Assessing the Financial and Fiscal Implications of Uganda's NDC-Aligned Transport Transition

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Abstract

Transport is Uganda's largest emitting subsector within the energy system, with road transport alone responsible for 66% of national greenhouse gas emissions and air pollution contributing to an estimated 28,000 deaths annually. Uganda's 2022 Nationally Determined Contribution (NDC) commits to a 24.7% reduction in emissions by 2030, with vehicle electrification at the centre of its transition strategy. Yet while least-cost technical modelling frameworks have identified viable decarbonisation pathways, their financial feasibility within Uganda's prevailing fiscal constraints and capital market conditions has remained largely unassessed.

The Model for Informed National Finance (MINFin) is used to translate technology deployment pathways derived from the Climate-Land-Energy-Water Systems (CLEWS) model into technology-specific financing requirements across three market segments: Residential households, Private commercial operators, and the Public sector. Two scenarios are examined; Business-as-Usual (BAU) and NDC-aligned transition, with analysis focused on rolling stock investment rather than underlying infrastructure.

The NDC pathway reduces cumulative investment requirements to US$266 billion by 2050, compared to US$310.9 billion under BAU, primarily through accelerated electrification. Both pathways nevertheless face near-term household affordability constraints, with cumulative funding gaps of approximately US$14–15 billion in the first eight years as upfront investment requirements precede income growth. In the private commercial sector, electric motorcycles emerge as the most financially viable technology, while minibuses and early-phase EV car deployment face structural deficits. The public sector remains broadly viable, driven in large part by surplus revenues generated through freight rail, though passenger rail faces growing losses under current fare structures.

Realising Uganda's NDC transport targets will require integrated policy interventions including targeted EV purchase subsidies, import duty relief, corporate tax incentives, and paratransit regulatory reform to bridge the gap between least-cost electrification ambitions and the financing realities faced by households, operators, and the government under the current NDC ambitions.

Keywords: *Transport planning, Transport transition, E-mobility, Financial Modelling, Uganda*

1. Introduction and Background

Efficient and sustainable transport is widely recognised as a catalytic investment priority that delivers economy-wide benefits, including improvements in health, industry, and trade (United Nations, 2016). In the context of climate change, transport is also integral to the energy transition and consequently, the sustainable development agenda (IEA, 2024). In sub-Saharan Africa (SSA), mobility currently accounts for around 10% of total greenhouse gas emissions, a share expected to increase as the vehicle fleet more than doubles from 25 million vehicles in 2021 to over 58 million by 2040 (Government of Uganda, 2023a).

Although transport dynamics vary across SSA, several structural challenges are common across countries, including Uganda. These include the dependence on high-emitting second-hand vehicle imports, dominance of informal transport services, and inadequate provision of non-motorised transport (Sturgess et al., 2024). In Uganda, urbanisation has significantly outpaced infrastructure development, leading to severe congestion, poor road conditions, and a lack of public transit options that have driven an increasing preference for motorcycles (or boda-bodas), now constituting some 51.6% of the total vehicle stock (MEIR Engineering & Research Ltd., 2023). As a result, transport in Uganda is now the largest emitting subsector within the energy system, with road transport alone accounting for 66% of emissions (Ministry of Water and Environment, 2022a). Severe air pollution is estimated to cause around 28,000 deaths annually, highlighting the urgency of climate interventions that could yield wide-ranging benefits for public health, safety, and development (O'Neill & Sawe, 2024).

Consequently, transport is positioned as a key enabling sector for realising its ambitious ten-fold growth strategy aimed at transforming the country into an upper middle-income economy by 2040 (National Planning Authority, 2013). The sector is also recognised as a relatively cost-effective emissions mitigation pathway in the country's updated 2022 Nationally Determined Contribution (NDC), which commits the country to reducing greenhouse gas emissions by 24.7% by 2030 (Ministry of Water and Environment, 2022c). In line with the Fourth National Development Plan (NDPIV), key measures include improving vehicle fleet efficiency, expanding public transit, and reducing reliance on motorised travel (National Planning Authority, 2025).

Central to this agenda is a growing emphasis on vehicle electrification. The National E-Mobility Strategy targets a full transition to electric public transport and motorcycles by 2030 and passenger vehicle sales by 2040, with investment requirements estimated at up to US$1.64 billion between 2023 and 2028 (Government of Uganda, 2023a). Complementing this is a push to localise elements of electric vehicle production, namely manufacturing 15,000 electric buses through the domestic Kiira Motors Corporation by 2040 (Mobility Rising, 2025). The Government of Uganda (GoU) is also investing heavily in expanding domestic production of oil and gas, reflecting an effort to reduce both vehicle and fuel import dependence (Boureima & Quenum, 2025). However, while the GoU's Public Investment Financing Strategy (2022) and National Climate Finance Strategy (2025-2030) recognise a toolkit of financial instruments for realisation for NDC transport targets, including green bonds, debt-for-nature swaps and public private partnerships, they do not explicitly evaluate whether such targets are financially feasible under prevailing fiscal constraints, capital market conditions, and risk profiles (Government of Uganda, 2022, 2025).

Despite a growing body of studies utilising technical optimisation models to uncover least-cost transport deployment pathways, the financial feasibility of such transitions is seldom assessed within prevailing national financing constraints, despite being the primary barrier to implementation in most emerging nation contexts (Felia et al., 2025; Sang et al., 2026). Financial discussions and fiscal mechanisms often centre on expansion and underlying infrastructure, while comparatively little attention is given to large-scale replacement of vehicle capital stock, which forms a large component of the low-carbon transition (Muvawala et al., 2021a; Noll et al., 2026; Osei – Kyei & Chan, 2016; Tukei et al., 2024). This asset-financing dimension of the transition is particularly salient in SSA contexts characterised by constrained domestic credit markets, high costs of capital, and significant informal transport activity, yet remains underexplored (Aidam et al., 2025; Estache et al., 2015; Walks, 2018). Finally, existing analytical tools typically address fiscal impacts or commercial profitability in isolation, with no existing framework capable of quantitatively assessing the cross-sectoral trade-offs associated with transport transitions in developing country contexts (ICAT, 2020; Nigro, 2019; U.S. Department of Energy, n.d.).

This study addresses these research gaps by analysing the financial implications of Uganda's transport transition across the residential, private, and public sectors, with particular attention paid to the trade-offs between fiscal sustainability, household affordability, and commercial viability. The Model for Informed National Finance (MINFin) is used to translate optimal technology deployment pathways derived from the Climate-Land-Energy-Water Systems (CLEWS) model into fuel-specific vehicle financing pathways under prevailing financing conditions in Uganda (Alfstad, El Hamady 2026). The CLEWS outputs used in this analysis are being applied in the context of analytical work supporting Uganda's third update to its NDC, providing a policy-relevant basis for the transport transition pathways examined here. The analysis focuses on investments required to expand and electrify road and rail vehicle fleets, rather than underlying infrastructure such as roads and ports. In doing so, it translates high-level emissions targets into fuel-specific vehicle investment pathways that inform near- and medium-term policy and investment decisions.

The remainder of this paper is organised as follows: Section 2 reviews the existing literature on financing national transport transitions. Section 3 describes the methods used, and Section 4 presents the main findings of the study. Section 5 concludes with implications for policymakers, limitations of the analysis, and avenues for future research.

2. Literature Review

2.1. Technical Modelling of Transport Transition

Optimisation-based modelling frameworks, designed to identify least-cost technology configurations capable of meeting specific emissions reduction or policy targets, are increasingly used to inform national decarbonisation planning in the transport sector (Felia et al., 2025; Kimuli et al., 2025; Sang et al., 2026). Given the cross-cutting nature of the transport sector, Integrated Assessment Models (IAMs) such as CLEWS, TIMES, and MESSAGE, are increasingly preferred, as they enable assessment of interactions between transport infrastructure, energy systems, and emissions reduction (Sang et al., 2026). In Uganda, a regional adaptation of the TIMES model, KAMPALA-TIMES, has been used to explore sustainable pathways for electrifying Kampala's transit systems through 2060, while CLEWS is currently being applied to support the nation's third NDC update (Kimuli et al., 2025) (Alfstad, El Hamady 2026). These models are useful for identifying and comparing technology deployment pathways, their associated cost requirements, and emissions reduction potential.

Recognising that transport systems are also socio-technical and behaviourally complex, there is growing literature advocating for more integrated socio-technical transport-energy modelling frameworks that address questions such as gender equality and inclusivity (Mbandi et al., 2024; Sturgess et al., 2024). However, this still leaves the critical dimension of financial feasibility, including issues around fiscal sustainability, consumer affordability, and commercial viability, largely overlooked in such models, despite its central role in determining whether proposed transitions can be realised in practice.

2.2. Financial and Economic Assessments of Transport Transitions

Existing literature on transport financing in developing country contexts are predominantly focused on the expansion and maintenance of core infrastructure such as roads, ports, and railway lines, rather than on vehicles or rolling stock (Estache et al., 2015; Gonzalez-Navarro & Zárate, 2023; OECD, 2018). This emphasis reflects the historical prioritisation of addressing large infrastructure deficits, which development and transport literature identify as a primary constraint to economic integration and growth (Gonzalez-Navarro & Zárate, 2023). The same pattern is evident in Uganda, where inadequate and poorly maintained roads are estimated to result in congestion-related losses equivalent to 6.7% of GDP annually (Muvawala et al., 2021b). These deficits are mostly attributed to insufficient and poorly managed public funds that typically rely on revenues from fuel levies, licensing fees, and road-user charges. This is exemplified by Uganda's Road Fund, which suffers from chronic cash flow shortfalls due to poor regulation and enforcement (Achola, 2016; Tukei et al., 2024). Historically, countries relied heavily on concessional development assistance and sovereign borrowing to bridge the financing gap; however, this model is becoming increasingly strained as declining availability of concessional finance coincides with growing investment needs (Enriquez et al., 2018; Mawejje & Munyambonera, 2017). Recent literature increasingly points to Public-Private Partnerships (PPP) as a potential mechanism for scaling investments, alongside efforts to strengthen domestic revenue mobilisation and improve the efficiency of public financing frameworks (Mawejje & Munyambonera, 2017; Osei – Kyei & Chan, 2016).

The transition toward low-carbon transport systems is anticipated to introduce additional fiscal challenges. Electrification of vehicle fleets, for example, will not only require significant capital investment in charging infrastructure and generation capacity, but may also reduce revenues from fuel-based taxation (Nguyen & Müsgens, 2026; Noll et al., 2026; OECD, 2023). Importantly, low-income countries face the highest exposure to potential revenue loss from declining fuel taxes, with over 12% exposure in Uganda compared to 4-8% on average globally, while being least equipped to source alternative financing and implement tax reforms (Noll et al., 2026). Congestion-based tolls, for example, have been shown to offset fuel tax losses in developed countries; however, weak regulatory enforcement in contexts like Uganda may render implementation difficult (Nguyen & Müsgens, 2026).

Several analytical tools examine individual components of the financing challenge, but do not offer integrated frameworks capable of analysing system-wide trade-offs. For instance, the Initiative for Climate Action Transparency's (ICAT) Transport Pricing Methodology allows policymakers to assess the fiscal and emissions impacts associated with different pricing policies including fuel subsides and taxes but doesn't directly consider impacts on consumer affordability and commercial viability (ICAT, 2020). By contrast, the Vehicle Infrastructure Cash-Flow Evaluation (VICE) model supports fleet managers in assessing the financial feasibility of converting vehicles to electric or natural gas (U.S. Department of Energy, n.d.). Similarly, the EV Charging Financial Analysis Tool enables assessment of the financial sustainability of private-sector funded charging networks (Nigro, 2019). However, both tools are designed for mature markets and are less applicable to developing market contexts, where commercial vehicle operators frequently depend on debt-based or lease-to-own financing models rather than balance sheet financing (Walks, 2018). Additionally, charging infrastructure typically relies on PPPs or development finance rather than purely private investment in developing contexts (Benitez & Bisbey, 2021). Moreover, existing tools do not address consumer affordability, particularly where vehicle acquisition depends heavily on domestic commercial lending with elevated interest rates in tight capital markets (Walks, 2018).

Overall, three critical gaps emerge from the transport financing literature. First, there is a disconnect between technical transport transition modelling and assessments of financial feasibility within existing national financing constraints. Second, fiscal discussions of transport financing in developing country contexts focus predominantly on public infrastructure rather than on vehicle fleets or rolling stock. Third, existing analytical tools examine either fiscal impacts or commercial cash-flow dynamics with no framework capable of quantitatively assessing cross-sectoral trade-offs within developing country contexts. As a result, a significant gap remains between national electrification ambitions and the financing frameworks required to deliver them.

2.3. Addressing the Research Gaps

This paper addresses the identified research gaps by examining the financial implications of Uganda's NDC-aligned transport transition across the residential, private, and public sectors, with particular attention to trade-offs between fiscal sustainability, household affordability, and commercial viability. The analysis utilises an emerging national finance planning tool MINFin, which translates technology deployment pathways from the CLEWS transport-energy nexus into fuel-specific vehicle financing requirements under prevailing fiscal constraints and market conditions in Uganda. Rather than focusing on supporting infrastructure, the modelling scope concentrates on investment needs associated with expanding and electrifying rolling stock across road and rail transport, reflecting the segment of the transition most directly tied to emissions reduction. By linking system-level transition modelling with vehicle and sector specific financing pathways, the analysis provides a quantitative assessment of how transport decarbonisation targets interact with financial realities, and thus informing evidence-based policy design and investment decisions.

3. Methodology

MINFin is a modelling approach that links to sectoral planning tools such as the Climate, Land, Energy and Water Systems (CLEWS) model and the Open-Source Energy Modeling System (OSeMOSYS), which are used to develop bottom-up least cost development plans. MINFin takes the costs associated with these plans to assess how changes in cashflows within each sector impact the overall affordability across technologies and market participants in the sector as outlined in *Luscombe et. al. 2026*. This is balanced between the Investment Needs – defined as the capital investments required within the sector, the Financing Requirements – the capital costs translated into repayments required to service debt and equity investments, as well as any additional operational expenses, and Funding Availability – the revenues and cash available within the sector to service these financing requirements. These cashflows are disaggregated between technologies and market participants. In instances where the Funding Availability exceeds the Financing Requirements, the technology is deemed affordable, whist when Financing Requirements exceed Funding Availability the technology is deemed unaffordable. Within the transport sector, in this implementation of MINFin, the model splits the market participants between Residential Households, Private Corporations and the Public Sector. This is used to assess the implications of market reforms on each of these participants, and on government expenditure and revenues based on taxation and subsidies.

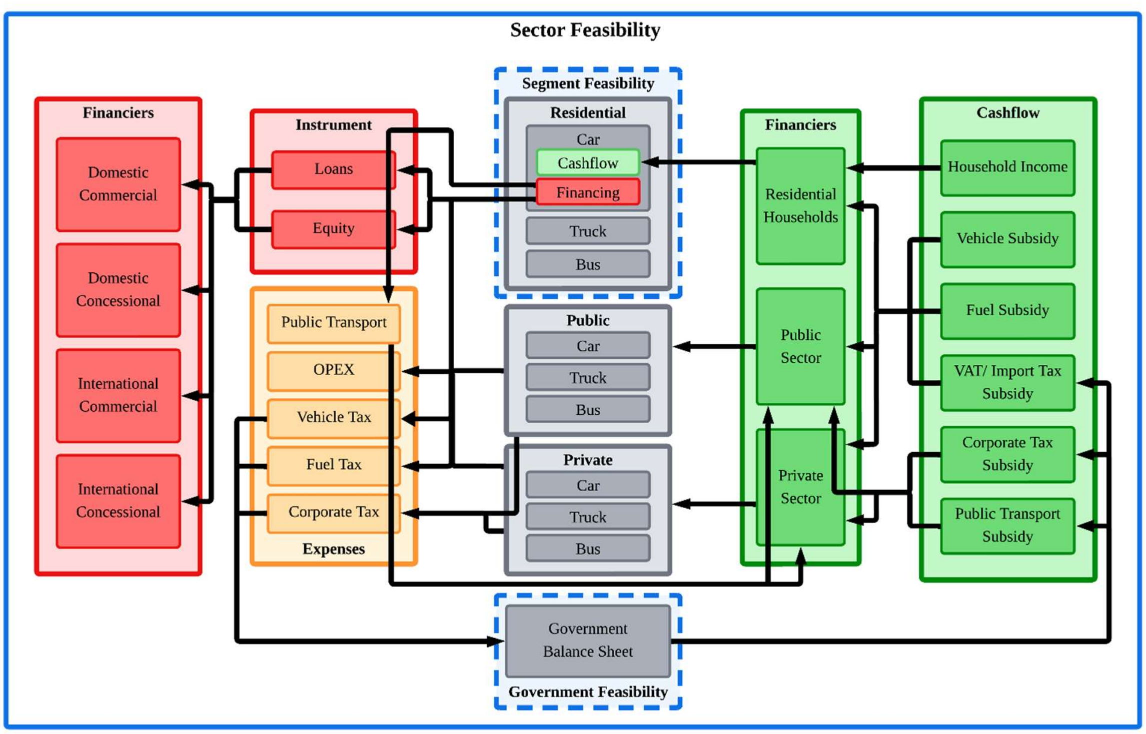

Figure 1. Conceptual mapping of cashflows in MINFin Transport Model. Arrows indicate the direction of cashflow, whilst boxes represent the parameters to which cash flows to and from.

3.1. Modelling

3.1.1. Investment Needs

To properly assess the investment needs of the sector, MINFin accounts for both the future, and historic investment needs. To model the existing Investment Needs, MINFin uses the existing vehicle stocks, matching the residual capacities calculated in CLEWS. These residual capacities are calculated by technology and are estimated based on available data. To calculate this, the market capitalisation of each vehicle stock was multiplied by the market share that each technologies holds. These were calculated for the latest year available and then projected forwards and backwards based on the technology life-span assumption used in CLEWS. The investment need for each vehicle stock was then estimated by multiplying each vehicle stock by the average capital cost (CAPEX) for each technology. These techs were further disaggregated between market participants by multiplying this value by the share that each participant (Residential, Private and Public) operates for each technology.

The future investment pathways for each scenario were collected based on the CLEWS modelling, a bottom-up cost minimising optimisation model implemented in Uganda that was used to project investment requirements for each of the scenarios. The scenarios analysed in this included:

1. **Business-as-Usual Scenario (BAU)** – the Least Cost Development Plan for Uganda [8] to meet projected demand across sectors at the lowest associated cost.
2. **Nationally Determined Contribution (NDC)** – The least cost development strategy that meets emissions targets and development goals as outlined under Uganda's current NDC commitments.

CLEWS produces technology-level investment profiles, that were once again split by the share that each participant (Residential, Private and Public) operates for each technology. MINFin is then used to compare the cost profiles associated with each of these scenarios, to not only assess the affordability each scenario in isolation but also compare and contrast the costs associated with transitioning from one plan to another. However, as a significant portion of this is financed through debt and equity financing, these investment needs must be translated into the corresponding repayment schedules to reflect the true experience of each market participant.

3.1.2. Financing Requirements

To assess the financing requirements, and obligations that market participants may experience when financing the purchase of vehicles, the investment needs outlined under the Historic and Future Investment needs as outlined by the residual capacity and future investments from CLEWS. For Debt and Equity obligations, the equations for this analysis are calculated in line with the standard MINFin methodology as outlined in *Luscombe et. al. 2026* with the following equations available in *Appendix Table A1*. For debt and equity obligations, these were calculated using *Equations 18-19* assuming Equal Principle Repayments, whilst Equity investments are calculated as an up-front expense for residential consumers, and as the expected rate of return on investments across the life of the technology for public and private participants. These financing obligations are split between technologies, consumer segments, and four potential sources of finance, with each of these carrying their own terms of finance, financing and currency shares.

For **Residential** market participants, Financing Requirements included the Debt and Equity (*Equations 18–19.*) financing of vehicle purchase both based on future investments outlined by CLEWS modelling, as well as any existing historic investments, vehicle operational costs from CLEWS, public transport expenditure (*Equation 11.*), Fuel Tax (*Equations 16–17.*), Vehicle VAT and Vehicle Tax (*Equations 13–15.*) expenses. Meanwhile, for **Private** and **Public** corporations operating in the transport sector, the Financing Requirements towards their operations include the Debt and Equity (*Equations 18–19.*) financing of current and future vehicle purchase, Vehicle Operational Costs (including fuel purchase, and operation and maintenance costs) from CLEWS, Fuel Tax (*Equations 16–17.*), Vehicle Tax (*Equations 13–15.*) expenses and Corporate Tax (*Equation 12.*), as outlined in *Table 1*.

3.1.3. Funding Availability

For **Residential** market participants, Funding Availability was calculated based on the share of household expenditure spent on transport projected in line with GDP growth rate (*Equation 1.*), vehicle purchase subsidies (*Equations 5–7.*) or fuel subsidies (*Equations 8–9.*). Meanwhile, for **Private** and **Public** corporations operating in the transport sector, Funding Availability was calculated based on the revenues generated by Freight and Public Transport operations based on average Fare or Freight Value, and activity for each technology (*Equations 3–4.*). as well as any additional government commitments towards public transport subsidies (*Equation 2.*). these market participants may also benefit from subsidies and tax breaks such as vehicle purchase subsidies, fuel tax subsidies or vehicle tax subsidies (*Equations 5–9.*), as well as corporate tax subsidies (*Equation 10.*) depending on the type of vehicle purchased and emissions reductions targets.

3.2. Data collection

3.2.1. GDP

Historic GDP values for Uganda were collected based on data published by the IMF (IMF, 2025). To align with the 10-fold growth strategy outlined by the Ministry of Finance, Planning and Economic Development (MoFPED 2025a.), the compound annual growth rate between the current GDP of US$ 64.993 Billion in 2025, and US$ 500 Billion by 2040 was calculated as 14.57%. This was applied to the GDP between 2025 and 2040, whilst beyond 2040, a more modest growth rate of 5.22% was used, based on the average historic GDP growth between 2010 and 2025.

3.2.2. Household Transport Expenditure

To calculate the availability of Household Income (HHI) to service the financial burden of the transport transition within the residential segment across the modelling period, total household expenditure data was collected from the World Bank (World Bank Group, 2024a), and projected across the modelling period in alignment with Uganda's GDP as outlined in *Section 4.2.1.* The share of this household expenditure spent on transport expenses was informed by the figures published by in the Uganda National Household Survey Report (UBOS, 2024), which averaged 7.2% across recent years. This value was then adjusted based on the GDP growth adjusted for income elasticity estimated at 1.54 for Uganda (Lebrand & Theophile, 2022). The share of HHI expenditure spent on transport expenses was capped at 14% in line with the average transport share of expenditure in upper-middle income countries (Lebrand & Theophile, 2022) as shown below in *Figure 2.*

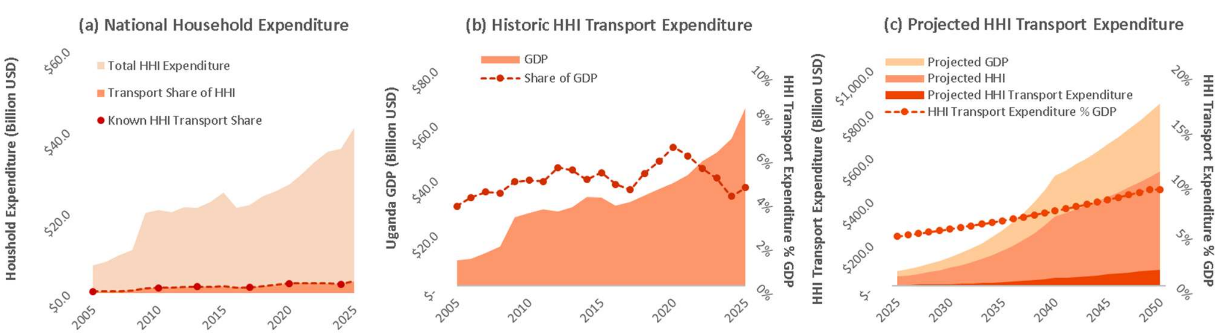

Figure 2. (a) Total household income expenditure in Uganda (World Bank Group, 2024a), as well as reported shares used for transport expenditure (UBOS, 2024). (b) Historic household transport expenditure as a percentage of Uganda's GDP (c) Projected GDP, household income expenditure and household transport expenditure under the tenfold growth strategy, with household transport expenditure as a percentage of GDP indicated.

3.2.3. Terms of Finance

Table 1 summarises the financing term assumptions used for vehicle purchases across technologies and sectors, with sector share representing the proportion of each technology purchased by residential, public, or private actors. For each sector, the weighted average cost of capital (WACC) is calculated by weighting the costs of equity and debt according to the estimated debt-to-equity ratio. The overall WACC for a given technology is then derived by weighting each sector's WACC by its sector share.

Table 1. Financing Term Assumptions by Technology (New) and Sector.

	Financing Term	Cars	Motorcycles	Trucks	Buses	Minibuses	Rail
Residential	Sector Share	75%	3%	0%	0%	0%	0%
	Debt:Equity	60:40	10:90	-	-	-	-
	Equity Return	0%	0%	-	-	-	-
	Equity Term	1	1	-	-	-	-
	Loan Interest	21%	34%	-	-	-	-
	Loan Term	10	2	-	-	-	-
	Loan Grace Period	0	0	-	-	-	-
	Sector WACC	**13%**	**3%**	-	-	-	-
Public	Sector Share	5%	7%	15%	100%	0%	100%
	Debt:Equity	17:83	17:83	17:83	17:83	-	80:20
	Equity Return	11%	11%	11%	11%	-	5%
	Equity Term	20	20	25	25	-	30
	Loan Interest	9%	9%	9%	9%	-	4%
	Loan Term	13	13	13	13	-	25
	Loan Grace Period	3	3	3	3	-	8
	Sector WACC	**11%**	**11%**	**11%**	**11%**	-	**4%**
Private	Sector Share	20%	90%	85%	0%	100%	0%
	Debt:Equity	75:25	50:50	75:25	-	75:25	-
	Equity Return	17%	17%	17%	-	17%	-
	Equity Term	25	20	25	-	25	-
	Loan Interest	23%	34%	23%	-	23%	-
	Loan Term	5	5	5	-	5	-
	Loan Grace Period	0	0	0	-	0	-
	Sector WACC	**22%**	**26%**	**22%**	**-**	**22%**	**-**
	Overall WACC	**14%**	**24%**	**20%**	**11%**	**22%**	**4%**

In the residential sector, equity finance represents the full upfront purchase of vehicles, estimated at approximately 40% and 90% of cars and motorcycles, respectively (Khisa, 2023). The remaining share is assumed to be financed through vehicle loans at prevailing commercial rates (Butuuro Financial Services, n.d.; Equity Bank Uganda, n.d.; Rugadya, 2025). All public sector vehicles are assumed to be financed through the government budget, except for rail wagons, which follow project-specific terms (African Development Bank, 2022b, 2022a, 2025). Historical budget data indicate that an average of 83% of funds are raised domestically as equity via tax and non-tax revenues and grants, with the remaining 17% is borrowed via sovereign bonds and external concessional sources (Ministry of Finance, 2024). An equity return of 11% reflects the public opportunity cost of investment, represented by Uganda's social discount rate (Jenkins et al., 2018). Finally, private sector vehicles are assumed to be financed through standard asset financing instruments offered loans by domestic banks, with the required upfront deposit treated as equity (Bank of Baroda Uganda, n.d.). The equity return is assumed as 17%, equivalent to the average yield on a domestic 10-year treasury bond, representing the opportunity cost of investing in a vehicle relative to a risk-free investment (Ministry of Finance, 2025).

Further details on the full parameterisation of financing terms are provided in the Appendix.

3.2.4. Historic Vehicle Stocks

For the historic vehicle stocks, these were calculated based on the reported values for the vehicle count, which covers much of Uganda's rolling stock. This was then split between technologies to match those used in CLEWS based on the market capitalisation by multiplying the stock by the market share that each technologies holds. These were calculated for the latest year available and then projected forwards and backwards based on the lifespan of the vehicles as assumed under the CLEWS modelling.

3.2.5. Tax Rates

Tax rates for the Business-as-usual scenario were set to prevailing rates as described in Section 3.4. In this modelling, this modelling assumes that all used fossil fuel road vehicles purchased under the Business-as-usual scenario are 10 years old, and as such attract a 50% environmental levy based on the CIF value, whilst under the NDC scenario, used vehicles are assumed to be 5 years old, attracting a 20% environmental levy. Additionally, imported vehicles must pay an import duty of 25%, import commission of 2% and an Infrastructure levy of 1.5%, as well as a withholding tax of 6% and VAT of 18%. For this modelling we assumed all vehicles purchased within Uganda's vehicle fleet are imported from over-seas due to the incredibly limited domestic vehicle market. For operational taxes on vehicles in Uganda, for the business-as-usual case, we assumed that this was absent outside of fuel taxes in line with what has historically been implemented in the country. For Fuel Tax, this has been set to Shs1,550 per litre for Gasoline and Shs1,230 per litre for Diesel (The Excise Duty (Amendment) Act, 2024) whilst the pricing for electricity purchased for EV charging includes a standard 18% VAT rate. For the standard Corporate Tax Rate of 30% was used for Freight and Public transport operators.

4. Results

4.1. BAU vs. NDC Investment Needs

The CLEWS model estimates annual capital investment requirements for each transport technology in Uganda over the period 2025-2050. Sectoral investment shares, presented in *Table 1.*, are mapped onto the corresponding technologies to provide an estimated indication of the distribution of investment burdens across residential, private, and public sectors.

As illustrated in *Figure 3,* total investment requirements increase steadily under the BAU scenario at an average annual rate of 14%, driven by the rising transport demand associated with the ten-fold growth strategy. This corresponds to an average annual investment requirement of around US$12 billion per year, amounting to a cumulative total of US$310.9 billion by 2050, of which 36% is attributable to vehicle and import taxes. Even under BAU conditions, electric vehicles account for the majority of investment (56.5%), primarily from the uptake of new and used electric cars, as they are expected to reach price parity with ICE cars around 2030. The residential and private sectors are projected to bear 44% and 48% of total investment costs, respectively.

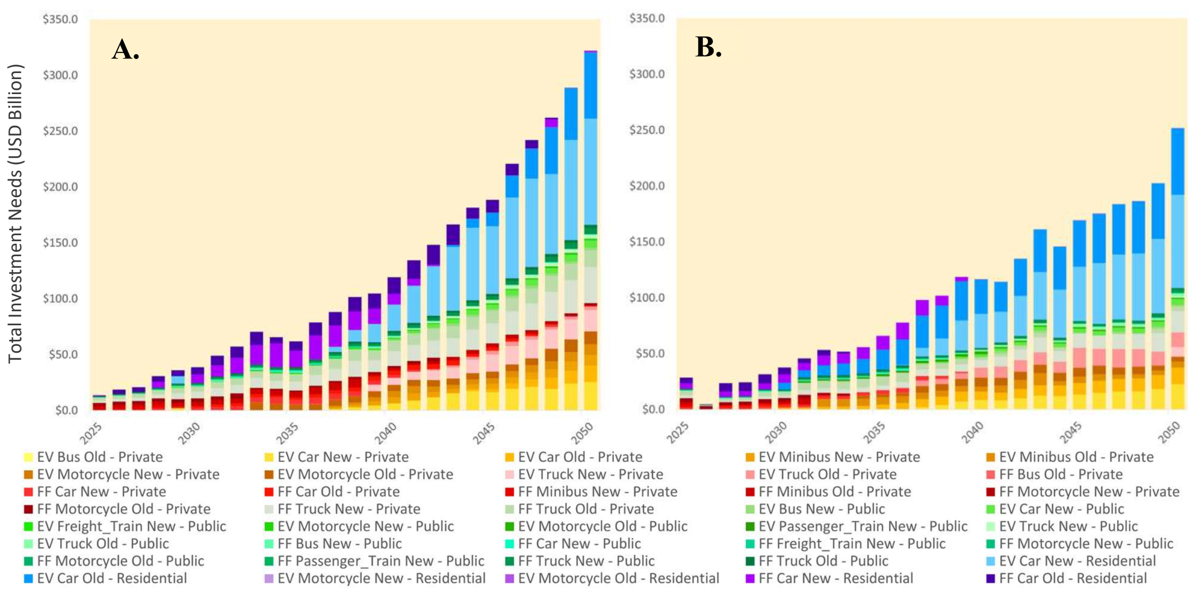

Figure 3. (A) Total (Post-tax) Investment Needs Under BAU Scenario in Billion USD, and (B) Total (Post-tax) Investment Needs Under the NDC Scenario in Million USD, 2025-2050

In the NDC scenario, the average investment requirement is approximately US$2 billion lower each year, resulting in a comparatively smaller cumulative total of US$266 billion by 2050, of which 30% is attributable to vehicle and import taxes. The reduced tax share is driven by a stronger transition towards electrification, with electric vehicles accounting for 77% of total investment. Under this scenario, the residential sector is projected to bear a larger share of the investment burden (53%), compared to 40% and 7% for the private and public sectors, respectively. However, it is important to note that the lower investment requirement relative to BAU only pertains to rolling stock, and does not capture the cost of expanding road and rail infrastructure.

4.2. The Transition's Impact on Household Affordability

4.2.1. Current Household Transport Expenditure

Uganda's automotive market was valuated at approximately US$600 million in 2023, reflecting rising demand for personal mobility, limited public transport infrastructure, and the increasing availability of imported second-hand vehicles (TraceData Research, 2025). Due to high upfront cost of vehicles relative to household income (HHI), vehicle purchase is largely supported through loans provide by domestic commercial banks, including Equity Bank and Stanbic Bank. Despite efforts to increase access to formal banking services, Non-Banking Financial Institutions (NBFIs) still play an important role in providing credit to underserved populations, often at significantly higher borrowing rates (Government of Uganda, 2023b).

In addition to the high cost of vehicle ownership, a reliance on imported fuels and the maintenance burden associated with older vehicles means that transport accounts for a substantial share of household expenditure. Household survey data indicate that in 2024 the average household spent around 14% of its income on fuel, 7.8% on vehicle operations and maintenance (O&M), and 4% on public transport (*Figure 4.*) [3]. While this represents a modest improvement from 2020, when fuel, O&M and public transport constituted 20%, 8.3%, and 7.2% of HHI respectively, the reliance on imported vehicles and fuels exposes the sector to global shocks. Although the Ugandan Shilling (UGX) has remained relatively stable in recent years, appreciating by 3.35% over the past year, any future depreciation could significantly increase vehicle import costs and fuel prices (Trading Economics, 2026).

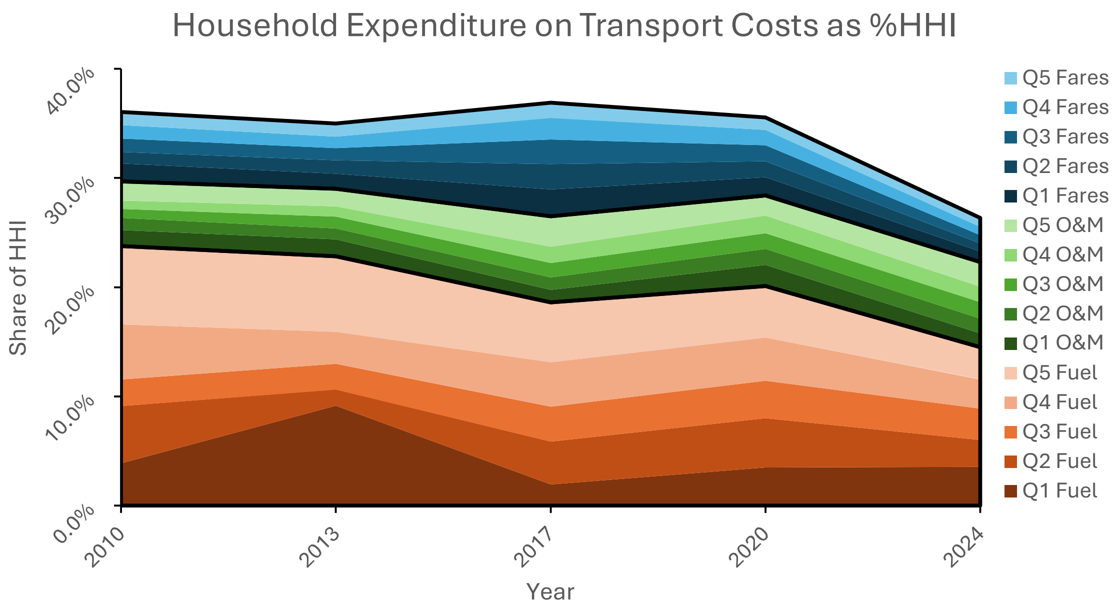

Figure 4. Household Expenditure (HHI) on Transport cost as a percentage of Household Income split between quintiles and costs (Public Transport Fares, Operation and Maintenance (O&M), and Fuel purchase costs) across a period between 2010 and 2024.

Due to the high financial to car ownership, there have been an increasing shift toward boda-boda motorcycles as a more affordable alternative. As shown in *Figure 5.*, new car registrations increased by only 5.2% between 2015 and 2023, compared to an 86.2% increase in motorcycle uptake over the same period.

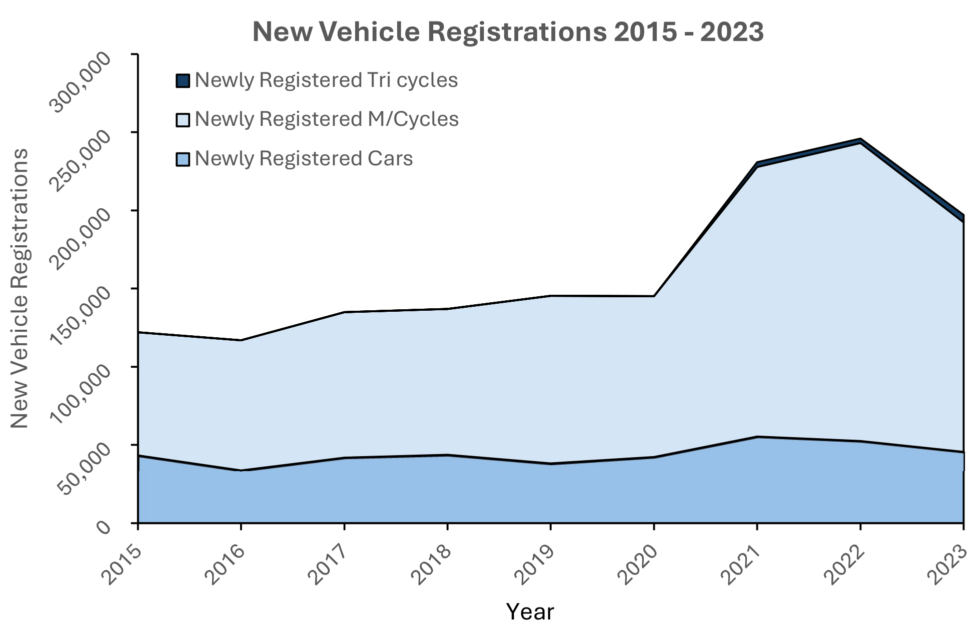

Figure 5. New Vehicle Registrations in Uganda between 2015 and 2023, as reported by UBOS [3]

4.2.2. The Transition's Impact on Household Affordability

Uganda's anticipated ten-fold GDP growth by 2040 is expected to substantially expand household capacity to spend on transport, with spending potential growing faster than income in line with an estimated income elasticity of transport demand of 1.54 (Lebrand & Theophile, 2022). Under these assumptions, household spending capacity is projected to increasingly exceed the level of expenditure required to meet mobility needs after 2032 under both BAU and NDC pathways. As shown in **Error! Reference source not found.**, actual spending is assumed to align with required transport expenditure, as households allocate only what is necessary to satisfy mobility needs rather than their full spending capacity.

However, despite improving affordability over time, the early transition period is constrained by upfront investment requirements that precede income gains associated with sustained economic growth. The first eight years of the BAU and NDC transitions are thus expected to face cumulative funding gaps of approximately US$14 billion and US$15 billion, respectively. These near-term affordability constraints represent the primary financing challenge for the residential sector, regardless of the transition pathway.

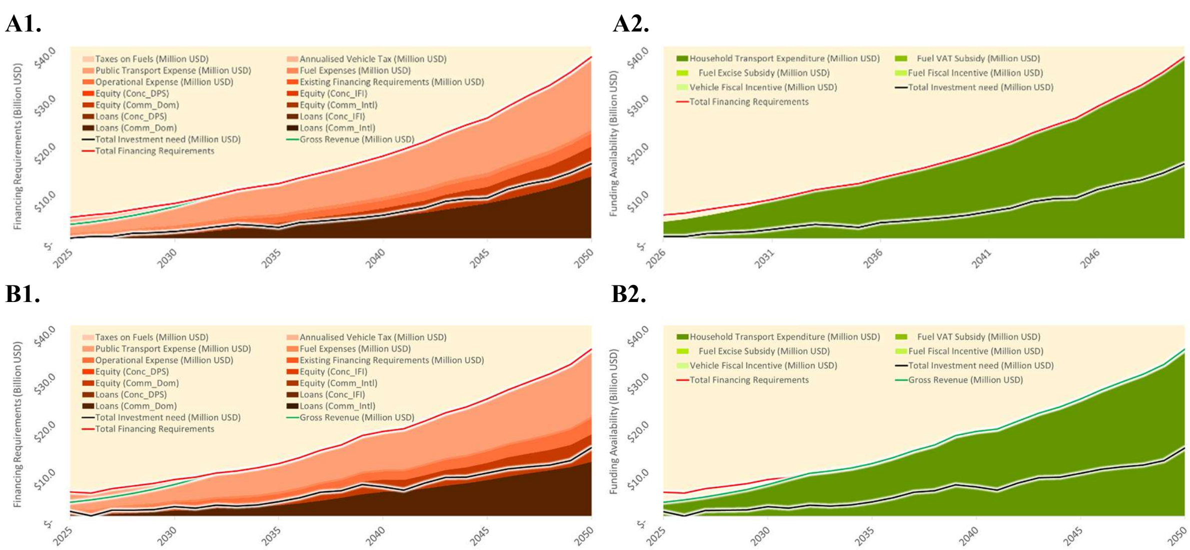

Figure 6. Residential Sector Financing Requirement and Funding Availability for the Business-as-Usual Scenario (A1. and A2.) and for the NDC Scenario (B1. and B2.) between 2025 and 2050.

Differences in the early financing gap reflect variations in the composition and timing of financing requirements, including legacy loan repayments for past vehicle investments, new investments financed by a combination of debt and upfront purchases, operating expenses, taxes, and public transport costs. Notably, the slightly larger financing gap under the NDC pathway reflects more front-loaded investments compared to BAU, rather than higher long-term costs.

Under BAU, cumulative financing requirements to 2033 is US$62.1 billion (14.4% of the US$430 billion by 2050), whereas under the NDC pathway, cumulative requirements over the same period are slightly higher at (15.1% of US$418.2 billion). Vehicle debt payments account for 26% of total BAU spending, upfront vehicle purchases 12%, and O&M and public transport expenses accounting for the remaining 62%. With an older and less electrified vehicle fleet under BAU, fuel and fuel tax expenses are significant at US$17.5 billion and US$8.8 billion, respectively. By contrast, the NDC pathway reduces O&M and public transport expenses (55.7% of total) as well as fuel and fuel tax costs (US$11.2 billion and US$4.6 billion, respectively), reflecting the shift toward electrification and newer, more fuel-efficient vehicles. However, upfront vehicle purchases are higher at US$56.2 billion, compared to US$51.9 billion in the BAU case. These findings suggest that near-term policy support should focus on reducing the upfront costs of EVs relative to ICE vehicles.

4.3. Commercial Viability

4.3.1. The Transition's Impact on Commercial Viability

The private commercial sector is expected to face the greatest financial pressure under both transition pathways. As shown in *Figure 7.*, financing requirements under BAU increase more rapidly than under NDC, reaching a cumulative total of US$309.3 billion by 2050. This exceeds BAU requirements by US$84 billion, or around US$3.2 billion annually. While a funding surplus is projected during the early transition years, amounting to US$418.5 million across the first two years under BAU and US$881.1 million through 2029 under NDC, cumulative financing gaps thereafter are estimated at approximately US$33.8 billion under the NDC scenario, and over double this amount at US$63 billion under the BAU pathway.

At present, commercial transport services in Uganda operate largely without direct fare subsidies or formal fare regulation. As a result, financial viability is primarily determined by the extent to which operational costs can be recovered through passenger or freight fares. As shown in *Figure 8.*, there is significant variation in the cost recovery of current fares across vehicle technologies, and moderate variation across transition pathways, as represented by the cumulative discounted financing gap across 2025-2050.

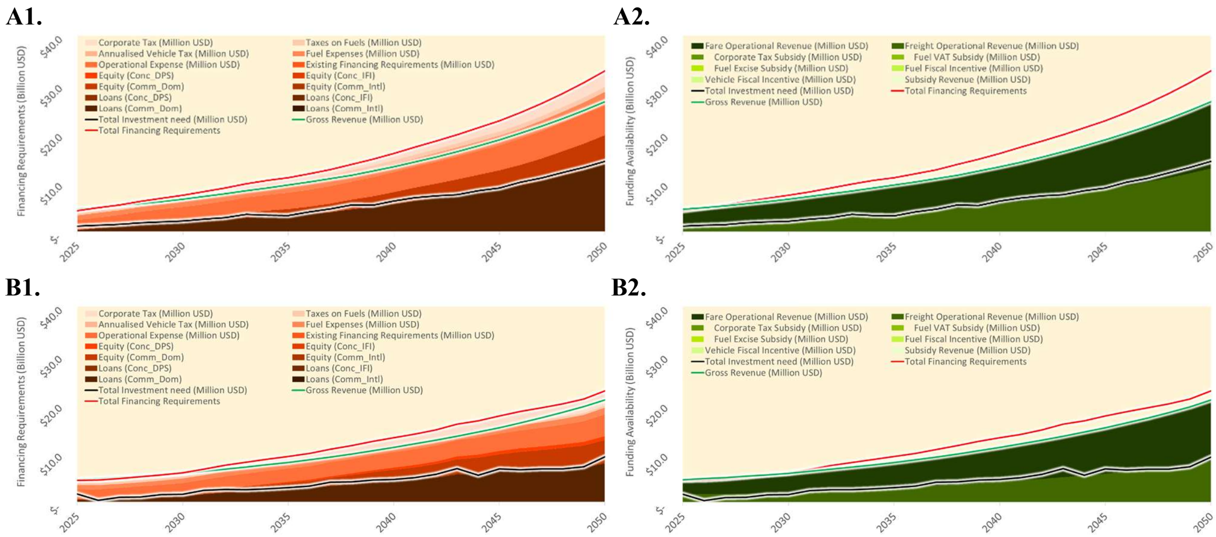

Figure 7. Private Sector Financing Requirement and Funding Availability for the Business-as-Usual Scenario (A1. and A2.) and for the NDC Scenario (B1. and B2.) between 2025 and 2050.

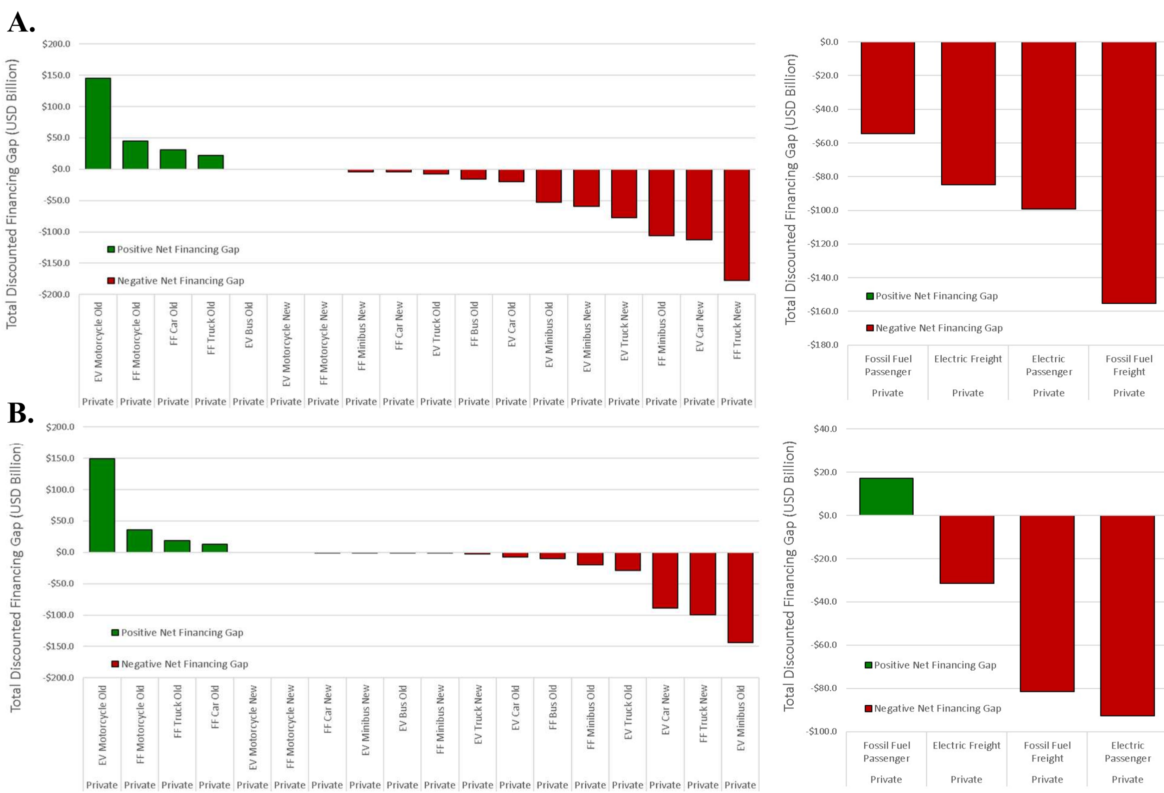

Figure 8. Cumulative Discounted Financing Gap by Private Sector Technology (left) and Service (right) at 10% Discount Rate, under a Business-as-Usual Scenario (A. – Top), and under the NDC scenario (B. – Bottom).

Notably, under both transition pathways, EV motorcycles emerge as the most financially viable technology. This is driven by low capital costs coupled with substantial reductions in fuel and fuel tax expenses relative to fossil-fuel motorcycles, which are about US$100 billion less profitable over the modelling period. Because operating costs constitute a larger share of total motorcycle costs, passenger fares closely track activity levels, allowing revenues to scale with utilisation. The funding surplus across the entire modelling period under both scenarios, shown in *Figure 9.*, effectively indicate that current boda-boda fares are largely cost-reflective. The result is consistent with observed market trends where commercial boda-bodas have proliferated in recent years.

In contrast, the pattern is reversed for EV and fossil fuel cars. *Figure 8.* illustrates that EV cars consistently rank among the least profitable technologies across both scenarios, whereas fossil fuel cars generate a funding surplus. This outcome is driven primarily by the timing of fleet transition and the capital-intensive nature of cars relative to motorcycles. As shown in *Figure 9.*, annual investments in EV cars increase steeply from the mid-2030s onward as electrification accelerates while fare collection lag behind, whereas investment in new fossil-fuel vehicles gradually get phased out yet continue operating and generating fare revenues. This timing mismatch creates a structural financing constraint during the transition period, pointing to a need for transitional support mechanisms aimed at smoothing upfront EV capital costs.

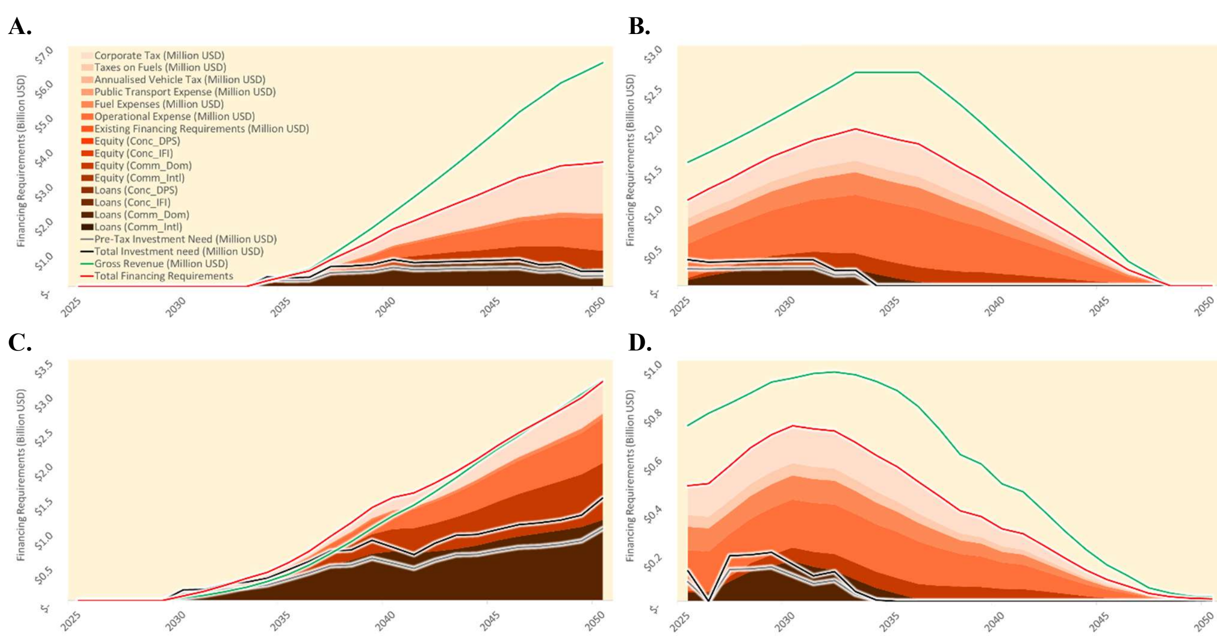

Figure 9. Private Sector Financial Viability of (A.) EV motorcycles, (B.) FF motorcycles, (C.) EV cars and (D.) FF cars under the NDC Scenario between 2025 and 2050.

Within the private sector, minibuses or matatus are the only consistently loss-making service, regardless of fuel type or transition pathway. As *Figure 10.* shows, the sector is loss-making across all years and technologies, suggesting that unprofitability isn't tied to the transition but rather suggests underlying structural challenges in their current business model. A detailed study of Kampala's paratransit system supports this finding, noting that inefficient passenger loading and scheduling, combined with a largely informal and unregulated fare system hampers system efficiency and, by extension, profitability for operators (Ndibatya & Booysen, 2020). The transition to EVs may only exacerbate the problem due to the additional upfront investment required, thus underscoring the study's emphasis on improving regulatory enforcement, reorganising ownership structures, and integrating modern technology for more efficient scheduling, booking, and fare collection (Ndibatya & Booysen, 2020).

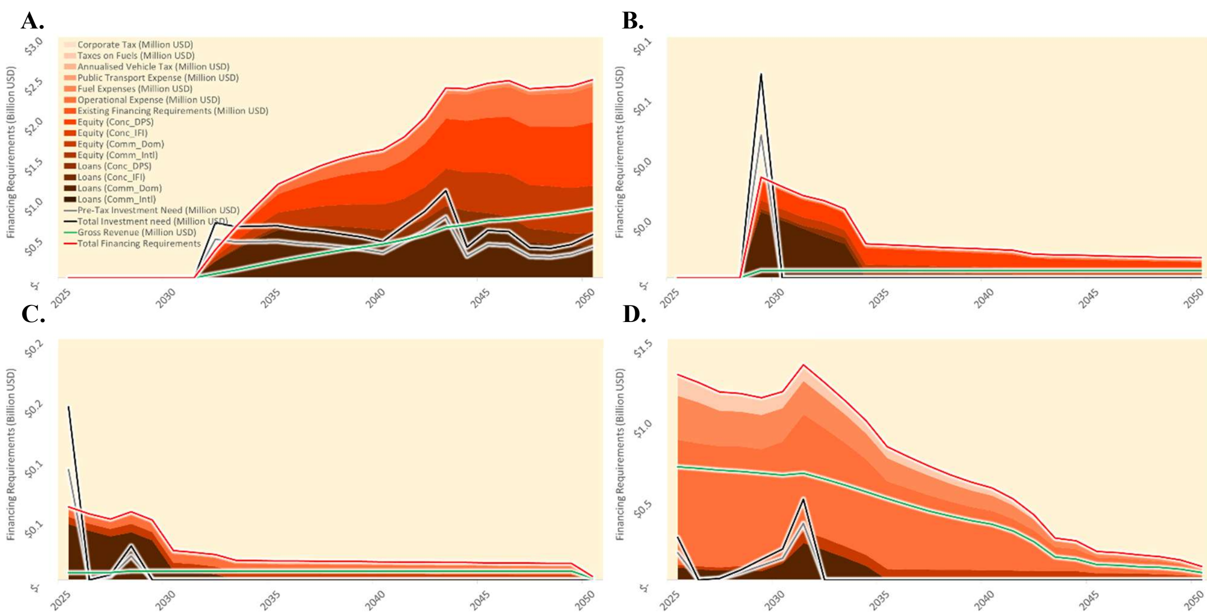

Figure 10. Private Sector Financial Viability of (A.) Old EV Minibuses and (B.) New EV minibuses and (C.) Old FF minibuses and (D.) New FF Minibuses under the NDC Scenario between 2025 and 2050.

Electrification of the trucking fleet delivers substantial financial gains, though the sector as a whole remains largely in deficit over much of the transition period. Across BAU and NDC scenarios, the cumulative discounted financing gap for EV trucks is roughly half that of fossil fuel trucks, amounting to net reductions in the deficit of almost US$80 billion under BAU and over US$40 billion under NDC (*Figure 8.*). This pattern reflects differences in cost structure and investment timing. As *Figure 11.* illustrates, old fossil-fuel trucks are extremely fuel-intensive but require minimal new capital investments, enabling freight revenues to remain in surplus for most of the modelling period. New, more fuel-efficient fossil-fuel trucks, by contrast, generate widening deficits as investment needs rise faster than associated revenue streams. EV trucks face similarly high upfront costs, but lower operating costs and increasing fleet utilisation help to bring the sector to near cost parity by 2050.

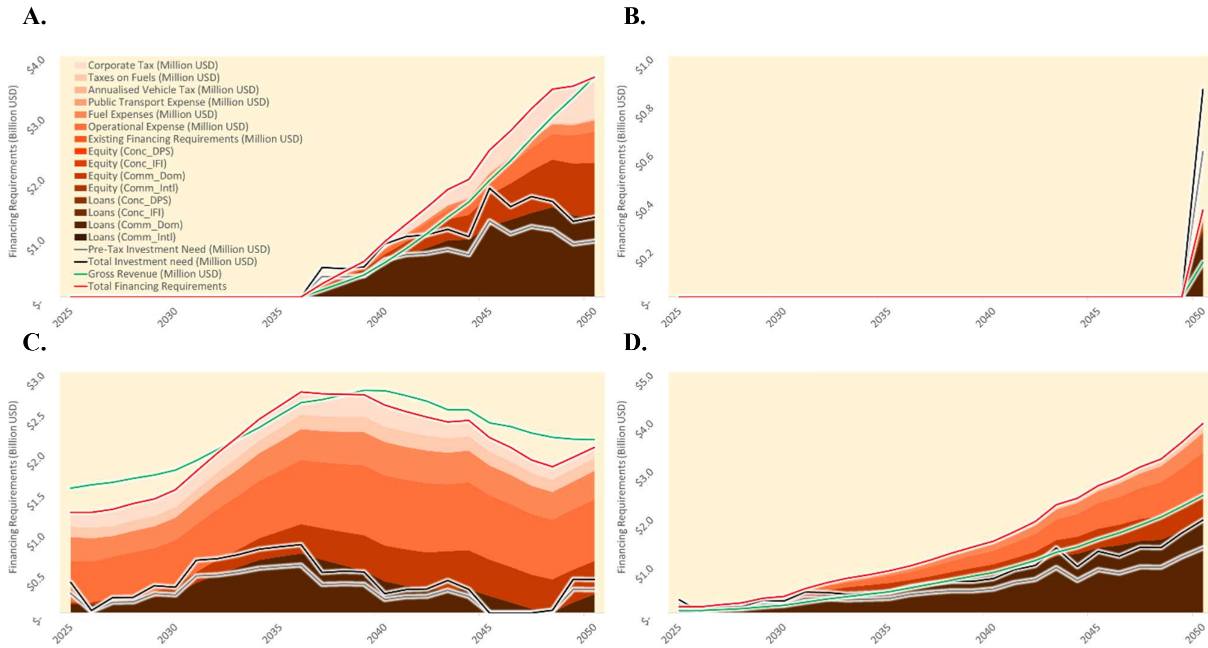

Figure 11. Private Sector Financial Viability of (A.)Old EV trucks and (B.) New EV Trucks, and (C.) Old FF trucks and (D.) New FF Trucks under the NDC Scenario between 2025 and 2050.

4.4. Public Investment Viability

In line with Uganda's shift away from dependence on motorised private vehicles toward mass public transit, substantial public investment in rail wagons for both passenger and freight services, as well as public buses, will be required under both BAU and NDC transitions. As shown in *Figure 12.* total public-sector financing requirements are estimated at US$57.8 billion and US$53.0 billion under BAU and NDC pathways, respectively. Compared with projected cashflows from passenger and freight revenues, the sector is expected to generate a substantial funding surplus across the entire transition period totalling US$32 billion and US$18.6 billion under BAU and NDC pathways, respectively.

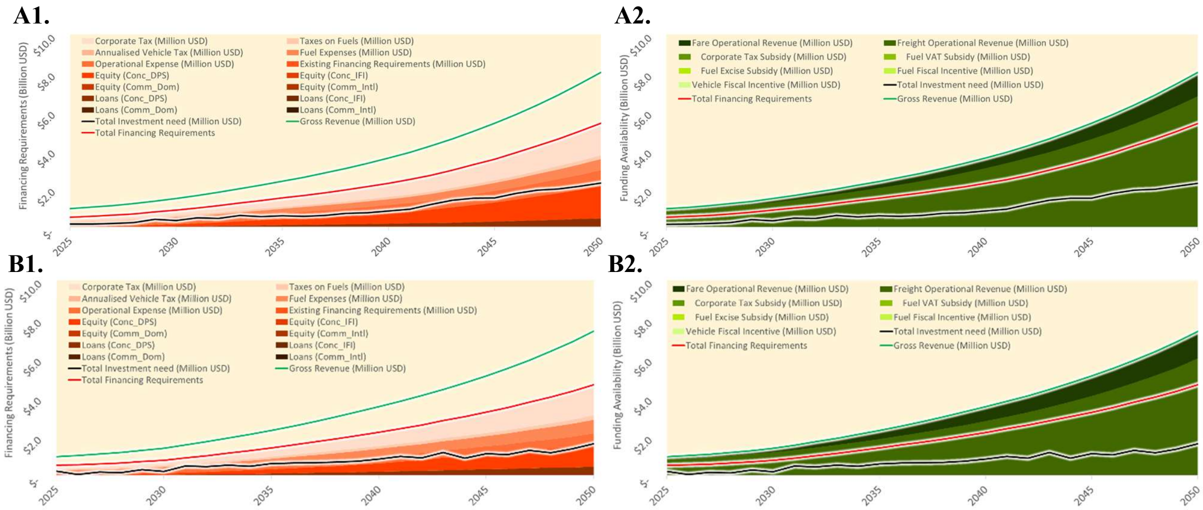

Figure 12. Public Sector Financing Requirement and Funding Availability for the Business-as-Usual Scenario (A1. and A2.) and for the NDC Scenario (B1. and B2.) between 2025 and 2050.

However, the sectoral picture masks discrepancies across services, with profitable freight operations expected to substantially offset loss-making passenger rail and bus services (*Figure 13.*). Under BAU, cumulative surpluses for freight rail wagons are projected at US$6.7 billion for fossil-fuel systems and US$26.1 billion electric systems. Under the NDC pathway, surpluses increase to US$23.5 billion for fossil-fuel freight rail but decline to US$8.8 billion for electric rail. These significant surpluses are driven by a combination of low operating expenses relative to road transport and high cost of rail freight transport in Uganda of about US$0.16 per tonne-km, which is five times than the world average of US$0.03 per tonne-km (SGR Uganda, 2018). It is also important to note that the analysis assumes full fare revenues are available to finance new rail wagon stock alone; in practice, a substantial share of these revenues would likely be allocated to financing and maintaining underlying rail infrastructure, implying that the financing surplus for rail services may be overstated.

By contrast, passenger rail services are expected to become increasingly loss-making under current fares averaging around US$0.03 per kilometre, as financing obligations increase in the latter half of the transition period and outweigh earlier surpluses (URC, 2025). Under BAU, cumulative financing gaps are projected at US$7.9 million for fossil-fuel rail and US$14.5 million for electric rail. Under the NDC pathway, the financing gap for electric rail widens substantially to US$251.8 million, reflecting the greater push towards electrification. Comparisons with fossil fuel rail are therefore limited in relevance, as the NDC scenario assumes minimal investment in such assets.

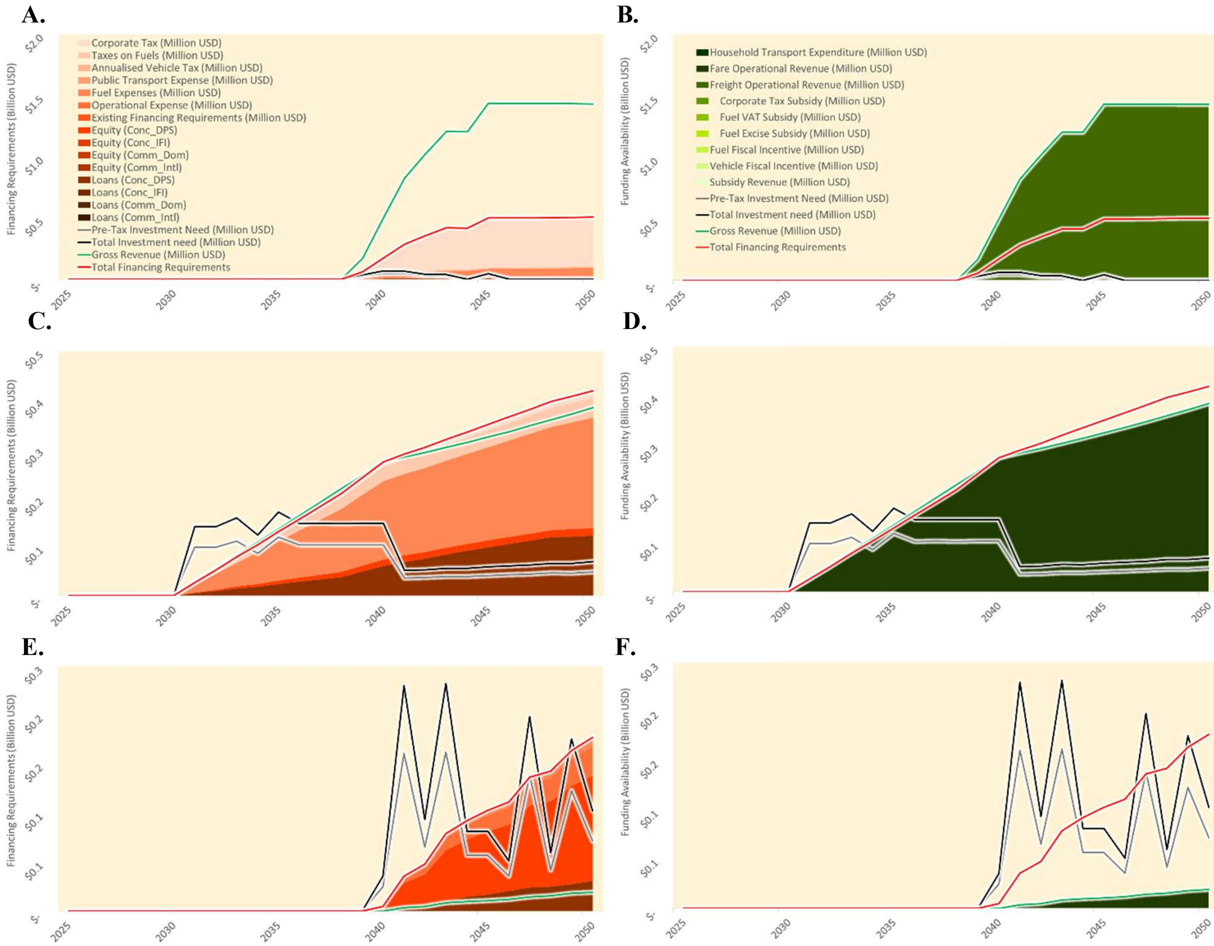

Figure 13. Public sector new electric rail freight financing requirements (A.) and funding availability revenue generation (B.), Public sector new electric passenger rail financing requirements (C.) and funding availability revenue generation (D.) and Public sector new electric passenger bus financing requirements (E.) and funding availability revenue generation (F.) under the NDC scenario between 2025 and 2050.

Financial pressures are even more pronounced in passenger bus services. Although the GoU is providing substantial budgetary and subsidy support for the domestic production of its first public electric bus flee – reflected indirectly in financing requirements that are based on lower public borrowing rates as opposed to higher commercial rates – this support is insufficient to offset the shortfall generated under current bus fares of US$0.12 per kilometre (Plus News, 2025).

Under BAU, new fossil fuel bus systems will require US$2.1 billion in financing compared with only US$238.8 million recoverable through current fares averaging US$0.12/km. Similarly, new investments in electric buses starting in 2040 require US$1.2 billion by 2050 against just US$120 million in available funding. Under the NDC pathway, fossil-fuel buses require US$1.5 billion in financing compared with US$182 million in funding, and electric buses require US$1.1 billion relative to US$116 million available. These results suggest that current fare levels are insufficient for financial sustainability and may to be increased or require additional fiscal support.

4.5. Governmental Fiscal Sustainability

4.5.1. Government Tax Revenue

The fiscal burden of the transport transition, in the absence of additional government interventions, is modest and largely front-loaded. As shown in *Figure 14.*, under the NDC pathway, import duty and VAT payments exceed those under BAU between 2030 and 2043, reflecting higher upfront vehicle investments. Net savings in the early (2026-2030) and late (2044-2050) periods partially offset this; however, the NDC pathway carries a net US$13.7 billion premium in import duty and VAT relative to BAU. Despite this, increasing savings from reduced fuel and corporate taxes under the NDC scenario nearly neutralise the fiscal impact, leaving a modest US$500 million net cost over the transition period. In particular, combined gasoline and diesel tax savings of US$12.2 billion substantially offset increased electricity VAT costs of US$0.9 billion.

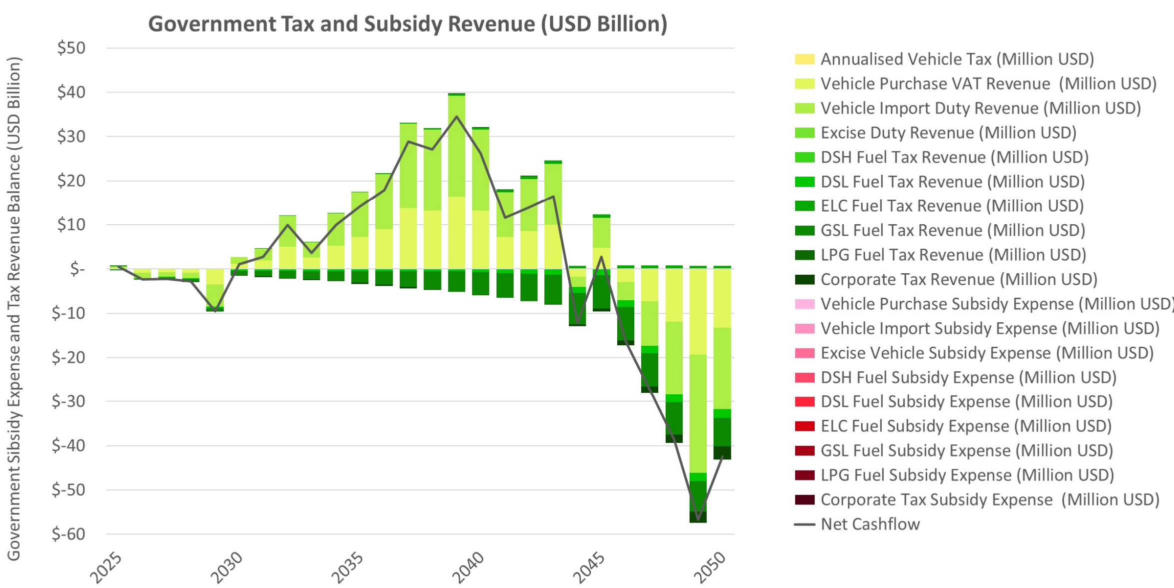

Figure 14. Incremental Government Tax and Subsidy Revenue: changes in revenue generated by Tax and Subsidy policies when shifting from the Business-as-Usual scenario to the NDC scenario between 2025 and 2050.

Some potential limitations of the analysis include the assumption that all vehicles are imported and that environmental levies are applied uniformly across vehicle types, in line with CLEWS assumptions. In practice, environmental levies differ between vehicles of different age, efficiency, and type, and exemptions for EV components from import duty for domestically manufactured electric vehicles could result in additional fiscal savings under the NDC pathway.

Table 2. Total Government Tax Revenues under BAU and NDC in Billion USD, 2025-2050.

	BAU	NDC	Incremental
Corporate Tax	**55.6**	**54.3**	**(1.3)**
Total Vehicle Tax	**154.3**	**168.0**	**13.7**
Vehicle Purchase VAT	*64.6*	*70.3*	*5.7*
Vehicle Import Duty	*89.7*	*97.7*	*8.0*
Fuel Tax	**30.6**	**19.2**	**(11.3)**
Diesel	*9.8*	*7.6*	*(2.1)*
Gasoline	*19.7*	*9.6*	*(10.1)*
Electricity (VAT)	*1.1*	*2.0*	*0.9*
TOTAL TAX REVENUE	**240.5**	**241.6**	**1.1**

4.5.2. Changes to Tax Policy

Consultations with the Ministry of Tax Policy indicate a planned shift from upfront levies towards annualised taxes, facilitated through the digitisation of vehicle licensing. Proposed annualised levies include road user charges that would contribute to the URF, which would replace traditional licensing fees (Parliament of Uganda, 2019). This approach could lower barriers to vehicle ownership and reduce reliance on debt financing. Similar proposals have been put forth in the past but were rejected over concerns around double taxation.

Policy discussions also emphasise modernising vehicle imports, including proposals to reduce the cap on the age of imported vehicles from 15 years to 8-10 years, aimed at reducing emissions and improving air quality (Ntege, 2018). This will likely increase the cost of imported vehicles as well as influence consumer preferences, such as encouraging shifts toward newer imports or alternative vehicle types.

5. Conclusions and Policy Implications

5.1. Policy Discussion

There are a number of key policy reforms that may help to address many of the shortfalls currently demonstrated within the sector, these are summarised below in *Table 3.* In the near term, the residential sector faces the most significant challenges in addressing short term financial obligations in achieving the NDC transition scenario. If household income and expenditure grow as forecast under the "Tenfold Growth Strategy" this limitation appears to be relatively short lived, with HHI growing sufficiently to meet and exceed the financial obligations of the NDC transition by 2031. To address this shortfall, short term financial incentives to promote the uptake of EVs such as import duty exemptions etc. may help to lower the financing obligations. Additionally, moving away from up-front tax and levies at purchase towards annualised taxation may lower these early repayments, and allow for further governmental tax revenue throughout later years across the life of the vehicle.

The private sector is the most adversely impacted by this transition and high growth in the transport sector, whilst affordable across the very early years, up until 2029, beyond this point under the NDC scenario, revenue growth is insufficient to keep pace with the additional expenses of this transition. This shortfall may be addressed by a number of interventions; with the growth in forecast HHI availability, increases to fare revenues may help to address shortfalls in the passenger transport portion of the private sector, whilst reforms to import duty such as the removal of duty for commercial EVs, as well as reduced corporate tax for EV freight operations could help to address this financial gap, and ensure a sustainable transition across these segments.

Table 3. Summary of policy reforms and approaches to address current financial constraints within Uganda's transport sector under NDC transition scenario.

	Recommendation	Impacts	Horizon	Instrument
1	Removal of import duty on EV vehicles	Household, Private	Immediate	Tax Relief
2	Concessional EV vehicle loan facilities for residential and commercial consumers	Household, Private	Short-Term	Credit Support
3	Smart / off-peak EV vehicle charging tariffs	All EV's	Short-Medium	Tariff-based
4	Shift towards annualised vehicle taxation	All Segments, GoU	Medium-Term	Tax Relief
5	Accelerated Depreciation for corporate EV investments	Private, Public	Short-Medium	Tax Relief
6	Cross-subsidise freight & passenger rail operations: likely through attribution of Infrastructure costs	Rail Operators	Medium-Term	Cross Subsidy
7	Cost-reflective passenger fares, and means-tested passenger subsidies	Passenger Transport	Short-Medium	Gov. Subsidy
8	Fuel Transition road map: Revenue replacement strategy development to ensure fiscal resilience	GoU	Short-Term	Fiscal Planning

9	Green-bond framework to help finance transport transitions	GoU, Public, Private	Medium-Term	Financial Instrument
10	Policy shifts in the ages of imported vehicles	All	Short-Medium	Regulatory

5.2. Limitations and Future Research

- Need to better align taxation with current Ugandan taxation policy, especially around the environmental levies charged to commercial vehicles, and the age-related tax policies on imported vehicles. With the significant changes to household income forecast based on the tenfold growth strategy, the age of vehicles is likely to decline further.
- Further scenario analysis around the feasibility of annualised tax implementation
- Further analysis around the fiscal implication of fuel, vehicle and corporate tax reforms
- At present MINFin Transport models the revenues for rolling stock, this is likely to underestimate the impact of transitioning from a Business-as-usual scenario to the NDC scenario as it does not account for the additional expenses of expanding the infrastructure required to service the electrification of Uganda's vehicle fleets.
- Fare revenue, especially for rail freight and passenger operations likely over-estimate the profitability of these technologies as they do not fully account for the capital and fixed costs associated with the supporting infrastructure, accounting for this infrastructural capex and fixed cost in future modelling would help to better reflect the sectoral affordability.
- At present this work assumes that all vehicles are imported, this is likely to differ from the real-world situation, as Uganda's domestic car market is likely to further develop in coming years, most notably with the significant public investments in Kiira Motors. This shift is likely to have implications for the import duties paid by consumers within the sector.
- With the prevalence of the informal transport sector in Uganda, and often mis-classified financing towards these vehicles, properly reflecting the cashflows for these actors can be difficult, and carries significant uncertainty.

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Appendices

A1. Detailed Financing Terms by Technology

A1.1. Car Financing

In light of recent tightening of government fleet acquisitions, public vehicles are estimated to account for approximately 5% of total new vehicle purchases, with private or household purchases comprising the remaining 95% (Africa Press, 2023). Publicly procured vehicles are assumed to be financed through direct government budget allocations and are modelled as 100% equity financing with 11% interest to reflect the public opportunity cost of investment in Uganda (Jenkins et al., 2018).

For residential consumers, equity finance represents the upfront purchase of vehicles by households, estimated at approximately 40% of total vehicles purchased, corresponding to a debt-to-equity ratio of 60:40 (Khisa, 2023). To reflect the immediate cost of purchase, equity is assigned a 100% rate of return. Based on stakeholder engagements with vehicle dealerships, households that purchase via loans typically borrow from commercial domestic banks or dealership financing packages, with a small proportion borrowing from informal lenders. Debt financing is assumed to carry an interest rate of 21%, reflecting prevailing commercial lending rates, with average loan terms of 5 years for second-hand vehicles and 10 years for brand-new vehicles and no grace period, consistent with standard consumer vehicle financing arrangements in Uganda (Equity Bank Uganda, n.d.; Rugadya, 2025).

A1.2. Motorcycles and Boda Financing

In Uganda, the majority of motorcycles are registered for commercial purposes and mostly operate within the informal sector in large urban centres. Estimates suggest there are currently more than 1.5 million boda-bodas, accounting for roughly 90% of the total motorcycle fleet (The Free Library, 2025). The remaining 10% is assumed to comprise 3% residential ownership and 7% public sector ownership.

For commercial operators, equity finance is defined as the upfront portion of the vehicle purchase paid by the operator, which is typically required to be at least 50% (Butuuro Financial Services, n.d.). The remaining is financed through asset-backed loans, with interest typically charged on a weekly or monthly basis on reducing balance (Butuuro Financial Services, n.d.). This results in effective annual interest rates of around 34%, with loan tenors of up to 2 years with no grace period (Butuuro Financial Services, n.d.). In this context, equity interest is defined as the opportunity cost of borrowing and is assumed equal to the cost of debt, to avoid overstating returns in largely informal and highly competitive markets where actual ROI benchmarks are scarce. Residential motorcycle purchases are expected to face similar terms where credit is used. However, given that most residential ownership occurs in rural areas with limited access to formal banking services, it is assumed that 90% are purchased outright. Publicly procured vehicles are assumed to be financed through direct government budget allocations and are modelled as 100% equity financing with 11% interest (Jenkins et al., 2018).

A1.3. Truck Financing

In the absence of recent disaggregated ownership data, the freight truck fleet is assumed to be predominantly privately owned (85%), with the remaining 15% assumed to be publicly owned and used for municipal or government operations.

For privately owned commercial trucks, standard asset financing terms offered by domestic commercial banks are assumed to apply: brand-new trucks require at least 25% of the vehicle cost upfront, while second-hand trucks require 40% (Bank of Baroda Uganda, n.d.). The remaining balance carries an interest rate of approximately 23%, reflecting a 2% margin above prevailing prime lending rates (Bank of Baroda Uganda, n.d.). Loan tenors are assumed to be 5 years for brand-new trucks and 4 years for second-hand trucks (Bank of Baroda Uganda, n.d.). Publicly procured vehicles are assumed to be financed through direct government budget allocations and are modelled as 100% equity financing with 11% interest (Jenkins et al., 2018).

A1.4. Bus Financing

Uganda is currently developing its first bus mass transit service, which aims to be fully electric by 2032 (PR Newswire, 2022). The project is financially supported by the Government of Uganda and backed by the World Bank, with all components, including e-bus manufacturing, delivered locally through Kiira Motors Corporation (KMC) (PR Newswire, 2022). The GoU holds a 96% stake in KMC and has committed to fully fund the pilot phase, providing substantial budgetary and subsidy support (Plus News, 2025). Stakeholder consultations with the Uganda Development Bank (UDB) indicate that it will assist with project preparation and financing of the underlying infrastructure, such as charging stations and bus ports. For modelling purposes, however, the project assumes 100% equity financing with 11% interest cost for simplicity.

A1.5. Minibus and Matatu Financing

Similar to the boda-boda industry, Uganda's minibus taxi industry is largely privately(Ndibatya & Booysen, 2020)ated (Ndibatya & Booysen, 2020). Thus, the same asset-finance loan terms were applied to the minibus sector.

A1.6. Rail Stock Financing

The procurement of rolling wagon stock in Uganda is fully publicly led and primarily financed through development finance institutions on highly concessional terms. The African Development Bank is currently supporting the URC in the acquisition of 100 flat wagons, with an estimated cost of US$137.2 million, under the broader US$412.4 million East Africa Community Railway Rehabilitation Support Project (African Development Bank, 2025) Of this total, the GoU is contributing US$79.8 million in cash, implying an approximate 80:20 debt-to-equity ratio (African Development Bank, 2022b). The financial internal rate of return (FIRR), estimated as 5.39% in the project appraisal, is assumed approximate the return on equity (African Development Bank, 2022b). A debt interest of 4.2% is applied based on AfDB lending rates prevailing in the appraisal year (African Development Bank, 2022a). Standard AfDB sovereign loan terms of 25 years' maturity, inclusive of an 8-year grace period, are assumed (African Development Bank, 2022b).

Table A1. Equations used in the MINFin Transport Model.

	Sectors	***Variable***	***Equation***	
Funding Availability	Res.	HHI Transport Expenditure	$HHI_{y,t}^{Tran.} = \left((HHI \cdot (1 + RGDP)^{y-b}) \cdot \omega^{Tran.}\right) \cdot \frac{FR_{y,t}^{Res.}}{\sum_t FR_{y,t}^{Res.}}$	*(1)*
	Priv, Pub.	Public Transport Subsidy	$PTS_{y,t}^{Res.} = Act_{y,t}^{P.Trn.} \cdot VSub_{y,t}^{PTS.}$	*(2)*
	Priv., Pub.	Freight Revenue	$Rev_{y,t}^{Frgt.} = Act_{y,t}^{Frgt.} \cdot Val._{y,t}^{Frgt.}$	*(3)*
	Priv., Pub.	Public Transport Revenue	$Rev_{y,t}^{P.Trn.} = Act_{y,t}^{P.Trn.} \cdot Fare._{y,t}^{P.Trn.}$	*(4)*
	Res., Priv., Pub.	Purchase Subsidy	$Sub_{y,t}^{Purch.} = CAPEX_{y,t} \cdot RSub_{y,t}^{Purch.}$	*(5)*
	Res., Priv., Pub.	Import Subsidy	$Sub_{y,t}^{Imp.} = CAPEX_{y,t} \cdot RSub_{y,t}^{Imp.} \cdot \omega^{Imp.}$	*(6)*
	Res., Priv., Pub.	Excise Subsidy	$Sub_{y,t}^{Exc.} = Count_{y,t} \cdot VSub_{y,t}^{Exc.}$	*(7)*
	Res., Priv., Pub.	Fuel Subsidies	$Sub_{y,t}^{Fuel} = \sum_f (Use_{y,t,f}^{Fuel} \cdot VSub_{y,t,f}^{Fuel})$	*(8)*
	Res., Priv., Pub.	Fuel VAT Subsidies	$Sub_{y,t}^{VAT} = \sum_f (Cost_{y,t,f}^{Fuel} \cdot RSub_{y,t,f}^{VAT})$	*(9)*
	Priv., Pub.	Corporate Tax Subsidy	$Sub_{y,t}^{Corp.} = (Rev_{y,t}^{Frgt.} + Rev_{y,t}^{P.Trn.}) \cdot RSub_{y,t}^{Corp.}$	*(10)*
Financ	Res.	Public Transport Expenditure	$PTE_{y,t}^{Res.} = \left(\sum_t Rev_{y,t}^{P.Trn.}\right) \cdot \frac{FR_{y,t}^{Res.}}{\sum_t FR_{y,t}^{Res.}}$	*(11)*
	Priv., Pub.	Corporate Tax	$Tax_{y,t}^{Corp.} = (Rev_{y,t}^{Frgt.} + Rev_{y,t}^{P.Trn.}) \cdot RTax_{y,t}^{Corp.}$	*(12)*

	Res., Priv., Pub.	Vehicle Purchase VAT	$Tax_{y,t}^{Purch.} = CAPEX_{y,t} \cdot RTax_{y,t}^{Purch.}$	(13)
	Res., Priv., Pub.	Vehicle Import Duty	$Tax_{y,t}^{Imp.} = CAPEX_{y,t} \cdot RTax_{y,t}^{Imp.} \cdot \omega^{Imp.}$	(14)
	Res., Priv., Pub.	Excise Duty	$Tax_{y,t}^{Exc.} = Count_{y,t} \cdot VTax_{y,t}^{Exc.}$	(15)
	Res., Priv., Pub.	Fuel Excise Duty	$Tax_{y,t}^{Fuel} = \sum_{f} (Use_{y,t,f}^{Fuel} \cdot VTax_{y,t,f}^{Fuel})$	(16)
	Res., Priv., Pub.	Fuel VAT	$Tax_{y,t}^{VAT} = \sum_{f} (Cost_{y,t,f}^{Fuel} \cdot RTax_{y,t,f}^{VAT})$	(17)
	Res., Priv., Pub.	Debt Repayment	$Debt_{t,y} = \sum_{c} \frac{CAPEX_{y,t} \cdot \omega_{t,c}^{debt} \cdot (1 + r_{t,c})^{GI_{t,c}}}{T_{t,c} - GP_{c,t}} \cdot \delta_{CY_t + GP_{t,c} \leq y < CY_t + T_{t,c}} + r_{t,c} \cdot \left(CAPEX_{y,t} \cdot \omega_{t,c}^{debt} \cdot (1 + r_{t,c})^{GI_{t,c}}\right) \cdot \left(1 - \frac{y - CY_t - GP_{t,c}}{T_{t,c}}\right) \cdot \delta_{CY_t + GI_{t,c} \leq y \leq CY_t + T_{t,c}}$	(18)
	Res., Priv., Pub.	Equity Repayment	$Equity_{t,y} = \sum_{c,x} \left(CAPEX_{t,y} \cdot \omega_{t,c}^{\text{equity}}\right) \cdot RoR_{t,c} \cdot \delta_{CY_t \leq y < CY_t + T_{t,c}}$	(19)

Where:

HHI	*= Household Income (Mil. USD)*	$\omega^{Imp.}$	*= Imported Share of Vehicles (%)*
$RGDP$	*= GDP Growth Rate (% p.a.)*	$\omega_{t,c}^{debt}$	*= Debt Share of Financing (%)*
Sub	*= Subsidy (Mil.USD)*	$\omega_{t,c}^{\text{equity}}$	*= Equity Share of Financing (%)*
$RSub$	*= Subsidy Rate (%)*	δ	*= 1 if conditions are met, otherwise 0*
$VSub$	*= Subsidy Volume per Unit (USD)*	FR	*= Financing Requirements (Mil.USD)*
Act	*= Activity (Mil.Tonne.km / Passenger.km)*	$CAPEX$	*= Capital Cost (Mil.USD)*
Val	*= Freight Value (USD per Tonne.km)*	CY	*= Commitment Year*
$Fare$	*= Public Transport Fare (USD per Passenger.km)*	GP	*= Grace Period on Principal (years)*
Rev	*= Revenue (Mil.USD)*	GI	*= Grace Period on Interest (years)*
$Count$	*= Vehicle Count (Mil. Vehicles)*	T	*= Term (years)*
Tax	*= Tax Cost (Mil.USD)*	RoR	*= Equity Rate of Return (% p.a.)*
$RTax$	*= Tax Rate (% p.a.)*	r	*= Interest Rate (% p.a.)*
$VTax$	*= Tax Volume per Unit (USD)*	y	*= Current Year*
PTE	*= Public Transport Expenditure (Mil.USD)*	b	*= Start year*
PTS	*= Public Transport Subsidy (USD per Unit)*	f	*= Fuel*
Use	*= Fuel Use (Units)*	t	*= Technology*
FR	*= Financing Requirements (Mil.USD)*	f	*= Fuel*
$\omega^{Tran.}$	*= Average % of HHI spent on Transport (%)*		