DECARBONISATION of transport in AFRICA

Opportunities, Challenges and Policy Options

Summary Report

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Foreword

This is the summary of the report on ***Decarbonisation of Transport in Africa: Opportunities, Challenges, and Policy Options***[1] which assessed the status and reviewed cross-cutting issues for facilitating the transition to net-zero transport in Africa. Issues reviewed included policy, institutional and technical capacity, strategies, technologies, financing, and social, legal, and regulatory frameworks. The report was prepared collaboratively by the Network of African Science Academies (NASAC) and the InterAcademy Partnership (IAP), with the sponsorship of the ClimateWorks Foundation and the African Climate Foundation.

The report was authored by a working group of African and international experts nominated by NASAC and IAP member academies. It builds on the success of a project on the same topic by IAP's regional network in Europe, the European Academies' Science Advisory Council,[2] and is therefore the second of IAP's regional reports on the topic. The recommendations in the report are the views of the Working Group and not necessarily those of NASAC or IAP.

The **Network of African Science Academies** is a network of 30 merit-based national academies in Africa. NASAC's main objective is to unite science academies and facilitate discussions on the scientific aspects of challenges of common concern, make joint statements, and provide science-informed advice to policy and decision-makers in Africa. Additionally, NASAC creates awareness of the value of science academies to socio-economic development and works with scientists to establish science academies in countries where none exist. Specifically, through its membership, NASAC continues to provide advice to regional bodies and organisations on science-related issues of importance to Africa's development. The secretariat of NASAC is based in Nairobi, Kenya. More information is available at www.nasaconline.org.

The **InterAcademy Partnership** is a global network of some 150 academies of science, engineering, and medicine. With its four regional networks—in Africa (NASAC), the Americas (the InterAmerican Network of Academies of Sciences, IANAS), Asia/Oceania (the Association of Academies and Societies of Sciences in Asia, AASSA) and Europe (the European Academies Science Advisory Council, EASAC), IAP provides a platform for mobilising regional and national expertise on wide ranging issues of global importance, and for facilitating cooperation with other key stakeholders and potential partners. IAP's secretariat offices are hosted by The World Academy of Sciences in Trieste, Italy, and the National Academy of Sciences in Washington, DC, USA. More information is available at www.interacademies.org.

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I. Introduction

The transportation sector is a significant contributor to global greenhouse gas (GHG) emissions, accounting for nearly a quarter of total emissions globally.[3] In 2022, worldwide carbon dioxide (CO_2) emissions from transportation were estimated at eight gigatonne, a 3% increase from 2021, according to the International Energy Agency. From 1990 to 2022, emissions from transport grew at an average rate of 1.7% annually, faster than any other sector, except for industrial emissions which rose at the same rate.[4] Transport emissions are driven by the sector's reliance on fossil fuels, which account for 90% of its energy needs. Road transportation alone accounts for 75% of all transport sector emissions, with passenger vehicles, including cars and buses being the primary contributors.[5] The health and financial impacts associated with current transport sector emissions are enormous. Estimates indicate that pollution from transport accounts for approximately 7.8 million deaths annually and incurs an economic cost of USD 1 trillion in health damages.[6]

Africa is a small contributor (4%) to global transport emissions due to its small market and low levels of vehicle ownership compared to other parts of the world (see Figure 1).[7] The average CO_2 emissions per person per year in Africa is 0.8 tonnes, significantly lower than the global average of 4.8 tonnes.

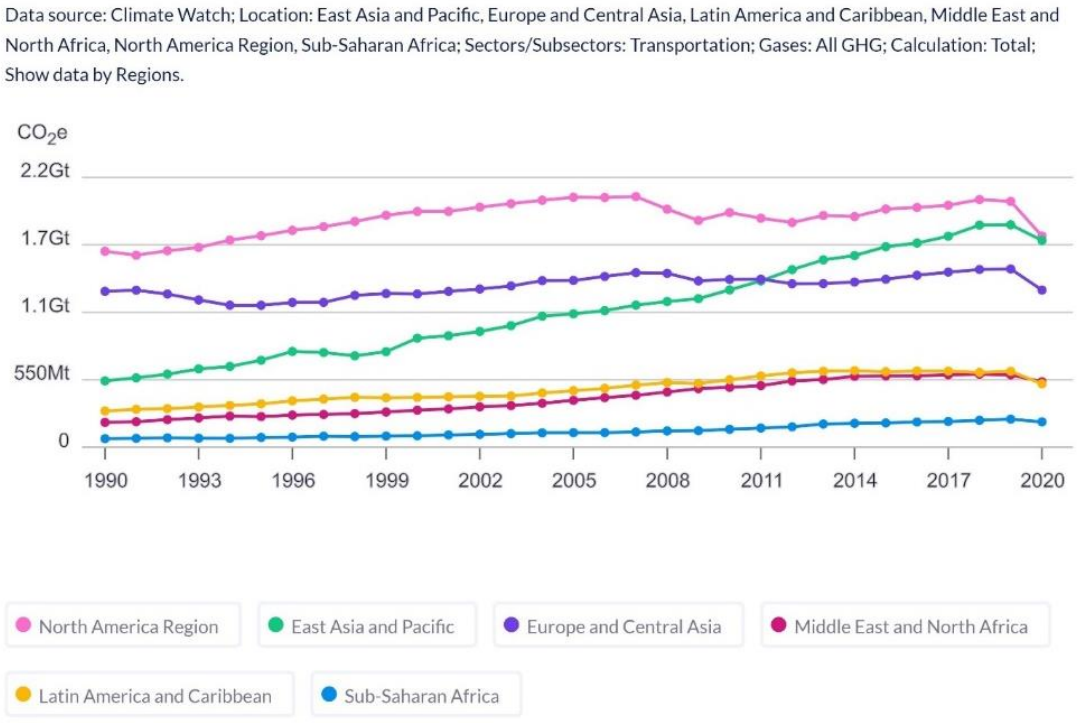

Figure 1: Global transport emissions by region (1990 – 2020)

Nonetheless, the economic and social growth currently taking place in Africa, coupled with rapid urbanisation, indicate that the continent will experience exponential growth in transport motorisation. This growth will be accompanied by a significant increase in transport-related emissions in the coming decades, and its aftereffects such as adverse health outcomes. Emissions from Africa's transportation sector are already increasing at an estimated annual rate of

approximately 7%, which is higher than the rate observed in other regions.[8] For instance, in the United States, the annual rate in transportation emissions was less than 1% between 1990 and 2017, and in the United Kingdom, it was 0.12% during the same period.[9] Africa's developing transport infrastructure, rich renewable energy resources, short daily travel distances, and young workforce offer the opportunity to adopt cutting-edge, low-emission technologies such as electric vehicles (EVs) without the significant overhaul required in more entrenched transport systems.

This summary presents the findings and recommendations of the report on *Decarbonisation of Transport in Africa: Opportunities, Challenges and Policy Options*.[10] The study, undertaken collaboratively by NASAC and IAP assessed the status, and reviewed cross-cutting issues such as policy, institutional and technical capacity, strategies, technologies, financing, social, legal, and regulatory frameworks essential for facilitating the transition to net-zero transport in Africa.

II. The need to decarbonise transport in Africa

As climate change impacts continue to grow, it is critical to decarbonise transport in Africa, where future carbon emissions are expected to grow rapidly. Decarbonisation of transport is the process of reducing or eliminating the carbon dioxide (CO2) emissions associated with transportation systems. This involves shifting from traditional internal combustion engine (ICE) vehicles to cleaner alternatives such as EVs, as well as improving infrastructure to support sustainable modes of transportation, such as public transit, cycling, and walking, to reduce the environmental impact of travel.[11] It entails not only changing the types of vehicles used but also implementing policies and technologies that promote energy efficiency and reducing GHG emissions.[12] Specifically, decarbonisation of transport calls for a system-wide approach that entails rethinking land use planning, strengthening institutions, mobilising more resources for transport, promoting collaboration between public and private sectors and planning more efficient transport services. Thus, decarbonising transport requires a multi-faceted approach that addresses vehicle emissions, energy sources, infrastructure development, and changes in individual and collective transportation behaviours.[13]

Shifting away from fossil-fuelled transportation provides economic, environmental, health, and infrastructure benefits to African countries. Environmentally, the shift from fossil fuel-dependent vehicles to cleaner alternatives, such as EVs powered by renewable energy sources like hydropower, solar, or wind, will significantly reduce air pollution and emissions of GHGs like carbon dioxide, diminish reliance on imported fossil fuels, and enhance Africa's energy independence and security. A transition to decarbonised transportation will also contribute to the preservation of Africa's rich biodiversity and natural landscapes, that are currently under threat from rising pollution and unsustainable utilisation. Economically, sustainable transport solutions can spur industrial growth and development, create employment opportunities, and alleviate poverty. Socially, in addition to health benefits, it can improve access to transport for all communities. Furthermore, decarbonisation of transport is crucial to the realisation of Africa's *Agenda 2063 – The Africa We Want*, the African Union's development blueprint.[14] Decarbonising the transport sector is also crucial for African countries to fulfil commitments to the Paris Agreement and the Nationally Determined Contributions (NDCs) and in achieving the Sustainable Development Goals (SDGs),particularly Goal 3 (Good Health and Wellbeing), Goal 11 (Sustainable Cities and Communities) and Goal 13 (Climate Action).

III. Current efforts to decarbonise transport in Africa

African countries have set ambitious goals in their NDCs to reduce transport sector emissions in line with the Paris Agreement.[15] For example, Burkina Faso, the Gambia, Guinea, Ethiopia, Liberia, Nigeria, and South Sudan have demonstrated commitment to decarbonise the transport sector by setting targets in their NDCs. Moreover, Burundi, Ethiopia, Rwanda, Sierra Leone, South Sudan, and Togo have defined the adoption and promotion of electric mobility (e-mobility) as one measure to transform their transport sector.

Countries like Cape Verde, Congo, Ethiopia, Rwanda, Seychelles, Sierra Leone, and South Sudan included in their NDCs actions to electrify public buses as an entry point for long term efforts towards more comprehensive electrification of transport.[16] Among the submitted NDCs, Burkina Faso, Morocco, Namibia, South Sudan, and Tanzania stand out for linking transport to renewable energy. Meanwhile, Cape Verde has set a target to electrify at least 25% of its land-borne transport fleet (new road vehicles) by 2030, supported by renewable energy sources. African countries have also featured transport adaptation actions in NDCs submitted, with 25 NDCs incorporating such measures. Notably, over half of these actions are geared towards enhancing the resilience of road infrastructure. Additionally, close to one-third of all transport adaptation actions revolve around integrating adaptation strategies into the design and planning of transport systems and infrastructure.[17]

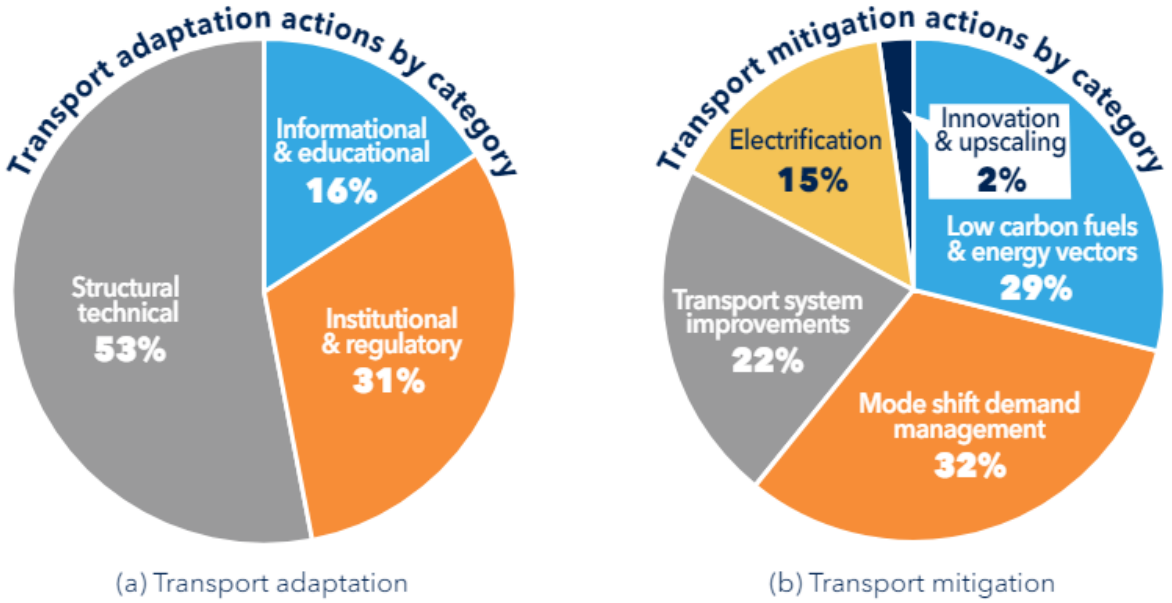

Figure 2: Transport sector GHG emissions adaptation (a) and mitigation (b) actions
***Source:** Adapted from Tokam (2022) "Climate Strategies for Transport in Africa."*

In general, African countries have identified different strategies to decarbonise transportation system including the electrification of road transport which is still in its early stages across the continent. Although the stage, scope, and scale of electric mobility development differ significantly among African countries, nations that are firmly on the e-mobility trajectory include Cote d'Ivoire, Egypt, Ethiopia, Ghana, Kenya, Mauritius, Morocco, Mozambique, Nigeria, Rwanda, South Africa, Tanzania, Tunisia, Uganda, Zambia, and Zimbabwe. These countries have either initiated the

development of policies and regulatory instruments or are executing pilot initiatives including assembling, retrofitting ICE vehicles to electric propulsion, manufacturing or setting up charging infrastructure.[18]

In many African countries, paratransit, which is often informal, decentralised, and operates on demand without fixed schedules, is the most common vehicle-based mode of public transport. Paratransit which consists of minibuses, vans, and three-wheelers (tricycle or tuk-tuks) and two-wheelers (motorcycles) is operated by private entities with minimal oversight and investment from government. To decarbonise urban mobility, efforts are focused on electrifying paratransit transport as well as modernising and integrating it into a well-organized public transport system.

In addition, cities are also working to improve urban areas by focusing on limiting travel through compact land use, transit-oriented development, and investments in non-motorised transport (NMT) infrastructure.[19] NMT transport which includes walking and cycling, is not only the most sustainable form of transport, but also the most prevalent mode of transport in most African countries. However, most cities lack safe cycling and pedestrian paths and as a result Africa has the highest proportion of pedestrian and cyclist deaths globally, accounting for 44% of the total number of road deaths.[20] NMT policies in Africa, though increasing, are limited to a few countries (see Figure 3).

African cities and urban centres are also increasingly turning to mass rapid transit (MRT) systems such as bus rapid transit (BRT) systems and Light Rail Transit (LRT) to enhance mobility. BRT runs on dedicated lanes, providing consistent and fast journey times, and usually operate large vehicles that can carry many passengers efficiently and quickly. This reduces the number of individual vehicles on the road, leading to lower emissions per passenger and contributing to the decarbonisation of transport. BRT systems have been implemented in cities such as Cape Town and Johannesburg (South Africa), Accra (Ghana), Cairo (Egypt), Dar es Salaam (Tanzania), Lagos (Nigeria), Marrakech (Morocco), and Dakar (Senegal).

The importation of used and often substandard internal combustion vehicles from developed countries threatens to lock African countries into high-emission transport systems. Several countries have thus implemented measures to curb the dumping of used vehicles such as banning of imports of used vehicles in South Africa, Sudan, Egypt and Seychelles and imposing age restrictions on imported cars in Angola, Rwanda, Morocco and Kenya. At a continental level, to align with the trade policy requirements as outlined in the African Continental Free Trade Agreement (AfCFTA), the African Organisation for Standardization (ARSO) and the African Export-Import Bank collaborated to harmonise standards and conformity assessment in the automotive sector. The partnership led to the alignment of 13 standards, encompassing roadworthiness, automotive fuels, transportation of hazardous goods by road, classifications of motor vehicles and trailers, cross-border road transport management, vehicle homologation, and provided suggestions to embrace global standards.[21] This harmonisation was also in line with recommendations of the 2020 UNEP report on the climate effects of the vehicle-import industry.[22]

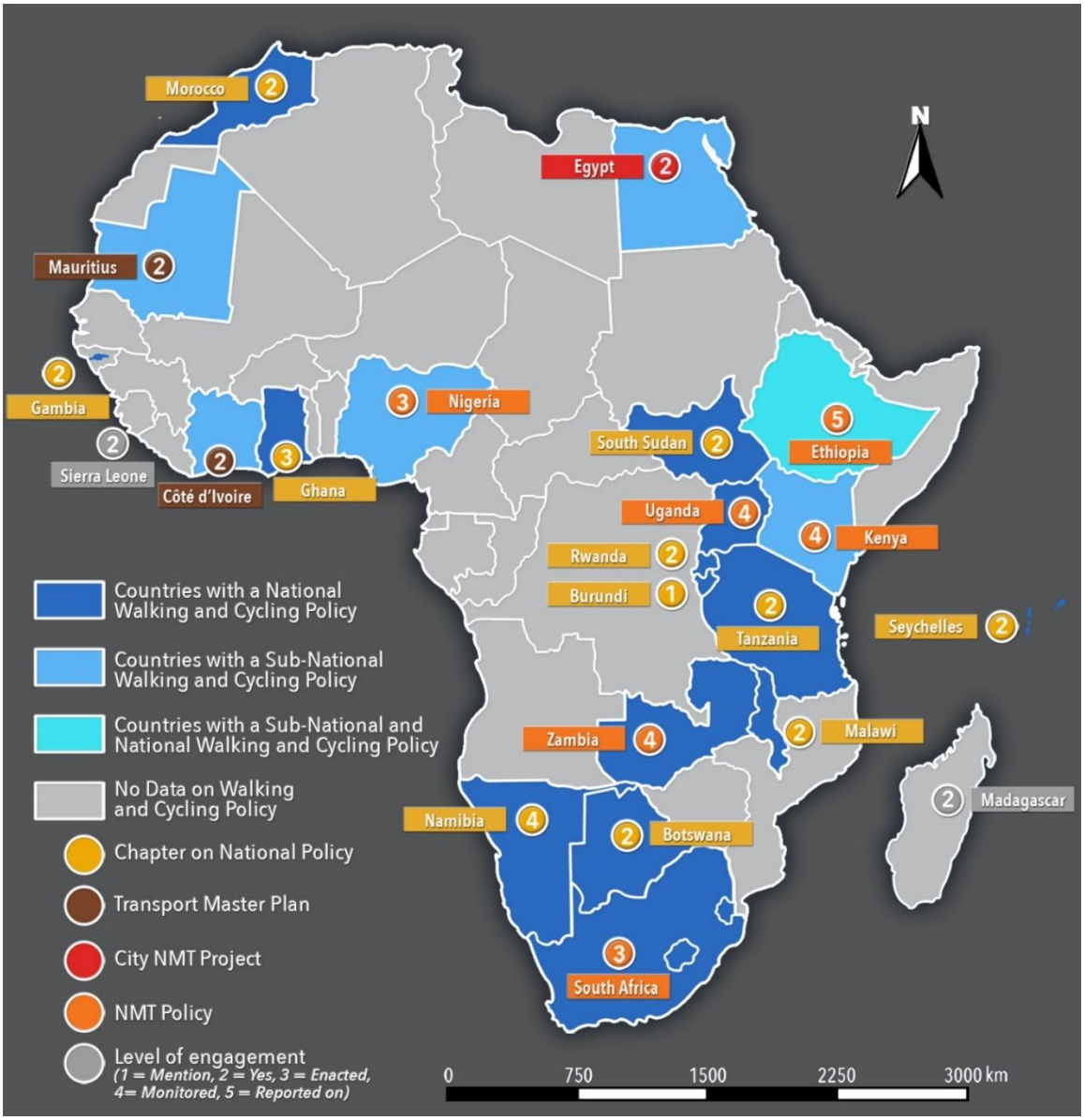

Figure 3: Non-motorised Transport Policies in African countries
Source: *Adapted from Collaboration for Active Mobility in Africa*

IV. Decarbonising Transport through the Enable-Avoid-Shift-Improve-Resilience Approach

The **Enable-Avoid-Shift-Improve-Resilience (EASIR)** approach provides a framework for decarbonisation of transport in Africa. Initially developed as the ASI approach, the framework sought to (1) improve access to jobs, goods and services while enabling users to **avoid** motorised trips by smarter land use and logistics planning; (2) **shift** the transport of goods and persons to the most efficient mode; and (3) **improve** the efficiency and environmental performance of transport systems through improved vehicle, fuel, and network operations and management technologies. The successful development and implementation of any policy however depends on the existence of

enabling institutional or governance frameworks. The Sub-Saharan Africa Transport Policy Program (SSATP), an international partnership administered by the World Bank, proposed a fourth action pillar—***Enable***—to complement the ASI approach based on the specificities of the African context.[23]

The working group that authored this report proposed the addition of a fifth pillar—**resilience.** This proposal builds on a 2022 World Bank report which assessed the potential for electrification of two-wheelers (motorbikes) and three-wheelers (tuk-tuk and tricycles) in Africa and highlighted the resiliency of these modes of transport. The resilience pillar thus recognises the necessity of creating or enhancing the durability and adaptive capacity of transport systems and infrastructure to withstand various stresses and shocks, including those exacerbated by climate change, environmental degradation, and social change.[24]

The EASIR approach can be adopted by individual transport users, companies, and policymakers as shown in Table 1. Electrification of transport, including the adoption of EVs, is currently touted as the most appropriate strategy for decarbonising transport. However, *decarbonisation* is not synonymous to *electrification*. Electrification can contribute to decarbonisation by replacing carbon-intensive energy sources with cleaner electric energy. But as discussed, decarbonisation encompasses a broader set of strategies aimed at reducing overall carbon emissions across all sectors of the economy. Thus, while the adoption of EVs within the transport sector can help address the carbon dioxide emission problem, it does not necessarily resolve other transport sector challenges in Africa, such as congestion, road safety, or the large amount of land required for transport infrastructure. Consequently, the electrification of transport needs to be considered as an integral component of a broader, more comprehensive strategy for developing sustainable transport systems in Africa, such as the EASIR approach.

Table 1: The Enable-Avoid-Shift-Improve-Resilience framework and its application to sustainable transport in Africa

Strategy	Description	Application in Sustainable Transport
Enable	Establishes the foundational governance, laws, institutions, and financial arrangements necessary for effective decarbonisation policies.	• Enabling the public sector to devise and execute effective policies by developing human resources, establishing sound licensing regimes, and setting up metropolitan transport authorities. • Training programs for urban planners on sustainable mobility. • Establishment of a metropolitan transport authority to coordinate public transport services across different municipalities.
Avoid	Aims to reduce the need for and the distances of travel, primarily through better urban planning and the adoption of remote work practices.	• Development of mixed-use communities (compact neighbourhoods) where residential, commercial, and recreational facilities are within walking distance, thus reducing overall travel demand. • Forecasting and planning for urban sprawl in urban planning. • Provide a proper information technology infrastructure as well as tax incentives to employers to encourage their staff to work from home. • Restricting vehicle access to central business districts, cultural and historical areas, and other busy urban areas. • Redesign streets to make NMT more appealing while encouraging intermodal lanes. • Promote and encourage ridesharing to limit or reduce the number of same-destination trips by many individuals by offering infrastructure high occupancy vehicle lanes. • Promote trends such as online shopping by reducing the taxes for online purchases. • Share information to road users via improved intelligent transport systems, social networks, and mobile applications to redistribute demand outside peak hours or redirect traffic congestion to alternate routes
Shift	Encourages moving travel demand from individual motorised modes of transport to more sustainable modes such as public transit, walking, and cycling.	• Improving existing public transport to mitigate emissions. • Expansion of bike-sharing programs in urban areas. • Investment in high-capacity, rapid transit systems like BRT (Bus Rapid Transit) and metro lines.
Improve	Focuses on enhancing the efficiency and environmental performance of transport systems through better vehicle, fuel, and network operations.	• Adopting cleaner fuels. • Introduction low emission vehicles (such as EVs). • Using road networks more efficiently to improve air quality and reduce emissions from transport. • Implementation of traffic management systems to reduce congestion and idling times. • Initiate media campaigns and workshops to promote EV purchase and educate the public about the health, cost and environmental benefits of EVs relative to ICEs. • Strengthen and enforce zoning laws that restrict commercial hubs alongside highways, which needs to be accessed via frontage roads, and ensure loading and offloading zones as well as proper parking spaces are allocated in industrial and commercial areas.
Resilience	Aims to enhance the resilience and adaptive capacity of transport infrastructure to withstand environmental, technological, and socio-economic changes.	• Developing durable infrastructure that can withstand extreme weather and climate variability. • Integrating flexible and modular design features into new transport projects to allow for future adaptations and technology integrations. • Building redundancy into the transport network to ensure service continuity during infrastructure failures or extreme events. • Engaging local communities in planning processes to ensure that infrastructure meets local needs and can be maintained with minimal local resources. • Implementing adaptive management practices that utilize real-time data to optimize maintenance and response strategies

V. Recommendations

To decarbonise transport in Africa, the following recommendations should be considered:

1. **City and regional authorities in Africa should promote local decarbonisation efforts.** There are numerous ongoing projects aimed at decarbonising transport in different cities and sub-regions of Africa. These projects include the growing adoption of electric mobility solutions, and implementation of mass rapid transit (MRT) such as bus rapid transit (BRT) systems and light rail transport (LRT). There is also an emphasis on non-motorised transport such as walking and cycling that demonstrate local successes in decarbonisation, with significant economic, social, and environmental benefits. These projects can be promoted by stakeholders such as city authorities, innovators, and researchers actively sharing insights and best practices. This includes creating platforms for knowledge exchange, setting up pilot projects, and establishing benchmarks for success. Similarly, regional authorities should spearhead the establishment of agencies to enhance governance and collaboration within Africa's transport sector.

2. **Governments in Africa should implement the Enable-Avoid-Shift-Improve Resilience (EASIR) approach for sustainable transport.** The EASIR approach's holistic nature, combining enabling policies, mechanisms to reduce travel demand, the promotion of sustainable transportation modes, improvements in vehicle and fuel efficiency, and enhancing the resilience of transportation systems directly addresses the multi-dimensional challenges of transport decarbonisation on the continent. The EASIR framework aligns with Africa's specific needs and global sustainability goals, underscoring its suitability. This recommendation is supported by analysis of successful case studies within the continent where elements of the EASIR approach have already been implemented, demonstrating tangible benefits in reducing carbon emissions and enhancing sustainable mobility. Case studies described in this report include the adoption of enabling policies such as EV incentives in Morocco and Kenya, the shift towards sustainable modes such as Rwanda's investments in cycling infrastructure, and South Africa's push for biofuel usage to improve fuel efficiency.

3. **Governments in Africa should provide incentives to industries to promote and support local manufacturing.** Decarbonisation of transport has the potential to drive industrial growth and create green job opportunities across Africa. There is growing local assembly and manufacturing of EVs in Africa, as well as initiatives to convert fossil-fuelled vehicles, including Africa's paratransit vehicles, to electric propulsion in African countries such as Kenya, South Africa, and Nigeria. The conversion of ICE vehicles to EVs particularly presents enormous potential considering the large number of used vehicles in Africa. Meanwhile, with some of the necessary infrastructure already present, existing ICE vehicle manufacturers could pivot to EV production if properly incentivised. These examples demonstrate that the continent's abundance of skilled mechanics, combined with the ingenuity and resourcefulness that African innovators demonstrate, provide the groundwork for a sustainable, scalable model of EV development tailored to the unique needs and opportunities of the rapidly emerging African EV market, while contributing to the global advancement of electric mobility. Opportunities extend into EV auto parts and battery manufacturing, leveraging Africa's critical mineral resources, alongside innovative business

models like pay-as-you-go charging and solar charging stations, and taking advantage of the continent's abundant solar energy. While policies to support local vehicle manufacturing are emerging in various African countries, the realisation of broad industrial ambitions requires a commitment to building the necessary human capital by skilling, up-skilling, and re-skilling workers, especially the youth, women, and unemployed. Incentives should be provided to industries to support local manufacturing of electric batteries and production and assembly of EVs, including two- and three-wheelers (motorcycles and tuk-tuks, respectively) as well as buses. This can be done through the provision of both policy and regulatory incentives such as tax breaks, subsidies, and facilitating partnerships between local industries and international companies. Such incentives will not only help achieve decarbonisation of transport goals but also drive inclusive economic growth in line with Africa's Agenda 2063 and the United Nations SDGs.

4. **Governments in Africa, industry, and academia should establish research partnerships to investigate energy demands and expected impact of EVs on the grid.** Transport electrification in Africa will increase the demand for electricity, and the current fragility of the electric grid poses a critical concern for the viability and sustainability of electric mobility. Adopting EVs will have significant impact on the electricity system in terms of generation, transmission, distribution, and accessibility. While EVs could also play a role in stabilising the grid, for example, through a vehicle-to-grid (V2G) approach, understanding the current state of power systems in Africa is crucial in evaluating the impact of EV deployment across African countries, as electricity is a central pillar of Africa's energy infrastructure. The capacity, reliability, and reach of these systems play a key role in determining how effectively EVs can be integrated and supported. Increased demand from EVs necessitates robust and diverse generation facilities and power sources. Transmission networks will need to be upgraded to handle the increased load, especially during peak charging times, requiring a resilient infrastructure. Similarly, the distribution system will face changes in load patterns, particularly in residential areas with home charging, demanding smarter and more responsive grid solutions. But despite the strong case for the electrification of transport in Africa, the lack of adequate investment in the power sector and insufficient research on the impacts of this electrification hinders the development of innovative solutions, the exploration of technology applications, and the conceptualisation, design, and implementation of effective strategies. Research collaborations can also further address these challenges by assessing the potential for charging EVs with renewable energy sources as well as on increasing local contents on EVs. In doing so, policy decisions on EV adoption and charging infrastructure will be context-specific, evidence-informed, and based on actual data.

5. **Governments in Africa should develop comprehensive financing and policy instruments to support the upgrade of power grid systems, the construction of EV charging networks, and overall improve the public transport infrastructure.** Inadequate financial frameworks hinder decarbonisation efforts in Africa, limiting the continent's ability to leverage transport decarbonisation as a catalyst for industrial growth and innovation, and job creation. The establishment of a robust EV ecosystem, already stimulated by the emergence of local assembly and manufacturing of EVs, ambitious innovations such as the conversion of gasoline-powered vehicles to electric propulsion, battery swapping, and investments in

renewable energy systems, as well as in inclusive non-motorised transport infrastructure, are constrained by inadequate finance. This scarcity of robust financial structures and investment may stem from multiple factors, including African countries' challenges in developing comprehensive financial policies and frameworks such incentives for EV buyers, and the hesitation of investors, who may not fully recognize the opportunities within the continent's evolving EV market. Therefore, addressing these financial barriers and enhancing investor confidence is crucial for unlocking the transformative power of decarbonisation through electrification in Africa. Innovative climate financing instruments can include infrastructure funding, blended finance, and green bonds, alongside taxes. This type of financing and policy instruments will encourage the acquisition of EVs, foreign investment, and inclusive business models that foster participation of SMEs and start-ups in the EV business ecosystem. In addition, governments can expand policy support to foster international cooperation, resource mobilisation, and the development of sustainable business models for electric mobility, leveraging existing approaches such as the Green Climate Fund, the World Bank's Global Facility to Decarbonise Transport (GFDT), or the African Development Bank's Green Mobility Facility for Africa (GMFA), and others that offer flexible financing solutions for climate and transport projects.

6. **Governments in Africa should prioritise the electrification of vehicle segments that provide the most immediate and highest decarbonisation benefits.** Analysis indicates that two- and three-wheelers, along with passenger buses on high-use routes, are attractive candidates for the first stages of transport electrification efforts due to their lower costs, high mileage, and extensive use. These segments present a significant opportunity for immediate impact. Additionally, four-wheelers such as taxis, ride-sharing vehicles, and other commercial fleets should be targeted in early decarbonisation efforts, given their frequent use and greater potential for reducing emissions. However, it is also critical to consider the role of private family cars. While these vehicles may not have the same high usage as commercial fleets on a per-vehicle basis, their cumulative impact due to sheer volume can be substantial. Tailored strategies based on vehicle use patterns and ownership costs are needed for this vehicle segment, as part of a comprehensive approach to electrifying four-wheelers.

7. **Governments in Africa should implement stricter rules and regulations that support emission reductions during the transition to decarbonised transport.** While the transition towards EVs presents a significant opportunity for emission reduction, the potential of regulatory measures to curb emissions from existing ICE vehicles also needs to be a priority. Stricter emission standards for vehicles, as well as the introduction of policies that discourage the importation of older, more polluting cars, could significantly support emission reduction goals. Policies banning or restricting old and high-emitting vehicles from metropolitan can also reduce urban pollution and encourage the adoption of cleaner alternatives while also improving air quality and enhancing the quality of life in urban areas. African governments are employing a diverse range of policy instruments to accelerate the decarbonisation of transport at continental and local levels. These are categorised into four main types: (1) **market-based instruments** (such as taxes, subsidies, fees, quotas, import duties, and penalties) (2) **regulatory instruments** (licenses, limits, prohibitions, laws); (3) **direct provisions** (governments directly providing goods or services to its citizens); and (4)

information provisions (dissemination of relevant, accurate, and timely information to the public). Market-based tools, like subsidies for electric vehicle purchases in Morocco and carbon taxes in South Africa, incentivise cleaner transport options. Regulatory measures, including emissions standards and vehicle import restrictions, have been implemented in Egypt and Kenya to curb pollution and encourage the adoption of cleaner vehicles. Direct provisions are evident in Ethiopia's investment in the Addis Ababa light rail system, directly enhancing public transport infrastructure. Information provisions play a crucial role in raising awareness and changing public behaviour towards sustainable transport options, as seen in Nigeria's campaigns promoting electric motorcycles. These varied policy tools, backed by strategic planning and investments, are critical to boosting the effectiveness of decarbonisation efforts across the continent.

8. **Governments in Africa and other stakeholders should implement just transition principles to foster a holistic and socially inclusive decarbonisation of transport.** Just transition principles advocate for a shift towards a sustainable economy, including transportation that prioritises equity and access for all, including vulnerable groups and marginalised communities such as women, persons with disabilities and older persons, indigenous communities, low-income populations, and residents of rural areas. Just transition principles also safeguard against exacerbating existing inequalities by adopting gender and socially inclusive approaches when formulating transportation policies, for example by addressing safety issues that prevent women from engaging in active transportation, such as walking, and by addressing equity between women and men in the transport workforce. Developing accessible infrastructure such as sidewalks, ramps, and elevators in bus parks and on vehicles caters towards the needs of persons with disabilities and older persons. Finally, just transition principles promote investing in infrastructure that supports both urban and rural transportation needs, and rural-urban connectivity, ensuring that decarbonisation benefits are equitably distributed across all regions.

9. **Governments in Africa should improve existing transportation systems and adopt sustainable land-use development.** Improving existing transport systems and adopting sustainable land-use developments such as compact and mixed-use development and transit-oriented development, are essential strategies to promote economic prosperity, social inclusion, environmental sustainability, and resilience. By prioritising these measures, African countries can create more liveable, equitable, and sustainable cities and communities for current and future generations. A holistic approach to sustainable transport can not only reduce carbon emissions but also has the potential to alleviate negative traffic externalities, thereby contributing to a healthier environment and improved quality of life. In Africa, where urbanisation is rapidly increasing, the need for efficient and sustainable transportation systems is more pronounced than ever. The implementation of mass rapid transit systems, such as the BRT systems in Lagos, Nigeria, and Dar es Salaam, Tanzania, exemplifies proactive steps towards sustainable urban mobility. Additionally, the development of light rail projects, like the Addis Ababa Light Rail in Ethiopia, serves not only to decrease reliance on individual car usage but also to spearhead the transition towards electrification of public transport networks. Similarly, the development and adoption of non-motorised transport (NMT) infrastructure plays a crucial role in shaping sustainable urban mobility landscapes. In Africa, several examples highlight the progress and commitment

towards enhancing NMT facilities. For instance, Nairobi in Kenya and Cape Town in South Africa have taken significant strides in developing bicycle paths and pedestrian walkways, inspired by the success of Rwanda's Kigali Car-Free Days, which promote active transport and raise environmental awareness.

10. **Governments in Africa should actively foster strategic collaborations, robust advocacy, and innovation to advance sustainable transport across the continent.** Decarbonisation efforts inherently disrupt the established and often entrenched regimes within the transport sector. These include the fossil fuel industry, transport sector operators, and institutions and institutional frameworks that govern transport systems in Africa. Entrenched regimes often have established powerful interests that are resistant to change due to financial, political, or ideological reasons. Decarbonisation involves reducing dependence on oil and other fossil fuels, which are the primary energy sources for conventional ICE vehicles. For transport sector operators such as the companies and organisations involved in manufacturing, operating, or maintaining transportation systems, decarbonisation will require adoption of new technologies, change of business models, and compliance with appropriate regulations. Similarly, policies, regulations, and incentives that encourage the adoption of cleaner transportation modes will disrupt institutional frameworks such as subsidies that have historically supported the fossil-fuel industry and transport systems or the associated fuel tax revenues for governments. Crucially, decarbonisation policies inherently challenge the status quo and can lead to significant economic, social, and institutional changes and tensions. To navigate competing interests, it is essential to actively engage stakeholders from traditional transport and fuel industries in crafting a shared vision for the future of transportation on the continent, while highlighting the economic, environmental, and social benefits. Such collaborations might include engagement with fuel industry representatives to explore the development of electric charging infrastructure as a new business venture and shifting the perspective from competition to complementary roles in the evolving transport ecosystem. Engaging stakeholders not as adversaries but as partners in progress can facilitate the development of integrated solutions that address economic, environmental, and social goals.

11. **Governments in Africa should establish a unified framework for decarbonised and sustainable transport aligned with continental aspirations and global climate change targets.** Progress towards decarbonised and sustainable transportation can be achieved and accelerated by adopting a common position on sustainable transport across Africa. While the African Union's Climate Change and Resilient Development Strategy and Action Plan (CCRDSAP) 2022-2032[25] already provides a comprehensive framework for climate action, including in transport, a distinct strategy or position dedicated to sustainable transport does not currently exist. A common framework on decarbonised and sustainable transportation can thus build on existing blueprints, including the African Union's visionary policies, and agreements such as the CCRDSAP 2022-2032, the 2023 Nairobi Declaration, Agenda 2063, Programme for Infrastructure Development in Africa (PIDA), the African Renewable Energy Initiative, the Paris Agreement, and its Nationally Determined Contributions and national long-term climate strategies of various African countries. A common position on sustainable transport would not only align with overarching continental and global objectives for climate change but can also leverage collective bargaining power in negotiations to secure

technology transfers, financial investments, and international support essential for the transition, and issues related to decarbonisation and overall improvement of the transport sector. Moreover, a pan-African consensus on sustainable transport can pave the way for the establishment of harmonised policies and interoperable infrastructure tailored to the continent's unique challenges and opportunities. Adopting a common position on sustainable transport across Africa does not imply a one-size-fits-all policy. Instead, a common framework should be based on shared principles that recognises the diversity of national circumstances and allows for flexibility in implementation. A common approach with time-bound objectives will serve as milestones, guiding the phased implementation of sustainable transport initiatives across Africa, ensuring that progress is both measurable and aligned with the overarching goal of fostering environmental sustainability and overall sustainable development, in line with Africa's Agenda 2063.

List of References

[1] NASAC and IAP, 2024. Decarbonisation of Transport in Africa: Opportunities, Challenges and Policy Options. Nairobi: Network of African Science Academies and InterAcademy Partnership. https://www.interacademies.org/publication/decarbonisation-transport-africa-opportunities-challenges-and-policy-options

[2] EASAC. 2019. *Decarbonisation of Transport: options and challenges*. https://easac.eu/publications/details/decarbonisation-of-transport-options-and-challenges

[3] IPCC. 2022. *Climate Change 2022: Mitigation of Climate Change*. https://www.ipcc.ch/report/ar6/wg3/

[4] IEA, 2023. *Transport*. https://www.iea.org/energy-system/transport.

[5] Tiseo, I. 2023. *Distribution of carbon dioxide emissions produced by the transportation sector worldwide in 2021, by subsector.* https://www.statista.com/statistics/1185535/transport-carbon-dioxide-emissions-breakdown/

[6] Anenberg, S. C., Miller, J., Henze, D. K., Minjares, R., & Achakulwisut, P. (2019). The global burden of transportation tailpipe emissions on air pollution-related mortality in 2010 and 2015. *Environmental Research Letters*, 14(9). https://iopscience.iop.org/article/10.1088/1748-9326/ab35fc

[7] UNFCCC, 2023. *Africa Climate Week 2023: Charting a Fresh Course for Climate Action*. Available at: https://unfccc.int/news/africa-climate-week-2023-charting-a-fresh-course-for-climate-action

[8] SLOCAT. 2021. *Tracking Trends in a Time of Change: The Need for Radical Action Towards Sustainable Transport Decarbonisation.* https://tcc-gsr.com/global-overview/africa/

[9] Ayetor, G. K., Mbonigaba, I., Ampofo, J., & Sunnu, A. 2021. Investigating the state of road vehicle emissions in Africa: A case study of Ghana and Rwanda. *Transportation Research Interdisciplinary Perspectives*, 11. https://doi.org/10.1016/j.trip.2021.100409.

[10] NASAC and IAP, 2024. Decarbonisation of Transport in Africa: Opportunities, Challenges and Policy Options. Nairobi: Network of African Science Academies and InterAcademy Partnership. https://www.interacademies.org/publication/decarbonisation-transport-africa-opportunities-challenges-and-policy-options

[11] Givoni, Moshe., and Banister, David. (Eds.). 2013.. Moving towards low carbon mobility. Edward Elgar Publishing. https://www.e-elgar.com/shop/usd/moving-towards-low-carbon-mobility-9781781007228.html

[12] Logan, K. G., Nelson, J. D., Chapman, J. D., Milne, J., and Hastings, A.: Decarbonising UK transport: Implications for electricity generation, land use and policy, EGU General Assembly 2021, online, 19–30 Apr 2021, EGU21-122. https://meetingorganizer.copernicus.org/EGU21/EGU21-122.html

[13] Anshelm, J. (2023). A tale of two crises: the emergence of an eco-keynesian coalition in Swedish transport decarbonisation discourse. *Environment and Planning C: Politics and Space*, 41(4), 787-807. https://doi.org/10.1177/23996544231151677

[14] African Union. *Agenda 2063: The Africa We Want*. Retrieved from https://au.int/en/agenda2063/overview

[15] GIZ and SLOCAT. *Climate Strategies for Transport in Africa*. https://slocat.net/wp-content/uploads/2022/05/Africa-NDC-LTS-transport-infographic.pdf

[16] Tokam, C. 2022. *Raising Ambition for Transport in African Countries' Climate Strategies.* https://slocat.net/raising-ambition-for-transport-in-african-countries-climate-strategies/

[17] Tokam, C. 2022. *Raising Ambition for Transport in African Countries' Climate Strategies.* https://slocat.net/raising-ambition-for-transport-in-african-countries-climate-strategies/

[18] Anumita Roychowdhury, Vivek Chattopadhyaya and Priyanka Chandola. 2023. *Electric mobility in Africa: A unique opportunity to leapfrog to clean air and low carbon mobility*. Centre for Science and Environment, New Delhi. https://www.cseindia.org/electric-mobility-in-africa-a-unique-opportunity-to-leapfrog-to-clean-air-and-low-carbon-mobility-11682

[19] ITDP Africa. 2023. *Bus sector modernisation a crucial precursor to electrification*. https://africa.itdp.org/bus-sector-modernisation-a-crucial-precursor-to-electrification/

[20] United Nations. 2023. *Road Safety Week: African nations steer towards reducing deaths.* https://news.un.org/en/story/2023/05/1136627

[21] Kithome, D., 2021. *What are the harmonized African standards for the automotive sector all about?* https://www.arso-oran.org/?m=202105

[22] UNEP. 2023. *West African Ministers adopt cleaner fuels and vehicles standards*. https://www.unep.org/news-and-stories/story/west-african-ministers-adopt-cleaner-fuels-and-vehicles-standards.

[23] Fatima Arroyo-Arroyo, Brendan Finn and Philip van Ryneveld. 2021. Urban Mobility in African Cities: Developing National Urban Mobility Policy and Delivering at the City level. Washington, DC: SSATP. https://documents1.worldbank.org/curated/en/099756001312217735/pdf/P1533110c5cf2a0b00a8f90e00776bfbc07.pdf

[24] World Bank. 2022. Arroyo Arroyo, Fatima; Vesin,Vincent; Tripodi,Antonino; Alfonsi, Raffaele; Chiavassa, Nathalie; Diallo, Mamadou; Lidozzi, Alessandro. *Pathways to Electric Mobility in the Sahel: Two and Three-Wheelers in Bamako and Ouagadougou*. Washington, D.C.: World Bank Group. http://documents.worldbank.org/curated/en/099355002132233505/P174592012d6e100d09f6f0c1fd37ad2d16

[25] African Union. 2022. *African Union Climate Change and Resilient Development Strategy and Action Plan (2022-2032)*. https://au.int/en/documents/20220628/african-union-climate-change-and-resilient-development-strategy-and-action-plan

About NASAC and IAP

The **Network of African Science Academies (NASAC)** is a network of 30 merit-based national academies in Africa. NASAC's main objective is to unite science academies and facilitate discussions on the scientific aspects of challenges of common concern, make joint statements, and provide science-informed advice to policy and decision-makers in Africa. Additionally, NASAC creates awareness of the value of science academies to socio-economic development and works with scientists to establish science academies in countries where none exist. NASAC's networking capacity serves as an effective resource for communicating appropriate thematic information and coordinating efforts among different sectors and stakeholders in academia, policy, and society. Specifically, through its membership, NASAC continues to provide advice to regional bodies and organisations on science-related issues of importance to Africa's development. It has also enhanced the capacity of academies in Africa to improve their roles as independent science advisors to governments and to strengthen their national, regional, and international functions. NASAC is the affiliate network for the InterAcademy Partnership in Africa. The secretariat of NASAC is based in Nairobi, Kenya. More information is available at www.nasaconline.org.

The **InterAcademy Partnership (IAP)** is a global network of 150 academies of science, engineering, and medicine. With its four regional networks—in Africa (NASAC), the Americas (the InterAmerican Network of Academies of Sciences, IANAS), Asia/Oceania (the Association of Academies and Societies of Sciences in Asia, AASSA) and Europe (the European Academies Science Advisory Council, EASAC), IAP provides a platform for mobilising regional and national expertise on wide ranging issues of global importance, and for facilitating cooperation with other key stakeholders and potential partners. IAP's secretariat offices are hosted by The World Academy of Sciences in Trieste, Italy, and the National Academy of Sciences in Washington, DC, USA. More information is available at www.interacademies.org.

DECARBONISATION OF TRANSPORT IN AFRICA:

Opportunities, Challenges and Policy Options

The transportation sector is a significant contributor of greenhouse gases, accounting for nearly a quarter of total emissions globally. Transportation is also a critical enabler of Africa's economic transformation and features prominently in the African Union's Agenda 2063. With growing climate change concerns, it is critical to decarbonise transportation because future carbon emissions are expected to increase. For this reason, the Network of Science Academies (NASAC) and InterAcademy Partnership (IAP) appointed an expert working group to conduct a study to assess the opportunities, challenges and policy options for decarbonisation of transport in Africa and prepare this report. This report also examines the necessary legal and regulatory frameworks, policies, institutional and technical capacities, strategies, technologies, financing, and social aspects that can contribute to the decarbonisation of transport in the continent. The report also included pertinent findings and recommendations for a holistic transition to decarbonised transportation, which African governments and other stakeholders should take into account.

This report can also be found on the NASAC website: www.nasaconline.org.

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