale of Carbon Revenues from International Shipping Based on Two Selected Examples

Figure 5.7. 100% Revenue Recycling to Support Shipping's Decarbonization (Dominioni et al. 2022)



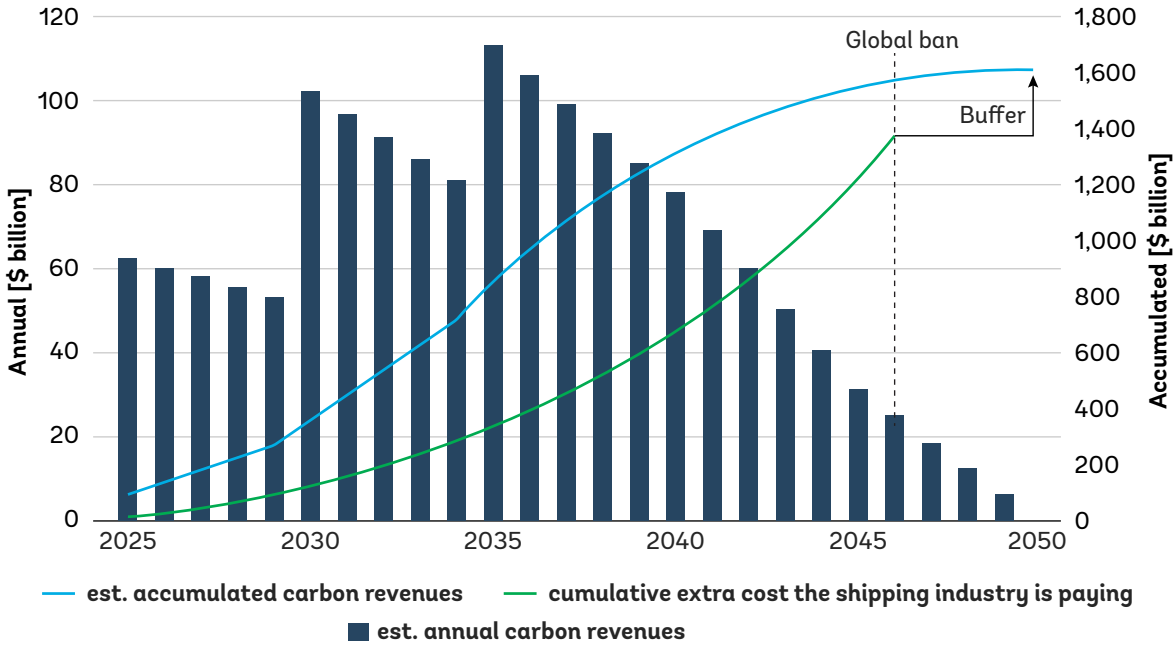
Based on techno-economic modelling conducted for the Getting to Zero Coalition[a] it is estimated that to fully decarbonize international shipping by 2050, the average carbon price would need to be around $191/ton CO_2 and reach a maximum of around $358/ton CO_2. Carbon prices could however be lower if revenues generated by the market-based measures are recycled to further support decarbonization of shipping, for example by subsidizing the deployment of zero-emission fuels and technologies. If 100 percent of revenues were recycled to support shipping decarbonization, in theory, this could lower the carbon price level by up to half, i.e., to an average of $96/ton CO_2 and a maximum of $179/ton CO_2 (but this would mean no revenues are left for other purposes, such as enabling an equitable transition). Depending on the level of revenue recycling, the average amount of revenue collected would range between $41 billion and $81 billion per annum, totaling between $1 trillion and $2 trillion.

Note:* The collected revenue should be considered in terms of the total amount of available revenue which can be distributed over the period of decarbonization (from 2025–2050), rather than assuming the revenue will be deployed only in the year it is collected. This scenario generally provides more subsidy/support for zero-emission fuels early in the transition when price spreads to zero-emission fuels are expected to be highest, and less towards the end of the transition when zero-emission fuels are more established and have a lower price spread.

a Baresic, Domagoj, Isabelle Rojon, Alison Shaw, and Nishatabbas Rehmatulla. (2022). "Closing the Gap: An Overview of the Policy Options to Close the Competitiveness Gap and Enable an Equitable Zero-Emission Fuel Transition in Shipping." Prepared by UMAS, London.

Box 5.1 Potential Scale of Carbon Revenues from International Shipping Based on Two Selected Examples (cont.)

Figure 5.8. "Earmark and return" with Buffer for Wider Use (Dominioni et al. 2022)



Note: (a) The data related to the earmark and return proposal stems from the Industry Transition Strategy. It is important to note that the accumulated cost gap during the transition is the difference between estimates of the cost of production of alternative fuels and the baseline cost being a forward-looking curve for the price of very low sulphur fuel oil (VLSFO) and liquified natural gas (LNG). The carbon price levels required to facilitate a transition (and enabling a buffer as well) would change with (1) the fossil fuel price assumptions and (2) the impact of key assumptions underlying the alternative fuels cost, e.g., levelized cost of electricity. (b) The notes were provided by the respective authors of the two studies.

The Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping[b] illustrates an 'earmark and return' global carbon levy system, coupled with a global ban on fossil-fueled vessels once most of the fleet has transitioned to alternative bunker fuels. Based on such an earmark and return logic, the carbon levy needs to be at least large enough to cover the cumulative extra cost the shipping industry is paying relative to a fossil fuel baseline in a transition to zero emissions by 2050. The projections are made assuming a carbon price starting at $50 (2025) with two hikes to $100 (2030) and $150 (2035) respectively. With these assumptions, the levy scheme accumulates funds to cover the extra cost for alternative fuels to the shipping industry. Additionally, the scheme accumulates carbon revenues of approx. $300 billion as a buffer, which can be used to address DNI amongst others.

b Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping. 2021. "Industry Transition Strategy." Copenhagen: Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping.

5.5 Leveraging Emissions Trading to Facilitate a Green and Socially Just Transition

Transformation of industries and a transition toward a net zero goal come at a cost. Many jurisdictions are ensuring that carbon revenues are used to facilitate green and a just transition. Some examples (ICAP 2023) follow:

European Union (EU): Major revision of the EU ETS took place in December 2022. Considering the increased ambition and expanded application of emissions trading, the revised ETS mobilizes the necessary enabling framework for the green transition. It commits more resources to funding energy transformation and industrial innovation, as well as helping vulnerable groups and microenterprises to invest in decarbonization. These resources include Member States' auction revenues and dedicated funds: the EU ETS's Innovation and Modernization Funds and the new Social Climate Fund will all have an important role in accelerating a socially equitable and just transition.

- **Innovation Fund:** The ETS Innovation Fund finances the commercial demonstration and deployment of innovative low-carbon technologies and industrial solutions to decarbonize Europe's energy-intensive industries, as well as energy storage and carbon capture, use, and storage. With a currently estimated budget of over EUR 34 billion ($35.7 billion), it is one of the largest grant-funding programs in the world, and it is funded entirely by the EU ETS. Since 2020, the fund has awarded over EUR 3.1 billion ($3.3 billion) to some 70 projects in a wide variety of sectors including chemicals, steel, cement refineries, green hydrogen production, and renewables. The latest call for large-scale projects under the Innovation Fund was launched in November 2022, with a budget of EUR 3 billion ($3.1 billion). It focuses on the "REPowerEU Plan" priorities, specifically hydrogen and electrification, clean-tech manufacturing, and mid-size pilots.

  With the agreed revision of the EU ETS, the Innovation Fund is being strengthened and adapted to the system's increased ambition. The fund's total size is estimated to be increasing by at least 18 percent and dedicated topics are being introduced in calls for proposals, including for the maritime sector. The Innovation Fund will also operationalize competitive bidding through carbon contracts for difference.

- **Modernization Fund:** Alongside support for innovation-driven transformation of the EU ETS sectors, the system also addresses Member States' different starting points in the green transition challenge. The ETS Modernization Fund is one of its solidarity mechanisms to help lower income Member States decarbonize and develop their energy systems. Currently, at least 70 percent of the budget, projected to be EUR 48.2 billion ($50.7 billion) in 2030, must be dedicated to priority projects that advance the beneficiary countries' transition to climate neutrality.

  Since 2021, around EUR 5 billion ($5.3 billion) has already been made available for investments in energy efficiency improvements, renewables, energy storage, and the modernization of power grids in the beneficiary countries. The agreed revision of the EU ETS increases the size of the Modernization Fund (by 2.5 percent of the allowances under the cap) and expands its support to Greece, Portugal, and Slovenia. Further, an even bigger share of the fund is committed to priority investments (up to 90 percent) and the limitations on funding fossil fuel projects are strengthened.

- **Social Climate Fund and auction proceeds:** The European Parliament and Council of the EU have also agreed to create a Social Climate Fund alongside the new ETS2. It will provide dedicated support to Member States to help vulnerable citizens and microenterprises undertake green investments in energy efficiency, decarbonization, and sustainable transport, such as home insulation, heat pumps, solar panels, and electric mobility. The Social Climate Fund will start operating before the ETS2 launches. In the period 2026–32, it will mobilize an estimated EUR 86.7 billion ($91.3 billion) across the EU, financed from auction revenues together with 25 percent of national contributions. Alongside the funding for green investments, Member States will also have the option of spending up to 37.5 percent of the fund's resources on direct income support for vulnerable households and transport users.

Québec, Canada: Since its inception in 2013, all the revenues from the cap-and-trade system, close to CAD 7 billion (above $5.1 billion), have been dedicated to the climate fight in Québec. The government has chosen to transfer all that money into Québec's Electrification and Climate Change Fund (FECC), which finances the measures outlined in the "2030 Plan for a Green Economy (PGE)." Each year, the government announces new and updated measures under the PGE to help electrify transport and buildings, encourage low-carbon strategies and innovation, increase energy efficiency, and help society and the economy adapt to the impacts of climate change.

5.6 Supporting Local Bus Operators Using Blended Finance Model

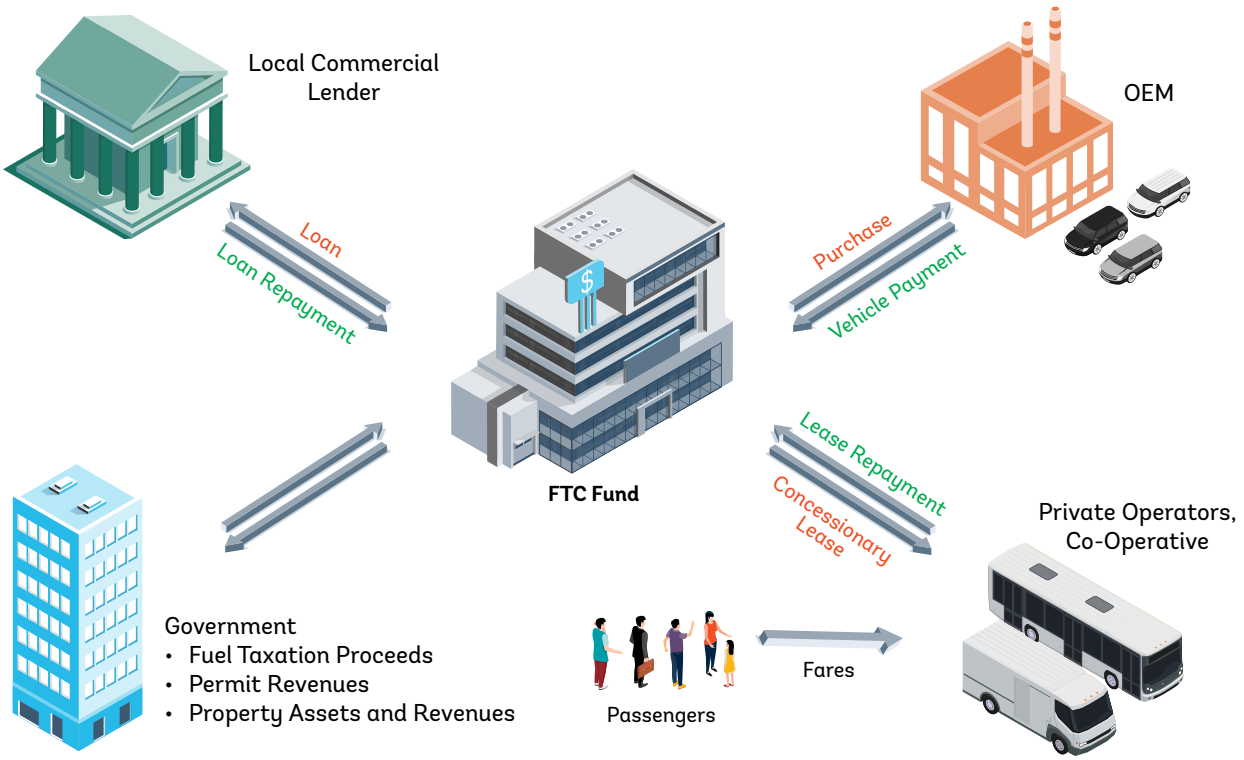
5.6.1. Mozambique's Transport and Communications Development Fund blending-to-lease model

Local bus operators face high barriers to invest in purchasing a fleet, so the Government of Mozambique established a dedicated institution to broker the financing. The Transport and Communications Development Fund (FTC) is a public institution established in 2010 to boost the integrated development of the transport and communication system. One of the main activities of the FTC is to support public transport sector operators in the procurement of buses, addressing the investment barriers faced by both public and private sector operators within Maputo and other major cities. During the five-year period 2015–19, FTC acquired 611 buses and distributed them throughout the country. It allocated more to the Metropolitan Area of Maputo—donating 180 buses from the Government of China; financing 100 buses through the local bank; and financing 250 buses through suppliers and the General State Budget (OGE). The state budget indirectly supported those financed by banks and suppliers. The blended finance model mixes grants from international partners, national or public budget concessional money, and preferential loans from local commercial banks.

Local private bus operating companies consist of individuals and cooperatives with limited capital. The bus fares are regulated to keep fares very low; at levels that do not enable operators to recuperate costs and invest in fleet modernization. Vehicles procured through the FTC are leased to operators under preferential loans (Figure 5.9). The FTC has been successful in procuring and making buses available to operators, helping to address under capacity in the system and filling the loss of market share in formal public transport operations. The main sources of revenues for FTC are 5 percent of the Fuel Tax, 60 percent of permit revenue, and state property assets and revenues from different sources.[71]

[71] Further information available at https://www.ftc.gov.mz/.

Figure 5.9 Cashflows in Mozambique's Public Transport Scheme



Source: Reprinted from Transport and Telecommunications Development Fund 2010.
Note: FTC = Transport and Communications Development Fund; OEM = original equipment manufacturer

However, loan servicing by operators on the vehicle-leasing scheme has been poor, pressuring the viability of the financing model. Operators reported lack of commercial performance and consequently the high rates of delinquency, owing to low fares and suppressed demand because of the COVID-19 pandemic. The implementation of automated fare collection underway using the FAMBA Card presents an important opportunity to address the prevailing challenges. This should bring benefits in terms of increased transparency over operator revenues and a means of collecting vehicle financing repayments before distributing farebox revenues to the operator.

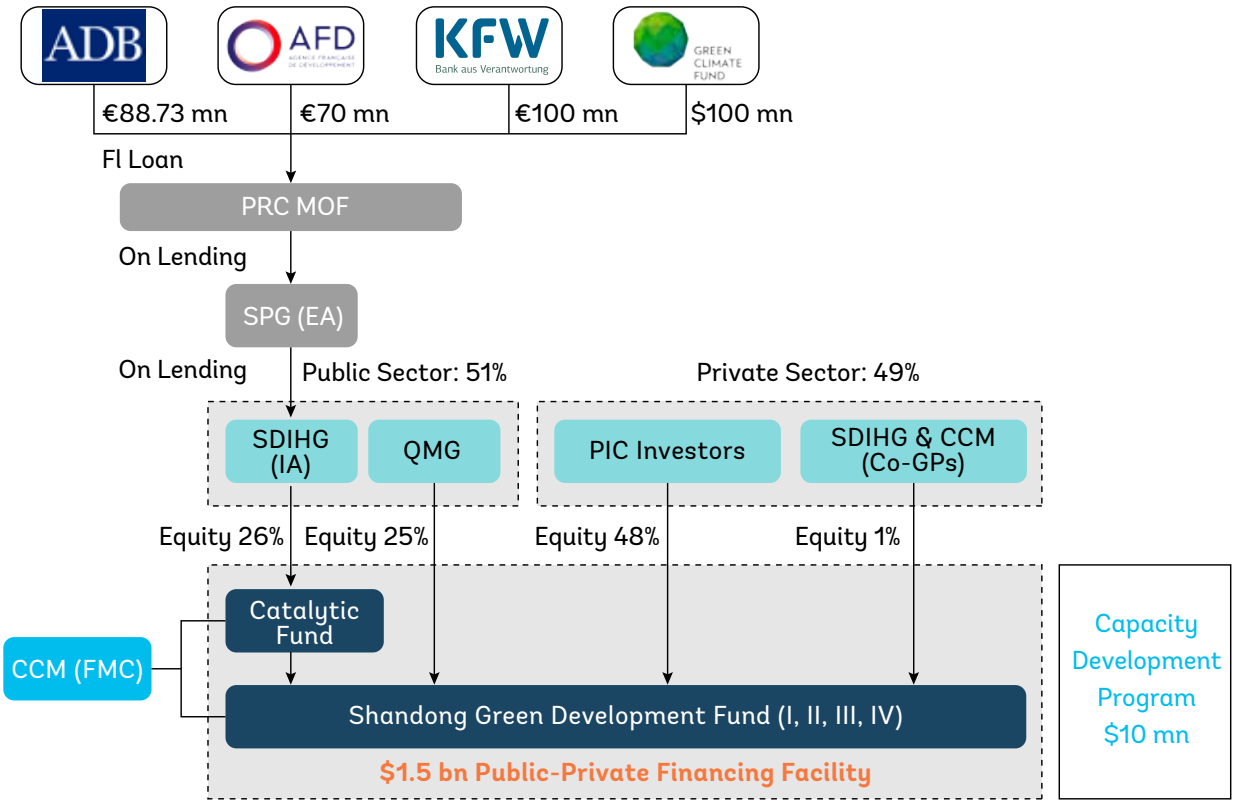
This structure can be scaled up in a regional financing facility. The financial inability of the local bus and other public transport operators to purchase and modernize their fleet is an issue not only in Mozambique but everywhere. Section 5.1 elaborates on the issues in detail and consequently suggests a scaled approach—such as a regional financing facility to provide blended financing solutions to SSA—which may make greening public transport more feasible.

5.6.2. Shandong Green Development Fund—Blended finance approach

Blended finance is crucial to mobilize significant private financing for scaling up climate investment. The Shangdong Green Development Fund is one such pilot project that uses international and public capital to crowd in private, institutional, and commercial (PIC) capital. This is used for climate positive subprojects assessed against both climate and financial eligibility criteria

(Figure 5.10). Initial capitalization was estimated at $1.5 billion. The Qingdao Municipal Government (QMG) invested about $375 million and international financial institutions including the Green Climate Fund provided approximately $400 million of sovereign loans as catalytic funding. Private capital raised from PIC sources stood at nearly $626 million and another $15 million came from general partners. Loan proceeds are channeled toward a 20-year Catalytic Fund. The Catalytic Fund is further transformed into four shorter-term Shandong Green Development Funds (SGDFs),[72] of which each has an investment period of four or five years. Distribution of the SGDFs will be made to the Catalytic Fund and reinvested in the next round of SGDF after deducting payments to the IFIs. A fund management company (FMC) was appointed as the manager of the Catalytic Fund and the SGDFs.

Figure 5.10 Financial Structure of the Shandong Green Development Funds



Source: Reprinted from Asian Development Bank 2020.
Note: CCM = CICC Capital Management Co., Ltd.; PIC = private, institutional, and commercial; QMG = Qingdao Municipal Government; SDIHG = Shandong Development & Investment Holding Group; SPG = Shandong Provincial Government.

Concessional sovereign and development finance help mitigate risks with clear conditionalities. The return on investment from the SGDFs will be satisfactory, due to the low hurdle rates required by each counterpart investor—PIC investors at 8 percent, public investors at 2 percent, and SDIHG at 3 percent. A mix of these funding resources allows the SGDFs to invest in subprojects with higher risk profiles that would otherwise rely exclusively on long-term sovereign funding or not proceed because of public funding gaps.

[72] Shandong Green Development Fund Project: Project Administration Manual (adb.org) https://www.adb.org/sites/default/files/project-documents/51194/51194-001-pam-en_0.pdf.

To ensure the harvest of transformational and advance benefits, all subprojects are categorized into three climate-related levels. These levels—transformational, advanced benefits, and good practices—are based on the Green Climate Fund (GCF) Investment Framework with different catalytic and financing terms and conditions from the most favorable to the least (Table 5.1). More than 10 percent of the funds should be invested in transformational subprojects and more than 60 percent in advanced benefits and transformational subprojects. The investment of all SGDFs is expected to achieve a minimum actual carbon emissions reduction of 1.5 million tons per annum.

Table 5.1 Indicative Terms and Conditions for Debt and Equity Investment

Debt Investment			
Client-related level	Maximum catalytic funding	Maximum tenor	Indicative interest rate
Transformational	67%	10	Discounted
Advanced benefits	50%	8	In line
Good practice	25%	5	Premium

Equity investment		
Climate assessment	Maximum catalytic funding	Exit strategy
Transformational	50%	<10 years
Advanced benefits	30%	<10 years
Good practice	0	not applicable

Source: Reprinted from Asian Development Bank 2020.

While the actual projects and their success are yet to be seen, the financing mechanism makes the blended financing model more relevant for lower income countries.

6

A Pathway to Climate Action

A Pathway to Climate Action

Every country should act concertedly to change the trajectory of climate action toward Paris Alignment in the transport sector. Identifying the opportunities and learning from successes can provide the necessary pathway for actions and investments in countries of all contexts. Common to every success story are some underpinning elements of an effective transport climate mitigation and adaptation strategy. These elements comprise: (a) setting a target to reduce emissions and adapt; (b) enacting the necessary regulation to create incentives along with a funding strategy that considers the impact and needs of each stakeholder; (c) enhancing the governance capacity and the efficiency of the public investment management framework; and (d) engaging the private sector to contribute with solutions and financing. Aligning roles to implement a transport Paris Alignment strategy will lay on different government levels and the international community to create the necessary environment.

The Paris Agreement, with its universal requirement on all countries to submit NDCs, marks a significant change in the framework of international cooperation to reduce GHG emissions. The landmark creates a unique opportunity to coordinate for global and country-specific actions. Many governments from the developed and developing world have not yet submitted a concrete plan for transport. This section presents a few investments and policy recommendations to develop a climate action strategy in developing countries and some guidance for the international community.

6.1 Set Transport Climate Action Goals

Recognizing the role of transport as one of the main contributors to GHG emissions is a fundamental step— integrating mitigation and adaptation measures without compromising mobility is even better. The world recognizes that GHG emissions from economic activities are accelerating climate change and detrimentally impacting human health. The causality between emissions and transport is well documented when it comes from internal combustion engine (ICE) mobility. Thus, decarbonizing transport is a critical priority. The challenge remains in addressing the effort without limiting economic growth and development for the less advanced economies that are less resilient and more accountable for these emissions. Developing economies can benefit from opportunities by decarbonizing transport and adopting more resilient mobility solutions for development.

Most countries signing the Paris Agreement have still to submit their commitment target to reduce GHG emissions from the transport sector through the NDCs. Approximately 20 high-income countries and 45 middle-income countries have recognized an economy-wide effort to reduce emissions spanning multiple sectors—infrastructure, agriculture, and industries. As shown in Section 2., the number of countries that submitted a reduction target for transport in their NDCs is much lower (figure 2.4).[73] Notably, the commitment is higher in middle-income countries. In general, the solutions

[73] UNFCC: NDCs stands for nationally determined contributions for national emissions reduction and adaptation to the impacts of climate change as part of the national climate action plans. Second round incudes 1st, 2nd and updated climate actions plans till the year 2030.

are not always straightforward, and, in many cases, the solution could affect vested interests. Clean technologies are not necessarily available to all countries and users, and multiple short-term priorities have an impact on limited resources allocated. And finally, while most people agree that some actions are required, legacy conditions could prevent them from transitioning to clean transport modes.

The international community is called to support developing countries set climate goals. The World Bank launched a series of Country Climate and Development Reports[74] (CCDRs) to investigate how climate change and actions align with each country's development aspirations, and identify potential drivers and pathways toward a diversified, low carbon, and resilient economy. The CCDRs serve to guide governments with their transport Paris Alignment strategy, and the preparation of NDCs and national adaptation plans (NAPs).

Finally, recent geopolitical conflicts have triggered an abrupt increase in fossil fuel prices with multiple consequences on economic development. Food and transport prices are two of the sectors that are deeply impacted. A comparable experience is the Oil Shock Crisis in the 1970s through the Organization of Petroleum Exporting Countries (OPEC) embargo, which impacted both sectors. On a more positive aspect, this experience also brought changes in the car manufacturing industry, looking for more fuel-efficient vehicles—with also higher prices for the more efficient technologies. Higher prices can contribute to technological improvements, but the complete set of direct and indirect effects of such prices in the short term is not yet clear, with many economies slowly recovering from the COVID-19 crisis and with limited capacity to use fiscal instruments. Altogether, it may end up affecting the commitments to reduce GHG emissions and/or slowdown their implementation plans.

6.2 Incorporate Climate Action Scenarios to Build Resilient Strategy, Policies, and Investment Plans

Paris Aligned transport is likely to follow different paths across countries. For instance, investing in public transport is likely to be a common measure in most cases. Some cities will rely on e-buses; for others, such technology could not yet be feasible. Efficient diesel buses could be the second-best solution while the authorities work on creating the conditions towards electric mobility. Similarly, the use of nonmotorized solutions, such as walking and cycling, is likely to differ across cities. Many of them depend on the proximity to jobs, land use regulation, and whether the supporting infrastructure exists. For large cities with low density of population, nonmotorized solutions are unlikely to capture a modal shift unless a combination of policies and fiscal incentives are implemented to make cities more compact. Likewise, investments in roads will be necessary in rural areas along with other policies for territorial developments assessing their impact on GHG emissions. In the end, the strategy will push for low-carbon paths where feasible, being pragmatic and considering the constraints and wider benefits.

Public investments in transport along with the regulatory framework must assess their impacts on GHG emissions and climate-related risks. It is recommended that transport masterplans contain an integrated analysis of infrastructure and services, through a multimodal angle and with a focus

[74] Available at https://databank.worldbank.org/source/country-climate-and-development-report-(ccdr).

on urban and territorial development. While multiple criteria determine the most convenient solution, climate and disaster risks, and GHG emissions should be addressed in all scenarios. Similarly, when it comes to new policies or a review of the existing regulatory framework, the recommendation calls for an analysis of their impact on GHG emissions and how they contribute to mitigation and adaption compared with their cost and funding plan. Ultimately, the pace to a net zero and resilient transport sector will be driven by the adoption of a regulatory framework, the planning and implementation capacity along with the necessary resources, and finally, the willingness to protect the environment.

The roadmap of the climate action strategy must recognize the complexity of transport governance and its ecosystem. National and subnational institutions, in many cases with unclear boundaries of responsibilities, cohabit with regulated and unregulated transport solutions. Many institutional arrangements are such that the focus when making decisions is based on infrastructure rather than on mobility, which is often disconnected from other developments in the urban and rural space. No single transport governance structure exists even when policy, implementation, and oversight functions are clearly recognized in most modes. Moreover, each transport mode is characterized by its own governance structure depending on whether it is necessary to regulate in different dimensions. Even within the same transport mode, different regulatory governance structures are adopted based on the sector's maturity. These issues must be factored into the strategy to future-proof transport and its implementation. It will signal the conditions for which public and private actors can take actions and become accountable to transform the sector.

6.3 Establish Green and Resilient Transport-specific Regulatory and Institutional Frameworks

Stable and robust regulatory frameworks, based on transport-specific climate action goals, provide a clear message and level of certainty to all stakeholders on which to base future investment decisions. Political and regulatory uncertainty, on the contrary, can be detrimental and increase perceived risk preventing investments and innovations to change transport. An example of that uncertainty would be absence of taxonomies, globally accepted standards and certifications, and a lack of granular policies and economy-wide transition plans at the country level. Moreover, the eligibility criteria—whether investments and actions are aligned with the Paris Agreement—requires fixing persistent data gaps across portfolio alignment metrics, transition plans and investment performance of climate-solutions. While all emissions matter, some equity considerations should be addressed when defining a growth-and-efficiency path to Paris Align transport for each country. To this effect, the World Bank has launched a Resilience Rating System which provides guidance on developing climate-resilient projects and a way to assess what projects are doing to increase climate resilience. The system evaluates two dimensions of resilience, each one rated from C to A+: the resilience of the project design – the project's ability to withstand impacts from climate and disasters -- as well as how people are being made more resilient through the project itself.

Effective regulations support climate action, and they span a plethora of transport and non–transport-related issues. The responsibility lies with different levels of government and the effort of the international community. Authorities can leverage from the international experience when extrapolating these regulations to each country-specific context. These regulations also can be seen in the context of the Avoid-Shift-Improve (A-S-I) framework and their cost or emission

reduction efficiency. For instance, avoid and shift measures—such as allocating road space for dedicated bus lanes—may be far less costly for enhancing transport access than other improvement measures, particularly in rapidly urbanizing developing countries (SLOCAT 2021).

Governments must cease subsidizing fossil fuel–based transport, instead of redirecting the same subsidies to support greener alternatives. This statement, however, has some caveats, for instance, when it comes to mass transport system until the transition to greener alternatives. Governments may still need to provide subsidies or remove price distortion vis-à-vis other transport mode (i.e., car users not facing the true emission, congestion, and infrastructure costs). This step is even more applicable to developing countries where resources are limited and a reallocation to the climate action–oriented pathway is needed urgently. And while the countries can learn from more advanced economies, there is need to assess the best way to allocate limited fiscal resources and the use policies to address price distortions. Importing blueprints without preparatory work, without a clear understanding of their impacts and final costs, is likely to fail.

6.4 Optimize Funding Mechanisms to Incentivize Climate Action

Any strategy to support transport climate action must be supported by a credible funding plan and certainty of sustainable funding base. And one of the first elements is a revenue stream balances efficiency and equity objectives. The challenge is to define an array of prices and eventually taxes/subsidies that are politically and financially sustainable. Once done, another issue is whether it is possible to align the collection of transport-specific taxes and fees collected, including those of fossil fuels, with public spending in the sector without defunding the government. Fuel taxes are the main source of fiscal revenues in most countries, but there are other options to optimize fiscal revenues while also supporting transport greening and resiliency.[75] Many governments apply some of these instruments in practice, although with different tax rate per jurisdiction. However, a share of the revenue stream generated by these instruments is not necessarily earmarked for transport but added to the general budget to finance the government expenditures. In other cases, fuel taxes are collected in earmarked funds that also finance other social policies beyond transport. Funding is important. Even so, the experience of the World Bank shows that often many opportunities come by addressing efficiencies in transport's governance issues—public investment management, procurement, monitoring, and oversight—and in public sector spending. Finally, if this is insufficient, it is a sovereign decision to prioritize spending to address climate change.

- **Defining a sustainable revenue stream to support public investments and transport policies.** For most governments, the solutions are based on optimizing tax schemes rather than on an expansion of the tax base. It would also demand rationalizing fares and fees toward transport infrastructures and services while addressing affordability and competitive issues. Carbon taxes or the trading emission rights reveal some interesting opportunities for the more advanced economies in the large spectrum LMICs. Even so, more tax collection does not translate into more sectoral resources, but it can facilitate implementing a Paris Agreement path provided political will - see examples from the European Union (EU) and Canada in previous sections. Governments can review the menu of transport-specific taxes and fees in line with the polluter-pays principle and other externalities, such as space occupancy for cars and road safety.

[75] Distance-based fees is a technologically feasible solution that possesses some challenges in terms of the cost of the technology and collection/administration of the fees. It also raises some issues of fairness when it comes to rural and semiurban areas if there are no substitutes or if fuel taxes are higher.

- **Review fuel tax schemes and phase off subsidies.** The tax rate is high in many countries but for others, their low fuel tax rates or even subsidized fuel prices represent missing opportunities to green the sector. Phasing off subsidies—diesel, petrol, gas—especially in oil exporting countries should accelerate along with measures to compensate for the transition. However, the distributional impacts of subsidy reform and externality pricing cannot be neglected. It clearly creates some challenges, especially for the lower middle-class. Any subsidy reform should address the vulnerability of the poor and lower middle-class. Moreover, the political economy can make such reforms impossible and thus government should work with relevant stakeholders.

- **Fuel decarbonization may require new funding schemes to compensate for missing fuel tax revenues.** Distance-based fees is a technologically feasible solution, which holds some challenges of the costs of the technology and collection or administration of the fees. It also raises some issues of fairness when it applies to rural and semiurban areas in the absence of substitutes or if fuel taxes are higher.

- **Assess the impact of implementing carbon prices on fuel producers or importers.** Such schemes have the potential to generate revenue, which will be particularly advantageous as the world recovers from the COVID-19 crisis. Further, unlike direct taxes, a carbon price can be placed upstream on fuel producers or importers. It allows for a broad coverage of transport activities. This can reduce administrative costs, promote compliance, and reduce tax evasion.

- **Fund transport decarbonization.** For many countries, their path is not about adding carbon pricing to fuel prices but to channel these resources into climate-friendly actions. Even so, more advanced developing economies have options to introduce some carbon taxes or emission rights. This approach can help mitigate the impact on cross-border carbon taxes as demonstrated in the EU or by other developed economies if implemented. The revenues can help provide for low carbon trade in developing economies, at least from a transport perspective.

- **Apply voluntary global carbon pricing.** Such schemes could potentially work in the maritime and aviation sectors to finance the transition. The countries should assess governance of such global schemes and the eligibility criteria to allocate the resources, and the impact on small economies and LICs.

- **Any cost increases to fuels or transport may impact low-income households, so the rollout and communication of changes to transport should be carefully planned and coordinated so that they are understood in the context of the more significant upsides.** Moreover, the implementation of carbon pricing or subsidy reforms should be accompanied with measures to address the most vulnerable as part of the policy design. Many measures to address transport emissions will have both immediate and longer-term benefits for citizens but some of them, like lower whole-of-life vehicle running costs and health improvements, may not be immediately obvious or materialized to the population and so, they will need to be explained. In isolation, cost increases can have detrimental impacts on low-income residents, and particularly those in rural areas who have fewer transport options and larger distances to travel. This can also cause social disturbance, for instance, as witnessed in Kazakhstan through the 2022 unrest that was sparked by increasing LPG prices or in France when some environmental taxes triggered some protest back in 2018–19. As such, the rollout should focus first on measures to expand and

improve affordable public transport. Measures that reduce costs for low-income households, such as targeted subsidies, public transport fare differentiation, or customs duty waivers should be delivered together with subsidy and tax reform to balance any cost impacts, and where possible cost changes can be implemented gradually over time to enable behavioral and other changes to keep pace. And this measures can better work if they are part of the general policy to address externalities through pricing and tax instruments.

6.5 Ensure Efficiency of Public Spending and Prioritization

Resources matter, but the quality of public spending is paramount.

- **Identify measures to improve the efficiency and impact of public spending.** Review recurrent and capital public spending in transport at national and subnational levels covering planning, procurement, investment, and oversight. There are many opportunities to enhance efficiency and the capacity to implement investments and policies, and in many cases, these opportunities occur at subnational level. Here is the importance of running a consolidated GHG emission analysis, and climate and disaster risk screening, at national and subnational levels, to better inform policy decisions.

- **Prioritize actions based on multiple criteria including GHG emissions and climate risk assessment.** Optimizing funding opportunities and enhancing the quality of public spending can create some fiscal savings. Eventually, prioritization of public policies can help reallocate actions as well as the transition to a low-carbon and adaptive economy. Moreover, the paths to adaptation and mitigation solutions are likely to differ across countries, and while there are lessons learned from different economies, each country will determine their optimal path to a low-carbon and resilience transport sector.

6.6 Focus on Research and Development by Leveraging Private Sector's Ability to Innovate

Innovation in the public sector is a particular challenge. Public agencies are understandably risk averse in matters involving safety, noticeably in transportation policy makers. Moreover, public procurement practices, which often depend on producing detailed specifications and awarding contracts to the lowest bidder, inhibit the introduction of new concepts, technologies, and practices. For these reasons, the classic centralized model of investing in basic research may not work well in the largely public sector environment of transportation systems. Neither does the private sector's willingness to draw on the fruits of these efforts to innovate. Entrepreneurs have little incentive to take risks when they face high barriers to market entry and relatively low assurance that they can derive profit from the introduction of new products.

In the large public presence of transportation infrastructure, government must therefore be more involved in facilitating research through incentives and funding as necessary. This is to ensure that the public will reap the benefits of improved products, services, and technologies being developed throughout the private economy. Numerous firms are offering new products and services in the

emerging field of intelligent transportation systems. Federal applied research, demonstrations, and support for open standards are needed to facilitate the procurement of those products and services by public agencies.

6.7 Finance the Transition Toward Green and Resilient Transportation

Transition finance signifies any form of financial support that helps high GHG-emitting sectors start to implement long-term changes to become greener. It bridges the gap between traditional and sustainable financing as governments begin the journey to net zero. Traditional forms of sustainable finance are not always a good fit for the transitional phase and for traditional investors. For example, a shipping company may use a green bond to finance research into green fuel, but investors may not be willing to accept the financing of a new, less carbon-intensive fleet of ships because of higher risk into an untested technology. Helping transport sector transition toward net zero emissions is a vital part of combating climate change. DFIs, investors and policy makers must step up their support.

For policy makers in developing countries:

- **Address the fundamental bankability issues in projects, which are reinforced even more in green transport projects.** It is usually claimed that the issue is not a lack of financing, but a lack of bankable projects. A balanced risk-return profile to both public and private sector partners entail: (a) an enabling environment to attract fair and transparent private sector competition, (b) robust regulations and good practices for contract management, and (c) government's commitment in the concessions contracts. Adding climate mitigation and adaptation factors to the already sound commercially viable project will increase its marketability and economic value in the long term.

- **Establish climate taxonomy and standards to package transport. The EU has developed some taxonomy of green finance and assets serving as an example.** Similarly, the Climate Bond Initiative has set its green standards for transport projects. Many countries are moving in this direction. More developing countries move toward including transport in their climate action roadmaps and recognize an urgency to establish the definitions, eligibility, measurement criteria, and benchmarks for green transport. Such measures unblock green regulations, financing, and manufacturing in the domestic markets.

- **Identify climate action–oriented pipeline of projects. While most of the public investment planning focuses on large scale economic needs and benefits, the typology of climate-screened projects may differ.** In many cases, climate-resilient projects require smaller investments, are more spread out among diverse stakeholders, are less defined as one cohesive project, and have shorter life span. For instance, buses in a small town have many providers operating at low scale. The type of investors looking to participate in bigger transport projects such as ports may not be a good match for such smaller green projects. Governments need to distinguish and set up dedicated units to build green project pipeline based on green taxonomy and standards, as mentioned above.

- **Consider the applicability of proven regulatory approaches such as the regulatory asset based (RAB) model, commonly used in energy and water utilities.** Such a model can help reduce uncertainty, making the return on investments more predictable, attracting private investors, and facilitating investments. In general, the RAB model, when compared with those regulated by contracts, provides a different risk-reward return, which is more suitable for some investors.[76] In the transport sector, airports in the UK and Peru are being regulated under this approach. The main drawback under this approach is whether authorities can ensure appropriate level of independency of the regulatory authorities and the predictability of such framework.

- **Carbon pricing can be a tool to augment the transition to net zero transport.** As seen in California, the revenues from carbon pricing can add up substantially to support major investment programs on climate action. Countries need to match pricing mechanism with proper governance of the funds to be reappropriated in a planned and transparent way.

Public policies for private financiers and companies:

- **Public and private actors must coordinate rapidly to develop a sustainable transport asset class.** Lessons learned from renewables, such as solar and wind, can help. Standardizing technical requirements in green and resilient transport projects and procurement practices can facilitate the creation of an asset class more suitable to private financing. One such initiative is a FAST-Infra Sustainable Infrastructure (FAST-Infra)[77] label. Originally announced at COP26 in Glasgow, the FAST-Infra Label is a consistent, globally applicable labelling system designed to identify and evaluate sustainable infrastructure projects, with the overarching objective of supporting infrastructure as a deep and liquid asset class. Another example is the City of Austin, where active mobility is packaged as asset for a bond instrument. As GHG emissions from transport sector overtake those from energy production, financing efforts must accelerate to stop the upward trend.

- **Harness new financiers who are focused on sustainability.** Institutional investors and climate funds look for fully packaged projects, which can transparently prove their green purpose. These may not be the same lenders and investors as for traditional projects. Developing countries must establish services to ensure and verify investments as green, and enact regulations for green bonds, climate reporting, and data measurement. Climate-oriented funds are dependent on good quality monitoring-reporting-verification services of projects. Financiers require verification services during implementation to ensure that the project is delivering the results originally planned and certified. These services are often not available in developing countries and are procured from international firms. As a result, the cost of preparation of green projects can weigh heavily on the public sector. This is an area of innovation and ingenuity for the private sector to step up and expand their services to countries where these investments are needed the most.

- **Scale-up investments in nontraditional Paris Aligned transport sectors and harness domestic capital markets.** The private sector so far has focused on ports and airports; however, climate mitigation and adaption investments are also opportune in other transport sectors such as roads and urban mobility. Traditional investors seeking large-scale investment and high return

[76] See https://www.worldbank.org/en/topic/transport/brief/global-facility-to-decarbonize-transport.

[77] See https://www.fastinfraplatform.com/.

profile may not be the right fit for green transport projects as they are smaller in scale and are more localized at subnational levels. Investors are beginning to look to invest in long-term ESG in emerging markets and in parallel, for more stable capital markets instruments such as bonds. Domestic capital markets are largely untapped and underutilized for green bonds. Private investors can aggregate investments in these green assets using the domestic capital markets or private placements in international markets. Investing in climate adaptation can pay off attractively, as in contrast, not making such investments can cost companies and governments. For instance, the road sector has a huge opportunity for climate adaptation and resilience. Given that most or transport's GHG emissions, infrastructure and mobility are road-based, the urgency is compelling to modernize road-based modalities with climate adaptation investments. Swiss Re (2021) reports that it is far cheaper to invest ahead of climate disaster than to pay to fix it afterward. The private sector needs to step up and recognize the opportunities in transport sector transition, especially the ones which are win-win for both public and private sectors.

For financial institutions:

- **DFIs need to scale up their financing to climate mitigation and adaptation in transport.** Not many governments in the developing world have taken active steps by implementing green and resilient transport in their Paris Agreement. MDBs can help them with the elements to develop a transport climate action strategy. A good example is the Country Climate and Development Report series that the World Bank launched which serves to identify a course of actions. Such roadmap, with other measures, can facilitate investments by providing certainty on long-term policies and expanding the investor base for climate finance. The low ratio of climate cofinance demonstrates that more effort is necessary.

- **DFIs can play a larger role in providing derisking instruments to mobilize private capital.** Most of the climate financing is channeled through traditional investment loan instruments (as discussed in Chapter 3), which means that DFIs are financing the projects with direct financing instead of leveraging other sources of financing, particularly from the private sector. Use of derisking instruments such as guarantees, lines of credit, and policy-based financing remains a small part of the overall portfolio across all MDBs. Consequently, the low level of private cofinance demonstrates that more effort should be applied to create the conditions that attract private financing.

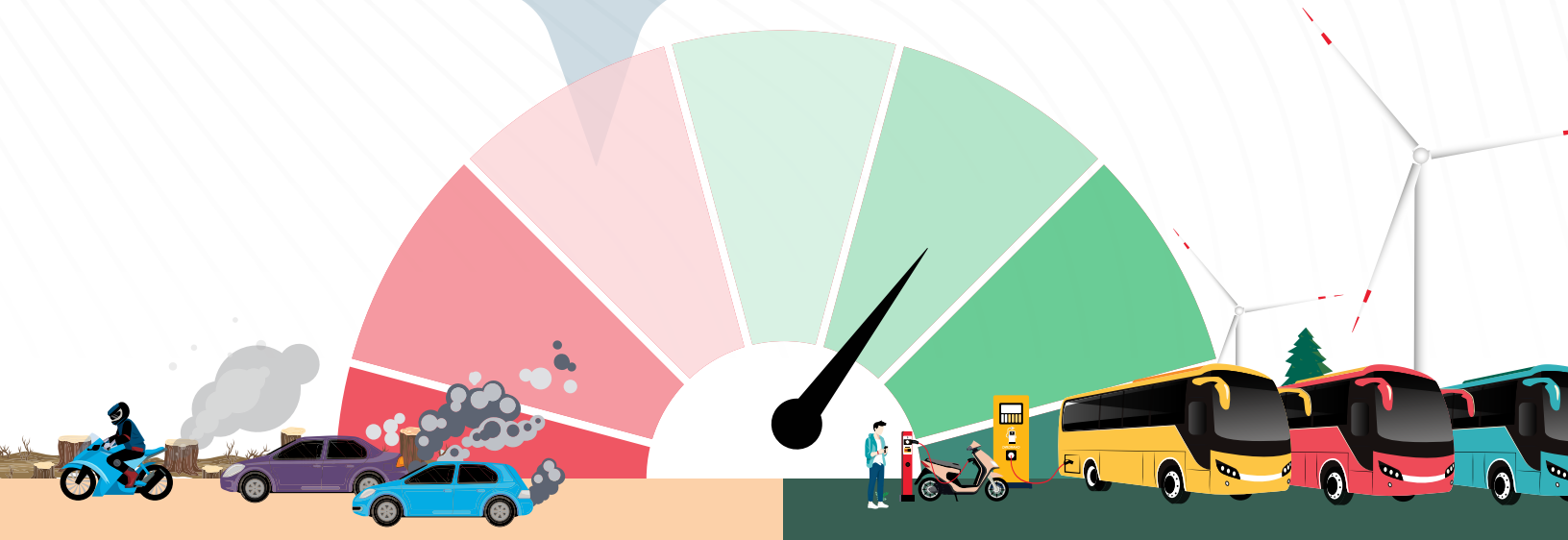
- **It is also necessary to leverage the role of the private sector in the provision of derisking instruments.** Given the scale of financing needed to close the investment gap and the limited capacity of MDBs to offer loans and derisking instruments, closing the gap requires innovative solutions along with a conducive enabling environment and a predictable revenue stream. Moreover, the use of derisking instruments provided by the private sector would be necessary. Although there are many institutions providing insurance instruments, they do not necessary cover climate events. At this urgent need of green financing, it could be useful to assess with private investors whether some risk- sharing mechanisms can help to support green start-up financing. Lessons learned from the unique coverage of construction risks by monoliners in greenfield projects, can help to identify possible avenues to bring similar solutions. Today, the private sector is unlikely to take those risks. However, it could be a role for the MDB to leverage resources, for instance, through the IDA Private Sector Window, and by government authorities enacting the necessary regulation to create the enabling conditions for derisking climate finance.

- **Domestic finance mobilization will be a key factor in moving toward green pathways.** It would reduce asymmetric information between foreign and local investors when the cost of capital in proportion to the country and political risks are taken into consideration. It helps to create national ownership. Financing regulatory reforms could be necessary, as well the role of project sponsor in search for domestic financiers and partners.

- **Scaling up small projects will bring private-sector investment and innovation.** Many climate-aligned solutions are at a local level in cities, which can be brought together in a scaled-up portfolio as in a regional financing facility. The World Bank is proposing such a facility for smaller and low-income countries, so a variety of blended finance instruments can be made available to support local bus operators for lease schemes of an electric bus, two- or three-wheelers, bicycle programs, construction of bike and pedestrian lanes, and charging stations, for instance.

- **Blending concessional and commercial financing will leverage new financiers in green transport.** Mozambique and China have demonstrated success (Chapter 5), based on the local needs of the schemes. DFIs can set up facilities to combine their convening power, concessional lending terms, and in-depth country or sectoral knowledge with domestic stakeholders. These actors could be bus companies at the municipal level and local private manufacturers or financiers. The presence of DFIs will ensure a link between the public sector and facility while the presence of private sector would bring the rigor of a commercial operation, which most of these schemes need. Over time, once the track record and operation are established, the DFI's support can be moderated to lever additional projects and investments.

7 Conclusion



Conclusion

The existential threat of climate change is evident and will require the transport sector to pursue a more aggressive approach to decarbonize. The need to rapidly reduce GHG emissions to meet the targets established in the Paris Agreement was brought to the forefront of the global agenda in November 2021 at the Conference of the Parties in Glasgow (COP26) with more than 137 nations making nonbinding commitments to achieve net-zero. In the recent COP28 in Dubai, the same message was reinforced, where the United Nations Climate Change Conference closed with an agreement that signaled the "beginning of the end" of the fossil fuel era by laying the ground for a swift, just and equitable transition, underpinned by deep emissions cuts and scaled-up finance.[78] The need to decarbonize has been further emphasized through the IPCC's sixth Assessment Report released in March 2023 which states that some impacts of global warming are now irreversible; however, there is still a window to avoid exceeding a 1.5°C temperature rise. This will not be achieved without an aggressive approach to decarbonizing the transport sector which has seen significant GHG emissions growth in the past 50 years and could grow by a further 50 percent this decade under a business-as-usual approach. Developed economies are better placed to address climate action challenges and apply technological solutions; however, total emissions from lower- and middle-income countries (LMICs) are already equal to those of developed nations, though still much lower per capita. Against a backdrop of population growth, and increased urbanization and motorization rates, the need to support LMICs to avoid locking into fossil fuels, in favor of pursuing a climate-friendly pathway is paramount, underpinned through knowledge sharing and financial support to bridge the infrastructure funding gap.

Each country must develop its own path to Paris Align transport; however, there are common elements to support this path. This report identified seven core elements that support the pursuit of green and resilient transport starting with the importance of setting climate goals. Funding and financing represent an important aspect of this approach. However, the need to have defined goals in the NDCs for transportation and developing a clear regulatory and institutional framework with fiscal incentives, or in some cases, removing the disincentives such as fuel subsidies, are critical to supporting desired behaviors and facilitate climate investment. National governments must improve their funding allocation to ensure funds are directed to low-carbon transit which takes into consideration GHG analysis and utilizes private-sector innovation where feasible. To this effect, the World Bank Group's Country Climate and Development Reports (CCDRs) are a core diagnostic that integrate climate change and development. They help countries prioritize the most impactful actions that can reduce greenhouse gas (GHG) emissions and boost adaptation and resilience, while delivering on broader development goals.

The recommendations to pursue a climate pathway have been stated, but how can concrete actions be delivered? Recognizing that there is no one-size-fits-all approach, and that each region or country has its own characteristics and hurdles to overcomes, the next step to advance the agenda to pursue a climate action pathway is to develop an overarching framework which identifies the levers available to governments to implement the recommendations and take concrete actions to green the transport sector in an approach that accounts for the local country context.

[78] UN Climate Press Release of December 13, 2023.

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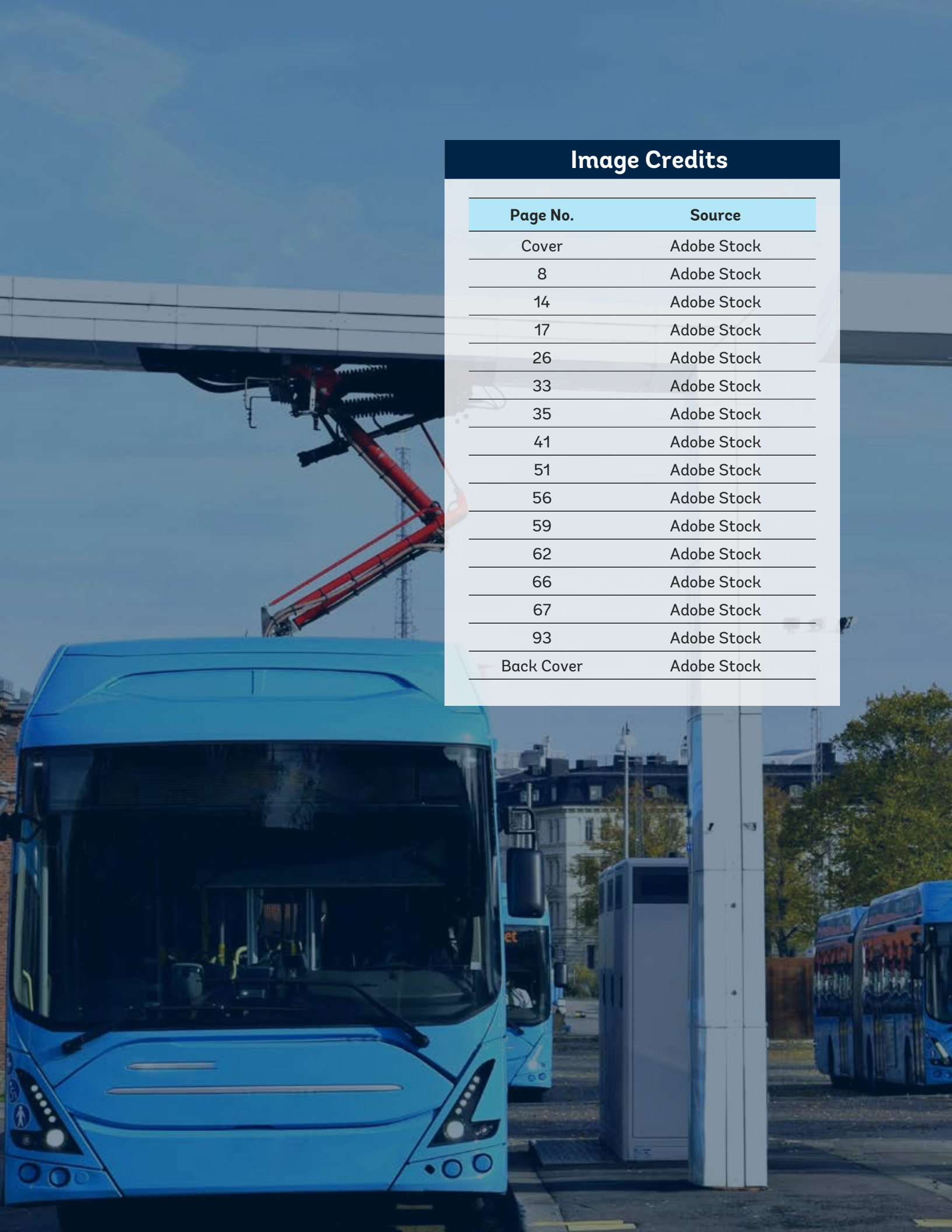

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