Transitioning from Fossil Fuel-Based Transport to Clean Energy Vehicles in Africa: Challenges and Prospects

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Kariuki Muigua

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Kariuki Muigua*

Abstract

Sustainable Development Goal 7 captures the commitments of nations in moving the world towards cleaner energy technologies. One of the greatest threats to this transition, however, is the transport sector especially in Africa which contributes a lot to air pollution as it still relies heavily on fossil fuel which contribute heavily to greenhouse gas emissions. This paper argues that if Africa is to keep up with the rest of the world in this transition, then it is the high time that it invested in electric vehicles in order to address the challenge of fossil fuel pollution sources.

1. Introduction

According to the current trends, the global number of light-duty cars will roughly double by midcentury, owing to increased prosperity, and demand for freight transportation (road, rail, sea, and air) as well as passenger aviation will also increase.[1] It has been argued that the transport sector has the potential to create an enabling environment for Africa's economic progress.[2] The downside to this is that in Africa, road transport emissions will continue to rise significantly as governments attempt to improve their road infrastructure networks for commercial activity, meeting the demands of a growing population and a growing middle class.[3] According to studies, mortality rates from outdoor air pollution in Africa have climbed by 57 percent over the last three decades, with pollution from motor vehicles accounting for at least 85 percent of the continent's vehicle fleet, some of which are antiquated and utilise outdated technologies.[4]

Notably, the Paris Agreement urges countries to increase their mitigation ambition in their Nationally Determined Contributions (NDCs) by reviewing and assessing their ambition and developing long-term low-carbon development policies.[5]

PhD in Law (Nrb), FCIArb (Chartered Arbitrator), LL. B (Hons) Nrb, LL.M (Environmental Law) Nrb; Dip. In Law (KSL); FCPS (K); Dip. In Arbitration (UK); MKIM; Mediator; Consultant: Lead expert EIA/EA NEMA; BSI ISO/IEC 27001:2005 ISMS Lead Auditor/ Implementer; Advocate of the High Court of Kenya; Senior Lecturer at the University of Nairobi, School of Law [February 2022].

[1] Creutzig, F., Jochem, P., Edelenbosch, O.Y., Mattauch, L., van Vuuren, D.P., McCollum, D. and Minx, J., 'Transport: A Roadblock to Climate Change Mitigation?' *Science* 350, no. 6263 (2015): 911-912, at 911.

[2] 'Transforming Africa's Transport Sector with the Implementation of Intended Nationally Determined Contributions' 1 <https://repository.uneca.org/handle/10855/23728> accessed 2 February 2022.

[3] Ibid, 2.

[4] Ayetor, G. K., Innocent Mbonigaba, M. N. Sackey, and P. Y. Andoh. "Vehicle regulations in Africa: Impact on used vehicle import and new vehicle sales." *Transportation Research Interdisciplinary Perspectives* 10 (2021): 100384.

[5] 'Road Transport • The Road towards Low Carbon Mobility' <https://www.climate-chance.org/en/card/road-towards-low-carbon-mobility/> accessed 2 February 2022.

Climate change mitigation requires a shift in production and consumption patterns in order to embrace more sustainable ways.[6] Notably, transportation is one of the main sectors that plays a critical role in attaining poverty eradication and sustainable development goals, as it is closely linked to and influences the development of other sectors of the economy.[7] It is against this background that this paper discusses the challenges and prospects of Africa moving towards adopting low or no emissions transport infrastructure.

2. Fossil Fuel-Based Transport and Climate Change: The Connection

SDG 7 states that increased use of fossil fuels without actions to mitigate greenhouse gases will have global climate change implications. Energy efficiency and increased use of renewables contribute to climate change mitigation and disaster risk reduction.[8]

Vehicle emissions are a major source of tiny particles and nitrogen oxides, both of which contribute to urban air pollution, and cars account for 25% of all energy-related greenhouse gas emissions globally.[9] Poor fuel quality, an aging vehicle fleet, and a lack of mandatory roadworthy emission tests are all contributing to Africa's rising greenhouse gas emissions, which are expanding at a rate of 7% per year.[10]

The global road transport carbon emissions have increased since 2000 as a result of a complex combination of human behavior, economic growth, public policy, and transportation legislation.[11] In many African cities and most African countries, the transportation sector is the leading source of urban air pollution and energy-related greenhouse gas emissions.[12] Millions of secondhand cars, vans, and minibuses transported from Europe, the United States, and Japan to low- and middle-income nations are hampering efforts to mitigate climate change, according to a UNEP report released in 2020. They pollute the air and are frequently engaged in car accidents. Many are of poor quality and would fail roadworthiness tests in exporting countries.[13]

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[6] Weijnen MP, Lukszo Z and Farahani S, 'Shaping an Inclusive Energy Transition' (Springer Nature, 2021).

[7] "United Nations. Economic Commission for Africa.; United Nations. Economic and Social Council (2009-08). Africa review report on transport: a summary. UN. ECA Committee on Food Security and Sustainable Development (CFSSD)/Regional Implementation Meeting (RIM) for CSD-18 (6th session: 2009, Oct. 27-30: Addis Ababa, Ethiopia).

[8] Environment UN, 'GOAL 7: Affordable and Clean Energy' (*UNEP - UN Environment Programme*, 2 October 2017) <http://www.unep.org/explore-topics/sustainable-development-goals/why-do-sustainable-development-goals-matter/goal-7> accessed 3 February 2022.

[9] 'Used Vehicles Get a Second Life in Africa – but at What Cost?' (*UNEP*, 26 October 2020) <http://www.unep.org/news-and-stories/story/used-vehicles-get-second-life-africa-what-cost> accessed 3 February 2022.

[10] Ayetor GK and others, 'Investigating the State of Road Vehicle Emissions in Africa: A Case Study of Ghana and Rwanda' (2021) 11 Transportation Research Interdisciplinary Perspectives 100409.

[11] 'Road Transport • The Road towards Low Carbon Mobility' <https://www.climate-chance.org/en/card/road-towards-low-carbon-mobility/> accessed 2 February 2022.

[12] 'African Countries Move toward Cleaner Car Imports' (*Climate & Clean Air Coalition*) <https://www.ccacoalition.org/en/news/african-countries-move-toward-cleaner-car-imports> accessed 2 February 2022.

[13] Environment UN, 'Global Trade in Used Vehicles Report' (*UNEP - UN Environment Programme*, 23 October 2020) <http://www.unep.org/resources/report/global-trade-used-vehicles-report> accessed 2 February 2022.

Globally, the transportation industry is anticipated to be responsible for roughly 23% of total energy-related carbon dioxide emissions, with the sector developing at a faster rate than most others with emissions expected to double by 2050.[14] Most African countries rely on used and old automobiles that are mainly outdated in technology, harming the environment significantly, especially when using contaminated fuel.[15] Electric vehicles, on the other hand, are rapidly growing in popularity among the countries that export the most used automobiles.[16] For example, Europe, which primarily exports cars to West and North Africa, has announced internal combustion engine phase-out targets, and a stronger electrification push is expected across Europe to meet its net zero 2050 goal and stronger new 2030 carbon target, while Japan, the largest exporter of used cars to Mozambique and other right-hand-drive countries in Eastern and Southern Africa, has set a 2035 phase-out date for internal combustion engine cars.[17]

While countries across Africa, South Asia, and Latin America are now aware of the consequences of used vehicles and are erecting import barriers to contain them, an outright ban on used vehicle import is not possible in many African countries due to growing consumer demand for cheap used cars, making it difficult for governments to prohibit the import of old cars or impose improved emissions standards even after adopting cleaner fuels.[18]

Addressing carbon emissions from the transport industry through adoption of cleaner technologies is one of the steps towards tackling climate change.

3. Transport Sector in Kenya

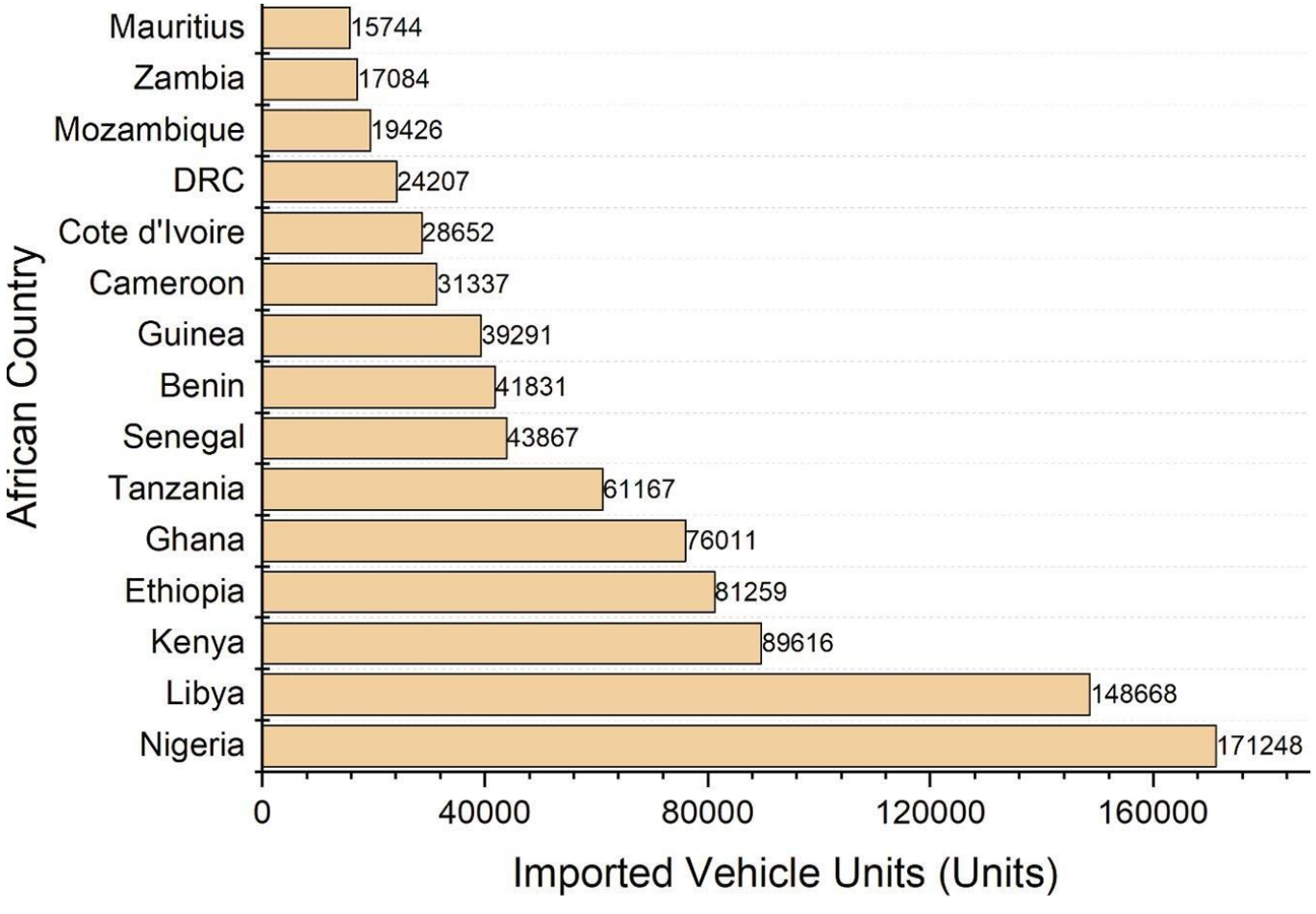
According to studies, Kenya's transportation sector contributes for 8.3% of the country's total GDP.[19] Because of Kenya's role as a trans-shipment hub for goods moving on to landlocked countries in East and Central Africa, with the Port of Mombasa serving as a critical landing point for goods, and links to the Northern Corridor that runs west across the country to the neighboring markets of Uganda, Rwanda, Burundi, and the Democratic Republic of Congo, transportation and logistics are at the heart of Kenya's economic narrative.[20] Furthermore, the road sub-sector accounts for over 80% of passenger traffic and 76

[14] Creutzig, F., Jochem, P., Edelenbosch, O.Y., Mattauch, L., van Vuuren, D.P., McCollum, D. and Minx, J., 'Transport: A Roadblock to Climate Change Mitigation?' *Science* 350, no. 6263 (2015): 911-912.
[15] Ayetor G and others, 'Vehicle Regulations in Africa: Impact on Used Vehicle Import and New Vehicle Sales' (2021) 10 Transportation Research Interdisciplinary Perspectives 100384.
[16] 'Africa's Bumpy Road to an Electric Vehicle Future' (*E3G*, 6 January 2021) <https://www.e3g.org/news/africa-s-bumpy-road-to-an-electric-vehicle-future/> accessed 2 February 2022.
[17] Ibid.
[18] 'Consumer Demand Doesn't Let Countries Ban Import of Cheap Used Cars' <https://www.downtoearth.org.in/news/governance/consumer-demand-doesn-t-let-countries-ban-import-of-cheap-used-cars-62135> accessed 2 February 2022.
[19] 'Transport in Kenya's Nationally Determined Contribution' (Changing Transport) 1 <https://changing-transport.org/publication/transport-in-kenyas-nationally-determined-contribution/> accessed 26 January 2022.
[20] 'Transport' (Oxford Business Group, 21 May 2017) <https://oxfordbusinessgroup.com/kenya-2017/transport> accessed 26 January 2022.

percent of freight, with Kenya's road network estimated to be 160,886 kilometers long, of which 61,945 kilometers are classified, and used by over 740,000 vehicles with a 6% annual traffic growth rate.[21]

The downside is that Kenya's transportation sector is the country's largest consumer of petroleum products and thus a major contributor to GHG emissions, accounting for roughly 67 percent of Kenya's energy-related CO2 emissions and 11.3 percent of total GHG emissions in 2015 for fuel consumption in civil aviation, road transport, and rail.[22] This may have a negative impact on Kenya's contribution to the Paris Agreement's goal of keeping global warming well below 2 degrees Celsius compared to pre-industrial times.[23]

Kenya is ranked among the African countries with the highest numbers of imported cars as shown below, as at 2019.



[21] Christopher Onyango, 'Kenya's Transport Sector: Measuring Its Value Chains and Exploiting Its Potential, Mr. Christopher Onyango, KIPPRA' (2019) 4 <https://unctad.org/system/files/non-official-document/aldc2019_kenya_servicestrade_Onyango_KIPPRA_en.pdf> accessed 26 January 2022.
[22] 'Transport in Kenya's Nationally Determined Contribution' (Changing Transport) 4 <https://changing-transport.org/publication/transport-in-kenyas-nationally-determined-contribution/> accessed 26 January 2022.
[23] Ibid.

Fig. 1. Number of used vehicle units imported to some African countries in 2019.[24]

Kenya's system, thus, requires a transition to more sustainable forms more than ever.

4. Development of Clean Energy Vehicle Technologies: Challenges and Prospects

With the Kigali Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, which entered into force on January 1, 2019, the world took an important step toward drastically reducing the production and consumption of powerful greenhouse gasses known as hydrofluorocarbons (HFCs) and limiting global warming.[25]

Only four African countries—Egypt, Morocco, South Africa, and Sudan—have banned the import of old vehicles, with another 25 imposing age limitations ranging from 15 to three years.[26] Several countries are combining age restrictions with tax measures to raise the cost of importing older vehicles, such as Kenya, which, in addition to limiting the age to eight years, has levied an added tax on older vehicles, raising the whole cost.[27]

The used car market has also hampered the development of a dependable manufacturing industry, with African governments failing to persuade manufacturers to invest in assembly plants, owing to a lack of suppliers, distributors, and component makers, as well as a lack of new vehicle demand.[28]

SDG 9 calls for construction of new greener infrastructures, retrofitting or reconfiguring existing infrastructure systems and exploiting the potential of smart technologies which can greatly contribute to the reduction of environmental impacts and disaster risks as well as the construction of resilience and the increase of efficiency in the use of natural resources.[29]

Target 9.a thereof seeks to facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least

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[24] Ayetor GK and others, 'Vehicle Regulations in Africa: Impact on Used Vehicle Import and New Vehicle Sales' (2021) 10 Transportation Research Interdisciplinary Perspectives 100384.< https://ars.els-cdn.com/content/image/1-s2.0-S2590198221000919-gr5_lrg.jpg> accessed 27 January 2022.

[25] 'World Takes a Stand against Powerful Greenhouse Gases with Implementation of Kigali Amendment' (UN Environment, 3 January 2019) <http://www.unep.org/news-and-stories/press-release/world-takes-stand-against-powerful-greenhouse-gases-implementation> accessed 27 January 2022.

[26] 'Consumer Demand Doesn't Let Countries Ban Import of Cheap Used Cars' <https://www.downtoearth.org.in/news/governance/consumer-demand-doesn-t-let-countries-ban-import-of-cheap-used-cars-62135> accessed 2 February 2022.

[27] Ibid.

[28] Alison, 'Are Africa's Used Car Import Bans Effective?' (*Global Fleet*, 22 June 2021) <https://www.globalfleet.com/en/safety-environment/africa-middle-east/analysis/are-africas-used-car-import-bans-effective> accessed 2 February 2022.

[29] Environment UN, 'GOAL 9: Industry, Innovation and Infrastructure' (*UNEP - UN Environment Programme*, 2 October 2017) <http://www.unep.org/explore-topics/sustainable-development-goals/why-do-sustainable-development-goals-matter/goal-9> accessed 3 February 2022.

developed countries, landlocked developing countries and small island developing States. Equally, SDG 17 envisages that stronger partnerships will contribute to environmental protection and sustainable development by mobilizing resources, sharing knowledge, promoting the creation and transfer of environmentally sound technologies, and building capacity.

Countries can build on this to move towards cleaner energy and sustainable transport system.

5. Transitioning from Fossil Fuel-Based Transport to Clean Energy Vehicles in Africa

Reduced emissions in the transportation sector will almost certainly necessitate a move to low-emission vehicles and fuels, with governments taking praiseworthy steps to minimize emissions in the transportation sector through law.[30]

Energy is regarded as Africa's key to development and the foundation for industrialization, with the expansion of renewables going beyond providing reliable energy and climate protection to promoting economic development, which will benefit and create new jobs and opportunities for entire industries, and reliable, sustainable energy will promote the provision of important basic socioeconomic services.[31]

It has been argued that while a 100 percent renewable economy would provide a long-term answer to climate change, energy security, sustainability, and pollution, converting the current transportation infrastructure appears to be one of the more difficult components of such a sustainable transition.[32]

While countries are working on adopting use of electric cars, importing countries, on the other hand, require regional coordination on age limits, fiscal measures, pollution rules, and fuel quality. They also need emissions, roadworthiness, and safety inspections, as well as a standardized methodology for vehicle registration and verification. To avoid dieselization, fuel efficiency efforts must be matched with increased emissions restrictions. Several countries that are building their own manufacturing and assembly capacities and enacting restrictive import restrictions must set pollution and safety regulations, as well as quality control for domestic production.[33]

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[30] Ayetor GK and others, 'Vehicle Regulations in Africa: Impact on Used Vehicle Import and New Vehicle Sales' (2021) 10 Transportation Research Interdisciplinary Perspectives 100384.

[31] 'The Renewable Energy Transition in Africa: Powering Access, Resilience and Prosperity | Africa Energy Portal' 3 <https://africa-energy-portal.org/reports/renewable-energy-transition-africa-powering-access-resilience-and-prosperity> accessed 14 January 2022.

[32] Antonio García-Olivares, Jordi Solé and Oleg Osychenko, 'Transportation in a 100% Renewable Energy System' (2018) 158 Energy Conversion and Management 266 <https://www.sciencedirect.com/science/article/pii/S0196890417312050> accessed 27 January 2022.

[33] 'Consumer Demand Doesn't Let Countries Ban Import of Cheap Used Cars' <https://www.downtoearth.org.in/news/governance/consumer-demand-doesn-t-let-countries-ban-import-of-cheap-used-cars-62135> accessed 2 February 2022.

5.1. Government's Tax Incentives on Electric Cars

The competition between used and new vehicles is primarily driven by price, and African countries' strategies to close the price gap have included banning the importation of used vehicles and encouraging the establishment of vehicle assembly plants by providing tax breaks and rebates to original equipment manufacturers, resulting in lower new vehicle costs.[34]

If Kenya and Africa in general is to ensure that their citizens embrace zero emissions vehicles, then they must work towards creating tax incentives on the cost of the vehicles. Rwanda's efforts are commendable, as the government approved an electric mobility adaptation strategy in April 2021, with the goal of increasing electric vehicles and motorcycles. The strategy includes a number of incentives for electric vehicles, plug-in hybrid electric vehicles, and hybrid electric vehicles.[35] In order to lower the cost of ownership and maintenance of electric vehicles, the Rwandan cabinet approved a strategy that exempted electric vehicles, spare parts, batteries, and charging station equipment from import and excise duties, as well as a zero-rated Value Added Tax on electric vehicles, spare parts, batteries, and charging station equipment from the ordinary vehicle import taxes of 25% import duty, 18% VAT, and 5% to 15% excise duty.[36]

While Kenya has made some similar efforts, the rate is so slow and the impact so small that it was previously reported that the Kenyan government aims to increase the uptake of electric vehicles in the country over the next five years, with a goal of having 5% of all registered vehicles in Kenya be electric by 2025, and all new public buildings must have charging stations.[37] This is a very low rate of progress considering that it was estimated that as at 2019 the electric vehicle industry in Kenya was still young with only 300 electric vehicles in the country.[38]

African countries thus need to invest more in encouraging production and uptake of electric vehicles to enable them eventually get rid of internal combustion engine vehicles.

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[34] Ayetor GK and others, 'Vehicle Regulations in Africa: Impact on Used Vehicle Import and New Vehicle Sales' (2021) 10 Transportation Research Interdisciplinary Perspectives 100384.
[35] 'Rwanda Unveils New Incentives to Drive Electric Vehicle Uptake' (The New Times | Rwanda, 16 April 2021) <https://www.newtimes.co.rw/news/rwanda-unveils-new-incentives-drive-electric-vehicle-uptake> accessed 26 January 2022.
[36] Ibid.
[37] 'Electric Vehicles to Make up 5% of Registered Vehicles in Kenya by 2025 - Kenyan Wallstreet' (28 October 2020) <https://kenyanwallstreet.com/electric-vehicles-to-make-up-5-of-registered-vehicles-in-kenya-by-2025/> accessed 26 January 2022.
[38] Ibid.

5.2. Adopting and Implementing Vehicles Standards in Africa

It has been observed that the different enforcement and testing regimes of world vehicle standards have made it difficult for Africa to adopt a unified vehicle standard, despite the fact that a unified vehicle standard has become even more necessary with the introduction of the African Continental Free Trade Area (AfCFTA), which should facilitate free vehicle trade across the continent.[39] At the moment, African countries are at various stages of adopting vehicle standards, with the African Organization for Standardization (ARSO) kicking off the development of a regulatory framework for the continent's automotive sector, with the only roadblocks being poor fuel quality, low consumer purchasing power, and a lack of data on used vehicle import.[40] There is also hope as Kenya banned used automobile imports older than eight years old in 2015, Tanzania charges an extra excise duty on used vehicles eight years old or older (counted from the year of production), and the entire East African Community began to apply standardised depreciation rates to these imports.[41]

There is a continuous need for African countries to explore frameworks such as AfCFTA to move the continent towards achieving verifiable vehicle standards.

5.3. Public-Private Partnerships for Funding, Research and Development and Operation of Electric Vehicles Infrastructure

Notably, worldwide vehicle legislation depends entirely on technology to reduce harmful emissions.[42] It has been correctly stated that the public and private sectors must collaborate openly, and state transportation agencies must remember their true purpose, which is to efficiently and effectively connect a region in a way that is inclusive of all parties who will be reliant on transportation infrastructure.[43] In other countries, such as the United States, the Department of Energy (DOE) collaborates with public and private sector partners to study, develop, and deploy technologies that improve the performance of electric vehicles.[44]

Notably, the construction and operation of a suitable electric vehicle charging infrastructure are prerequisites for the development and sustained operation of electric vehicles, as well as being important strategic measures for promoting a revolution in energy consumption and green development and as such,

[39] Ayetor GK and others, 'Vehicle Regulations in Africa: Impact on Used Vehicle Import and New Vehicle Sales' (2021) 10 Transportation Research Interdisciplinary Perspectives 100384.
[40] Ibid.
[41] 'African Countries Move toward Cleaner Car Imports' (*Climate & Clean Air Coalition*) <https://www.ccacoalition.org/en/news/african-countries-move-toward-cleaner-car-imports> accessed 2 February 2022.
[42] Ayetor GK and others, 'Vehicle Regulations in Africa: Impact on Used Vehicle Import and New Vehicle Sales' (2021) 10 Transportation Research Interdisciplinary Perspectives 100384.
[43] Callaway M, 'Transport in Kenya: Creating a More Efficient Network through Public-Private Partnerships', 7.
[44] 'Alternative Fuels Data Center: Electric Vehicle Research and Development' <https://afdc.energy.gov/fuels/electricity_research.html> accessed 26 January 2022.

in order to promote the development of electric vehicles, it may be useful to offer these services to mobilize initiatives by the government and market, where the government may play a leading role in infrastructure construction according to the public–private partnership (PPP) model, to share risks and achieve a win–win situation if the public and private sectors engage in clear communication and reach agreements about how social capital can be guided to participate actively in the provision of public goods and services.[45] Such collaborations are important if the continent is to achieve its dream of transitioning to electric vehicles.

6. Conclusion

Africa is considered the last frontier in the automotive industry, and it is expected to be the last to transition from fossil fuels to electric vehicles. As a result, it is critical that clean mobility become a priority immediately. [46]

Because of high rates of urbanization and economic growth, the continent is experiencing an unprecedented rate of motorization, and as a result, most countries in the region are unable to plan and provide adequate transportation infrastructure and services, as well as take advantage of technological advancements seen in other regions to improve energy efficiency and reduce vehicle emissions.[47] In the fields of environment and transportation, there is a need for governments, the private sector, civil society, and development to collaborate, as this will allow the continent to develop a set of measures to move to cleaner mobility, based on good practices and case studies from within and outside the region.[48] Notably, SDG 17 provides that achieving the ambitious targets of the 2030 Agenda requires a revitalized and enhanced global partnership that brings together Governments, civil society, the private sector, the United Nations system and other actors, mobilizing all available resources.[49]

With global automobile markets rapidly shifting due to a mix of technological advancements, rapidly falling costs, and technological advancements, the African continent may have an opportunity to adopt electric mobility as a more sustainable means of transportation.[50]

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[45] Tong Yang and others, 'Innovative Application of the Public–Private Partnership Model to the Electric Vehicle Charging Infrastructure in China' (2016) 8 Sustainability 738, 738 <https://www.mdpi.com/2071-1050/8/8/738> accessed 27 January 2022.

[46] Ayetor GK and others, 'Investigating the State of Road Vehicle Emissions in Africa: A Case Study of Ghana and Rwanda' (2021) 11 Transportation Research Interdisciplinary Perspectives 100409.

[47] 'Africa Clean Mobility Week' (*UNEP - UN Environment Programme*) <http://www.unep.org/events/conference/africa-clean-mobility-week> accessed 2 February 2022.

[48] Ibid.

[49] Environment UN, 'GOAL 17: Partnerships for the Goals' (*UNEP - UN Environment Programme*, 2 October 2017) <http://www.unep.org/explore-topics/sustainable-development-goals/why-do-sustainable-development-goals-matter/goal-17> accessed 3 February 2022.

[50] 'Africa's Bumpy Road to an Electric Vehicle Future' (*E3G*, 6 January 2021) <https://www.e3g.org/news/africa-s-bumpy-road-to-an-electric-vehicle-future/> accessed 2 February 2022.

Through targeted regulatory reforms, strategic international cooperation and public-private partnerships, Africa is capable of investing and achieving the global dream of transitioning to hybrid and electric vehicles and modes of transport as part of the larger agenda of achieving sustainability in all sectors of economy and combating climate change.

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