THE CLIMATE JUSTICE
CHARTER ALTERNATIVES

ECO-SOCIAL HOUSING AND TRANSITION TOWNS

CLIMATE
JUSTICE
CHARTER
MOVEMENT

Eco-mobility and Clean Energy Public Transport for South Africa

Executive Summary

This is a policy framework to guide eco-mobility and clean energy public transport alternatives to accelerate a deep just transition as envisioned by the Climate Justice Charter championed by the Climate Justice Charter Movement (CJCM). This policy framework will show why transportation is imperative to address legacies of apartheid, confront the climate crisis and secure a climate justice future. Anchoring this democratic systemic reform, to accelerate the deep just transition, are different policy mechanisms, based on global research. Included are policy tools and actions for government, communities, workplaces and sectors. Government has the largest and arguably most strategic role to play in driving the transportation transition, but through people and worker power from below. Policy imperatives to guide the government's role include: bans, incentive schemes, infrastructure, research, financing, technological innovation and economic growth, oceans transportation, and taxi reform. Policy tools and actions for communities, workplaces, and sectors are smaller but equally as powerful and cover the following thematic areas: activism, economic development, employee incentives and programs, and private infrastructure.

An ecologically, economically, and socially just and sustainable transportation transformation requires numerous systemic shifts. The following list indicates but a few of the most important systemic changes that are urgently required and are unpacked in various ways throughout the policy framework:

- Decouple (separate) population growth from transport emissions through eco-mobility (walking and cycling). Along with policy, economic, and infrastructural interventions, a change in thinking from treating pedestrians and cyclists like externalities to valuing them as equal road users is important.
- Rapid decarbonization of existing public transport systems through renewable energy approaches. Research and development should also prioritise emergent renewable

energy technologies such as hydrogen powered trains, battery powered trains, solar powered railways, and wave and electric boats.

- Make shifting road to rail for both non-passenger and passenger transport an immediate priority. Additionally, better explore and integrate ocean and coastal non-passenger and passenger transport.
- Robust engagement with taxi associations and a clear and consistent formalization agenda.

Introduction

The Climate Justice Charter Movement (CJCM) is guided by goals, principles, and systemic alternatives that seek to bring about a deep just transition that can realize a sustainable and transformed future. Transportation is one of the systemic interventions contained in the Climate Justice Charter (CJC) (Climate Justice Charter Movement, 2023). Transportation is one of the largest sectors contributing to anthropogenic climate change with projections to continue to grow (Wang & Ge, 2019). In addition, the lack of safe, affordable, and available transportation is a uniquely frustrating and unjust experience lived by many South Africans daily (Gumbo & Moyo, 2020). The lack of both passenger and non-passenger functioning transportation options is a result of apartheid spatial planning and related systemic inequalities, the failure and crisis state of public institutions such as the Passenger Rail Agency of South Africa (PRASA) and Transnet, and car- and road-centric cultures that have met the needs of wealthy individuals and industries but created largely unsafe, unhealthy, and unfair transportation systems for the majority of people (Gumbo & Moyo, 2020; Masie & Bond, 2018; Olojede, 2021). Lastly, walking and cycling for transportation, (eco-mobility alternatives as defined by the CJC), are also not available in South Africa due to planning approaches that have prioritized car-centric lifestyles. Eco-mobility approaches are critical to the just transition as they are the only transportation options that have the potential to separate population growth from an increase in transportation emissions (ICLEI, n.d.). Eco-mobility approaches also have the potential to massively reduce urban transportation emissions, which is critical because urban centres are major sites of emissions and African cities are rapidly growing, so ensuring that eco-mobility options are available within appropriate geographical contexts is key to sustainable urban population growth (Porter et al., 2021).

Through mobilizing the CJCM, the CJC offers this policy framework as an alternative to the present and an opportunity for the future. This policy framework will outline the goals of the policy, briefly explain the current state of transport sector emissions, offer a critique of the current state of South African transport institutions, briefly note some key takeaways of global examples, lay out the policy framework with multiple policy mechanisms grouped thematically,

and end by noting obstacles and challenges to realizing eco-mobility and clean energy public transportation systems.

Goals of the Policy

The goals of this eco-mobility and clean energy public transport policy framework for South Africa are to accelerate the deep just transition by:

- Driving home that the country's passenger and non-passenger mobility needs must be centered through eco-mobility and clean energy public transport approaches. This requires a rejection of a continued reliance on fossil fuels, and a rejection of car-centric planning.
- Accelerating the deep just transition through inspiring a change in thinking from single car ownership to public transportation ridership and eco-mobility for the society. The measurement of success is the safe and effective eco-mobility of all and in particular transforming the wasteful, resource intensive and polluting consumption habits of the wealthiest members of society such that their first choice is to take public transportation or walk or cycle rather than drive a car.
- Lay out the details for an eco-mobility and clean energy public transport democratic systemic reform to achieve policy choices with different mechanisms for government, institutions, and civil society to engage with. These choices activate modal and fuel switching approaches.
- Demonstrate the possibility of mobilizing eco-mobility and clean energy public transport alternatives based on global lessons and examples.

Transport Sector Emissions and Challenges Internationally and in South Africa

Transportation makes up a quarter of total global greenhouse gas (GHG) emissions and is the fastest-growing contributor to emissions (Wang & Ge, 2019). Transportation emissions are driven by both population growth and economic growth, making it a very difficult sector of emissions to decarbonize (Wang & Ge, 2019). Energy use in the transport (both passenger and non-passenger transport) sector has increased and is likely to continue increasing (Wang & Ge, 2019). The most recent international energy agency (IEA) report confirmed that transportation was nowhere close

to meeting the goals of the Paris Agreement, making it imperative that countries who are engaging in the deep just transition make decarbonizing transport an immediate priority (IEA, 2022a).

Transport is understood through modes, including, railways, roads, domestic waterways (mostly rivers), aviation (domestic and international), international and coastal shipping, and pipelines (transport of liquid resources) (Wang & Ge, 2019). Transport is separated by passenger and non-passenger transport. Passenger transport refers to the sector of transport concerned with providing public transport (Wang & Ge, 2019). Non-passenger transport is concerned with the movement of goods, resources, and raw materials (Wang & Ge, 2019).

Road transport makes up the largest portion of total transport emissions (IEA, 2022a). Passenger road vehicles (individuals driving private cars) make up the largest contributor to road transport emissions (Brand, 2021; IEA, 2022a, 2022b; Wang & Ge, 2019). Across all modes road passenger vehicles are the biggest contributor to global transport emissions (IEA, 2022a, 2022b). Transport is still very dependent on fossil fuels, with 91% of its fuel mix coming from oil, which has remained largely unchanged over the last 50 years (Brand, 2021; IEA, 2022a; Wang & Ge, 2019).

It was reported in 2022 that between the year 2000 and 2020 the transport sector in South Africa made up of 12.7% of energy sector emissions, which constitutes 81% of total emissions in the country (forestry fisheries & the environment, 2022). Unfortunately transport sector emissions are not tracked on their own, they are tracked as part of the energy sector only. Using this calculation: (12.7 x 81) / 100 = 10.287%, we can estimate **that transport sector emissions are approximately 10.3% of South Africa's total emissions.** However, this conflicts with an earlier report which reported that the transport sector contributed 13.3% to energy sector emissions, which make up 80% of the country's overall GHG emissions (forestry fisheries & the environment, 2017). This could be because the 2022 report included 2020 data, which saw a slight drop in transport sector emissions globally from the COVID-19 pandemic (forestry fisheries & the environment, 2022; IEA, 2022a). **Road transport, including passenger and freight makes up 91.2% of transport related emissions in South Africa** (Department of Transport: South Africa,

2018). Shipping related emissions are around 2%, but they are likely not entirely captured as emissions are not counted once vessels are beyond the Exclusive Economic Zone (EEZ) (Department of Transport: South Africa, 2018; forestry fisheries & the environment, 2017). South Africa ranks 13th in the world globally for transport related emissions (Department of Transport: South Africa, 2018; Olojede, 2021). It is a priority for the CJC to decarbonize transport by switching from road to clean energy rail and coastal ocean transport systems and eco-mobility. The South African Government's 'Green Transport Strategy' partially supports this with a strong focus on shifting road transport to rail transport as part of reducing transport sector emissions (Department of Transport: South Africa, 2018). This is certainly not wholistic enough.

The transport transition that is already unfolding globally is the 'EV's for everyone' approach. According to recent trends reported by the IEA, the electric car market is maturing and consumer spending on EV's is increasing every year (IEA, 2022a). The trend to just replace fossil fuel cars with electric ones and call it a 'just transition' fails to adequately address sustainability, equality, and justice in multiple ways. First, electric vehicles add electricity demand to already and increasingly constrained grids, which could reinforce fossil fuel dependencies if renewable energy cannot meet demand (Englund, 2021; Hensley et al., 2018). The potential creation of fossil fuel dependencies for electricity will work in opposition to the deep just transition. Second, electric vehicles create unnecessary resource competition for already scarce resources that are critical materials for the renewable energy transition and in many cases are located globally within indigenous territories which are high in biodiversity (Hensley et al., 2018; Owen et al., 2022). It can be argued that, when the public transport transition is more aligned with justice and sustainability, prioritizing the renewable energy transition is more critical than the 'EV's for everyone'. Third, the EV's for everyone approach reproduces the same type of low density, spatial sprawl that has created the highly unsustainable ways of life that are so prevalent today (Hensley et al., 2018). Low density cities characterized by sprawl and interlinked with highways create serious land-use pressures that also threaten biodiversity (Hensley et al., 2018). Additionally, African cities are currently growing faster than the global average and Africa is projected to have some of the largest cities in the world by 2050 (Hoornweg & Pope, 2017). Africa also hosts extremely unique and extremely biodiverse ecosystems, some of which are in and

around cities, such as the Cape Floristic region in Cape Town (Archer et al., 2021). It is therefore imperative that African countries strategically plan for high-density urban growth and well-functioning urban and country-wide public transportation systems to avoid car-centric cities that encourage unequal, unnecessary, and unsustainable lifestyles. Finally, it is well established that cars do not offer democratic ways of valuing and using road space (Peñalosa, 2013). Cars take up a disproportionate amount of road space, about 80% more road space than busses and bicycles (Peñalosa, 2013). The unaffordability of cars for most people means that they are a technology option only available to the wealthiest people in society, and people who use less expensive mobility options such as public transport, mini-bus taxis, or walking and cycling, are allocated a much smaller percentage of road space (Peñalosa, 2013). Further, because every South African pays for road space through taxes, yet very few people are privileged enough to use most of the road space while others must take transport options that are presently less efficient and less safe, the car-centric model reproduces inequality (Peñalosa, 2013). Therefore, the CJC rejects the 'EV's for everyone' approach on the basis that it is not ecologically sustainable, and it reproduces existing inequality dynamics.

The State of South Africa's Transport System and Institutions

In 2022, rail transport moved 154,679 tons of raw goods while road transport carried 839,218 tons (StatsSA, 2023). The corresponding incomes are R34,82 million and R167,320 million, respectively (StatsSA, 2023). Compared to 2021, non-passenger rail payloads are down 12 percentage points and road non-passenger payloads are up 22.5 percentage points (StatsSA, 2023). To meet the goals of the South African government's current transportation policy approach (Green Transportation Strategy) (Department of Transport: South Africa, 2018) and advance the goals of the CJC's policy approach, both non-passenger and passenger transportation need to shift to clean energy rail and coastal ocean transport, rapidly.

Transnet and the Passenger Rail Agency of South Africa (PRASA) are the two primary transport institutions that handle the planning, maintenance, and operation of transportation systems in South Africa. Transnet's responsibilities cover non-passenger transport and PRASA's responsibilities cover passenger transport. Transnet is overseen by the Department of Public

Enterprises while PRASA is overseen by the Department of Transport. South African Transport Services was created in the 1800's as a public agency to be responsible for freight and passenger rail services, pipeline construction, and port management (Department of Public Enterprises, n.d.). Up until the 1970's all goods transport in South Africa was done by rail (Williams, 2021). As the economy grew, competition did as well, and the government moved away from protecting rail as the trusted carrier of goods to allow for road transportation in 1977 (Williams, 2021). Road transportation was mostly captured by private companies and therefore much of the value that could have otherwise gone into the railway network went into the private sector (Williams, 2021). In the 1990's, Transnet was created and took over non-passenger transport services (Department of Public Enterprises, n.d.). The South African Rail Commuter Corporation (SARCC) took over passenger rail transport services and served until the creation of PRASA (PRASA, n.d.). PRASA was established between 2004 and 2009, and was allocated all passenger transport services including Metrorail (urban commuter rail services), Shosholoza Meyl (long distance passenger rail services), and Intersite property management services (management of train yards and properties owned by PRASA) (PRASA, n.d.). This split was initially created to have a more streamlined approach to the railway network, since the infrastructure, needs, and management of freight and passenger transport are different (Department of Public Enterprises, n.d.; PRASA, n.d.; Sibande, 2012). This led to contractual disputes however by the mid-2000's, with Transnet and SARCC fighting over which agency was responsible for maintenance, repairs, and upgrades to railway infrastructure (Sibande, 2012). Many of these disputes were never resolved and consequently the needed maintenance not done (Sibande, 2012). This was compounded by the fact that much of the country's railway infrastructure was in need of significant investment at this point in time, since the locomotives and railways were nearing their end of life (Sibande, 2012). The split of the institutions also created additional safety, operational, and accountability problems which have reduced the institutional capacity to deliver effective transport services (Williams, 2021). The combination of allowing in private sector competition in road transport, the split of Transnet and PRASA (formerly SATS and SARCC), and aging infrastructure set the stage for rail transport to already be in decline by 2010 (Williams, 2021).

State-capture and cable theft have further reduced these institutions' capacity to provide functioning transportation. Transnet and PRASA are institutions that have been crippled by mismanagement and corruption (Callaghan et al., 2021; Development Policy Research Unit University of Cape Town, 2021). The state-capture years saw billions of rands siphoned from both PRASA and Transnet, as well as dodgy sales of property and infrastructure (Callaghan et al., 2021). Transnet is currently the focus of diplomatic ordeals that are trying to resolve contractual disputes with Chinese Railway Rolling Stock Company (CRRC) (Khumalo, 2023). A shady set of contracts worth R54bn was awarded to CRRC during state capture years for the purchase of 1,064 diesel and electric locomotives (Khumalo, 2023). CRRC delivered the locomotives but it was later found out that they massively overstated the price of the trains and understated their tax liability to the South African Revenue Service (SARs) (Khumalo, 2023). Aside from the contracts being a state capture event, more than 100 of the locomotives need maintenance work and CRRC is refusing to deliver the parts to do so (Khumalo, 2023). Though Transnet announced earlier this year that it had reached an agreement with CRRC, the parts never came through, hence the ongoing diplomatic engagements (Khumalo, 2023). In addition to having to procure the parts on the market which will be costly, the locomotives being out of operation has negatively affected three key rail corridors that account for 50% of Transnet's Freight Rail revenue (Khumalo, 2023). Such events are just one piece of a much larger history that has led to the loss of billions of Rands of public funds through contracts and tenders at both PRASA and Transnet (Callaghan et al., 2021; Development Policy Research Unit University of Cape Town, 2021). In addition, damaged railway lines from flooding, declining export volumes of coal and iron ore, missing the latest commodity export boom, and declining public and private sector confidence hang over Transnet's future (Mahlaka, 2022a, 2022b). Transnet has recently announced they will be abandoning 35% of the country's railway lines to focus their efforts on operating the most profitable lines and invite in private sector bids to operate and maintain the busiest sections of railway (Artymiuk, 2023; Mahlaka, 2022b; Preston, 2023). The narrative from Transnet is that the remaining 65% of the railway network is still functioning, but other authors suggest that the whole of the rail network could be on the brink of collapse (Williams, 2022). The bidding process that Transnet facilitated

largely failed, demonstrating that there is not much private sector interest in picking up the tab of a deeply indebted and failing SOE (Mahlaka, 2022a).

Transnet's failure has further environmental, social, economic and infrastructure costs to the road network (Williams, 2022). The increases of large trucks that are transporting raw goods as well as the consistent overloading of those trucks has caused serious damages to the road network (Williams, 2022). The weight of trucks is largely unregulated in South Africa, despite a contract to introduce the Road Traffic Quality System (RTQS) in 1991, a technology to record the weights of trucks passing tolls, it was never actually introduced (Williams, 2022). By 2015 there are some weigh bridges throughout the country but not enough to discourage overloading, aside from the fact that these weigh bridges are not always manned (Williams, 2022). Other efforts to discourage overloading have been made, as well as to keep trucks in good working condition, but there are allegations of widespread corruption in the certification processes (Williams, 2022). The impacts are that roads deteriorate faster than anticipated; it has been estimated that overloading by 10% reduces the lifespan of roads by 8-10 years (Williams, 2022). Even if overloading beyond legal limits were to be reduced, South Africa's maximum load is 56,000 kilograms, which is the highest in Southern Africa and 55% higher than in the United States (Williams, 2022). There were few comprehensive planning strategies undertaken to invest in road infrastructure, which has led to a game of catch up, where roads are consistently in decline and the government is consistently having to respond to repair them (Williams, 2021). Despite that private vehicles have been increasing on the roads in increments of 5% to 10% every year, expenditure has not kept pace (Williams, 2021). The impact on the roads in South Africa from Transnet's failures also highlight why freight transport must return to the rails: the continued reliance on private trucking unfairly skews value that could be captured by the public sector to the private sector, which is not paying their fair share for road transport costs, and it creates unsafe conditions for other drivers on the roads.

A much smaller SOE, PRASA was also complicit in state capture (Open Secrets, 2021). A highly connected web of SOE executives facilitated large scale corruption that unfolded mostly between 2009 and 2015, and was uncovered in Thuli Madonsela's *Derailed* report (Open Secrets, 2021). The impact of state capture on ridership is hard to refute. Just 15 years ago, PRASA had

80% more riders than it does now (Open Secrets, 2021). The cost of state capture was felt in a very raw way by train users who witnessed a decline in services and eventually opted for more expensive modes of transit such as using mini-bus taxi's and private cars (Open Secrets, 2021). The hardest hit have been the most marginalized in society, with many of the train lines that service poorer neighbourhoods having service completely shut down, such as Cape Town's central line (Open Secrets, 2021). This has led to long travel times for commuters, with a single commute to work from the outskirts of Cape Town to the inner city now taking approximately 2 hours and 50 minutes (one way) (Schmidt & Mortlock, 2018). Further, the scars left by apartheid spatial planning, where many were forced to the outskirts of urban areas, has compounded transportation inequalities (Open Secrets, 2021). South Africa's network of urban trains is uniquely situated to be able to provide high quality public transport, if they can be run by a functioning SOE (Open Secrets, 2021).

There is an addition layer of failure that the South African Government's lack of delivery on effective public and freight transportation has caused, which is the social, fiscal, and emotional cost of road accidents. The vision of transportation offered by the CJC brings in an additional health and safety perspective which is the opportunity to mitigate or eliminate entirely road accidents and to mobilize the funds from road accidents into financing mechanisms for public and freight transportation. In 2019, the Road Traffic Management Corporation (RTMC) spent R176 billion on road crashes (Mlambo, 2020). Aside from the immeasurable cost in loss of life associated with these tragedies, fatal crashes make up about 70% of the spending in this category (Road Traffic Management Corporation, 2021). The average cost of one fatal road crash is R3.9 million of public funding (Road Traffic Management Corporation, 2021). There are emissions associated costs too, with R61k on average being spent dealing with delays and congestions, and an unknown amount of gigatons of carbon dioxide (Road Traffic Management Corporation, 2021). In 2015, 3.4% of the country's GDP was spent on cleaning up road crashes (Road Traffic Management Corporation, 2021). In addition to being a drain on the economy, road accidents cause immense pain and suffering for loved ones, and untraceable costs associated with people who are injured in accidents and may be sole breadwinners for the family. The public transport transition offers us a way to re-allocate these resources, mitigate social harms, and make mobility

safer for society. The shift from passenger road transport to passenger rail transport has the potential to mitigate accidents dramatically, reducing funding needed for the Road Accident Fund (RAF).

The Climate Justice Charter Vision for Eco-mobility and Clean Energy Public Transport

The CJCM vision for eco-mobility and clean energy public transport holds at its core the perspective that transportation problems are systemic failures and therefore require systemic solutions, and an awareness of the interconnectedness between institutions, the economy, and social well-being. This vision of transportation incorporates notions of simple living and zero waste, working less, an economy built around climate and environmental jobs, eco-centric manufacturing, and the importance of multiple types of knowledge for the acceleration of the deep just transition. The transformation envisioned here is a democratic, systemic reform that can take these intersecting ideas forward into a holistic policy approach. Further, this policy framework offers solutions that can grapple with these systemic failures and offer different types of policies for different actors (government, communities, workplaces, and sectors). It seeks to secure a just, liveable, and democratic future. The vision of transportation offered in this policy framework rests on the basis that a failure of government to deliver functioning transport systems is an outsourcing of multiple externalities to individuals and sectors who should not be forced to pick up the tab for state failures. Further, the CJC believes that streets and road infrastructure are public goods yet a minority of people, those able to afford private cars, are currently able to use them. Every individual pays for road infrastructure through taxes but not every individual benefits equally. A more democratic, just, and ecologically sustainable approach centres on public transportation and eco-mobility that can meet the mobility needs of all.

Lessons from other contexts

Based on research that reviewed transportation systems and transitions in other countries the following key takeaways are included here for consideration to help empirically ground this policy framework:

Public transportation is capital intensive and requires sustainable, innovative, and progressive financing measures (Ch'ng & Cheng, 2020; Lindau et al., 2010). Many countries (e.g: Brazil, Colombia, Chile, Vietnam) have experimented with public-private partnerships (PPP) to fund public transportation systems, but each have had context specific shortcomings related to privatization (Ch'ng & Cheng, 2020; Lindau et al., 2008). In many cases, the involvement of the private sector led to rapid declines in services and in no cases has public transportation been sustainable over the long-term to reduce car dependency (Lindau et al., 2008, 2010). The only country with long-term public transportation financial sustainability that has led to a decline in car drivership is China, in which it has been financially backed completely by the state (Jones, 2022).

Bus rapid-transit (BRT) tends to be more cost-effective than light rail-transit LRT or metro systems (Arendse et al., 2022; Lindau et al., 2008, 2010). However, LRT have larger carrying capacities (Mohammed & Gouda, 2015). Public perceptions suggest that buses are not seen to be as attractive as metros and LRT systems (Ashmore et al., 2019; Mohammed & Gouda, 2015). A mix of BRT, LRT, pedestrian and cycling infrastructure has shown to be best provided through intermodal integration. This has to be strategically planned and maintained, and can also provide additional resilience.

Developers and planners need to maintain an awareness of how public transportation development impacts on commercial and residential areas (Lindau et al., 2008, 2010). Potential negative impacts need to be anticipated and mitigated. In the case of Bogotá, aggressive development of public transport depots with a PPP model that allowed for commercial marketing and opportunities at these depots changed the urban form so much that in some cases, housing needs changed (Lindau et al., 2008, 2010).

Transit-oriented Development (TOD) is shown to be a best practice for public transport development and integration (Cervero et al., 2008; Lindau et al., 2010)**.** Further, a growing body of research shows how requiring parking minimums reinforces car-centric culture, and an easy way to support public transportation in land-use planning is to stop requiring parking minimums in new developments (Kirkman, 2010; Litman et al., 2023; Mattioli et al., 2020). In many examples

where countries are encouraging public transport transitions, the combination of TOD and re-orienting land-use planning to be geared towards eco-mobility and public transportation infrastructures was further noted (Litman et al., 2023).

Political continuity (across administrations) and the decentralization of decision-making is credited as being key to many countries' successes, as transport projects tend to have long-term timeframes (Berney, 2010; Lindau et al., 2008, 2010). Colombia embodied deep democratic governing principles, and extensive community engagement, and it had local leadership that saw the path to greater equity as public transport for everybody, not the private car (Peñalosa, 2013).

Despite the availability of public transport, car ownership is still increasing in every country that was reviewed except for China. It is very clear in China that car ownership is decreasing because of hard-line policy stances banning cars from certain parts of cities and making license plates very difficult to get through license plate lotteries, especially in Beijing (Quan & Xie, 2022). In Brazil, the presence of vehicle manufacturers, marketing campaigns supporting car ownership, and federal tax incentives that encourage private vehicle ownership are to blame for increasing car ownership (Lindau et al., 2008, 2010). In Colombia, a mix of hard-line policy (banning drivers from commuting by car more than three times per week), and community-building (challenging Bogotáns to a day of riding their bikes in the city) was used to disrupt the inertia of car-centric commuting (Welch, 2021).

The dedication of research institutions and think tanks was found across most examples and they have been imperative to successful implementation of policies. These institutions are situated nationally, locally, and sometimes at middle levels of government and can help supply technical guidance and expertise, maintain progress when there are political or procedural disruptions, and continue building knowledge to refine decision-making (Ch'ng & Cheng, 2020; Lindau et al., 2008, 2010).

All modern and efficient public transport systems are characterized by the digitization and integration of ticketing systems. Integration of ticketing is necessary for fare payment, making payment easy, very accessible and a simple calculation for the user (Ch'ng & Cheng,

2020). Digitization of the system is important for safety, monitoring, real-time information for operators and users, and data collection for further decision-making (Ch'ng & Cheng, 2020).

Countries that have encouraged cycling are shown in the literature to have a good balance of infrastructure, policy, and cycling culture, such as Colombia and the Netherlands (Cervero et al., 2008; Hull & O'Holleran, 2014). In Colombian examples, dedicated bikeways or 'ciclorutas', along with political campaigns by leadership (challenges), and policy (banning driving), shaped a city that belongs to bicycles (Cervero et al., 2008; Welch, 2021). Further, cyclists in Bogotá, participate in Bicycle Colectivos which mobilize large numbers of people for group rides (Copenhagenize, 2019b). Recently, Bogotá's urban planners have announced a goal to have a bicycle lane 500 meters from every home and are integrating with public transport by installing bicycle garages close to BRT stations (Copenhagenize, 2019b). City planners have a goal of building 13,000 new bicycle parking spots by 2027 (Copenhagenize, 2019b). In Amsterdam, improvements are being made to existing infrastructure, including building new bike routes to minimize rush hour traffic, widening existing tracks by 2.5 meters for increased capacity, building more low-speed cycle streets and redesigning intersections for more protected cycling space (Copenhagenize, 2019a). The City of Amsterdam is also disincentivizing cars by removing 11,000 car spaces (1,500 annually) and replacing this with bike parking, trees, and pedestrian pathways (Copenhagenize, 2019a). Further, planners are connecting bike and pedestrian traffic by building a bicycle bridge over urban rivers (Copenhagenize, 2019a). They are also banning mopeds and motorized scooters from using cycling tracks (Copenhagenize, 2019a). In Copenhagen, the recent construction of 12 dedicated bicycle and pedestrian bridges is connecting bicycle lanes throughout the city, with more bridges still being constructed (Copenhagenize, 2019c). The bridges have 5.5 meter wide bike lanes in each direction with separated pedestrian lanes (Copenhagenize, 2019c). The region has spent a total of 20.6 million euro in creating eight new routes, totaling more than 167 km's of lanes (Copenhagenize, 2019c). Special bike friendly features on the lanes include: improved wayfinding (signage) and lighting, wide cycle lanes, repair stations, and timed intersections (Copenhagenize, 2019c). The extent of the bicycle infrastructure goes for 20 kilometers outside the city centre (Copenhagenize, 2019c).

Pedestrianization, the process of creating pedestrian (walking) friendly spaces by reducing or banning vehicular traffic, is a growing trend globally (Rapid Transition Alliance, 2018). Pedestrianization is the process of making areas walking friendly through banning or strongly disincentivizing vehicle traffic through high tolls or high parking fees (Rapid Transition Alliance, 2018). Pedestrianization is happening primarily in urban environments as cities are uniquely situated to be dense and walkable (Rapid Transition Alliance, 2018). Many cities are rolling out long-term planning strategies that slowly increase the space allowed for pedestrians and cyclists while strategically restricting space for cars (Clugston, 2019; Duxfield, 2022; Rapid Transition Alliance, 2018). Barcelona has taken an approach called 'superblocks' which has strategically identified streets to be converted to green streets for pedestrians and cyclists only and refurbished with greenery (Duxfield, 2022). By 2024, 1 in 3 streets in Barcelona will be green streets (Duxfield, 2022). Oslo has also taken this approach and has made its city center completely car-free (Clugston, 2019). Oslo has done this by removing all parking in the city center, and shifting their focus of who is a street user from a car to a pedestrian and cyclist (Clugston, 2019). Pedestrianization is often criticized as leading to gentrification of neighborhoods, but there is growing evidence that low traffic neighborhoods can disproportionately benefit disadvantaged communities if there is strategic implementation (Voce & Walker, 2021). If communities are desirable because they are walkable, and there is a limited number of walkable communities in a city, this can lead to gentrification (Voce & Walker, 2021). But if governments take strategic approaches to democratically roll-out pedestrianization programs, then this can have co-benefits for equality and social well-being (Voce & Walker, 2021).

Shared-bike systems (SBs) and shared electric systems (SEBs) have exploded in popularity in North American and Asian megacities and have created new industries with climate job growth (Chen et al., 2020; Copenhagenize, 2019d; Reilly et al., 2019; J. Zhu et al., 2022; Z. Zhu & Lu, 2023). Bike-share programmes are technologies that allow a user to temporarily rent a bike for a reasonable fee, often charged by the time the bike is rented, and then returned later (Chen et al., 2020). Bike-share systems that are successful are characterized by wider public transport system integration, typically on integrated ticketing applications that

are usually based on a mobile phone, or transaction kiosks available at the docking stations (Chen et al., 2020).

Renewable energy locomotives and ships are in their infancy, but the potential for research, development, and manufacturing exists (Caballar, 2020; Hirschlag, 2020; Popovich et al., 2021; Sharpe, 2020). Renewable energy locomotives such as hydrogen powered trains, solar powered railways, and battery powered trains are not yet well developed but are rapidly being researched and could be an emerging area of industrial development (Hirschlag, 2020; Popovich et al., 2021; Sharpe, 2020). Electric, and wave powered boats are even further away but are also an emerging area of technological development (Caballar, 2020). Countries in the global north and global south are exploring these technologies and as an emerging area of technological development South Africa can get ahead of the research, development, deployment, and manufacturing.

Finally, it is worthwhile to highlight the public transport transition in Kigali, Rwanda to draw on lessons for how an African city successfully brought the mini-bus taxi industry into a formalized bus industry. Kigali has 392 buses in its fleet that operate 63 routes, serving 382 stops and are stored at 4 bus depots (Arendse et al., 2022). The bus system is utilized primarily for commuter transport to and from work, 88% of passengers are between 21-45 years old (Arendse et al., 2022). Recent improvements in public lighting, speed control, and road safety campaigns have contributed to riders reporting that they feel safe on the bus and have a positive perception of the bus systems (Arendse et al., 2022). In 2008, Kigali started reforming its public transport system with the help of national government (Arendse et al., 2022).

Formalizing the minibus and motorcycle taxi industry was a crucial step in the reform and included requiring operators to establish cooperatives or companies and go through a formal licensing process (Arendse et al., 2022). The reform process required consistent, long-term, multi-stakeholder collaboration and very strategic implementation (ITDP Africa, 2021). Kigali started discussing public transport reforms in 2008 and "in 2011, the Ministry of Infrastructure (MININFRA) initiated the development of the first public transport policy and strategy for Rwanda." (ITDP Africa, 2021, p. np). The policy was drafted by technical staff from

MININFRA, “the City of Kigali, and the Rwanda Utilities Regulatory Authority (RURA).” (ITDP Africa, 2021, p. np). The policy became the guide for formalizing public transport in Kigali after it was approved in 2012 (ITDP Africa, 2021). The City of Kigali Council and RURA implemented the policy (ITDP Africa, 2021). The formalisation process was “led by the City of Kigali through the mayor’s office, coordinated by MININFRA, and overseen by the Office of the Prime Minister.” (ITDP Africa, 2021, p. np). The formalisation process was also aided by “a steering committee comprised of government institutions and private sector operators” that helped “plan and design solutions to address public transport challenges and expedite the formalisation process.” (ITDP Africa, 2021, p. np). “The reforms included forming cooperatives and companies in place of the former associations.” (ITDP Africa, 2021, p. np). There was initially resistance from the minibus taxi owners, “they did not understand how they would benefit from operating within cooperatives.” (ITDP Africa, 2021, p. np). The steering committee was imperative in convincing the minibus taxi owners to form cooperatives and companies (ITDP Africa, 2021). Part of the incentive was that “bus owners could get credit and loans from banks and would have the ability to bid for government tenders for public transport operations.” (ITDP Africa, 2021, p. np). The minibus taxi owners eventually joined and formed several cooperatives and companies: the Rwanda Federation of Transport Cooperatives (RFTC), currently the largest bus operator in the City of Kigali, and the Royal Express and the Kigali Bus Service (KBS) (companies). (ITDP Africa, 2021). “Minibus owners under RFTC have equal shares and earn profits based on equity. Royal Express and KBS operate as companies with individual owners run by appointed management teams.” (ITDP Africa, 2021, p. np).

Kigali’s bus system is described here:

“Three bus associations or companies operate in Kigali in four zones: Kigali Bus Services (KBS) operates zone 1, Royal Express operates zone 2 and Rwanda Federation Transport Cooperatives (RTFC) operates zones 3 and 4. Following a rendering process, these bus companies were awarded a contract with 5-year licenses to operate in their respective zones. Lead by the second-generation services contract, bus companies are required to use cashless payment systems and meet certain high occupancy targets. **Private bus companies own, operate, maintain and scrap their bus assets, while the government provides and maintains**

infrastructure required. Fares are regulated by the Rwanda Utilities Regulating Authority (RURA), and the government subsidises bus operations and a percentage of the fares." (Arendse et al., 2022).

Some of the benefits and incentives provided that encouraged taxi drivers to formalize included regular training provided by the government, which then meant the drivers were eligible for licenses, and certificates of good conduct (ITDP Africa, 2021). The government also lifted importation taxes on large busses, making them more accessible for the cooperatives and companies to purchase (ITDP Africa, 2021). The government also fast-tracked loans for the transportation cooperatives and companies, which added a further incentive to formalize (ITDP Africa, 2021). Working conditions have improved with working hours being reduced, salaries are stable and ensured by the government and all workers in the public transportation sector have universal medical care (ITDP Africa, 2021). Drivers also have first priority to be considered for other jobs in the transportation sector such as in bus depots and garages, should they desire to change jobs or become unable to perform their job as a driver (ITDP Africa, 2021).

Further, as part of their drive to continuously improve efficiency and quality of bus services, the government is looking to implement second generation contracting model where government payments to the operators would be based on a fixed payment per bus-kilometre. The per-km amount would be revised annually according to changes in fuel prices, inflation, and other factors. Currently, public transport services and bus fares are not integrated. However, as a start, Kigali has "digitised their fare system by incorporating smart card payment technologies in all buses." (Arendse et al., 2022, p. 3). The second generation of contracts will see further digitisation and upgrades that are planned to be integrated into a mobile application, so riders will be able to plan their trips based on their needs (Kuteesa, 2019). Kigali is also planning to dedicate more road space to bus only lanes, in an effort to make public transport faster and more convenient than driving a car (Kuteesa, 2019). Kigali's bus system is currently not electric, though national level government is trying to drive motorized transport to electrify. Kigali is part of the TUMI E-Bus Mission City Network (of which Cape Town is also a participant), a learning network run by ICLEI and UITP and funded by the German Ministry for Economic Cooperation and Development, to help participating cities in the global south electrify their bus fleets (Arendse et

al., 2022). National level policies have been approved to aid electrification however the lack of funding, subsidies, and high capital costs and uncertainty over the technology make bus operators reluctant to electrify (Arendse et al., 2022).

Policy Framework

The role of government

The government has the largest, strongest, and most strategic role to play when it comes to implementing eco-mobility and clean energy transport alternatives that can accelerate the deep just transition. The government's role to accelerate the deep just transition through eco-mobility and clean energy public transport systems can broadly be categorized under two categories for policy creation and implementation: fuel switching and modal switching. Fuel switching is concerned with decarbonizing transport systems through electrification and deployment of renewable energy technologies as well as using cleaner fuel mixes in the interim as transition fuels. Modal switching is concerned with shifting from private transport to public transport, as well as switching freight transport from road to rail and coastal ships and ferries. The CJC rejects the EV transition and recommends that the South African government's policy approach also do so. The EV transition will work anti-thetically to the deep just transition as it: (1) reinforces car-centric planning and lifestyles which contribute to unhealthy, unsafe, and unhappy cities and communities (Montgomery, 2013; Pelzer, 2010); (2) contributes unnecessarily to resource competition and resource scarcity for raw materials that are needed for the renewable energy transition (Hensley et al., 2018; Owen et al., 2022); (3) contributes to increased energy demand which can contribute to carbon lock-in by reinforcing fossil fuel dependencies (Englund, 2021; Hensley et al., 2018; Winkler et al., 2023); (4) does not enable the CJC's vision of a deep just transition characterized by collective ownership, socialized goods, or offer systemic solutions to systemic issues such as inequality and poverty.

The policies that are offered here are just some in a suite of tools that are appropriate for governments to create and implement to enable eco-mobility and clean energy public transport alternatives. The policies that are offered further in this framework are grouped by the type of

policy mechanism with examples provided. These policies are in line with the CJC vision of a deep just transition.

Bans and Disincentives:

- Ban sales of new internal combustion engine (ICE) vehicles by 2030 and sales of all fossil fuel vehicles (cars and trucks) by 2035 to meet South Africa's Nationally Determined Contributions (NDCs) (Erasmus, 2023). The ban can be tailored based on the duty class of the vehicle and available technologies.
    - Alternatively, plan for a ban on the sale of new ICE vehicles while strategically rolling out public transportation infrastructures so that alternatives exist. Undertake robust policy analysis and research to ensure that a ban on the sale of new ICE vehicles does not encourage the EV transition. The approach of banning new ICE vehicles but allowing existing / used cars to be sold can also be taken.
- Ban incentives for the purchase of private vehicles and do not offer new ones.
- Ban private vehicles from some parts of urban centers. Replace vehicle space with pedestrian and cycling zones.
- Consider bans that would introduce air flight rationing if we overshoot 1.5C.
- Ban internal domestic flights once internal passenger train transport for cross-country trips is available.
- Increase tolls and fuel levies for trucks on all national highways.
- Increase policing and effectiveness of national database for fines for poor driving, bad maintenance of vehicles, overloaded trucks and bad truck driving.
- Change current frequent flyer incentive programs into frequent flyer taxes to discourage flying. This should be progressively calibrated to target frequent flyers from wealthy classes.
- Immediately install weighing technologies and softwares and introduce heavy penalties for overloaded trucks.

Incentive Schemes:

- Provide decommodified, efficient, reliable and safe clean energy mass bus, rail, ferry and ship options for passenger transportation.
- Incentivize carpooling of private passenger vehicles by allowing them to travel in faster carpool lanes that can be digitally monitored and protected by barriers so people cannot easily jump between lanes.
- Offer incentives for converting ICE vehicles to electric vehicles for large, multi-passenger, and heavy-duty class vehicles. Do not offer incentives to retrofit private passenger vehicles (to incentivize people to take public transport as opposed to driving). Offer incentives for the retrofit of taxis, emergency vehicles such as ambulances, etc.
- Offer government tax incentives (tax credits for instance) for purchasing bicycles as opposed to cars, including e-bikes.
- Set and require procurement targets for clean energy busses and mass transport technologies on a yearly basis. Set incentives (such as tax incentives) to make these more affordable.
- Incentivize the retrofit of fossil fuel busses into electric or clean energy busses through incentive schemes.
- Prioritize the immediate modal switch from air to rail for in-country passenger transportation through the development of a high-speed rail network that links the country's major cities that is powered by renewable energy. Use incentive schemes such as frequent flyer taxes and penalties to encourage passenger rail transportation.

Infrastructure:

- Roll out democratically planned eco-mobility infrastructure for walking and bicycle use in all communities, villages, towns and cities.
- Strategically identify areas in the centers of South African cities to be dedicated car-free zones with priority pedestrian areas.
- Set dedicated yearly targets to convert entire streets to pedestrian and cycling streets. Restrict traffic on these streets to allow for local traffic only or disability parking.
- Convert existing street parking spaces into separate and protected walking and cycling lanes.

- Strategically identify parking lots to be converted into urban green spaces, interconnected by walking corridors.
- In priority pedestrian areas, mandate that cyclists walk their bikes to avoid any collisions with pedestrians.
- Undertake robust research to identify the best infrastructure requirements for separating cycling and pedestrian lanes. Ensure that pedestrians and cyclists will both be protected from collisions and have lanes that prevent them from traveling too fast (for cyclists) and from colliding with one another.
- Scrap requirements for parking minimums in new developments.
- Do not construct new roads and new parking lots that prioritize car-centric transportation.
- Introduce requirements for developers to identify how new developments (commercial and residential) can be easily integrated into public transport modalities.
- Require safe bicycle parking in all new developments.
- Set dedicated yearly targets to install bicycle parking throughout urban areas.
- Use permanent nature-based solutions such as waterways, planters, and trees to be barriers between cycling lanes and traffic.
- Protect all cycling and pedestrians' lanes and zones through hard infrastructure (as opposed to soft infrastructure such as paint) that cannot be driven through.
- Identify existing gas stations to be converted into charging stations. Allow these to be sites to also experiment with renewable energy deployment. Offer priority charging to taxis and individuals carpooling to incentivize public transport behavior.
- Require commercial buildings to convert a specified percentage of their existing parking spaces into spaces that can have other uses, such as hosting renewable energy, urban food gardens, or green spaces.
- All universities to pro-actively integrate their transport infrastructure into eco-mobility and clean energy mass public transport systems.

- Select some publicly owned parking garages for priority conversion into mixed use developments. These can host residences, small business, public transport depots, and/or bicycle parking.
- Ensure people who are disabled will have inclusive and accessible spaces through infrastructure design that prioritizes disabled people's needs. Design for the needs of the most marginalized first.
- Set requirements to couple rail transportation with renewable energy development. Explore the various emerging technologies such as solar locomotives, but also couple solar and wind energy development into electricity for rail.
- Require inter-modal connectivity assessments for all spatial planning, land-use, and development projects. Stipulate land-use and spatial planning requirements in policies to ensure that cycling, walking, busses, and trains can be integrated into one coherent system.
- Require shared-bike or shared-electric bicycle schemes to be strategically located close to public transport inter-modal connectivity points. Ensure provisions can be made for cyclists to either take their bikes with on busses and trains or provide safe storage options at public transport depots.

Research, Think Tanks, Capacity Building and Democratic Planning:

- Immediate establishment of an interdisciplinary research agenda and national government institute on public transportation needs and options, including multiple modalities, and for technical capacity building and transport system planning and financing.
- Create democratically appointed review committees with eco-mobility and public transportation expertise to review all spatial planning and land-use projects to ensure these projects are in line with this policy framework.
- Coordinate research capacity with Human Sciences Research Council and universities.
- Through local government begin home-based origin destination studies at national, regional, and local levels to begin collecting data to inform transportation decisions.

- Through climate crisis planning, dedicate bridging bodies such as task forces and steering committees, made up of interdisciplinary collaborators and experts, at the national level that are tasked with coordinating the transportation transition across all scales of government.
- Incorporate transportation data needs into the census and regular data collection efforts of Stats SA.
- Develop a bottom-up national transport just transition strategy based on this framework and informed by national climate planning.

Financing:

- General transport tax, progressively calibrated to payroll, to finance public transport systems.
- Subsidies for private rail freight, progressively calibrated to profit of the business, as a source of government revenue. Scale back on subsidies for private road freight.
- Leverage worker pensions to finance investments into transportation systems.
- Road accident fund resources should be mobilized into funding this policy framework, including developing eco-mobility transportation infrastructures, and shifting road to rail transport.
- Require the Development Bank of South Africa (DBSA) and other development finance institutions to have deep just transition financing stipulations when approving new projects. Include eco-mobility and clean energy public transport requirements based on this policy framework.
- The country's financing resources should be prioritized to mobilizing the deep just transition, including eco-mobility and public transportation systemic alternatives.
- Prioritize eco-mobility and clean energy public transportation alternatives in the Department of Transport's 2023/2024 R72.5 billion budget.
- Urgently resolve the Transnet debt crisis.

Technological Innovation, Eco-Centric Manufacturing and Climate Jobs:

There is immense potential in the transition from existing transport systems to also create clean energy technology in the country, promote eco-centric (limited extraction, zero waste, clean energy) manufacturing and develop climate jobs. This includes:

- Research and develop emergent electric technologies in country such as electric ships, electric trams, locomotives, and electric heavy-duty equipment.
- Develop domestic eco-centric manufacturing for all renewable energy mass transport systems for buses, rail infrastructure, and ships.
- Develop eco-centric bicycle manufacturing in-country, including e-bikes to enter domestic markets. There is opportunity for a commodity boom in the cycling industry and the South African economy can capture much of that market with strategic planning.
- Create youth employment opportunities in the bicycle repair industry. These can even be permanent or pop-up / mobile bicycle repair shops.
- Create zero waste employment opportunities through resource, re-use, redesign, recovery, recycling, and re-manufacturing of bicycle parts and all transport vehicles.
- Create employment opportunities in the construction sector through eco-mobility and public transportation infrastructure.
- Create employment opportunities through incentivizing and offering business opportunities for shared bike and shared electric bike companies to deploy in urban South African spaces.
- Create employment opportunities through bicycle security guards.

Oceans Transportation:

South Africa is uniquely situated with two oceans flanking the country. These oceans can be integrated into a domestic clean energy public transport system. Instead of freight transportation, just for export, this can be replanned and resourced for domestic freight transportation from coast to coast. Moreover, options like clean energy ferries, ships, and boats for public transportation from coastal town to coastal town needs to be explored. This is to be done with due regard to the impact on ocean wildlife and eco-systems. While current private ocean-based journeys exist in the form of cruises between different destinations in South Africa,

the government should explore this market for public passenger transportation options and prioritize the deployment of electric boating technology. This modal switch can be developed and marketed to citizens needing to move long or short distances. A new democratic and digital platform public utility for clean energy oceans coastal transport to be established involving workers, users, and coastal communities in all key levels of decision-making.

Taxi Reform:

Modelled like the Rwanda example, create a state-cooperative model built around different routes in a city. The government should bring in the taxi industry and offer them tenders to operate different routes in zones that can be negotiated with the taxi federations and municipalities. The taxi association operators should provide the capital for the buses, the government provides the infrastructure and sets operating and road safety standards. The government should create incentivizes that will benefit the taxi associations such as offering stable working conditions and hours, salaried pay, healthcare benefits, disability protections, and access to financing. The government should also develop additional opportunities for the taxi industry such as taking over delivery services from the private sector, and investigate additional mobility needs where taxi federations can play a role in the transition. The system should be digitized and have multiple mode integration ticketing available for riders to pre-plan and pay for their rides.

The role of communities

Civil society and communities have major roles to play in activating this policy framework. In addition to individual behavior change by utilizing public transport more frequently, activism can also help mobilize the deep just transition.

Activism:

Cyclists have a repeated and long history of critical mass demonstrations that have taken over streets as public spaces to demand not to be treated like externalities on the road (Wright, 2011). Critical mass bike rides are a popular tactic that were historically first organized in European cities to demand safe conditions for children cycling to school after an epidemic of

children were hit and killed while riding their bikes (Wright, 2011). This culture has since been popularized and turn into pop-culture events in many South and North American cities, now known as monthly 'bike parties' (veloDash, 2021). Bike parties amalgamate large groups of cyclists who take over the streets once a month and have been shown to have effects on transportation policies and planning, as well as encouraging people to start cycling (veloDash, 2021).

South Africans seeking to mobilize this CJC eco-mobility and clean energy public transport policy framework could:

- Organize bicycle and pedestrian based critical mass demonstrations that take over entire streets with clearly communicated demands such as developing safe and accessible eco-mobility and public transportation infrastructure.
- Regularly host bicycle parties with pre-planned routes, amalgamate large groups of cyclists to take over streets using non-motorized transport and strategically use the bike parties for spreading political campaign messages.
- Engage with the Open Streets Movement to mobilize the above. Open Streets Project | The Movement For Open Streets.
- Engage with the cycling advocacy group BYCS BYCS | BYCS to mobilize the above. BYCS hosts a bicycle mayor network, who are tasked with cycling advocacy in their communities. CJC activists should engage their local networks as well as replicate many of the tactics BYCS uses in their localities.
- Invite political participation from local elected officials to close certain parts of cities to motorized traffic for a single day out of the month and use streets as public spaces of transformative possibilities.
- Leverage social media and influencer culture to promote eco-mobility public transportation as a trendy commute choice. Further stigmatize car ownership.
- Leverage social media and influencer culture to promote further sustainable and responsible long-distance travel behaviors such as responsible flying and choosing not to fly.

- Integrate eco-mobility and public transportation education and classes early on in schools.
- Create and campaign for the idea of a climate tax for frequent flyers, calibrated to progressively tax wealthy passengers who take more than one long-haul overseas flight a year, and more than three roundtrip flights within a year (Zheng, 2023).

The role of workplaces and sectors

Workplaces and sectors also have a role to play in realizing eco-mobility and clean energy public transport systems. Workplaces can support eco-mobility and public transportation through technological innovation and economic growth, through employee and student programs, and through making their infrastructures eco-mobile and public transport friendly.

Technology, innovation, and the economy:

Besides the state's role, across the economy such a democratic systemic reform can stimulate the following:

- Development of software applications that can handle integrated ticketing across multiple transport modalities.
- Development of public transportation digital infrastructure that can handle the real-time monitoring and deployment of public transportation needs.
- Research, develop, and capture the emerging electric locomotive sector. Manufacture these technologies in-country.
- Research, develop, and capture the emerging electric shipping sector. Manufacture these technologies in-country.
- Found, deploy, and grow shared bike and shared electric bike businesses.
- Capture the booming bicycle industry through manufacturing in-country, and create a repair sector for the industry.
- Create a secondhand bicycle economy that mobilizes resource recovery and re-use.
- The transformation of Prasa and Transnet into democratic and digital public utilities with workers and users of their services being given participation rights in the board and other decision-making structures.

Employee and student incentives and programs:

- Through a progressive payroll and tax, subsidizing clean energy public transport systems, provide for decommodified transport access, but with cheap and reasonable fares for those who can pay, as part of a 'trust system' which would not require policing but which would encourage commitment and pride in the system.
- Unions to develop eco-mobility and clean energy public transport policies to support their members and promote such a system.
- Offer fun events to encourage employees and students to make use of public transportation. This can be especially useful when trying to encourage new technology uptake.
    - For example: host free breakfasts at certain locations when employees and/or students ride their bicycles or use public transportation to get to work. Collaborate with activist groups at these events to spread campaign information.
    - Give out free items that are useful for cyclists such as bike lights, helmets, locks, etc.
- Host bike trial programs for employees and students. Employees and students can apply to sign up to receive a bike for a specified trial period. Require a deposit with a guaranteed refund if the bike is returned. As part of receiving the bike, require their participation in a free bicycle safety workshop where they are familiarized with how to safely cycle on streets and be a responsible road user.
    - Offer and advertise competitive grant programs to popularize this model. Especially leverage influencers and social media for youth uptake.
- Host 'bike / walk to work' and 'take public transport to work' events and offer employee and student incentives for participation (an extra day off, financial incentives, etc).
- Reduce business travel by shifting to teleworking and hybrid working modalities. Determine and set company standards to reduce unnecessary travel and encourage other industries to do the same.

    - For regular engagements such as yearly conferences, shift from requiring in-person attendance at every event to focusing in-person attendance to be every other year.
- Experiment with hybrid conferencing styles.
- Install indoor and outdoor bicycle storage racks. Hire bicycle guards.

Private infrastructures:

- Convert desirable parking spaces to bicycle parking spaces, leaving a few spaces for disabled people.
- Offer employee storage facilities for workplace equipment. This is especially important if employees are required to bring equipment with them that is hard to cycle, walk with, or take on public transport.
- Work with municipalities to convert private parking facilities to public transportation depots and eco-mobility infrastructure.

Obstacles and challenges

Some obstacles and challenges exist in realizing this policy framework. This includes cultivating road safety and shared use road cultures, overcoming state failures to revitalize state institutions, making non car lifestyles desirable and trendy, taxi sector reform, and resisting the electric vehicle transition. Road safety is very real hazard in South Africa with an estimated 3% of the country's GDP being spent on road crashes yearly (Mlambo, 2020). In addition to poor infrastructure, unregulated vehicles are also to blame, and very reckless driving cultures which often treat other road users as though they do not exist (Mlambo, 2020). Overcoming this road culture is imperative to the success of eco-mobility alternatives but can be accomplished through democratic engagement and creating a shared culture of safety and respect on the roads (Cervero et al., 2008). Likewise, cyclists and pedestrians need to adopt responsible road behaviour which can be done through public education campaigns, public road safety cultures, and better infrastructure that does not prioritize car-centric mobility (Cervero et al., 2008). Second, state institutions need to have new life breathed into them which can be done through democratic principles, socialising ownership of transport as a collective good, and creating highly

transparent processes to mitigate corruption. Third, car-centric culture has shaped our lifestyles from how we consume to how we move. Breaking free from the car requires an individual level change in thinking that must happen tangentially to systemic shifts. This can be fostered through leveraging social media, influencer culture, and creating a social culture that promotes non car-centric lifestyles. Fourth, taxi sector reform is critical for public transportation to be a success, which requires early, sustained, strict, and an enforced agenda by the government (Arendse et al., 2022; ITDP Africa, 2021). Lastly, the rise, uptake and attractiveness of electric vehicles, autonomous vehicles, and semi-autonomous vehicles as emerging technologies are attractive for the wealthy but are not in line with the vision of eco-mobility and public transportation offered by the CJC for a variety of reasons. Though a preferred approach in the South African Governments new policy paper on Electric Vehicles (DTIC, 2023), EV's are not a preferred choice as their development and manufacturing can inadvertently reinforce carbon-intensive developmental path dependencies and they do not encourage a departure from car-centric cultures. The supply chain involved in producing EV's requires many transition minerals, many of which are in or near indigenous lands and biodiversity hotspots, bringing human rights issues to the fore (Kemp et al., 2022). Further, all new extraction requires the continued use and dependence on fossil fuels for the actual extraction activity and contributes to land-use change and biodiversity decline, conflicting with the vision for justice and transformation in the CJC. Second, EV's represent a shallow transition in that they allow for the same to continue with a technology that is only slightly cleaner when driven, but not in its production. EV's do not encourage a break from car-centric cultures nor do they foster more democratic road cultures. A transition with EV's does not help to transform urban spaces to being more just, climate-friendly, or democratic, but rather reproduces much of the same of what we already have. Resisting this agenda through mobilizing eco-mobility and public transportation as a collective good is imperative to realizing a just, democratic, and sustainable future for all.

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