



Electrifying Public Transport in Intercity, Rural Areas and Secondary/ Satellite Cities in Rwanda

Status Quo Assessment
January 2024

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Table of Contents

- List of figures..... 4**
- List of tables 4**
- List of acronymes..... 5**
- 1. Introduction and Context 6**
 - 1.1. Scope and Objectives 6
 - 1.2. Expected Benefits and Impacts 6
 - 1.3. Transport Sector GHG Emissions 7
 - 1.4. Rwanda’s Administrative Structure.....10
 - 1.4.1. Secondary and Satellite Cities.....11
- 2. Policies and Governance 13**
 - 2.1. Policy Framework.....13
 - 2.2. Regulatory Framework.....16
 - 2.2.1. Public Transport Regulation16
 - 2.2.2. Public Transport Responsibilities16
 - 2.3. Planning Framework17
- 3. Public Transport Status Quo 18**
 - 3.1. Data Collection.....19
 - 3.2. Summary (Aggregated Data).....20
 - 3.3. Organizational Aspects21
 - 3.3.1. Rwandan Federation of Transport Cooperatives (RFTC)21
 - 3.3.2. Rural public transport22
 - 3.3.3. Organizational insights.....23
 - 3.4. Operational Aspects.....23
 - 3.4.1. Intercity Public transport.....25
 - 3.4.2. Intracity Public Transport.....26
 - 3.4.3. Rural Public Transport.....27
 - 3.4.4. Operational insights27
 - 3.5. Financial Aspects.....28
 - 3.5.1. Business and Financial Scheme28
 - 3.5.2. Financial insights.....29
 - 3.6. Environmental Aspects.....30
 - 3.6.1. Environmental insights31
 - 3.7. Ongoing Efforts to Improve Public Transport.....31

- 4. Electrification Market Assessment..... 32**
 - 4.1. Rwanda Energy matrix32
 - 4.1.1. Electricity generation33
- 5. Status of Bus Electrification 34**
- 6. SWOT Analysis 35**
- 7. Conclusions and Recommendations 40**
- References 42**
- Annex: Overview of key stakeholders 44**

List of figures

Figure 1. Rwanda's energy sector GHG emissions, tCO ₂ eq	8
Figure 2. Road transport GHG emission, tCO ₂ eq	9
Figure 3. Cumulative number of registered vehicles by category (2006-2018).....	10
Figure 4. Districts of satellite and secondary cities within the scope of the study	11
Figure 5. National public transport network.....	13
Figure 6. NDC emissions reduction scenarios	14
Figure 7. Reduction of Well-to-wheel (WTW) GHG emissions in a national electric mobility scenario	14
Figure 8. Public transport minibuses.....	18
Figure 9. Public transport coasters	19
Figure 10. Public transport buses	19
Figure 11. Location of bus stops.....	24
Figure 12 Distribution of population by accessibility class by province.....	25
Figure 13. Portion of intercity fleet in the total upcountry fleet.....	25
Figure 14. Portion of each fleet type within the total intercity fleet.....	26
Figure 15. Fleet composition in rural areas.....	27
Figure 16. Total energy supply in 2021	33

List of tables

Table 1. Population in selected districts.....	12
Table 2. Summarized Public transport data for intercity, secondary and satellite cities, and rural areas.....	20
Table 3. Key parameters of the intracity public transport	26
Table 4. Fuel consumption per year by intercity, intracity and rural public transport	30
Table 5. Estimated annual emissions by intercity, intracity and rural public transport (MtCO ₂)	31
Table 6. Installed capacity and electricity production in 2023.....	34
Table 7. Projection of electricity	34
Table 8. SWOT Analysis	36

List of acronymes

ATPR	Association des Transporteurs des Personnes au Rwanda
BAU	Business-as-usual
BMWK	German Federal Ministry for Economic Affairs and Climate Action (BMWK)
BRD	Rwandan Development Bank
CAGR	Compound Annual Growth Rate
CIT	Corporate Income Tax
EAC	East African Community
EDCL	Energy Development Corporation Limited
EUCL	Energy Utility Corporation Limited
EV	Electric Vehicles
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
ICE	Internal Combustion Engine
IEA	International Energy Agency
IKI	International Climate Initiative (IKI)
ITDP	Institute for Transportation and Development Policy
MININFRA	Ministry of Infrastructure of Rwanda
MoE	Ministry of Environment of Rwanda
NDC	Nationally Determined Contributions
PPP	Public-private partnership
REG	Rwanda Energy Group
RFTC	Rwandan Federation of Transport Cooperatives
RITCO	Rwanda Inter-Link Transport Company
RTDA	Rwanda Transport Development Agency
RURA	Rwanda Utility Regulatory Authority
SSATP	Africa Transport Policy Program
SWOT	Strengths, Weaknesses, Opportunities, and Threats
UETCL	Uganda Electricity Transmission Company Limited
UNEP	United Nations Environment programme
VKT	Vehicle Kilometres Travelled
WHO	World Health Organization
WTW	Well-to-wheel emissions

1. Introduction and Context

1.1. Scope and Objectives

The project ‘Mobilize Net-Zero - Facilitating the global transport transformation’ is implemented by the *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ) and is funded through the International Climate Initiative (IKI) of the German Federal Ministry for Economic Affairs and Climate Action (BMWK). Its primary objective is to encourage national governments worldwide to amplify their commitments toward decarbonising transport through collaborative international partnerships. By fostering alliances with progressive nations and leveraging exchange platforms like the Transport and Climate Change Week, Mobilize Net-Zero aims to facilitate cross-border learning and raise awareness on sustainable transport practices.

Within the scope of Mobilize Net-Zero, GIZ is supporting the government of Rwanda to develop a flagship project on decarbonising the public transport sector, with a specific focus on intercity transport, secondary and satellite cities, and rural transport. The main goal of these activities is to showcase a comprehensive transformation model while expediting the shift towards high-quality, flexible, and zero-emission public transport services in Africa—a leapfrogging process.

Additionally, recognizing that women rely more heavily on public transport and are affected much more by safety and accessibility issues, as well as limited access to job opportunities in the sector, their perspective is of particular importance; the project will thus pay particular attention at gender-based considerations of decarbonizing public transport in Rwanda.

This first report presents the status quo of the transport sector in Rwanda, delving into the country's climate objectives, the existing regulatory and planning framework, and the current state of intercity and rural transport systems in secondary and satellite cities. These insights serve as the foundation for formulating recommendations aimed at fostering the net-zero transformation of the sector.

1.2. Expected Benefits and Impacts

Adopting sustainable transport practices, and particularly improving and electrifying the public transport sector in Rwanda, will contribute to several general positive impacts that are well aligned with the government’s both economy-wide and sectoral policies and objectives:

- **Reduced greenhouse gas emissions:** Transport is a major source of greenhouse gas emissions, which are contributing to climate change. Sustainable transport can help to reduce these emissions by shifting towards cleaner modes of transport and improving the efficiency of vehicles and infrastructure. In Rwanda, the transport sector is responsible for 57% of energy-related GHG emissions, although motorization rates are comparatively low (however experiencing an average yearly growth of 10% in the last decade) and non-motorized transport, especially walking, accounts for more than half of all trips ([SSATP, 2020](#)).
- **Improved air quality and health:** Transport is an important source of air pollution in urban areas in Rwanda, which can cause respiratory and other health problems. This issue has gained importance in the last years, as the levels of particulate matter

significantly exceed WHO recommended levels on a regular basis (SSATP 2020), prompting the development of the 2014 'Strategy for Reduction of Traffic Congestion and Air Pollution in the City of Kigali'. Improving and promoting public transport can help reduce those emissions and improve air quality. As with greenhouse gas emissions, an ageing and highly polluting vehicle fleet is the main source of air pollution in Rwanda's transport sector. The public transport fleet in intercity, rural areas and secondary/satellite cities has an average age of 19 years.

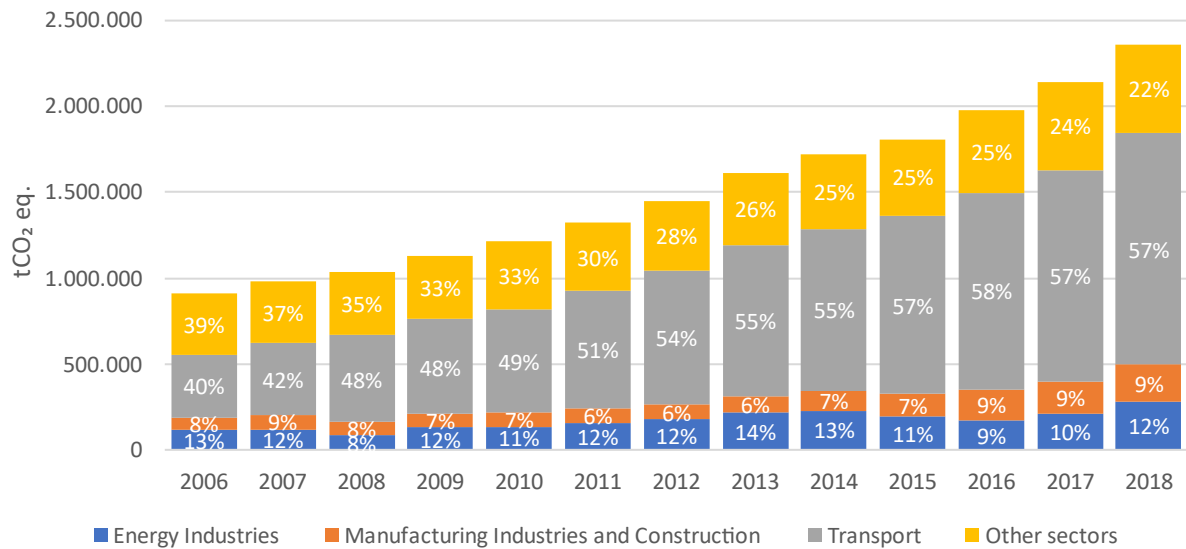
- **Increased access:** Sustainable transport can improve mobility for all groups in society, thereby enhancing access to jobs, education, and other essential services. This is particularly important in Rwanda, where the government aims to raise the proportion of the urban population to 35% by 2024 ([MININFRA, 2019](#)). This will be achieved by promoting urban development and growth in secondary and satellite cities. Currently, public transport is limited to a few corridors on the main national roads, which correspond to the country's intercity public transport service connecting the main urban nodes. In other words, public transport in urban and intercity areas outside of Kigali is largely the same. While 23% of people in Kigali have reasonable access to public transport (living within 500 metres of a bus station), this is the case for less than 3% of the population outside the capital (MININFRA, 2019).
- **Job creation, protection, and improved working conditions:** Investing in the electrification of the public transport sector can lead to new job opportunities, as the required service (maintenance, repairs, handling and recycling of batteries, etc.) and physical (installation and operation of charging stations) infrastructure must be built from the ground.
- **Reduced oil dependency:** Rwanda is dependent on fossil fuel imports, and the transport sector is one of the largest consumers of fossil fuels. Decarbonizing the transport sector, coupled with increasing the share of renewable energy, will help Rwanda reduce these import dependencies and improve its trade balance.

1.3. Transport Sector GHG Emissions

According to the National Greenhouse Gas Inventory (2016-2018) from the National Institute of Statistics, the energy sector in Rwanda emitted 2.35 million tCO₂e in 2018. The transport sector was the largest contributor, accounting for 57% of these emissions (see figure below).

82.8% of GHG emissions reported from the energy industries are attributed to electricity generation, amounting to 229,680 tCO₂e in 2018. Given the relevance of the electricity sector for public transportation electrification, a detailed assessment of the subsector can be found in Section 4.

Figure 1. Rwanda's energy sector GHG emissions, tCO₂eq

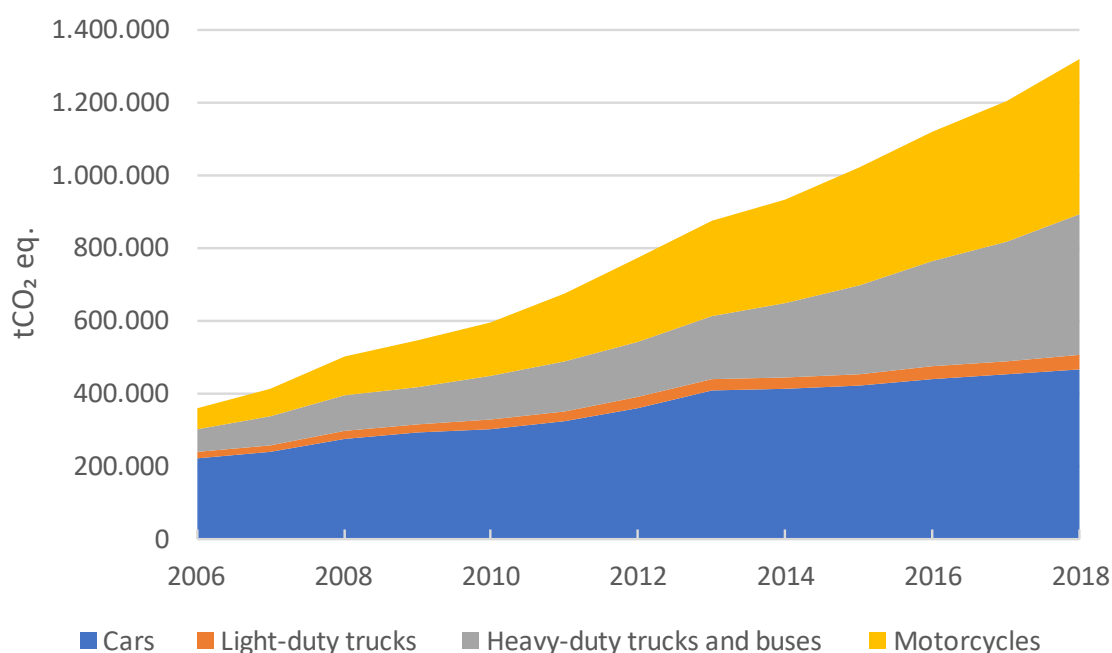


Source: National Institute of Statistics of Rwanda, 2021

Transport emissions have consistently increased over the years, with a 12% compound annual growth rate (CAGR) from 360,000 tonnes in 2006 to 1.34 million tCO₂e in 2018 - the highest in the sector. Within this sector, road transport remained on top of emissions for the whole period with 98% of the total emissions in 2018 (1,32 million tCO₂e). This subsector has experienced an annual growth between 2006 and 2018 of 11,5%.

The figure below provides a breakdown of the road transport GHG by vehicle category. At the beginning of the period, cars accounted for 61% of total GHG emissions and had a CARG of 6.5%, reflecting a steady but comparatively lower growth rate. Heavy-duty trucks and buses, experiencing a substantial CARG of 16.0%, emerge as a notable source of emissions growth, drawing attention for the development and implementation of cleaner technologies in the freight and public transport sectors. Finally, motorcycles experienced the highest CARG of 18,1%, starting with 16% of total road transport emissions in 2006 and ending with 32% in 2018.

Figure 2. Road transport GHG emission, tCO₂eq

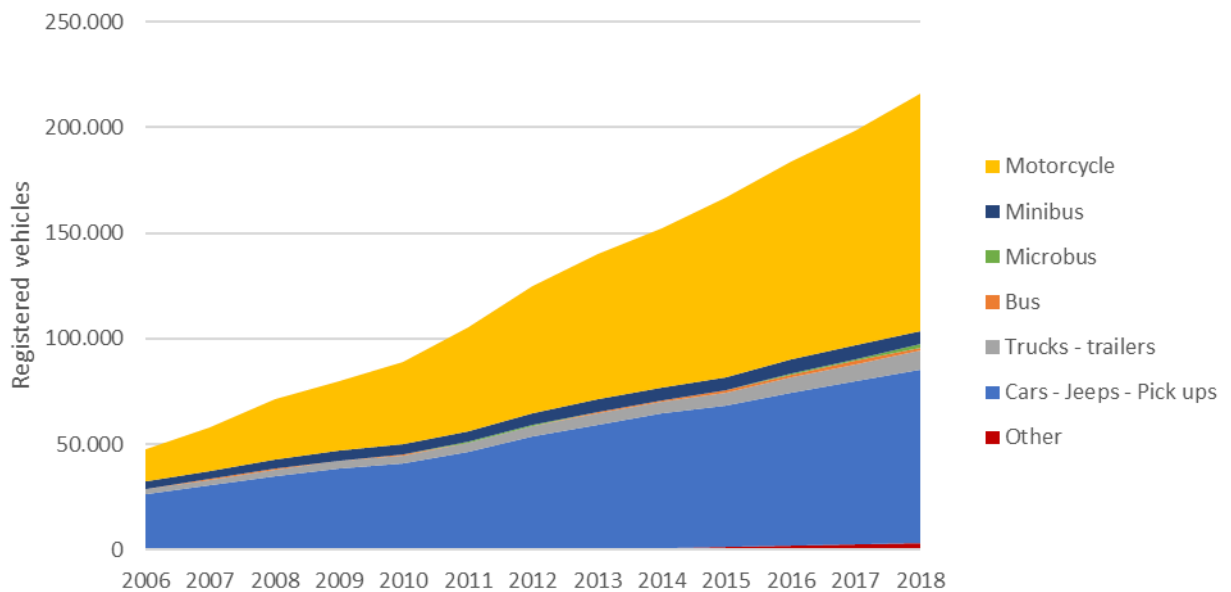


Source: National Institute of Statistics of Rwanda, 2021

The main factor contributing to the raise in GHG emissions in the transport sector is the rapid expansion of the vehicle fleet; the annual vehicle growth rate is 12% (Ministry of Infrastructure (MININFRA), 2021). This growth in recent years has been fuelled by rapid urbanization, economic development, and increased personal mobility, and is particularly seen with motorcycles, which now account for nearly half of the total vehicle fleet. The following figure provides insights into the cumulative number of registered vehicles across different categories from 2006 to 2018. The total number of registered vehicles has consistently increased, reaching 216,090 in 2018, with a CAGR of 13.4%.

Cars, jeeps, and pickups maintain the largest share throughout the period, representing a consistent portion of the total vehicles, with a CAGR of 10.0%. Trucks and trailers, though growing at a CAGR of 11.8%, contribute to a significant but relatively stable share. Buses, minibuses (coaster), and minibuses show notable increases in their respective shares, particularly buses with a substantial CAGR of 27.3%. This observed growth in the bus fleet, compared to micro- and minibuses, is the result of government efforts to increase the share of higher capacity vehicles, a process that has been accompanied by a sectoral reform shifting away from an informal to a regulated sector. In line with the GHG emissions, the dynamic growth of motorcycles results in an expanding share, emphasizing their increasing presence in the overall vehicle mix. Despite their relatively small numbers in 2006, motorcycles carve out a more significant share by 2018, showcasing their rising popularity.

Figure 3. Cumulative number of registered vehicles by category (2006-2018)



Source: National Institute of Statistics of Rwanda, 2021

Furthermore, Rwanda's significant dependence on imported gasoline and diesel for transport underscores the importance of prioritizing decarbonization efforts in this sector. In response to this challenge, Rwanda, as a member of the East African Community (EAC), has committed to its 2050 vision, which emphasizes the need for immediate climate action and alignment with the Paris Agreement. The 2020 update of the Nationally Determined Contributions (NDC) prioritizes the transport sector. This is reflected in initiatives such as the construction of bus rapid transit lines, support for non-motorized transport lanes, and the introduction of electric buses.

1.4. Rwanda's Administrative Structure

Rwanda is divided into four provinces, the City of Kigali, and 30 districts, each with urban and rural settlements. However, despite this structured division, many of the country's resources, key players, and infrastructure developments are concentrated in the capital city of Kigali. The concentration of resources and development opportunities in Kigali has resulted in relative neglect of secondary and satellite cities, creating disparities across regions.

To tackle the issue of disproportionate concentration in Kigali, which includes its growing traffic congestion, the government is developing secondary cities such as Musanze, Rubavu, Rusizi, Nyagatare, and Huye. Additionally, proposed satellite cities like Bugesera, Rwamagana, and Muhanga aim to decentralize urban growth. This expansion strategy promotes balanced development by distributing resources and opportunities, as stated by the Government of Rwanda in 2022. Different instruments have been deployed by the Government to develop secondary and satellite cities; these include but are not limited to:

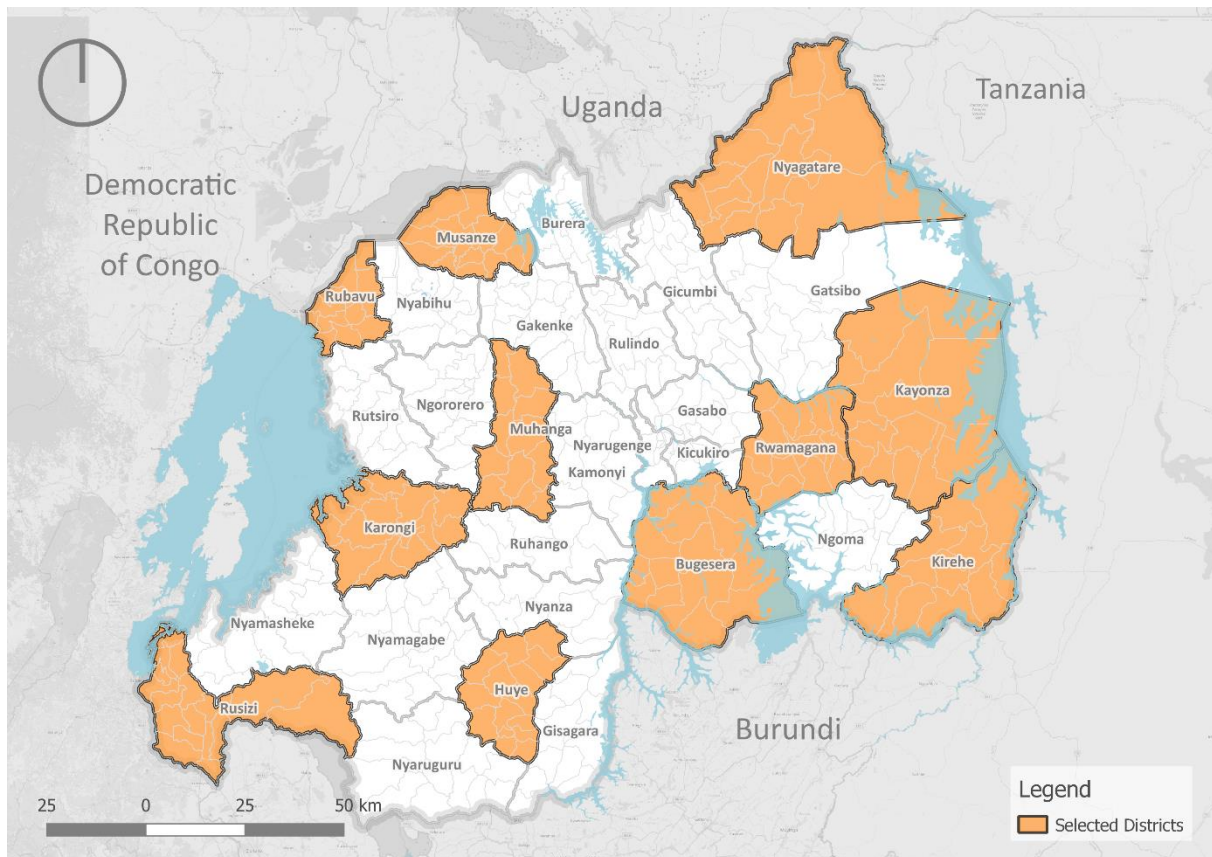
- preparation of master plans;
- provision of infrastructures (tarmac roads, water treatment and supply facilities, internet network, modern health facilities, modern markets, hotels, universities, etc);

- delegation / decentralization of specific sectoral competences and capacities to local governments, mainly through the establishment of sectoral managers in secondary and satellite cities

1.4.1. Secondary and Satellite Cities

In line with this vision, and after discussions between MININFRA and GIZ, the project partners agreed to focus its efforts in bus electrification in intercity and intracity public transport, that is 8 secondary cities and 3 satellite cities that concentrate 42% of the total urban population: Muhanga, Nyamata, Rwamagana, Nyagatare, Huye, Muzanse, Rubavu, Rusizi, Kayonza, Kirehe and Karongi, located in the country as shown in the following figure.

Figure 4. Districts of satellite and secondary cities within the scope of the study



Source: GIZ, 2023

Considering that Rwanda’s population is predominantly rural (72% in 2022¹), the availability of public transport in those areas is crucial for residents to access essential services, markets, and employment opportunities, and including them in the study is key for addressing the country’s environmental and economic challenges. Therefore, this report also includes an overview of the rural public transport, mainly in the districts highlighted in the previous map, which account for 38.6% of the total rural population in the country.

¹ National Institute of Statistics Rwanda

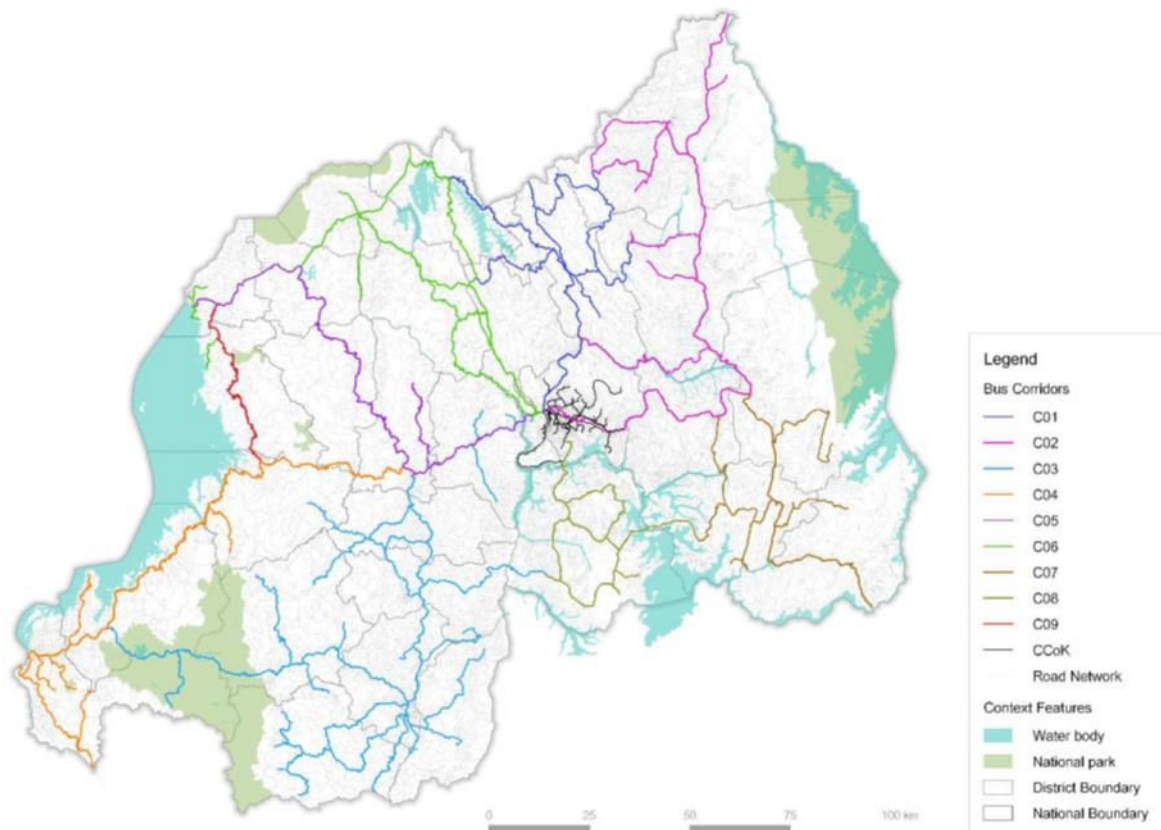
Table 1. Population in selected districts

City type	Province	District	Selected city	Total District Population 2022	% of rural population within District
Country	-	Rwanda	-	13,246,394	72%
Capital	Kigali	Kigali	Kigali	1,745,555	13%
Satellite	Southern Province	Muhanga	Muhanga	358,433	76%
	Eastern Province	Bugesera	Nyamata	551,103	60%
		Rwamagana	Rwamagana	484,953	63%
Secondary	Eastern Province	Kayonza	Kayonza	457,156	86%
		Kirehe	Kirehe	460,860	94%
		Nyagatare	Nyagatare	653,861	76%
	Western Province	Rubavu	Rubavu	546,683	46%
		Rusizi	Rusizi	485,529	67%
		Karongi	Karongi	373,869	91%
	Southern Province	Huye	Huye	381,900	79%
	Northern Province	Musanze	Musanze	476,522	51%

Source: National Institute of Statistics Rwanda, 2022

The connectivity of intercity, intracity and rural public transport network in the country is presented in the following figure.

Figure 5. National public transport network



Source: (Ministry of Infrastructure (MININFRA), 2019)

2. Policies and Governance

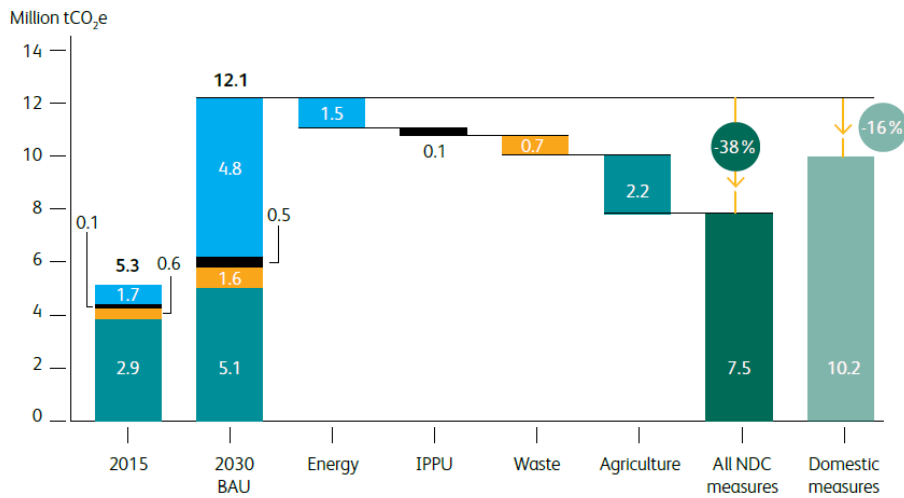
2.1. Policy Framework

This section provides the framework within which public transport planning efforts should be directed to achieve the NDC targets and the climate and public transport objectives that the country has set for the coming years, which have been derived from the following policy and strategic documents:

1. Updated Nationally Determined Contribution, Ministry of Environment, 2020.
2. National Transport Policy and Strategy for Rwanda, Ministry of Infrastructure, 2021
3. Strategic Paper on Electric Mobility Adaptation in Rwanda, Ministry of Infrastructure, 2021
4. National Greenhouse Gas Inventory (2006-2018), Ministry of Environment, 2021

In Rwanda's Nationally Determined Contribution (NDC) the country set the target of a 38% reduction in GHG emissions compared to business-as-usual (BAU) in 2030, equivalent to an estimated mitigation of up to 4.6 million tCO₂e in 2030 (MoE, 2020).

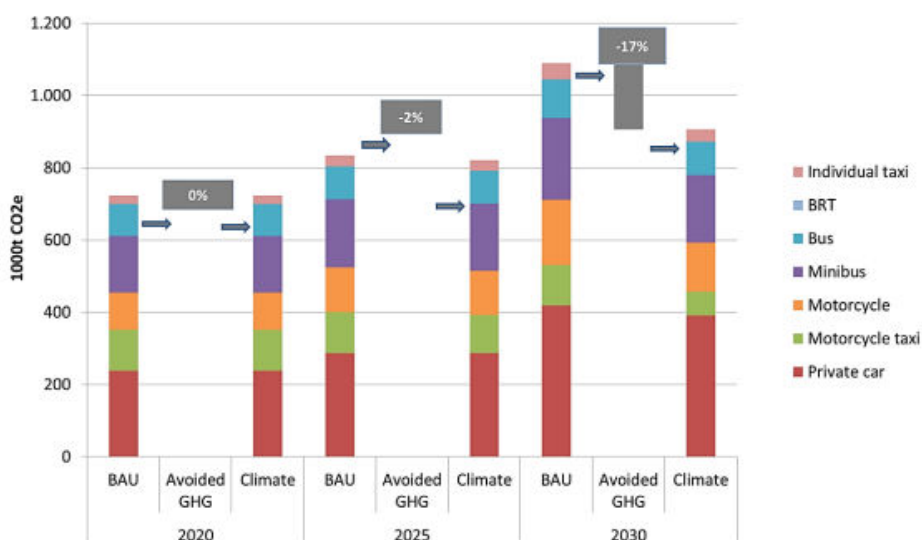
Figure 6. NDC emissions reduction scenarios



Source: Updated Nationally Determined Contribution, Ministry of Environment, 2020

Through the Ministry of Infrastructure, the country has also identified the potential to reduce greenhouse gas (GHG) emissions by 17% (182,000 tCO₂e) in 2030 with the introduction of electric vehicles (EVs) compared to a business as usual (BAU) scenario. The EV scenario has been defined in the study in the light of the proposed market-based electric mobility policy, which focuses on enabling the use of electric vehicles where they are economically viable, at least in the medium term, or at little additional cost to the taxpayer, but can make a significant contribution to energy independence, air quality improvement and/or GHG mitigation. In this scenario, public transport (excluding taxis) is a significant driver of absolute emissions reductions, with a contribution from buses and minibuses of 55,000 t CO₂e in 2030 (FONERWA, 2019).

Figure 7. Reduction of Well-to-wheel (WTW) GHG emissions in a national electric mobility scenario



Source: Fonerwa 2019

Beyond the electrification of vehicles, Rwanda's government has developed a policy framework that focuses on promoting green and climate-resilient transport, developing efficient and reliable public transport services, and protecting the environment by reducing transport emissions.

The proposed targets and objectives at the national level, established in the National Transport Policy and Strategy for Rwanda by the Ministry of Infrastructure in 2021, are:

- Promoting green and climate-resilient transport:
 - i. Develop the required infrastructure to facilitate electric mobility, including charging stations, power grids, and battery recycling facilities.
 - ii. Implement incentives to facilitate investment in electric mobility, such as tax breaks, subsidies, and preferential financing
 - iii. Phased adoption of electric vehicles (including e-buses), starting in 2020.
 - iv. Convert 30% of motorcycles, 8% of cars (including jeeps), 20% of buses and 25% of taxi and mini/microbuses that could reduce GHG emissions by approximately 17% 2030. (KFW - Fonerwa, 2019)
- Developing efficient and reliable public transport services:
 - i. Prioritize public transport in the design and operation of urban roads, ensuring dedicated lanes and bus stops.
 - ii. Ensure that the public transport system is integrated, reliable, secure, affordable, and accessible to all users, regardless of physical ability.
 - iii. Encourage competition "for the market" rather than "in the market," promoting innovation and efficiency in the public transport sector.
 - iv. Enhance the use of intelligent transport systems (ITS) to improve public transport services, such as real-time route information and demand-responsive routing.
 - v. Establish a framework to support public transport services where proven necessary, such as through subsidies or public-private partnerships.
 - vi. Promote the shift from low to high occupancy vehicles, i.e. phase out mini- and microbuses and increase the share of high occupancy buses
- Protecting the environment by reducing transport emissions:
 - vii. Promote the purchase of low-polluting vehicles, including electric vehicles and trains, through incentives and awareness campaigns.
 - viii. Continue periodic vehicle inspection and testing for safety, compliance with emission standards, and certification of auto garages.
 - ix. Implement measures to mitigate the environmental impacts of electric vehicles, such as those associated with battery disposal.

2.2. Regulatory Framework

Rwanda's transport sector is regulated by several laws and policies, including the Law Governing Inland Transport and Waterways, the National Transport Policy, and the Rwanda Urban Mobility Strategy. These laws and policies aim to ensure the safety, efficiency, and sustainability of the transport sector.

2.2.1. Public Transport Regulation

The participation of the private sector in public transport is regulated through a service contract under route franchising (net cost contract). The organs responsible for road public transport operations are the Rwanda Transport Development Agency (RTDA), Rwanda Utility Regulatory Authority (RURA), and the City of Kigali. The regulation in Rwanda requires that intercity or multi-stop services use buses of at least 25 seats, that vehicles are no more than 20 years old, and that all public transport operators use e-ticketing or other automated fare collection methods. E-ticketing mechanisms are widely regarded as beneficial measures for streamlining public transport services by reducing the time and effort required for fare collection. This can also minimize fraud and enhance revenue collection.

Existing regulations, however, are not yet fully implemented. As shown in chapter 3, minibuses and coasters account to 38% and 54% of the total fleet in intercity, rural areas and secondary/satellite cities, respectively. According to SSATP, one of the main challenges refers to the existing service contracts, which currently have a duration of 5 years and *“do not facilitate fleet improvement including the introduction of higher occupancy vehicles by operators (...) It is therefore recommended that the duration of bus operating contracts be extended to 7 years or more in order to provide operators with greater certainty and to facilitate investment in fleet recapitalization and the replacement of low occupancy vehicles (...) on routes that encompass long trip distances”* (SSATP, 2018). A potential solution being explored currently by RURA refers to the shift from route licences allowing competition-in-the-market between operators, to a franchise model that would lead to competition-for-the-market at the route level.

2.2.2. Public Transport Responsibilities

Operators are responsible for developing and submitting bids to Rwanda Utility and Regulatory Authority (RURA) to operate routes; developing timetables and staff schedules (subject to validation by RURA); providing and maintaining premises and vehicles; managing the day to day operations on given routes; providing supervision of routes, ensuring service quality and dealing with disruptions; controlling the use of passes and collecting any cash revenues on buses; complying with the national laws and regulatory regimes, including Operating Licenses; providing data that is required by RURA; and recruiting, training and managing staff.

On the other hand, RURA, as the National Agency, is responsible for planning and determining the route network; specifying the frequency; setting and monitoring quality and safety standards; setting vehicle capacities and minimum standards; agreeing with the schedule prepared by the operator; setting fares and monitoring its implementation; licensing fare collection operators, licensing speed governors suppliers; and coordinating public customer service contacts, complaints, comments and compliments. District governments of secondary and satellite cities currently have no regulatory, planning or policy-making powers for public transport. Their current responsibilities are mostly limited to the management and maintenance

of road infrastructure, and their staff consists mostly of one road and one electrical engineer. The identification of new public transport routes can also originate at the district level, based on assessed changes in the demand for PT services as the cities develop. This usually happens through consultations with the local population, after which the district government assesses the feasibility to service new lines with the private operators (e.g., whether there are enough vehicles that can be (re)assigned). In the districts interviewed by GIZ (Huye, Muhanga, Nyagatare and Rwamagana/Kayonza) interest was shared by government representatives to create new PT routes and by private operators (especially the Rwandan Federation of Transport Cooperatives (RFTC), which operates the majority of coasters and minibuses) to acquire new vehicles (see Chapter 3.3.) to cater for the growing demand in these areas.

With the recent preparation of master plans for all secondary and satellite cities, institutional changes are expected in the near future. During interviews with the above-mentioned districts in 2024, GIZ was informed of plans to establish local transport departments (or, at the minimum, to introduce (urban) mobility managers) with greater regulatory and planning powers. As most secondary and satellite city master plans have only recently been adopted or are still under review by the national cabinet, there is no clear timeline for when these institutional changes are expected to be implemented.

The upcoming institutional developments represent a great opportunity to ensure that electric mobility is properly taken into account at the local level. The electrification of the public transport fleet could thus be complemented by capacity building measures for secondary and satellite cities, as well as an institutional assessment of the competences to be acquired in the field of electric mobility.

Finally, and considering the goals of public transport electrification, it is worth mentioning that the expansion, maintenance, and operation of energy infrastructure are under responsibility of Rwanda Energy Group (REG), a state-owned company, through its two subsidiaries – the Energy Utility Corporation (EUCL) and the Energy Development Corporation (EDCL). The Ministry of Infrastructure and REG jointly plan the generation and transmission as well as electrification projects.

2.3. Planning Framework

The review of the strategic documents has also provided valuable insights into the roadmap laid out by the government to achieve its environmental targets. This collection of strategies, plans, and measures has been organized into three main categories: public transport, electric mobility, and other initiatives.

- **Public transport:** The government's plan for public transport focuses on expanding and improving city bus services, providing supporting infrastructure, introducing concessional fares, and implementing integrated electronic fare collection. The government also aims to transition to gross cost contracts and to minimize breakdowns by supporting the introduction of a modern bus fleet. (Ministry of Infrastructure, 2021)
- **Electric mobility:** In this regard, the government focuses on developing technical standards, sound business models, efficient placement of charging infrastructure, improved grid reliability, and collaboration with international partners. The government is also considering introducing differential time-of-use rates for electricity to mitigate grid

load effects and lower the tariff for EV battery chargers during low demand periods. (KFW - Fonerwa, 2019)

- **Other initiatives:** In addition to the specific initiatives outlined, the government has also implemented other measures to improve public transport, such as electronic ticketing systems for intercity buses, mobile phone-based booking systems, and automated fare collection used in buses in the CoK. (Ministry of Infrastructure, 2021).

3. Public Transport Status Quo

This section explores the current state of public transport vehicles, categorized by the type of service: intercity, intracity and rural. their passenger capacity as defined in both regulations and industry practices. To understand the classifications used in the types of vehicles used to operate those services, it is important to note the following: Passengers Road Transport Regulations N°007/TRANS/RT/RURA/2015 defines a bus as having more than 25 seats, while a minibus falls between 14 and 24 passengers. However, in practice, the public transport landscape can be broken down into three main classes: Minibuses, coasters and buses.

1. **Minibus:** A vehicle which has carrying capacity ranging from 14-24 passengers.

Figure 8. Public transport minibuses



Source: ITDP, 2024

2. **Coaster:** A vehicle which has carrying capacity ranging from 25-35 passengers

Figure 9. Public transport coasters



Source: Kigalitoday, 2024

3. **Bus:** A vehicle which has carrying capacity of 36 passengers

Figure 10. Public transport buses



Source: Kigalitimes, 2024

3.1. Data Collection

All data presented in the present report is secondary data collected from the following sources:

- National transport policy and strategy for Rwanda (MINIFRA, 2021)
- Strategic paper on electric mobility adaptation in Rwanda (MINIFRA, 2021)
- Rwanda: Inclusive and Electric Last Mile Connectivity Study (World Bank, 2021)
- Feasibility study on e-mobility, (FONERWA, 2019).

- Road and Public Transport Accessibility Study in Rwanda (MININFRA, 2019)
- Statistics in transport sector (RURA, 2022)
- Interim report for the development of business models for Public Transport services for intercity and rural bus routes (RTDA, 2023).

The additional data on the number and names of operators that provide public transport services on the nine corridors, were shared by 'Association des Transporteurs des Personnes au Rwanda (ATPR).

3.2. Summary (Aggregated Data)

The statistics in **Fehler! Verweisquelle konnte nicht gefunden werden.** indicate that the public transport is dominated by coasters followed by minibuses, while the number of buses is still low.

Table 2. Summarized Public transport data for intercity, secondary and satellite cities, and rural areas.

SN	Data category	Quantity (total)	Intercity	Intracity	Rural
1	Total fleet size (number)	1,835	561 (30%)	17 (1%)	1,257 (69%)
2	Minibuses (number)	706	71 (10%)	4 (1%)	631 (89%)
3	Coasters (number)	1,008	405 (40%)	10 (1%)	593 (59%)
4	Buses (number)	121	85 (70%)	3 (2%)	33 (28%)
5	Average age for public transport vehicles (years)	19	14	12	27
6	Number of corridors ²	9	9	2	9
7	Number of routes	613	72 (12%)	4 (1%)	537 (87%)
8	Average route length (Km)	69	94	18	65
9	Average daily Vehicle Kilometer Travelled, VKT (Km)	276	376	108	256
10	Number of operators ³	33	33	3	33

² The total number of corridors is nine. These nine corridors are used by intercity and rural public transport services while intracity services use only two of them.

³ Companies that operate on intercity routes, also operate on rural routes, and three of them extend their services to intracity routes.

Source: (Rwanda Utilities Regulatory Authority (RURA), 2022), (Rwanda Transport Development Agency (RTDA), 2023)

All minibuses (hiace) and 93% of coasters are manufactured in Japan by Toyota Motor Corporation, while common buses brands are Yutong, Higher, and Hyundai with a share of 54%, 18% and 16% of the total fleet, respectively (Rwanda Utilities Regulatory Authority (RURA), 2022). All Public transport vehicles follow standards set by RURA in the regulations No 010/TL-TPT/TRANS/RURA/2021 OF 14/12/2012 governing public transport bus services.

Rwanda Federation of Transport Cooperative (RFTC) is the biggest operator with 38% of the total fleet on 68% of all routes, followed by RITCO, Volcano, Horizon, and Stella, with 5%, 4%, 4%, and 3 % of the total fleet respectively on 10% of all routes (Rwanda Utilities Regulatory Authority (RURA), 2022).

All public transport licenses in intercity, intracity and rural public transport have a net cost contract nature with no subsidies.

3.3. Organizational Aspects

Public transport services in intercity areas and secondary and satellite cities are provided by private companies, with the exception Rwanda Interlink Transport Company (RITCO), which is a public-private partnership transport company, owned by the Rwandan Federation of Transport Cooperatives (RFTC) and the Government of Rwanda.

3.3.1. Rwandan Federation of Transport Cooperatives (RFTC)

Due to the especial organizational nature of RFTC and associated companies (RITCO, and Jali Investment Group, and the later has three subsidiaries, namely Jali savings and credits Plc, Jali Transport and Jali Real Estates), its importance regarding its market size and its role in owning and operating the majority of bus parks throughout the country, this sub-chapter is entirely dedicated to presenting RFTC organization and offering an assessment of its readiness to electrify its fleet.

RFTC refers to the umbrella organization that encompasses 12 regional cooperatives distributed throughout Rwanda. Generally, each regional branch has its headquarters in a major urban center (i.e. secondary or satellite city) and is responsible for the following functions:

- Organization and management of members, consisting of the owners of the vehicles;
- Ownership and operation of part of the vehicle fleet, which is comprised both of vehicles owned by RFTC, and those owned by its (individual) members;
- Acquisition of new vehicles, usually through loans from the Rwandan Development Bank (BRD) facilitated by the national representation of RFTC for the fleet owned by regional RFTC branches, or through loans from Jali Finance to private vehicle owners (more details below);
- Application / request of operating licenses from RURA and assignment of vehicles to routes;

- Identification of new routes (sometimes in coordination with district government and RTDA);
- Ownership and/or lease of parking spaces, usually at the bus park / main station, garage, fuel station or car wash.

The national branch of RFTC, located in Kigali, is responsible for the overall coordination and representation of its members, and also for providing financial support to the regional branches for the acquisition of new vehicles. For this purpose, the national representation negotiates the loans with the Rwandan Development Bank (BRD) or private banks and provides the requisite guarantees on behalf of the regional branches. In addition, the national branch plays an important role in providing the maintenance infrastructure to its members, signing a maintenance agreement with a private garage which has branches across the country where RFTC operates.

RFTC owns two companies which include RITCO, and Jali Investment Group, and the later has three subsidiaries, namely Jali savings and credits Plc, Jali Transport and Jali Real Estates. They are responsible for providing additional public transport services, as well as support services and infrastructure to the regional RFTC branches and their members:

- Jali Saving and Credits Plc provides access to finance to the private members (i.e. individual vehicle owners) of RFTC;
- Jali Real Estates Ltd owns the majority of bus parks/terminals throughout the country;
- Jali Transport Ltd provides public transportation services in the City of Kigali;
- RITCO provides public transport services in the City of Kigali and intercity areas and is a public-private partnership (PPP) between RFTC and the Rwandan government.

3.3.2. Rural public transport

Compared to the well organized and consolidated public transport ecosystem in intercity areas and secondary / satellite cities, the organizational landscape in rural areas, in particular minibus operations, resembles what is commonly known as paratransit services:

- Ownership and operations are fragmented, whereby not companies, but individual operators and vehicle owners provide public transport services.
- The vast majority (631 vehicles, or 89%) of the remaining minibus fleet in the country operates in rural areas. The average age of these vehicles is 27 years.
- Unlike urban public transport, which is characterised by growing demand and an insufficient supply of vehicles, rural public transport is not nearly as profitable, suffers from much lower demand, and services are severely hampered by the challenges posed by unpaved roads (and rainfall).
- The challenges and characteristics presented above constrain access to finance for fleet renewal, which in turn negatively impact the attractiveness of these services and vehicles, especially when other alternatives are available (e.g. coasters).
- Fragmented operations do not enjoy the benefits of the support infrastructure provided by RFTC and/or private companies, such as the availability of maintenance services.

3.3.3. Organizational insights

All the regional branches of RFTC interviewed by GIZ share the same perception that minibuses are becoming increasingly unattractive to passengers compared to coasters, as the latter offer greater space and comfort for the same price and offer express services (less stops). Equally, all branches have either recently purchased new coasters (not second-hand) and/or have plans to expand their fleets, reflecting a growing and unmet demand for public transport services across districts.

Because of the wide range of functions performed by RFTC and its subsidiaries (from providing public transport services, to acquiring and financing vehicles, to providing parking infrastructure), Rwanda's cooperatives appear well positioned to explore the electrification of their fleets and the provision of charging infrastructure. They have also clearly expressed an interest in this technology, but their members have not yet had any direct experience with electric mobility. Another challenge is the relatively long distances travelled by RFTC vehicles, which can go beyond 200 km per day. Due to Rwanda's hilly topography, it is essential to test the technical feasibility of electrifying the public transport fleet under current operating conditions and to identify the routes with the greatest potential for electrification. However, as most vehicles make between 1.5 and 2 round trips per day (which explains the long distances), the feasibility of opportunity charging between round trips should be explored.

On the other hand, the particular characteristics of rural public transport makes electrification in these areas particularly challenging and highly unlikely to happen in the short to medium term without significant government support and intervention.

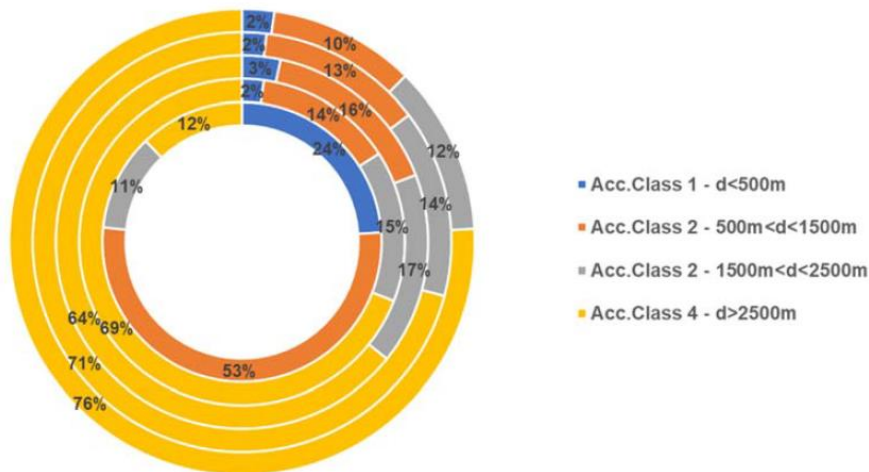
3.4. Operational Aspects

Public transport services in intercity, secondary and satellite cities as well as rural areas are provided by private operators using minibuses, coasters, and buses. Paved intercity routes represent 96% and pass through secondary and satellites cities. Unlike intercity routes, 20% of rural routes are unpaved and present poor conditions during rainy seasons.

The average daily VKT per vehicle is approximately 276 km for all services combined. The average daily VKT per vehicle for intercity, intracity and rural routes, are 376 km, 108 km and 256 km respectively (Rwanda Transport Development Agency (RTDA), 2023).

The connectivity of intercity and rural public transport network and bus stops are illustrated on the map in *Figure 5. National public transport network* and *Figure 1112. Location of bus stops*.

Figure 13 Distribution of population by accessibility class by province



The inner ring represents the City of Kigali, whereas the others represent (in order) the Southern, the Western, the Northern, and the Eastern Provinces.

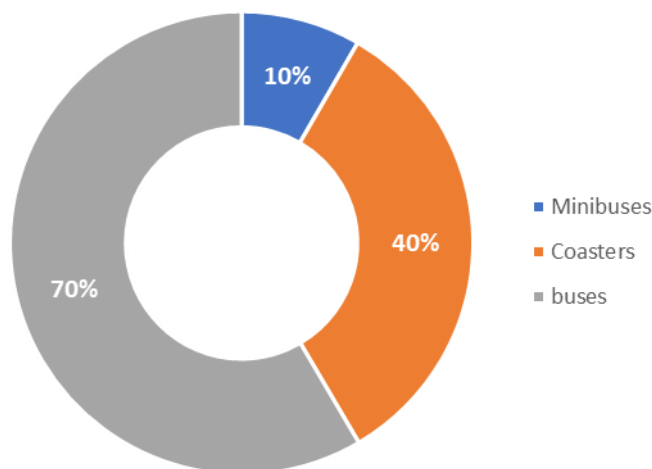
Source: (Ministry of Infrastructure (MININFRA), 2019)

3.4.1. Intercity Public transport

Intercity public transport refers to services that connect cities, namely the City of Kigali, secondary, satellite cities, and district main towns. There are 561 vehicles that operate on 72 Public transport service routes (12% of total routes) that are allocated in 9 corridors. The average route length is 94 km, and the fleet size includes 71 minibuses, 405 coasters as well as 85 buses. The average age of the fleet is 14 years, with 28 years for minibuses, 14 years for coasters, and 5 years for buses. Each vehicle has an average daily VKT of 376 km (Rwanda Transport Development Agency (RTDA), 2023).

The portions of intercity fleet and each fleet category within the total upcountry public transport fleet are indicated in the following figures.

Figure 1415. Portion of intercity fleet in the total upcountry fleet

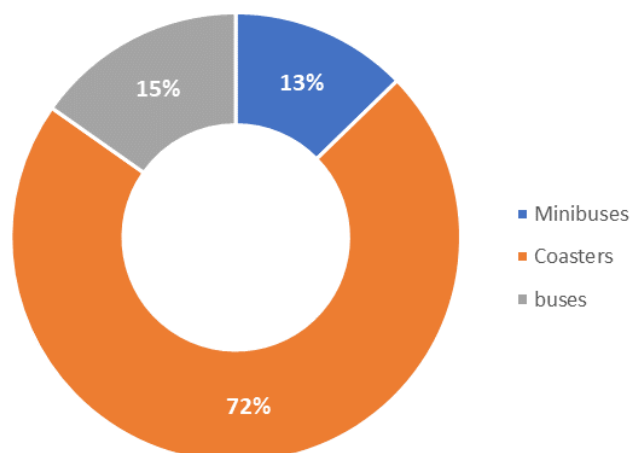


Source: (Rwanda Utilities Regulatory Authority (RURA), 2022)

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Intercity Public Transport accounts for 31% of the total upcountry fleet (561 out of 1,835) and more buses are operated on intercity routes compared to intracity and rural routes.

Figure 1617. Portion of each fleet type within the total intercity fleet



Source: (Rwanda Utilities Regulatory Authority (RURA), 2022)

As indicated in the Figure 1617 above, the intercity public transport is dominated by coasters followed by buses with express service (vehicles pick passengers at the origin and pay a flat fee for the whole route even if they alight along the route) whereas minibuses provide a multi-stop service (vehicles pick passengers at stops along the routes and pay the distance travelled). All public transport vehicles consume fossil fuel with contribute to air pollution.

3.4.2. Intracity Public Transport

Intracity public transport refers to passengers' transport by public vehicles within secondary and satellite cities.

Currently, there are four intracity routes that start and end within secondary and satellite cities. These include services in Rubavu and Huye cities on the routes of Mahoko-Rubavu CBD, Rubavu CBD-Brasserie, and Rubavu CBD-Nkora as well as Huye CBD-Rango in Huye City. The key parameters of the intracity public transport are summarized in the **Fehler! Verweisquelle konnte nicht gefunden werden..**

Table 3. Key parameters of the intracity public transport

Parameter	Value/Number
Total intracity fleet size (nr of vehicles)	17
Minibuses (number)	4
Coasters (number)	10
Buses (number)	3
Av age for Minibuses (years)	29
Av age for coasters (years)	7
Av age for buses (years)	7

Parameter	Value/Number
Overall average age (years)	12
Number of corridors	2
Number of routes	4
Average route length (km)	18
Average trips per vehicle	6

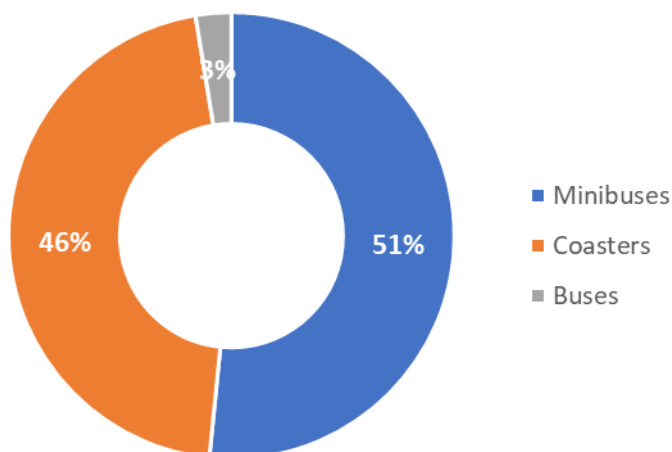
Source: (Rwanda Transport Development Agency (RTDA), 2023), (Rwanda Utilities Regulatory Authority (RURA), 2022)

To improve intracity public transport, RTDA is proposing more services in secondary and satellite cities anticipating the future increase in passenger trips (Rwanda Transport Development Agency (RTDA), 2023).

3.4.3. Rural Public Transport

The passenger transport by public vehicles from capital city and secondary cities as well as rural areas to rural and vice versa is referred to as rural public transport. In the operation, the vehicle distribution stands as follows: 51% minibuses, 46% coasters, and the remaining portion comprises buses (see following figure), this predominance of minibuses is due to lower demand per route compared to intercity public transport.

Figure 18. Fleet composition in rural areas



Source: (Rwanda Utilities Regulatory Authority (RURA), 2022)

However, despite their prevalence, minibuses exhibit the highest average age, with 27 years. Coasters follow with an average age of 14 years, while buses boast the youngest fleet, averaging 7 years. This paradox underscores the importance of strategic fleet modernization efforts to ensure efficient and reliable rural transportation.

3.4.4. Operational insights

Public transport across intracity, intercity, and rural areas faces significant challenges related to infrastructure and market dynamics. As far as road infrastructures are concerned, 6% and

12% of the total routes in these services are unpaved and partially paved, respectively. Operations on the non-seasonal roads are very difficult in rainy seasons and public transport services are often disrupted due to impassable roads. Not only non-seasonal roads pose a challenge in rainy season but also in dry season due to increase in repair and maintenance costs. Consequently, most of unpaved roads are operated by old minibuses, and few coasters, which are neither express nor scheduled. While the infrastructure challenge is most severe in rural areas, it negatively impacts all public transport sectors.

Charging infrastructure is at the moment is not much developed outside of Kigali. A master plan for charging infrastructure in Rwanda is currently being developed with funds from the European Union. This problem is compounded by a lack of regulations and technical standards regarding the construction and operation of charging stations.

On the other hand, the market is open, lacking limitations on the number of vehicles compared to demand. This discourages investment in newer, more reliable fleets. The consequence is an aging vehicle population, further exacerbating operational difficulties and hindering service quality improvements across all public transport services. Although route-based service contracts between RURA and public transport operators are well implemented and adhered to, there is still widespread competition in the market within routes and between operators, and even within operators, as in the case of RFTC. While this situation may alleviate the problem of insufficient supply in the present time, it may also negatively affect long-term planning and investments.

An important factor to consider is the relatively long distances travelled per day, ranging from an average of 108 km per day for urban (intracity) services to 376 km per day for intercity services. Under these operating conditions, it is highly unlikely that electric vehicles will be able to cover these distances on a single charge, requiring either opportunity charging or changes to the network. On the other hand, the concentration of ownership of the bus parks by Jali Real Estates (a subsidiary of the Rwandan Federation of Transport Cooperatives, but used by all operators) may facilitate the introduction of charging infrastructure, as most operators and their vehicles use these bus parks for operations, and there are few overnight parking facilities (bus park, car wash or garage). In other words, the existing shared infrastructure can be used as the basis for a shared charging infrastructure (bus parks for opportunity charging, and overnight parking spaces for overnight charging).

3.5. Financial Aspects

3.5.1. Business and Financial Scheme

Public transport services in Rwanda are provided by the private sector, except one company, RITCO Ltd, which is under a public private partnership (PPP) framework. Before starting public transport business, an operator is required to request an operating license from the Rwanda Utility Regulatory Authority (RURA).

As far as approximate capital cost is concerned, a new minibus costs 75,000,000 RWF, a new coaster costs 85,000,000, and a new bus costs 100,000,000 RWF. The estimated operational cost is 1784.7 RWF/km (Rwanda Transport Development Agency (RTDA), 2023).

Public transport is financed through equity and local commercial banks loans. The return of investment relies on revenues from the fare which is set by RURA.

As far as the fiscal incentives are concerned, buses with least 50 seats are exempt of customs duty during importation. Revenues from public transport services also do not pay VAT.

In addition to the above-mentioned incentives, specific fiscal incentives are provided during importation of electric vehicles including e-buses, these include:

- Electric vehicles, spare parts, batteries and charging station equipment be treated as VAT zero rated products.
- Exemption of import and excise duties on electric vehicles, spare parts, batteries and charging station equipment.
- Exemption of withholding tax of 5% at customs.

Companies manufacturing and assembling electric vehicles (battery electric vehicles, plug-in hybrid electric vehicles and hybrid electric vehicles) in Rwanda are given other incentives in the investment code such as 15% Corporate Income Tax (CIT) and tax holiday (irrespective of the investment value).

3.5.2. Financial insights

Fleet renewal is still considered a challenge for operators and a constraint to the government's efforts to phase out low occupancy public transport vehicles. SSATP identifies two main challenges related to funding and financing public transport in Rwanda:

- Existing service contracts do not allow for subsidization (net-cost) and “do not facilitate fleet improvement including the introduction of higher occupancy vehicles by operators (...) It is therefore recommended that the duration of bus operating contracts be extended to 7 years or more in order to provide operators with greater certainty and to facilitate investment in fleet recapitalization and the replacement of low occupancy vehicles (...) on routes that encompass long trip distances” (SSATP, 2020).
- Although there is funding dedicated to public transport infrastructure and a road maintenance fund is in place, there is no overarching or strategic planning and policy framework for urban public transport and/or urban mobility (funding).

In addition to the above challenges identified by SSATP, the consultation conducted by GIZ revealed that most vehicles operating in rural areas are minibuses with individual ownership. These are the oldest vehicles and electrification will face the greatest challenges:

- As mentioned above, most rural roads are still unpaved and significantly impacted by seasonal weather events. Disruptions to public transport operations are therefore common and difficult to foresee.
- Individual ownership of minibuses significantly constrains access to finance, which is usually facilitated to public transport operators via their associations (e.g. RFTC in the case of cooperatives, and ATPR in the case of intercity bus services).
- Service provision in rural areas still lacks sufficient demand to make such operations profitable enough to facilitate fleet modernization. This stands in stark contrast with public transport in intercity and secondary/satellite cities, where supply is meeting a growing demand, as evidenced by the ongoing (planned) expansion of the vehicle fleet by several cooperatives and companies.

- The difference in the average age of minibuses, on the one hand, and buses and coasters, on the other, provides additional evidence for the difficulty of modernizing a service that is perceived as unattractive and inconvenient by both operators and users. In Rwanda, where fares are regulated and are the same regardless of vehicle type, convenience is the determining factor, favouring express services (i.e. coasters and buses) at the expense of multi-stop and uncomfortable minibuses.

Another barrier to electrification of the public transport fleet is the well-known higher CAPEX of electric vehicles compared to ICE equivalents. There are currently no e-buses owned by public transport operators in Rwanda. Instead, the few e-buses are owned, provided, maintained and charged by BasiGO on a pay-as-you-drive basis. This model is proving attractive to operators. However, questions remain about the scalability and replicability of this model outside the capital. It is therefore necessary to explore additional business models and financial mechanisms that can both accelerate the electrification of the fleet and make electric mobility accessible to a wider range of operators.

3.6. Environmental Aspects

Public transport in intercity, intracity and rural areas use approximately 25,778,157.12 Litres of fuel per year, representing 5% of all petroleum imports in Rwanda, as indicated in **Fehler! Verweisquelle konnte nicht gefunden werden..** fuel consumption rates differ per vehicle type (Rwanda Transport Development Agency, 2019).

Table 4. Fuel consumption per year by intercity, intracity and rural public transport

Vehicle type	Fleet size	Fuel type	Fuel consumption rate (Litres/100km)	Annual VKT (km)	Fuel consumption per year (Litres)
Buses	121	Diesel	40	10,970,586	4,388,234.4
Coasters	1008	Diesel	15	91,391,328	13,708,699.20
Minibuses	706	Petrol	12	64,010,196	7,681,223.52
Total	1,835.00		67.00	166,372,110.00	25,778,157.12

Source: (Rwanda Utilities Regulatory Authority (RURA), 2022)

To estimate annual CO₂ emissions generated by public transport in intercity, intracity and rural areas, the formula from Ligtering et al., 2016 was used:

1. CO₂ [g/km] ~ 23.7 * FC [litres/100km] (petrol)
2. CO₂ [g/km] ~ 26.5 * FC [litres/100km] (diesel)

Minibuses consume petrol and account for 38% of the total fleet, whereas coasters and buses consume diesel and account for 62% of the total fleet.

The estimated quantity of emissions per year from public transport buses that operate in intercity, intracity and rural areas, amounts 70.000 tCO₂ as indicated in the following table.

Table 5. Estimated annual emissions by intercity, intracity and rural public transport (tCO₂)

Vehicle type	Fleet size	Fuel type	Fuel consumption (Litres/100km)	Annual VKT (km)	Estimated annual emissions (tCO _{2i})
Buses	121	Diesel	40	10,970,586	10,000
Coasters	1008	Diesel	15	91,391,328	40,000
Minibuses	706	Petrol	12	64,010,196	20,000
Total	1,835			166,372,110	70,000

Source: (Rwanda Transport Development Agency, 2019)

In East African Community member states, the maximum level of sulphur content is 50 ppm for diesel and 150 ppm for gasoline (United Nations Environment programme (UNEP), 2019).

3.6.1. Environmental insights

Rwanda's CO₂ emissions from the transport sector are relatively low due to low levels of motorisation. However, as has been observed over the last few decades, this is changing rapidly, particularly with the significant growth of motorcycles. Electrification will play a major role in reducing transport emissions, especially in combination with additional avoid and shift measures. In the context of public transport, electrification in the short term can primarily be aimed at expanding the inadequate public transport supply in Rwanda and phasing out the oldest and most polluting vehicles (i.e. minibuses). The electrification of the fleet is also a great opportunity to implement measures to improve the attractiveness and accessibility of such services, both to increase ridership and to discourage private motorisation and the continued growth of moto taxis.

Rwanda is highly vulnerable to climate change. The country is expected to experience more intense, albeit shorter, rainy seasons, as well as temperature increases, especially during dry seasons (United Nations Environment Programme (UNEP), NA). These changes in the weather and temperature are expected to have direct impacts in the transport sector, including damage to road infrastructure from flooding and slides, as well as potentially higher operational costs and inefficiencies due to increased maintenance to infrastructure and rolling stock, higher energy consumption and reduced battery performance from rising temperatures. These factors require careful consideration when assessing the feasibility of introducing electric public transport vehicles in intercity and rural areas, and secondary / satellite cities.

3.7. Ongoing Efforts to Improve Public Transport

Considering current issues that compromise public transport services in intercity, intracity and rural areas, Rwanda Transport Development Agency (RTDA), commissioned a study with the title 'development of business models for public transport for intercity and rural bus routes'. The study aims at developing suitable business models for improving the quality of public transport services.

The cities covered by the study include secondary and satellite cities, so it will bring reforms that will affect the operation of public transport in these cities. The study is expected to be completed by the end of June 2024. The study will propose necessary reforms in terms of planning, operations, financing, and regulatory framework. The planning aspect will define changes in existing public transport network, route assignment, fleet size and standards as well as level of service.

In terms of operations, requirements for operators will be defined. These include skilled human resources, and capacity to cover both capital and operational costs. A suitable mechanism for ensuring adequate service provision will also be proposed.

Regarding financing, the study will also determine capital and operational costs based on the defined level of service as well as relevant public transport fare to recover the investment with acceptable profit margin with determined return period.

The existing regulatory and institutional framework will be reviewed to ensure a proper implementation of proposed interventions that aim at improving public transport services.

4. Electrification Market Assessment

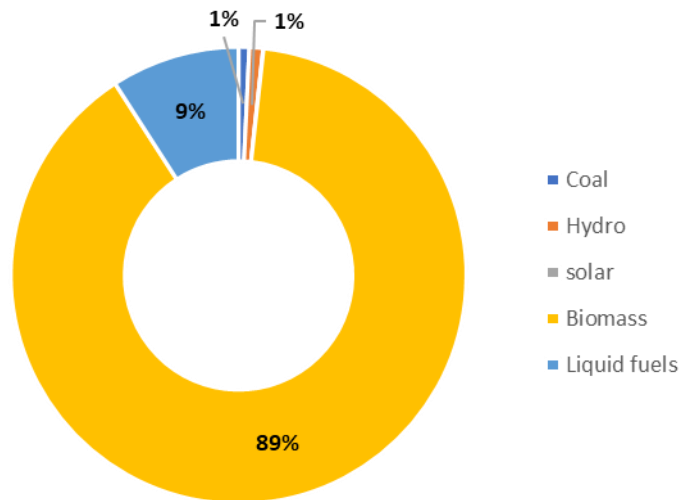
In Rwanda, expansion, maintenance, and operation of energy infrastructure are under responsibility of Rwanda Energy Group (REG), a state-owned company, through its two subsidiaries – the Energy Utility Corporation (EUCL) and the Energy Development Corporation (EDCL). The Ministry of Infrastructure and REG jointly plan the generation and transmission as well as electrification projects. (Rwanda Energy Group (REG), 2023).

4.1. Rwanda Energy matrix

The major primary energy consumption in the country is biomass, including wood, wood waste, and charcoal, (180,676 TJ accounting for 89% in 2021) (IEA, 2022). It is widely used for cooking in both urban and rural areas and in various industries such as tea estates, brick-making, food production, charcoal manufacturing. Liquid fuels (such as diesel, gasoline, residual fuels, and LPG) are primarily consumed by power generation industries and transportation. (Republic of Rwanda, 2021).

In Rwanda, 97% of the energy is generated domestically, primarily from biomass, hydro, and solar sources. However, when it comes to liquid fuels, only 11%, specifically natural gas, is produced within the country; there are not crude oil refineries in Rwanda.

Figure 1920. Total energy supply in 2021



Source: International Energy Agency, 2022

According to the National Greenhouse Gas Inventory (2016-2018) from the National Institute of Statistics, in 2018 the transport sector consumed 11.45% of the total energy and 91% of the energy generated by liquid fuels. Despite not being the subsector with the highest consumption, it was the one with the highest GHG emissions in the energy sector (57%) (see Section 1.3).

4.1.1. Electricity generation

As of June 2023, the total installed capacity to generate electricity in Rwanda was 353.5 MW from different power plants. 62.4% of that capacity corresponds to renewable sources (hydro, methane gas⁴ and solar) (see **Fehler! Verweisquelle konnte nicht gefunden werden.**). While thermal units, especially diesel generators, contribute a significant portion (17%) to the installed capacity, their actual contribution to electricity production is notably lower at 9%. The Rwanda Energy Group (REG) aims to optimize cost-effective sources, such as hydropower, which represents 40% of total electricity production. Thermal units are reserved primarily for peak demand hours, ensuring efficient utilization of resources (Rwanda Energy Group (REG), 2023).

Although Rwanda generates most of its electricity locally, it imports all its petroleum products through the ports of Dar es Saalam in Tanzania and Mombasa in Kenya. There is a petroleum supply pipeline route that runs from the Mombasa refinery to Nairobi via a 485 km pipeline, and then continues on to Kigali through Uganda using tanker trucks along a 1,250 km route. The import quantity amounts to 535,722,892 litres annually in which 349,230,438 litres are used in road transport (Ministry of Trade and Industry , 2020).

⁴ The methane gas is found in Lake Kivu which contains high concentrations of methane gas (CH₄) and carbon dioxide (CO₂), particularly at depths ranging from 270m to 500m.

Table 6. Installed capacity and electricity production in 2023

Technology/source	Installed capacity (MW)	Share capacity (%)	Electricity production (GWh)	Electricity Mix (%)
Hydropower	109.7	31	494.61	39.6
Thermal power	58.8	17	113.34	9.1
Imports	46.1	13	129.20	10.4
Shared plants	12.0	3	49.89	4.0
Peat fired PP	85	24	176.74	14.2
Methane gas	29.79	8	266.17	21.3
Solar	12.1	3	17.83	1.4
Total	353.5	100	1,247.77	100

Source: (REG, Sep 2023)

On the other hand, of the total electricity imported, an average of 27.1 MW is sourced from Uganda through the Shango–Mbarara Overhead Transmission Line (OHTL) connecting the Uganda Electricity Transmission Company Limited (UETCL) and REG. This electricity import incurs a cost of approximately USD \$1.5 million per month for Rwanda in 2023. (UG Standard, 2024). Imports are projected to decrease from 10% in 2023 to 7% by 2030, resulting in a reduction of 50 GWh (**Fehler! Verweisquelle konnte nicht gefunden werden.**).

Table 7. Projection of electricity

Year	Locally produced - (GWh)	Imported electricity- (GWh)	Total electricity (GWh)	Demand	Self-sufficiency (%)
2023	1,118.40	129.2	1,247.77	1,241.6	90.1%
2025	1,390.40	168.6	1,559.0	1,527.8	91.0%
2030	2,380.10	179.5	2,559.6	2,489.3	95.6%

Source: (REG, June 2023)

The CO₂ emission factor for electricity and heat generation in Rwanda decreased from 242 tCO₂/GWh in 2016 to 199 tCO₂/GWh in 2021, representing a significantly lower level compared to the average emission factors in the rest of the world (approx.. 3.000 tCO₂/GWh in 2021) (International Renewable Energy Agency (IRENA), 2023)

5. Status of Bus Electrification

The number of electric vehicles has increased over time in Rwanda, however only two companies are currently operating e-minibuses and e-buses. These include GO Green that has fourteen 23-seater e-minibuses and BasiGO that has four city e-buses with carrying

capacity of 70 passengers. Go green operates e-minibuses supplied by KAS AUTO, a Chinese company, while e-buses owned by BasiGO were supplied by Zongthong, a Chinese company. All these vehicles operate in the City of Kigali.

Most of charging stations are concentrated in the City of Kigali. However, Kabisa, an e-mobility company, expanded its public charging services in secondary and satellite cities. These include Muhanga, Rubavu, and Musanze (KABISA, 2023).

In addition to RTDA's study to improve public transport in intercity and rural areas, the following activities are currently underway to address public transport electrification throughout the country:

- Regulations and technical specifications for charging infrastructure, including ensuring interoperability as well as tariff structures, are currently being prepared by RURA.
- Master Plan for charging infrastructure, funded by the EU, will propose, among others, locations throughout Rwanda in which charging stations could be located, including those for public transportation.
- Study to assess the impact of electric mobility on Rwanda's electricity grid, commissioned by the World Bank, will cover all types of vehicles, including private and public transport.

6. SWOT Analysis

Based on the previous assessment the following SWOT analysis refers to the potential electrification of public transport in intercity, secondary and satellite cities, and rural areas.

Table 8. SWOT Analysis

Theme	Strengths	Weaknesses	Opportunities	Threats
Institutional	<ul style="list-style-type: none"> At central level, well structured and capable sectoral regulatory and policy-making institutions with clear mandate. 	<ul style="list-style-type: none"> The responsibilities of electric mobility are not legally allocated to a specific institution. Even though National Transport Policy and Strategy for Rwanda envisages the establishment of transport authorities in secondary and satellite cities, none was created so far, severely constraining the power and ability of local governments to plan and regulate public transport services. 	<ul style="list-style-type: none"> The planned institutional changes at the district level in the context of the recently adopted master plans represent a window of opportunity to equip local governments with the required capacities and competences regarding e-mobility and public transportation 	<ul style="list-style-type: none"> Currently no existing strategy nor integrated approach towards supporting the electrification of public transport outside of the capital exist, beyond the existing incentives in place, which cover the entire e-mobility market.
Regulatory	<ul style="list-style-type: none"> Well implemented regulatory framework that facilitated the shift from fragmented and informal to consolidated and professional public transport operations in the last decade. Electrification of public transport is identified as a policy priority and of strategic relevance by the government of Rwanda. 	<ul style="list-style-type: none"> Although contractual arrangements and processes are well implemented and adhered to, competition between (and within, in the case of RFTC) operators within routes may solve the supply problem on the short term, but may also affect long-term planning by operators. 	<ul style="list-style-type: none"> The recently adopted master plans for secondary and satellite cities, as well as the ongoing study to reform intercity transport by RTDA represent an opportunity to assess the current contractual arrangements and route planning to facilitate the introduction of electric vehicle operations whenever feasible. The Government agenda for green transport provides a conducive environment for penetration of e-buses. Ongoing strategies and instruments to promote the update of electric vehicles 	<ul style="list-style-type: none"> The lack of regulations regarding provision and operation of charging infrastructure may affect interoperability, increase safety hazards, negatively impact grid instability, and delay the rollout of infrastructure.

Theme	Strengths	Weaknesses	Opportunities	Threats
			<p>could be reviewed and adapted to the case of public transport in intercity, rural areas and secondary/satellite cities.</p> <ul style="list-style-type: none"> RURA is currently assessing the shift from route licensing (competition-in-the-market) to route franchising (competition-for-the-market). 	
Organizational	<ul style="list-style-type: none"> The national associations RFTC and ATPR play a key role in facilitating access to finance to expand and modernize the fleets of their members. Many operators are planning to expand their vehicle fleets due to a perceived increase in demand for public transport services. This trend is expected to increase with the planned and expected growth of secondary and satellite cities. 		<ul style="list-style-type: none"> Concentration of ownership of bus parks in the hands of Jali Real Estates (RFTC subsidiary), may provide an interesting business model to build and operate charging infrastructure. 	<ul style="list-style-type: none"> Low-demand for public transport services and fragmented ownership of minibuses in rural areas significantly constrain the ability for fleet modernization.
Operational	<ul style="list-style-type: none"> (Significantly) lower operational costs, especially compared to old vehicles (average age 19 years). 	<ul style="list-style-type: none"> The electrification of buses requires specific skills in maintenance and repair of both electric buses and charging stations, however there is a gap in these skills. Few charging stations outside of Kigali and none for public transport vehicles. 	<ul style="list-style-type: none"> Charging infrastructure to be built in Kigali's main transport hub (Nyabugogo) can be used for electric operations of intercity routes departing from the capital. 	<ul style="list-style-type: none"> E-buses have limited range while daily average VKT for intercity operations is 376 km, which may lead to the reluctance of operators to embrace the shift to electric buses. Uneven access to electricity in rural areas may limit charging

Theme	Strengths	Weaknesses	Opportunities	Threats
		<ul style="list-style-type: none"> Public transport operators outside of Kigali have no previous experience nor knowledge about electric vehicles. 		<p>opportunities and thus constrain the electrification of mostly minibuses. However, this can be offset by installing charging stations in urban nodes for rural services connected to cities.</p>
Financial	<ul style="list-style-type: none"> Comprehensive set of fiscal and non-fiscal incentives for the adoption of EVs are in place. 	<ul style="list-style-type: none"> Currently, the only business model that has proved viable for the adoption of e-buses in Rwanda is the pay-as-you-drive scheme offered by BasiGO, whereby infrastructure, maintenance and rolling stock are provided by the latter. The scalability and replicability of this model to all forms of public transport is yet to be demonstrated. Despite the general incentives provided by the Government of electric vehicles, there is still lack of specific incentives for electric buses, coasters and/or minibuses to lower their capital costs. Existing net-cost contracts with a duration of 5 years do not incentivize the modernization of the fleet. 	<ul style="list-style-type: none"> There is an opportunity to develop and test new financing and business models, especially in the current atmosphere of high appetite by the financial sector and national government as well as public transport operators to invest in green technologies, as evidenced by the recently announced Ireme investment facility. 	<ul style="list-style-type: none"> Higher capital costs may constrain the capacity of incumbent operators to electrify their fleets. (Significant) investments allocated to the electrification of public transport may come at the cost of investing in other areas of priority (e.g. public transport improvements, such as fleet renewal to non-electric vehicles, expansion of the fleet and network, etc.).
Energy	<ul style="list-style-type: none"> More than 60% of electricity generation is sourced by renewable energies. 		<ul style="list-style-type: none"> The high share of renewable energies in the electricity mix, coupled with electric mobility, 	<ul style="list-style-type: none"> Although most urban centers of secondary/satellite cities have a high electricity coverage, the

Theme	Strengths	Weaknesses	Opportunities	Threats
			can facilitate the decarbonization of the (public) transport sector.	impact on the grid from a potential electrification of public transport vehicles is unknown.

Source: GIZ, 2024

In addition to SWOT analysis, the following data gaps were identified during the status quo assessment that are relevant for a complete assessment of the public transport sector and its electrification potential:

1. Current capital and operational costs of operations
2. Required electricity to electrify public transport
3. Passenger demand in areas of concern
4. Electricity readiness and impact on the grid along public transport routes
5. Air quality along public transport routes

7. Conclusions and Recommendations

After discussing the findings of this report with project partners (MININFRA, RURA, RTDA, RDB, Green Fund, and representatives of secondary and satellite cities, the following conclusions and recommendations were agreed upon:

1. Recent and ongoing plans to expand the fleets by various operators evidence a general perception of growing and unmet demand for public transport services, especially as secondary and satellite cities experience rapid growth. It is thus recommended that fleet electrification in the short and medium term should aim primarily at expanding the existing fleet, with the objective of achieving full decarbonization in the long term.
2. Although minibuses still constitute the majority of the existing public transport fleet, they are regarded as increasingly outdated and less attractive by both operators and passengers. The Rwandan government has expressed its intention to phase out these vehicles, in favour of buses with higher capacity. As an exception to the first conclusion, electrification represents an opportunity to phase out minibuses in intercity and secondary/satellite cities in the short and medium term.
3. In rural areas, however, minibuses may remain relevant in the foreseeable future due to low demand for public transport services, fragmentation of supply, as well as low profitability. As a next step, government efforts should aim at consolidating the industry to improve the organizational and financial foundations of rural operators.
4. The study to be conducted as a next step to this report shall assess the feasibility of electrifying public transport operations in intercity, rural areas and secondary/satellite cities, by identifying the routes and operations with the greatest electrification potential, as well as recommending regulatory (i.e. contractual), operational (i.e. route planning and charging modalities), as well as financial (i.e. financial mechanisms and business models) changes to facilitate the shift to electric public transport. In line with conclusion number two, it should also assess and identify cases in which minibuses may be replaced by higher capacity electric alternatives (coasters or buses).
5. Both local governments and public transport operators have minimal to none exposure to electric mobility and lack the necessary capacity to properly embrace these technologies. On the one hand, local governments are expected to gain additional competences regarding public transport planning. On the other hand, public transport

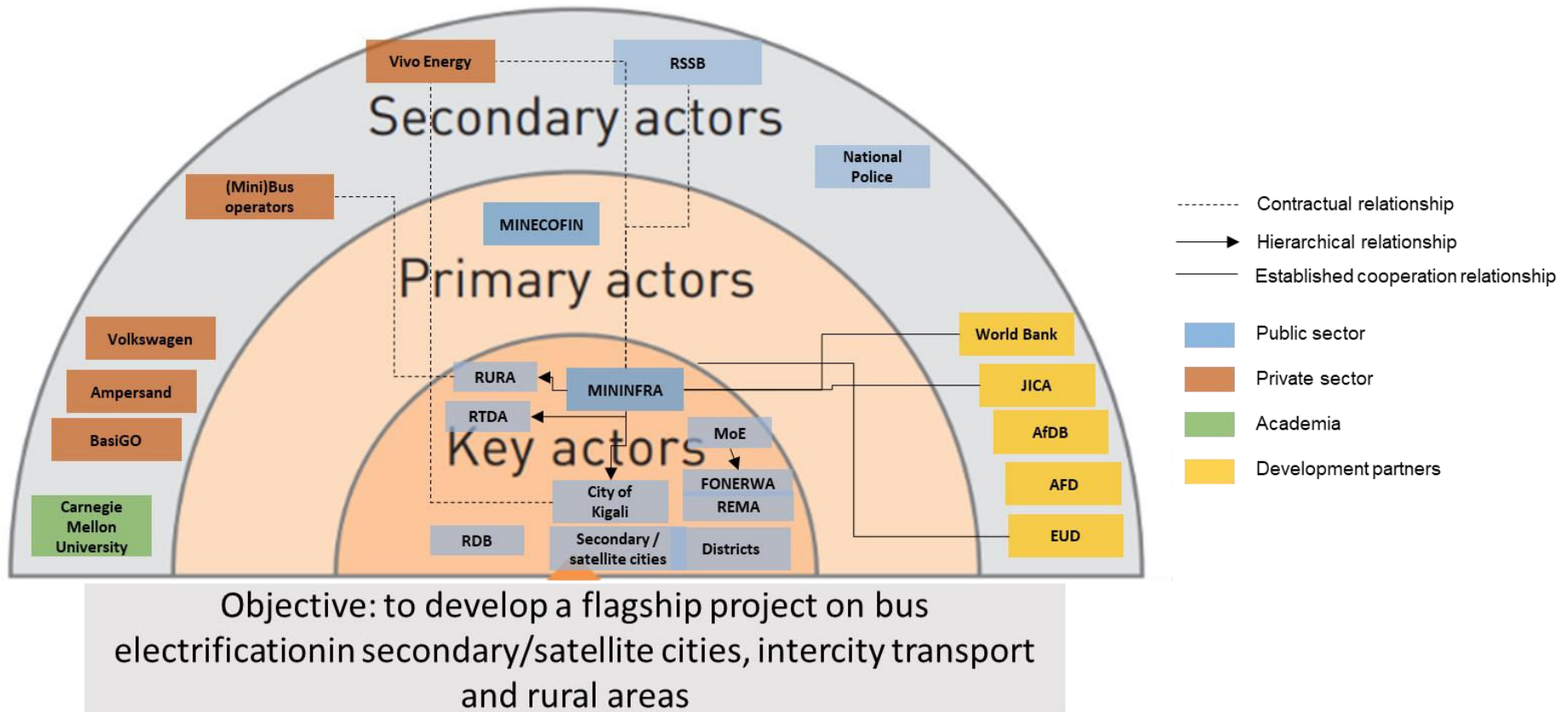
operators show great interest in acquiring electric vehicles. The need for awareness raising and capacity building on how to regulate, plan, operate and maintain electric public transport vehicles will become more and more pressing in the short term. Project partners expressed interest and the need for a variety of support measures, ranging from benchmarking, case studies and study tours from and to other countries, to awareness raising on electric mobility and its benefits, as well as trainings on how to plan for (electric) public transport operations.

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Annex: Overview of key stakeholders



Stakeholder	Functions
Public Sector	
Ministry of Infrastructure (MININFRA)	<ul style="list-style-type: none"> • Develop policies, regulations, and technical standards. • Evaluate project performance and monitor progress toward national transport system goals. • Support the implementation, staffing, and capacity building of local Transport Authorities. • To initiate programs to develop, rehabilitate and maintain an efficient and integrated national transport infrastructure network, including roads. • To supervise activities meant to elaborate, monitor, and assess the implementation of national policies and programs on matters relating to habitat and urbanism, transport, energy. • To facilitate, promote and engage the private sector to invest in infrastructure. • Develop the policy and strategy of road public and freight transport and implementation mechanisms. • Monitor the implementation of policy and strategy of road public and freight transport. • Coordination of institutions involved in public and freight transport
Rwanda Transport Development Agency (RTDA)	<ul style="list-style-type: none"> • Plan for public and freight transport • Establish networks, routes, travel schedules and service parameters for public transport. • Develop and manage procurement procedures. • Manage public transport service contracts. • Promote sustainable PT. • Monitor decentralized local administrative entities' activities related to PT.

Stakeholder	Functions
	<ul style="list-style-type: none"> • Collect and manage data for PT. • Advise the Government and local Authorities on Public and Freight Transport matters. • Provide technical support to City of Kigali and Secondary Cities whenever requested
Rwanda Utility and Regulatory Authority (RURA)	<ul style="list-style-type: none"> • Issue regulations on public and domestic freight transport • Advise the Government and local Authorities on Public and freight Transport matters. • License a person to carry out public or domestic freight transport and related activities. • Set fares on public transport services. • Inspect public and freight transport services. • Collect and manage data for Public and Freight Transport.
City of Kigali and Secondary / satellite cities	<ul style="list-style-type: none"> • Only City of Kigali: Plan, design, and manage public transport and taxi services. • Prepare the local transport plan. The local transport plan shall be addressed as City Transport Plan (or Master Plan) or District Transport Plan depending on the extent of jurisdiction of the specific Transport Authority • Plan, design, implement, and maintain roads and other urban transport facilities. • Develop an inventory of roads, bridges, terminals, depots, collection facilities, and other transport facilities
Rwanda Development Board (RDB)	<ul style="list-style-type: none"> • Facilitate the involvement of private sector in Transport Sector
FONERWA	<ul style="list-style-type: none"> • Facilitate access to climate finance. • FONERWA is the vehicle in Rwanda through which environment and climate change finance is channelled, programmed, disbursed and monitored.

Stakeholder	Functions
Ministry of Environment (MoE)	<ul style="list-style-type: none"> • Develop and disseminate the environment and climate change policies, strategies, and programs. • Monitor and evaluate the implementation and mainstreaming of environment and climate change policies, strategies and programs across all sectors, especially productive sector. • Oversee and evaluate institutions under its supervision by providing guidance on the implementation of specific programs to be realised by the institutions under its supervision and local government. • Mobilise the necessary resources for the development, protection and conservation of the environment for the climate change adaptation and mitigation.
Rwanda Environment Management Authority (REMA)	<ul style="list-style-type: none"> • Implement Government environmental policy. • Advise the Government on policies, strategies and legislation related to the management of the environment as well as the implementation of environment and climate change related international conventions as may be required. • Prepare and publish a report on the state of environment in Rwanda every four (4) years. • Establish measures to prevent and mitigate climate change and adapt to its effects. • Carry out a research, studies and other relevant activities in the field of environment and climate change and to publish the findings. • Monitor and evaluate development programs and projects to ensure the compliance with laws and regulations on environment in their preparation and implementation phases.
Rwanda Standards Board (RSB)	<ul style="list-style-type: none"> • Establishment and publication national standards. • Disseminating information on standards, technical regulations relating to standards and conformity assessment. • Raise awareness and promote the importance of standards and quality service as tools to improve market access, technology transfer and sustainable development. • Participate in monitoring standardization at national, regional and international level. • To participate in putting in place technical regulations relating to standards.

Stakeholder	Functions
Rwanda Energy Group (REG)	<ul style="list-style-type: none"> • Increasing investment in development of new energy generation projects in a timely and cost-efficient manner to expand supply in line with national targets, • Develop appropriate transmission infrastructure to evacuate new plants and deliver energy to relevant distribution nodes; and • Plan and execute energy access projects to meet the national access targets.
Private sector	
Technology and infrastructure providers (BASIGO, KABISA, Volkswagen, KASAUTO)	<ul style="list-style-type: none"> • Provision of charging infrastructure • Manufacture/ assemble Electric vehicles. • Repair and maintenance of both electric vehicles and their charging infrastructure.
Public Transport operators (ATPR, RFTC).	<ul style="list-style-type: none"> • Provision of Public transport fleet • Provision of Public transport services
Development organizations	
Development partners (JICA, WB, KOICA, EUD, AFD, AfDB, ITDP, GGGI)	<ul style="list-style-type: none"> • Provide Technical and financial support for Transport projects.

Stakeholder	Functions
Academia	
Carnegie Mellon University	<ul style="list-style-type: none"> • Conduct research in Transport sector. • Advise the Government on Transport policies and strategies
University of Rwanda	

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Registered offices
Bonn and Eschborn, Germany
T +49 228 44 60-0 (Bonn)
T +49 61 96 79-0 (Eschborn)

Friedrich-Ebert-Allee 32 + 36
53113 Bonn, Germany
T +49 228 44 60-0
F +49 228 44 60-17 66

Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
T +49 61 96 79-0
F +49 61 96 79-11 15

E info@giz.de
I www.giz.de
I www.changing-transport.org

Authors:
Francois Zirikana, Linda Cáceres Leal, Mateo Gómez Jattin

Contributors:
Daniel Bongardt

Layout:
Linda Cáceres Leal