NDC ASPECTS

Policy Brief

Shifting unavoidable private mobility to lighter electric vehicles

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Key messages

- Private motorized road mobility (cars, 2-3 wheelers) accounts for about 45% of transport emissions. The share of larger passenger vehicles – specifically sport utility vehicles (SUVs, including pickup trucks) in the global car fleet increased from 8.5% in 2010 to 31.4% in 2022 and were the biggest driver of passenger transport emissions of the last decade.
- The current strategy globally consists essentially in accelerating the electrification of road vehicles. While electrification is necessary for the climate goal, it is not a silver bullet and larger (electric) cars bring larger externalities related to congestion, car injuries, use of public spaces, energy and use of physical resources.
- Therefore, after having shifted all possible private motorized mobility towards public transportation, going lighter and smaller is one of our best bets to satisfy mobility needs. In some developed countries, like Germany or the USA, more than 50% of current car travel demand could be satisfied by light electric vehicles (LEVs). This should become a policy priority to promote LEVs and discourage SUVs for the unavoidable private mobility.
- According to our analysis, the development and penetration of LEVs in our mobility systems and societies depend on many barriers and enablers, which should be addressed by targeted policy interventions and need a deep understanding of national ecosystems.

Introduction

The trend of SUV sales has been increasing through the years both as a result of OEM strategies and shifts in consumer perceptions and attitudes. SUVs constitute approximately 45% of new private car sales globally in 2021, with the USA at 66%, the EU at 45%, India at 35% and South Africa at 49%. This trend is also applicable to electric cars, with 40% of global battery electric vehicle (BEV) sales being SUVs (IHS Markit, 2018). This has led to an increase in energy and resource consumption which negates fuel efficiency gains (EPA, 2023; IEA, 2019) along with increased risk of accidents, life cycle emissions and reduced urban space.

In addition, current national and transport strategies, as reported in the framework of the Paris Agreement in the Nationally Determined Contributions, reveal a lack of avoid- and shift-related measures for the transport sector with a major focus on electrification (Slocat, 2022; WRI, 2019). With increasing GDP per capita and thus private vehicle ownership (currently 14% per household in India in comparison to 78% in Germany and 92% in USA) in developing countries, passenger car activity is projected to double in 2050 in comparison to 2020 (Senzeybek et al., 2024). It is thus important to contain private car ownership and SUV trends across all regions and to satisfy travel needs with solutions with a lower environmental impact, such as LEV.

Indeed, recent analysis revealed that 50% and 62% of all mileage driven in car intensive countries like Germany and USA can be driven by lighter electric vehicles (LEVs) (Ehrenberger et al., 2022). This resulted in an emission reduction potential of 44% and 29% for Germany and USA in 2030 for passenger transport, based on methodology described

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in (Ehrenberger et al., 2022) using travel surveys and considering trip length, accompaniments, trip purpose and age, among others. Differences arise from distribution of trip lengths and characteristics, emission factors of vehicles and energy supply carbon intensity. Considering another development context like India, if 80 % of new sales of 2 wheelers and 3 wheelers are electric by 2030 to achieve the Indian FAME policy targets (NITI Aayog & RMI, 2019), this could lead to a reduction of 15% in tailpipe emissions. This could even reach up to a reduction of 46% in tailpipe emissions if 50% of all car usage is carried out by e-microcars.

However, the development and penetration of LEVs in different markets relies on many socio-economic, infrastructural or institutional aspects. Factors like consumer needs and sensitivities to cost (upfront and total cost of ownership) and convenience, infrastructure and regulations for safety, charging and multimodality, regulations and monitoring structures, gender suitability, supporting manufacturing ecosystem and other regional specificities will determine the rate at which this transition can occur. In addition push and pull measures need to be in place to discourage use of heavier and more polluting personal transport.

An emerging vehicle class of lighter and electric vehicles offer a new vision for personal transport which shifts away from heavier and less efficient SUVs. The objective of the paper is to present a review of existing policies which can support a shift towards LEVs. In this paper, you will find a **comparison of the environmental impact of SUV versus LEV, a framework to analyze barriers and enablers to accelerate the penetration of LEVs in markets, and finally policy examples from all around the world addressing some of these key aspects**.

Environmental impact: SUV versus LEV

Over the last decades, the vehicle size increased, for example by 1 cm every 2 years in the past 20 years in the EU (Transport & Environment, 2024), and the global average weight of vehicles increased by 15% in the past 10 years (GFEI, 2023).

SUV is becoming the new conventional car in most markets. E-SUVs are on average 30 % heavier than a passenger car and 4 times heavier than an e-microcar. This means that e-SUVs require larger batteries to achieve the same autonomy and more associated critical materials. This means that they require more energy to move and associated energy-related emissions. Their size requires also more road or public spaces used.

Light electric vehicles (LEVs) range from e-scooters, e-bikes, and e-mopeds to e-quadricycles and microcars and present key environmental advantages compared to SUVs, as presented in Table1.

For example, compared to electric microcars:

- Battery size for e-SUV are ca. 5 times larger and thus burdens critical material usage and recyclability.
- Energy consumption of e-SUV are ca. 3 times more owing to their larger mass to payload ratio.
- Space used for SUV are ca. 3 times more: A reconsideration of shared urban land use needs to be done in the context that average occupancy in German trips is only 1.4 people (Brost & Ehrenberger, 2022).
- GHG emissions for e-SUV are ca. 3 times more: Electric microcars have an lifecycle analysis (LCA) based emission factor of ~50 CO_{2eq}/km compared to ~160 CO_{2eq}/km for electric SUVs. The LCA based emission factors for electric 2 wheelers and smaller LEVs are even lower in the range of 6-20 CO_{2eq}/km.

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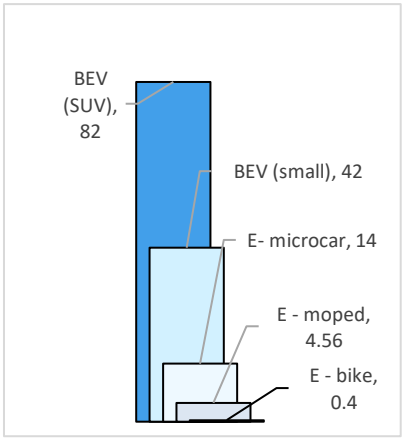
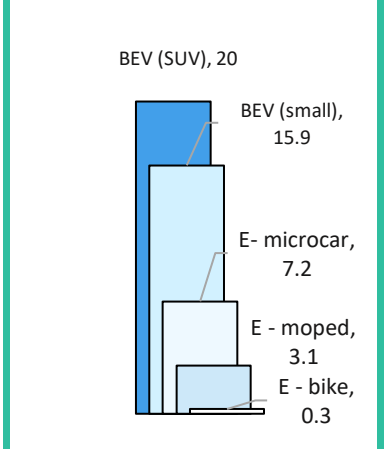
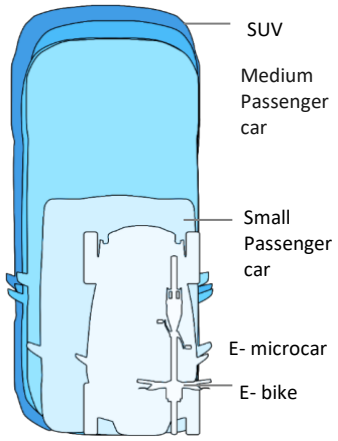
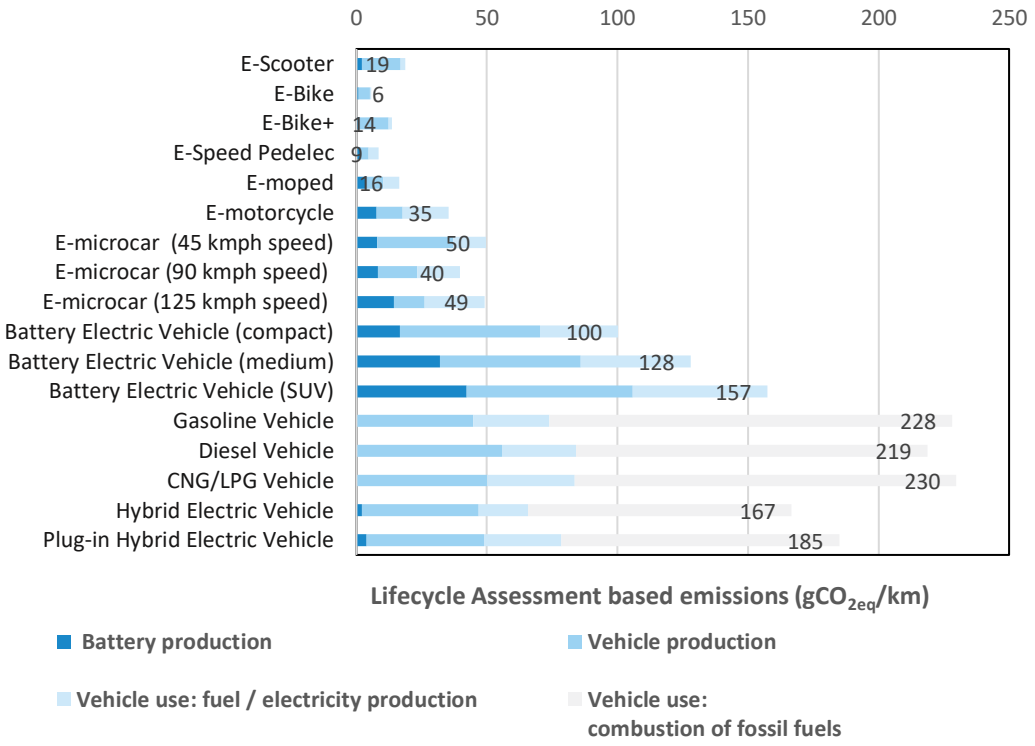
Table 1 Comparison of parameters for passenger vehicles

Battery Capacity (kWh)	Energy consumption (kWh/100km)	Size and Space
		
Lifecycle based Emissions (gCO_{2eq}/km)		
		

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Note: Battery capacity and energy consumption based on models, Macina Central 7 F, TVS iQube, Microlino, Fiat 500e and VW ID.4 and data from manufacturers or EV-Database.org. Size based on exemplary models, Renault Twizy, Smart fortwo, Mercedes B-Class, VW Tiguan, Mercedes GLE. LCA emissions from (Ehrenberger et al., 2022)

Analytical framework of action levers

Given the better environmental impact and potential to satisfy mobility needs in an equivalent manner than SUVs, key actions should be taken in the coming years to enable this shift to lighter and smaller electric vehicles. Based on a workshop and reviews, Table 2 proposes a framework to analyze actions to favor this transition. It gathers action levers according to the type of actors (e.g. policymakers and planners, consumers and vehicle manufacturers) and different key objectives and goals in the transition towards sustainable mobility (e.g. reduction of car use, complement rather than compete, safety, inclusion…).

Table 2. Actions to support lighter and electric vehicles

Aspects\Who	Policymakers and Planners	Consumers	Vehicle manufacturers
Reduction of car usage and incentivize LEV development	〉 Lifecycle emission-based fleet targets instead of tailpipe emissions. This can be translated as energy efficiency targets also. 〉 Support and finance Small and Medium Enterprises venturing in microcars and LEVs. 〉 Subsidize vehicle use over ownership. 〉 Focus on suburban travel (where public transport is not viable) and medium sized cities (like Smart cities for India) and leverage data and digitalization for land use planning 〉 Convert and electrify city municipal fleets	〉 Create awareness about sustainable lifestyle and vehicle mode choices within the consumer's set of possibilities. Identify ways to reward or recognize this. 〉 Spread awareness on the effect of splitting use of modes based on needs. 〉 Spread awareness on shifting from ownership mindset to usership.	〉 Update and simplify regulations constantly for e-quadricycles, e-2W, e-3W and e-bikes 〉 Promote diversification of portfolio to cater to mobility as a system and increased modularity. 〉 Build and promote partnerships to standardize payments, vehicle components and inter-operability 〉 Encourage local production and maintenance.

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Aspects\Who	Policymakers and Planners	Consumers	Vehicle manufacturers
Complement rather than Compete	〉 Provide safe and reliable public transport as first priority, then infrastructure for non-motorized transport (NMT) which would be complemented with seamless access to lighter and electric vehicles.	〉 Discourage shift from low emission modes like walking and bicycling for short distances to LEVs.	〉 Provide avenues for public-private partnerships for public transport
Safety and infrastructure	〉 Develop safe environments for optimum mobility solutions in the area by employing digital and standardized data-based solutions for faster reform 〉 Update and research on safety requirements of new LEVs and other heavier vehicles for batteries and interacting with other vehicles. 〉 Pull measures like traffic calming and push measures like parking fees, efficiency-based registration fees. 〉 Assistance to city plans for investment and policy for infrastructure from the national level.	〉 Better training, tolerance and awareness of different modes.	〉 Focus on both active and passive safety features and initiate technological cooperation between OEMs for safety. 〉 Proactively include and market pedestrian and cyclist safety features.
Inclusion and equity	〉 View LEVs as a means for mobility equity and accessibility across social classes and gender. Subsidize especially considering these factors. 〉 Set fleet targets for circulation of shared vehicles in neglected areas		〉 Increase sensitivity to consumer needs of gender, age and disability in the design process 〉 Promote industry cooperation to enable 'small,' non-profitable' base models and charging infrastructure to decouple upfront costs to increase affordability.

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Aspects\Who	Policymakers and Planners	Consumers	Vehicle manufacturers
	〉 Create framework to enable base vehicle models and charging solutions for all (like battery swapping where needed) for mass uptake especially in developing countries		

Key real-world policy examples

Following the review of action levers in Table 2 we provide some real-world examples of how lighter and electric vehicles are being incentivized globally and in cities primarily. This includes a collection of policy and technologies that reward use of LEVs and discourages use of heavier vehicles like SUVs. Apart from this list of measures, further examples of ongoing practices for payment integration, physical and institutional integration of micromobility and public transportation can be seen in (ITDP, 2021).

Push-pull measures

- Higher parking fees for SUVs can be implemented as being done in in Tubingen and Freiburg (SAZ Bike, 2022) and Paris (EU Commission, 2024) where electric vehicle weighing above 2 tonne are also included.
- A weight and CO_2 based registration tax which now includes electric vehicles can be introduced as being done in Norway (Norwegian Tax Administration, 2024; OECD, 2021) and is being worked on in New York (Senate Bill S6657, 2023)
- Pedestrian and cyclist injury and fatality safety should be included in updated safety ratings of cars and SUVs which surprisingly is not included in the USA (Bloomberg, 2022) (unlike Europe (Euro NCAP, 2024)) through not just braking and assistance technology but also vehicle weight and speed considerations.
- Implement traffic calming for increased safety like in Bologna (The Mayor, 2023) , Amsterdam (Veiligverkeer, 2023) and Brussels (EU Comission, 2023) which are converting their cities to a 30 kmph city in a widespread manner.
- Higher subsidy focus should be placed on electrified mass transport like public transport and high e 2-wheeler and 3-wheeler in comparison to cars as done in India under FAME II policy (Ministry of Heavy Industries, 2022). This should further be extended to smaller electric cars instead of larger ones.

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Equity and inclusion:

- Subsidy:
  - E-bike subsidies can be provided on the basis of income like being done in France which offers up to 4000€ for lower income households (Fietsberaad Crow, 2022).
  - Higher focus on equity related programs are being introduced in the USA to reduce historic inequities in transportation access like in Atlanta where a higher subsidy is being provided for cargo bikes and lower income households. Similarly, in Boston, aged, low income groups and disabled people are being given subsidies up to 1500$ for bikes and cargo bikes (City of Boston, 2024).
  - Equity in not just vehicle purchase but also provision of charging infrastructure and other infrastructure should be parallelly maintained as is the focus of research cities in the USA (NREL, 2022).
- Inclusion

  LEVs should also be seen as a mobility option for increased inclusion across genders, life-stage, disability and age. An example of this in action lies in the Kei car usage in Japan. 65% of Kei car users in Japan are female drivers and 44% are older than 40 with 68 % users using them every day (JAMA, 2021).

Mobility lifestyle awards and incentives

- App based monetary awards for sustainable transport:
  - Individuals can be awarded to use sustainable modes like in the UK via an app (Railway technology, 2023) which includes public transport and cycling and also incorporates contexts of feasibility when calculating scores for monetary rewards.
  - Applications for routing options for sustainability and health can be introduced as is done in Nordic countries (Nordic Innovation, 2023) which also helps planners for monitoring activity. Similarly, eco-friendly routing as done in Google Maps should not just limit to fuel efficiency as currently done (Google) but also include indicators of total LCA based footprint of trips to be undertaken.
- Incentives like mobility wallets is an option to promote sustainable modes like the monthly 150$ mobility wallet provided for low income groups to use and save for any mode of transport apart from a car in LA (City of Los Angeles Department of Transportation, 2024) since 2023.

Data based policy and innovation:

Different sources of stationary and mobile data collectors can be used for vehicle availability and forecast, trip patterns, safety and transport planning (Hans-Heinrich Schumann et al., 2023)

- Incident and speed data can be used for improving safety of bikes and e-bikes like in Amsterdam (LEVA-EU, 2022)

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- Safety levels can be improved by identifying hotspots through recording and visualizing collision data and fatality of NMT and vehicle modes as is being done in New York (NYC Crash Mapper, 2023)
- Using data-based platforms like the battery swap systems for e-motorbikes in Rwanda which supports livelihoods dependent on commercial fleets (Bboxx, 2022)

Car sharing fleets

E-microcars and e-mopeds and motorbikes have recently started to be integrated in municipality fleets and car sharing fleets all around the world.

- In Europe, e- microcars are now slowly becoming a part of car sharing fleets (Invers GmbH, 2024) like Enjoy (Enjoy, 2024) in Rome which employs battery swapping for its service. Specialized fleets like Carvelo (Mobility Academy, 2024) has an extensive coverage in Switzerland with e-cargo bikes and mini e-cargo trucks.
- In India, last mile delivery have rapidly incorporated e 2-wheelers in their fleets (Global Fleet, 2024). Electrification of 3-wheelers, which are a popular informal transport mode in India, have also increased rapidly, with 50% of vehicle sales in 2023 as electric (Ministry of Road Transport & Highways, 2023)

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POLICY BRIEF

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