UNIVERSITY OF CAMBRIDGE
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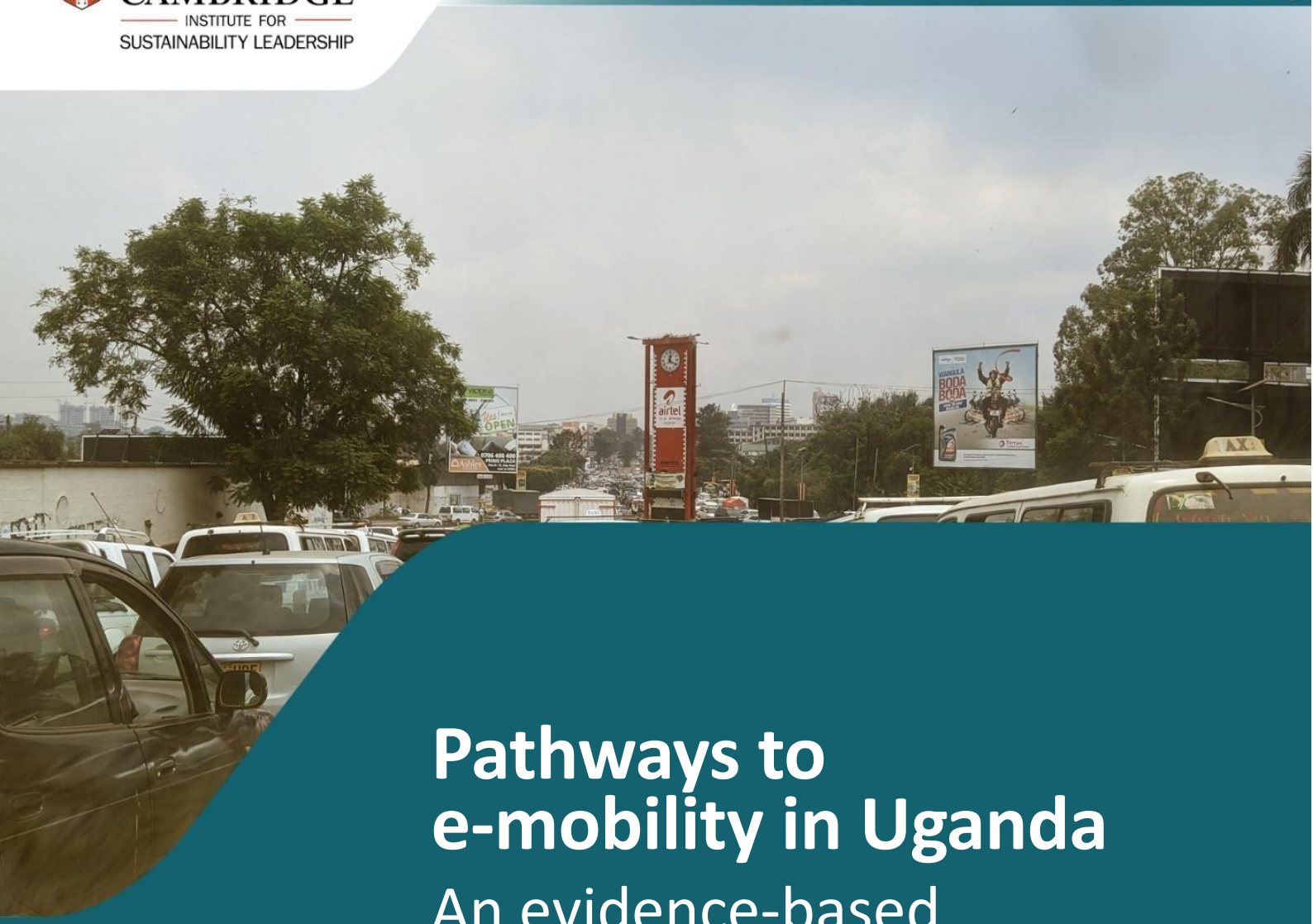
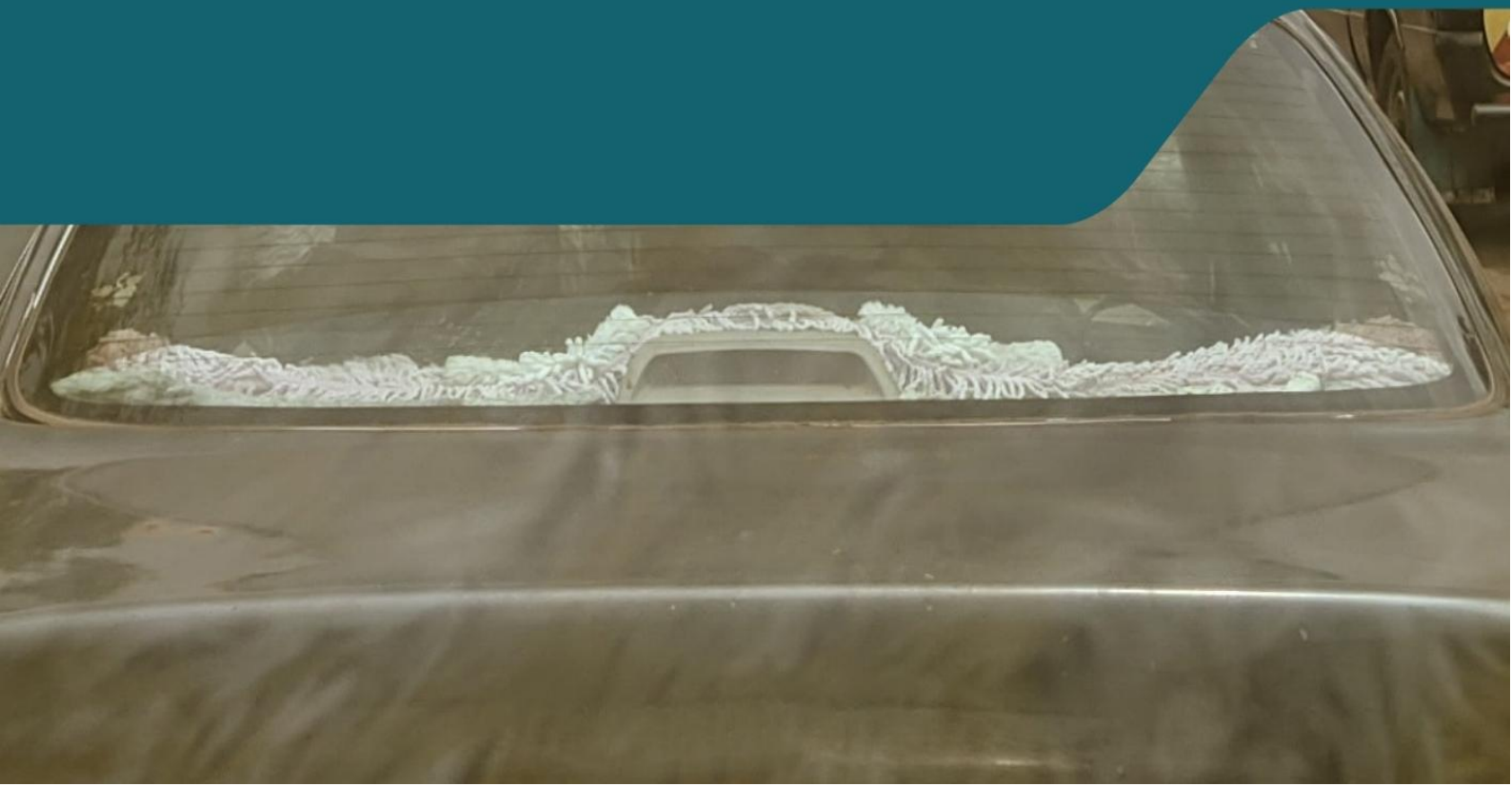
Policy Briefing



Pathways to e-mobility in Uganda

An evidence-based approach to transition



The University of Cambridge Institute for Sustainability Leadership

The University of Cambridge Institute for Sustainability Leadership (CISL) partners with business and governments to develop leadership and solutions for a sustainable economy. We aim to achieve net zero, protect and restore nature, and build inclusive and resilient societies. For over three decades, we have built the leadership capacity and capabilities of individuals and organisations, and created industry-leading collaborations, to catalyse change and accelerate the path to a sustainable economy. Our interdisciplinary research engagement builds the evidence base for practical action.

Authors

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Introduction

The development of low-pollution transportation in cities is critical to improving the health, environment, and quality of life of urban people, while simultaneously dealing with transport-linked greenhouse gas emissions (GHG). Electric mobility (e-mobility) offers a direct, transformational solution to cleaning up air pollution in Uganda's cities, reducing health risks, GHG emissions and dependency on fossil fuel imports, with the potential to create thousands of 'green' jobs in the process[1]. Given that over 90 per cent of Uganda's electricity is derived from renewable energy sources, the electrification of transport will have a particularly favourable impact on the country's climate change response.

Transition towards e-mobility in Uganda's urban centres requires deep, multi-partner collaboration. The social, political and economic aspects of cities like Kampala will need to be considered alongside the appropriateness of new technologies and regulatory mechanisms. It is critical that e-mobility is implemented in the context of a wider vision and set of policies that reduce congestion, integrate different modes of transport, and promote healthy, active travel choices.

Our work at the University of Cambridge Institute for Sustainability Leadership (CISL) is facilitating this transition by furthering collaboration between stakeholders in business (e-mobility start-ups and logistics companies), policymakers in Uganda and motorcycle riders' associations to co-design an effective pathway to phase out petrol-driven engines. Collaboration between policy, business, academic and community organisations is a pivotal theme of our work, intended to address the inherent complexity of the transition, overcome siloed decision-making, and work towards inclusive and effective interventions.

This policy briefing aims to improve understanding of the state of e-mobility in Uganda and how best to achieve the transition to low-pollution, low carbon and jobs-rich transportation. Drawing on the collaborative research conducted as part of a Prince of Wales Global Sustainability Fellowship at CISL, supported by AstraZeneca, the briefing provides recommendations for those looking to facilitate a just, sustainable and—above all—urgent transition to e-mobility in Uganda. Our research suggests that this transition will be most effective when it is inclusive and supported by effective policy built upon a robust evidence base.

Key recommendations include:

1. Draw up policies to guide an e-mobility pathway
2. Build local capacity in the e-mobility sector
3. Identify and address barriers to early electric vehicle adoption
4. Build capacity for re-use and recycling of e-waste (especially batteries)
5. Incorporate e-mobility into existing transport modes.

A multi-sectoral and multi-disciplinary approach to transition will remove barriers to adoption in each part of the e-mobility ecosystem, fostering the widest possible distribution of benefits.

[1] We Mean Business Coalition (2022). Rapid switch to clean energy would see a 4-person household spending $2,000 less each year, and create nearly 2 million jobs across G7.

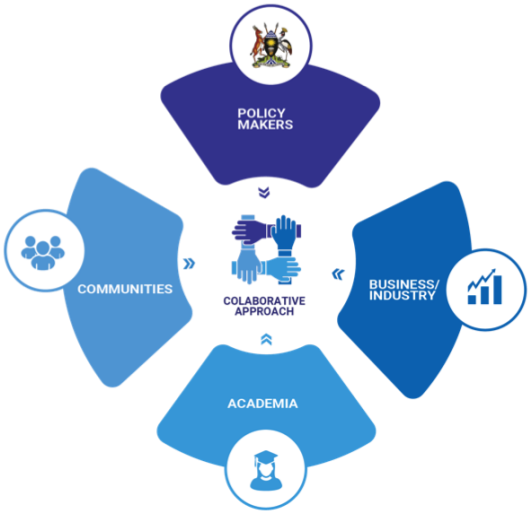

Figure 1: Key stakeholders in our collaborative approach

Background

Like many African countries, Uganda is experiencing fast population growth and rapid urbanisation, leading to a staggering increase in mobility (motorised transport in particular) as people and goods move around the country with ever increasing frequency (Evans et al., 2018). A particular increase can be observed in 'non-conventional transport' provided by minibuses, vans and motorcycle taxis (boda bodas), which has led to the degradation of urban air quality with negative impacts on the environment and human health. The rapid pace of motorisation and urbanisation, coupled with unplanned and uncontrolled urban expansion, has also led to widespread traffic congestion which exacerbates air pollution as vehicles 'idle' while static or moving slowly (Barnes et al., 2018). Motorised transport is responsible for 24 per cent of direct CO_2 emissions (from fuel combustion), a pollutant that is primarily responsible for global warming and contributes significantly to respiratory illness. Road vehicles—including cars, trucks, buses, and two- and three-wheelers—account for nearly three-quarters of transport CO_2 emissions.

Many cities in Uganda are facing air pollution problems linked to transport-related emissions (Okure et al., 2022; Singh et al., 2021). Exposure to high concentrations of air pollutants increases the incidence of Chronic Obstructive Pulmonary Disease (COPD), asthma, lung disease, heart disease, and premature death (Kelly and Fussell, 2015; WHO, 2021), with consequent impacts on quality of life and the economy. Uganda has a high burden of respiratory diseases with a population level prevalence of asthma estimated at 11.02 per cent (Kirenga et al., 2019) and COPD at 16. 2 per cent (van Gemert et al., 2015). A study on rates of asthma and COPD exacerbations in a tertiary urban hospital in Uganda showed that up to 59.6 per cent of the patients experienced an acute exacerbation in the first year of follow up (Kirenga et al., 2018).

State of e-mobility in Uganda

Recognising the benefits of e-mobility, the Government of Uganda (GoU) established a State Enterprise—Kiira Motors Corporation (KMC)—in 2014, jointly owned by the Government of Uganda (96 per cent) and Makerere University (4 per cent). KMC was intended to champion value addition in the nascent motor

vehicle industry in Uganda through technology transfer, contract manufacturing and supply chain localisation (Kiira Motors Corporation, 2022). Part of KMC's strategic plan is to develop and make vehicles that utilise solar or electric charging. However, minimal progress has been made to date, with e-mobility in Uganda still at a nascent stage due to high upfront investment costs, lack of enabling policies, and lack of infrastructure for e-mobility. GoU is engaging private e-mobility operators and international development partners to explore ways to transition to greater use of electric vehicles (EVs), including electric bodas. This engagement is being led by the Ministry of Energy and Mineral Development (MEMD), Ministry of Works and Transport (MoWT), Kampala Capital City Authority (KCCA), and other government agencies. Besides engaging the various stakeholders, the GoU is promoting the use of electric transport solutions to combat air pollution and related health burdens among other advantages.

There are currently three private sector companies (Bodawerk, Zembo and Mojo energies), one parastatal (Kiira Motors Limited) and two academic development initiatives (Nakawa Vocational Training College and International University of East Africa) specialising in e-mobility solutions and services. Most entities in the e-mobility space fall under the two-wheeler segments (e-bodas). Zembo imports and sells new electric motorcycles, whereas Bodawerk assembles lithium-ion battery energy packs for use in transportation and agriculture, and Modjo Energies retrofits petrol powered motorcycles to electric by integrating electric motors. The two academic initiatives (Nakawa Vocational Training College and International University of East Africa) carry out research on electric two-wheelers, while KMC builds private electric vehicles, solar-powered electric buses, and diesel-powered buses. New players are also entering the market, though all specialist e-mobility firms remain in the discovery/early stages.

Currently, the most common electric vehicles are electric bodas (e-bodas), which operate with battery swapping, battery leasing and charging stations as the leading services. The purchase price of e-bodas is higher than petrol-powered bodas due to high battery costs, but life cycle costs are lower due to cheaper operation and maintenance which offset the upfront costs.

Recommendations

We offer the following recommendations for policymakers in Uganda seeking to facilitate a just, sustainable and—above all—urgent transition to e-mobility:

1. Draw up policies to guide an e-mobility pathway

The Government of Uganda (government) has an opportunity to develop policy frameworks that define and guide the transition to e-mobility. These could include regulatory, tax and financial incentives.

1.1 Financial incentives

The government could offer context-based incentives during the early phase of e-transition, such as purchase incentives to individuals and companies seeking to build electric fleets. This includes lowering or exempting certain taxes and tariffs for electric vehicle (EV) users, industry, and commercial service providers, while preparing to gradually phase them out once the EV industry becomes self-sustaining. Measures such as: i) price subsidies; ii) tax breaks; and iii) a range of privileges for using EVs like subsidised electricity tariffs for charging have been applied successfully by several countries to incentivise early

adopters. In Norway, buyers of VAT are exempt from VAT[2], while all hybrid and electric vehicles are sold duty-free in Mauritius.[3]

Feasibility studies should be conducted to guide assessment of the actual costs and benefits of the transition and how to provide the incentives. This could be achieved through studying the possible savings on fuel, operations and maintenance; the impact of carbon emissions on the environment; health impacts averted as a result of reduced tailpipe pollutants; and potential green jobs that could be created along the e-mobility supply chain.

1.2 Non-financial benefits

These could include: (i) granting access to restricted traffic lanes and areas, which include bus lanes and high occupancy vehicles or (ii) the development of infrastructure, including increasing the number of charging points. Installing and supporting charging infrastructure in public places and on highway routes is key for the market penetration of EVs. However, assessing the interdependence of the two is vital to ascertain the ratio of EVs to charging stations and avoid the classic chicken and egg strategy problem.

1.3 Disincentivising Internal Combustion Engine (ICE) vehicles

Policies on tax increments targeted at conventional ICE vehicles for environmental reasons can influence the speed of transition to EVs. It reduces the cost-competitive advantage such vehicles might have over EVs if the latter are exempted from these increments. Whether it is intentional or not, this policy could affect the EV market by increasing the operational costs of ICE vehicles.

Policy implementation could be the most impactful area in which the government can create an enabling environment for EV market growth. These incentives could be implemented through the third National Development Plan (NDPIII 2020/21 – 2024/25 climate change objectives) which aims to maintain and/or restore a clean, healthy and productive environment and reduce climate change vulnerability and carbon footprint. A number of actors—including Ministry of Energy and Mineral development (MEMD), Ministry of Works and Transport (MoWT), Kampala City Council Authority (KCCA), National Environmental Management Authority (NEMA), Ministry of Water and Environment (MoWE) and the private sector—have been identified to lead these objectives.

The policies should provide clarity on the short, medium (the next five to seven years), and long term to provide companies and other stakeholders a degree of certainty in their planning and investment. They should be assessed carefully (through monitoring and evaluation programmes) to increase the evidence base for mid-term corrections and mitigate against unintended consequences. The government should lead the development of standards for batteries and other components used in electric vehicles to help avert the arrival of sub-standard products on the market which could erode end-user trust.

2. Build local capacity in the e-mobility sector

The e-mobility sector will require qualified skilled personnel and experts as it expands. It is essential that the human resources are available to enable accelerated growth in the sector. Local capacity can be built

[2] Zhang, Y., Qian, Z. (Sean), Sprei, F., & Li, B. (2016). The impact of car specifications, prices and incentives for battery electric vehicles in Norway: Choices of heterogeneous consumers. *Transportation Research Part C: Emerging Technologies*, 69, 386–401.
[3] Barry, M., Damar-Ladkoo, A., 2016. Consumer behaviours towards eco-cars: a case of Mauritius. Stud. Bus. Econ. 11, 26–44.

through introduction of courses in secondary and tertiary institutions to equip young people with the capabilities they need to build Uganda's future sustainable economy. Existing specialised vocational training institutes like the Nakawa Vocational Training College can offer more technical courses specifically focused on e-mobility. E-mobility curricula will help in the training, reskilling and upskilling of workers across the mobility sector, enabling significant opportunities for innovation and job creation. New capabilities are needed in electrification of energy supply to support an e-mobility 'ecosystem' comprising manufacturing and retrofit of EVs, charging infrastructure and numerous, diverse applications of EVs from passenger movements to retail delivery, and domestic services to last mile health deliveries.

Building capacity aligns with the NDPIII climate change strategy which prioritises the improvement of education, awareness raising, and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning. Government actors identified to lead this include the National Planning Authority (NPA), MoWE, Ministry of Finance, Planning and Economic Development (MoFPED), and the Ministry of Local Government (MoLG). The NDPIII also prioritises the integration of education for sustainable development in national curricula at all levels for an environmentally literate citizenry, led by MoWE and the Ministry of Education and Sports (MoES).

3. Identify and address barriers to early EV adoption

Although electrification of road transport (replacing ICE vehicles with electric vehicles) is vital to urban economic development and wellbeing, research shows that the diffusion of EVs is proceeding slowly (Stockkamp et al., 2021). Further research is needed into the reasons for this, funded, for example, through the Research and Innovations Fund (RIF) or directly by the private sector and international development partners. Understanding the potential scale and nature of the e-mobility market is critical in order to design effective EV policy and business strategy. Early adopters of EVs in Uganda are currently facing considerable challenges, including high upfront costs of adoption, high taxes on lithium batteries and high interest rates from banks. Addressing these barriers through subsidies such as tax breaks, incentives on electricity tariffs, lower interest loans or grants will be critical to accelerate adoption.

Electric buses produced by Kiira Motors are worthwhile because of their high passenger-to-vehicle and low emissions-to-passenger ratios. However, the high initial price of buses may limit their impact in the short term, for example until battery prices have declined to an economically favourable level. In the near-term, smaller EVs present a key opportunity, with charging (or battery swap) infrastructure and price remaining the principal barriers to increased adoption.

Under the NDPIII, the development of local finance solutions tailored to micro, small and medium enterprises engaged in the production and deployment of climate positive technologies is a priority. Identified lead actors include Uganda Development Bank, MoWE, MoFED, NPA and the private sector. The NDPIII also prioritises the building of partnerships between government and financial institutions to bring forward financial instruments such as climate and green bonds.

4. Build capacity for re-use and recycling of e-waste (especially batteries)

Accelerated adoption of EVs will lead to increased end-of-life waste from electric and electronic equipment (EEE) on a time lag of seven to ten years. The development of facilities for the re-use and recycling of batteries and battery components should be put in place now to cope with the anticipated growth of e-waste volumes. Through NEMA and alongside the National Enterprise Corporation (NEC), the government launched Uganda's first national e-waste management facility in 2021. This facility is

supported by the existence of various policies, including the National Environment Act 2019, the National Environment (waste management) Regulations 2020, the E-Waste Management Policy 2012, the E-Waste Management Strategic Plan, and the E-Waste Guidelines 2016. However, one of the major challenges will be ensuring that battery end-users do not discard e-waste inappropriately, for example with other streams such as domestic waste. To avoid this, specialist e-waste collection centres will be required in all key urban centres, alongside a significant effort to raise awareness about how to manage e-waste. Without safe disposal or ideally remanufacture or recycling of e-waste there exists a high risk of soil, air and water pollution. E-waste facilities should not solely be seen as a cost: they are also a business and job creation opportunity.

Through the NDPIII, the government has prioritised reducing the adverse per capita environmental impact of urban areas in Uganda with maintenance of habitable air quality and innovative municipal and other waste management, and lessening waste generation through prevention, reduction, recycling, and reuse, to transition towards a circular economy. The actors identified to lead this include MEMD, MoWT, NEMA, KCCA, MWE and the Ministry of Lands, Housing and Urban Development (MoLHUD).

5. Incorporate e-mobility into existing transport modes

The plan to accelerate e-mobility should be addressed in parallel with existing transport modes such as non-motorised transport (NMT) and Bus Rapid Transit (BRT), so that the different modes complement each other efficiently. Buses can hugely increase road carrying capacity; hence, the installation of more bus lanes and/or BRT along key transport corridors would provide major, complementary benefits to e-mobility transition. Electric motorcycles in particular can also supplement journeys where buses cannot pass. A multi-modal transport system where people can reliably take different forms of transport within a city (ie an 'integrated transport system') requires strong coordination among transport providers.

A number of cities have experienced challenges when implementing integrated public transport solutions or pushing for new technical standards and fuel taxation (Goodfellow, 2015), highlighting the challenge of urban transformation and potential challenges to e-mobility. Protests and unrest instigated by policies addressing climate change have been significant in some countries. Examples include the halting of mandatory vehicle inspection in Uganda (Bagala. 2017), the contesting of regulations on fuel taxation in France during the "Yellow Vests" protests (Mehleb et al., 2021), and similar reactions to the imposed technological standards in the electrification of jeepneys in Metro Manila (Agaton et al., 2019). It is wise to understand the social dynamics of the transport system through collaborative stakeholder engagement to ensure successful policy implementation.

Conclusions

Demand for electric mobility is growing in Uganda. Current assessments show that it has the potential to reduce local air pollution (and related health burdens) and GHG gases in Uganda's cities, creating tens of thousands of green jobs within a flourishing sustainable economy. Our research suggests that the transition will be most effective when it is inclusive (involving all relevant actors) and supported by effective policy built upon a robust evidence base. A cross-sectoral and multi-disciplinary approach to economic transition has the potential to remove barriers to adoption in each part of the e-mobility ecosystem, fostering the widest possible distribution of benefits to Uganda's citizens through a rapid, orderly transition.

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