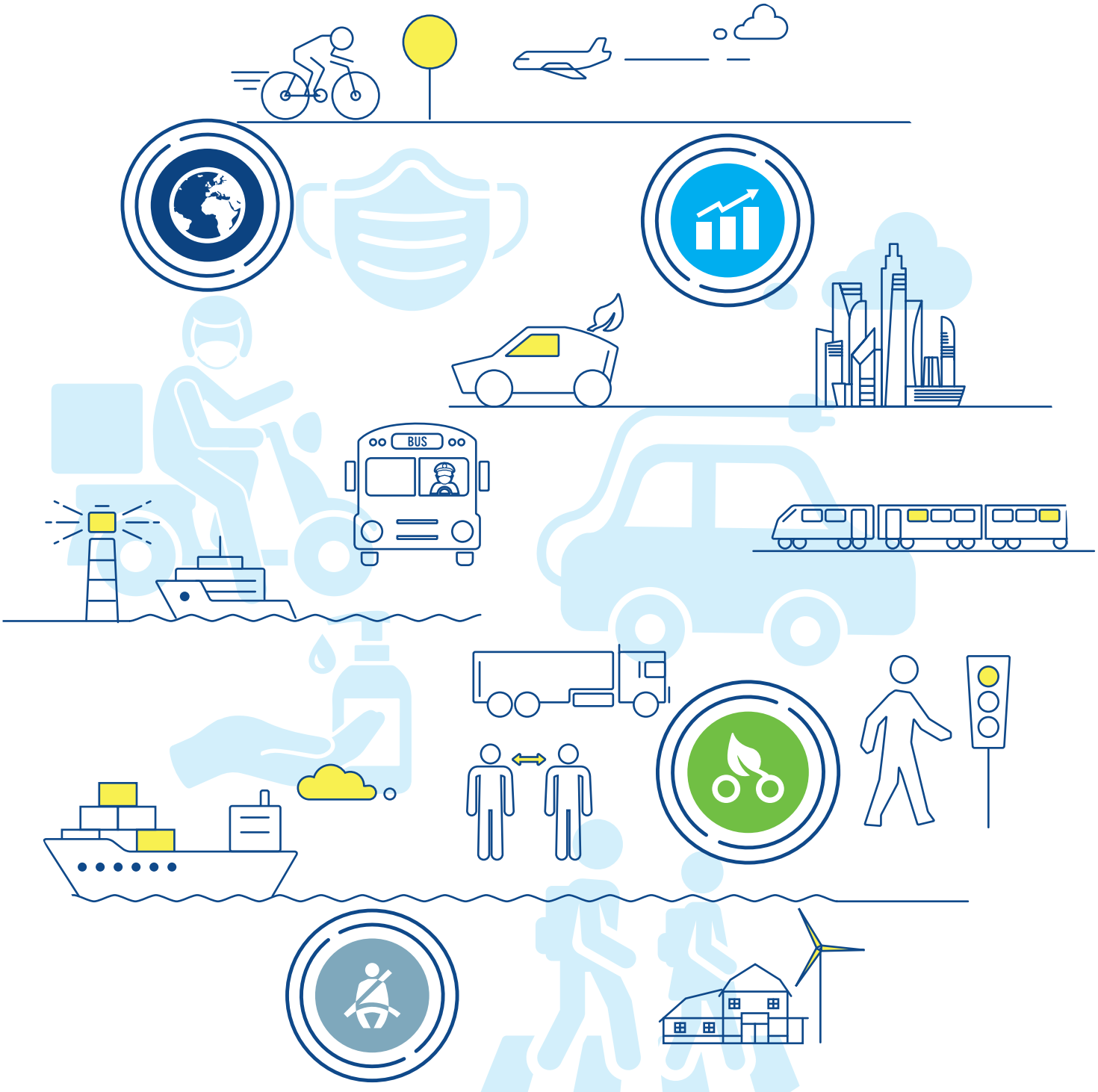
GRA IN ACTION SERIES

Sustainable Electric Mobility: Building Blocks and Policy Recommendations

SUSTAINABLE mobility FOR ALL™



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SUSTAINABLE mobility FOR ALL

Sustainable Electric Mobility: Building Blocks and Policy Recommendations

WORLD BANK GROUP

german cooperation
DEUTSCHE ZUSAMMENARBEIT

TUMI
Transformative Urban Mobility Initiative

UITP ADVANCING PUBLIC TRANSPORT

Table Contents

List of Abbreviations

AFD	Agence Française de Développement
ASI	Avoid, Shift, Improve
BMZ	German Federal Ministry for Economic Cooperation and Development
C40	C40 Cities Climate Leadership Group
CEM	Clean Energy Ministerial
CPM	Catalogue of Policy Measures
COVID-19	Coronavirus Disease 2019
EU	European Union
EV	Electric Vehicle
EVI	Electric Vehicles Initiative
FIA	Fédération Internationale de l'Automobile (International Automobile Federation)
FCEV	Fuel Cell Electric Vehicle
GHG	Greenhouse Gas
G20	Group of Twenty
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GFEI	Global Fuel Economy Initiative
GRA	Global Roadmap of Action
ICAO	International Civil Aviation Organization
ICE	Internal Combustion Engines
IEA	International Energy Agency
IFP	International Federation of Pedestrians
IsDB	Islamic Development Bank
ITF	International Transport Forum
ITS	Intelligent Transport Systems
KfW	KfW Development Bank

MaaS	Mobility as a Service
NGO	Nongovernmental Organizations
OEM	Original Equipment Manufacturer
SDG	Sustainable Development Goals
SLOCAT	Partnership on Sustainable, Low Carbon Transport
STA	Sustainable Transport Africa
SuM4All	Sustainable Mobility for All
TCO	Total Cost of Ownership
TUMI	Transformative Urban Mobility Initiative
UA	Unmanned Aircraft
UIC	International Union of Railways
UITP	International Association of Public Transport
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
V2G	Vehicle-to-Grid
V2X	Vehicle-to-Everything
WBG	World Bank Group
WHO	World Health Organization
WRI	World Resources Institute
ZEV	Zero Emission Vehicles

Foreword

Sustainable Mobility for All (SuM4All) is the premier advocacy platform for international cooperation on transport and mobility issues. It brings together 55 public organizations and private companies including bilateral partners, multilateral development banks, U.N. organizations, intergovernmental organizations, and civil society with a shared ambition to transform the future of mobility. It is an innovative model for action in transport that leverages the knowledge, expertise, and influence of its Member organizations to assist countries worldwide in their ambition to attain universal access, efficiency, safety, and green mobility.

SuM4All action in countries is guided by a data-informed approach to diagnose transport and mobility issues and a coherent global policy framework contained in the *Global Roadmap of Action toward Sustainable Mobility* (GRA). The GRA offers a catalogue of more than 180 policy measures to achieve sustainable mobility. Based on this novel attempt, SuM4All partnership's priority for 2020 was clear; its implementation in countries—with South Africa as the first beneficiary country—and its refinement in four cutting-edge policy areas: data sharing, e-mobility, gender, and transport–energy nexus.

SuM4All Members joined working groups with a mandate to get a better understanding of these four areas, collect global experience, and deep dive into the associated policy measures in the GRA to make them more actionable for country decision makers. We are pleased to share the second of five papers that will be published in 2021 in the "GRA in Action" series. The paper unpacks the GRA's policy measures on electric mobility into 3 action fields, 7 building blocks and 69 policy recommendations to promote sustainable e-mobility at all levels of government as a call to action for policy makers.

We thank the Transformative Urban Mobility Initiative (TUMI) and the International Association of Public Transport (UITP) for leading the engagement with our Members on this important topic, contributing to raising its visibility for policy making, and leading the production of this paper in a collaborative way.

Sustainable Mobility for All Steering Committee
(On behalf of our 55 Member organizations)
March 2021, Washington, D.C

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Note: *Does not necessarily reflect the position of all FIA members.

Executive Summary

Why is it important to get electric mobility (e-mobility) right? Electrification of the sector has never been more prominent and relevant to the ongoing debate on the future of mobility. Given that the transport sector is responsible for more than one quarter of energy related greenhouse gas (GHG) emissions, governments worldwide need to take ambitious steps to limit global warming and achieve the goals of the Paris Agreement.[1] Transport accounts for a large proportion of local air pollutants contributing to seven million premature deaths annually worldwide.

Electric mobility is viewed as one of the ways to help transform mobility in support of sustainable development objectives and decarbonization goals. Nevertheless, there is considerable discussion on the best policy framework for an integrated and sustainable introduction of electric mobility. This paper aims to help public policy makers at the international, national, regional, and local levels accelerate the development of sustainable electric mobility. While the adequacy of the various e-mobility models must be assessed in view of local circumstances, the paper aims to define actionable public policy recommendations for different levels of public policy.

The Catalogue of Policy Measures (CPM) from the *Global Roadmap of Action toward Sustainable Mobility* (GRA) contains more than 180 policy measures that have been used and tested around the world in support of sustainable mobility. This paper takes a deep dive into policies and global experience available to act on "integrate new mobility solutions to existing transport"—measure 116 in the CPM—and associated measures including "establish electric vehicle manufacturing mandates", "support vehicle connectivity and smart charging regulations", "use public procurement to support vehicle electrification", "development of infrastructure for road transport electrification", "invest in railway electrification", "promote public discussion on new mobility solutions", "support R&D to optimize the life cycle of vehicle batteries" and "inform users about new sustainable solutions".

Starting from the GRA, SuM4all's e-mobility working group analyzed the main barriers to electric mobility development, identified essential building blocks for successful public policies in the field of electric mobility, and provided policy recommendations for three different categories of target audiences:

1. International development public policy community: bilateral and multilateral development organizations, international finance institutions, United Nations programs and agencies as well as international think tanks and nongovernment organizations (NGOs);
2. National public policy community: groups within a country such as national governmental ministries and agencies as well as think tanks and NGOs;
3. Local public policy community: city or regional authorities and agencies as well as think tanks and civil society organizations.

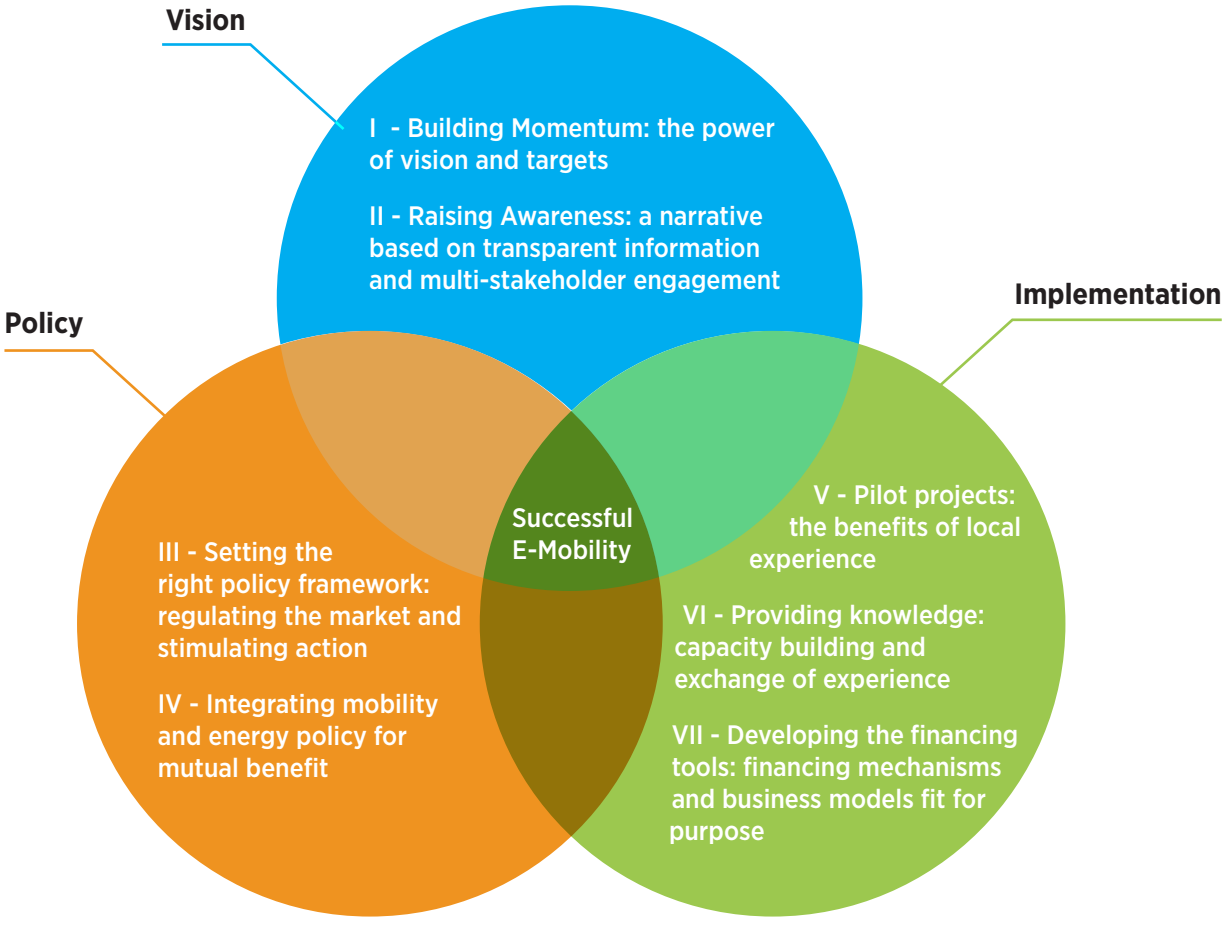
The structure of the paper is divided into three main sections: Part I sets the scene and introduces electric mobility as key ingredient of sustainable mobility. Part II outlines seven essential mutually reinforcing building blocks of successful public policy for sustainable electric mobility, linked closely to policies in the CPM. Part III sets out actionable public policy recommendations for international, national, and local institutions to support the scaling up of sustainable electric mobility in the short and medium term.

An analysis of practice around the world shows that development and climate goals can only be achieved with sustainable mobility. Electric mobility is an essential component of a broader transformation of the transport sector. It should be powered by low carbon and renewable electricity and has no exhaust emissions at the point of use. A clear message laid out in this paper is that e-mobility is more than the electric car. All transport modes must be considered for feasibility, when implementing e-mobility solutions. In some circumstances, it is a powerful tool to shift travel and transportation to cheaper and more efficient modes—for instance, from cars to e-bikes and e-buses—and increase access to opportunities for many. Policy must combine electrification of the existing fleet with greening of the grid and promoting modal shift to capture the potentially great benefits of electric mobility while maximizing its contribution to the development of sustainable mobility. Additionally, policy must avoid unnecessary travel through integrated urban development and compact city planning.

An in-depth review of existing barriers shows a broad range of obstacles to the development of sustainable electric mobility. These range from policy and legislative barriers, lack of capacity and knowledge, market and financial barriers as well as technical challenges. Many of the identified barriers cannot be overcome by a singular actor or policy measure, but require a coherent set of interventions by different actors and at different levels—international, national, and local.

Therefore, we define seven essential building blocks of successful public policy for the development of sustainable electric mobility, ultimately leading to policy recommendations for the different levels of decision making. The various building blocks are mutually reinforcing and interconnected elements, which present the foundation of successful public policy. They are grouped into three key action fields—vision, policy, and implementation (figure ES-1).

Figure ES-1. Three action fields containing seven essential building blocks.



Taking the three action fields and their building blocks as an illustrative example, it can be stated that every electric mobility vision should be articulated by clear and specific electric mobility targets or mandates to focus efforts and measure progress. Many countries and regions are announcing targets to set a reliable policy framework toward electric mobility and the better integration of energy and mobility. When implementing electric mobility projects, pilot projects are well suited to test the right financing, provide local experience, and build the necessary capacities to make the case for e-mobility successfully.

While the priorities for the development of electric mobility depend on local circumstances and mobility needs, international, national, and local policy together need to provide a coherent and consistent locally appropriate public policy framework to catalyze the development of sustainable electric mobility.

This paper identifies recommendations at all levels of governance. For the first target audience—international development public policy community—we recommend among others, to use the powerful voice of international actors with governments to raise awareness and promote sustainable electric mobility, whenever appropriate. Global initiatives like EV100 or EV 30@30 are helpful tools to do so (see box II-4). International support can help developing countries, which lack resources and capabilities, implement good electric mobility policy and avoid negative effects of unsustainable transport. Supporting harmonized carbon accounting frameworks, international standards for battery life cycle, second-hand vehicle markets as well as supporting balanced and accurate information about electric mobility should be key efforts for a broader shift for sustainable mobility.

Acknowledging that national policy, through legislation and funding, has a strong influence on the development of electric mobility, the main recommendations toward the national policy community are to set clear electric mobility and transport sector targets to reduce GHG emissions—such as phase out of combustion engine vehicles—to help build momentum and provide solid policy frameworks for long-term planning. This includes aligning taxation and carbon pricing with a sustainable transport vision, for example bonus–malus systems and temporary subsidies for sustainable and active electric mobility segments.

On the local city level, the potential to avoid or reduce the need to travel and shift modes is highest, as many trips are of short distance. Policies which focus on the reallocation of street space and promotion of the "15-minute city"[2] should have priority. Electrifying suitable bus routes and advancing bicycle infrastructure for electric city logistics are effective ways for cities to promote new forms of electric mobility. Considering local context, established forms of electric mobility—rail, tram, and trolley bus—could be expanded.

In conclusion, we argue that supporting a sustainable electric mobility development in cities on a national level and in the development cooperation community will require clear and coherent policies in transport and energy. With this paper, its building blocks and policy recommendations, we have laid a solid basis to inform decision makers about effective policy measures, which will catalyze their electric mobility efforts[3]. If implemented well, electric mobility can support an accessible, efficient, safe, and green mobility for all.

Notes

1 The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016. Its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. To achieve this long-term temperature goal, countries aim to reach global peaking of greenhouse gas emissions as soon as possible to achieve a climate neutral world by mid-century. Link: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

2 The 15-Minute City Project is a concept where citizens have local access to the majority of goods and services within 15 minutes. It is an information resource designed to help access-focused urban transformations be ambitious, inclusive, measurable, and effectively implemented. Link: https://www.15minutecity.com/

3 All findings of the paper are based on a methodological process of knowledge generation. In a multilevel approach, all 16 group members participated in the form of bilateral interviews, which built the foundation of this paper. Focused group discussions, regular group meetings, and the use of various engagement mechanisms guaranteed a balanced and transparent production process, where the members could feed in their extensive knowledge of e-mobility.

PART I.
Introduction

Background

Formed in 2017, Sustainable Mobility for All (SuM4All) brings together a diverse and influential group of transport stakeholders with a commitment to speak with one coherent voice and act collectively to implement the UN's sustainable development goals (SDGs) and transform the transport sector. SuM4All published the Global Roadmap of Action (GRA) in October 2019 that helps countries act to progress toward sustainable mobility for all (box I-1).

Box I-1. Global Roadmap of Action toward Sustainable Mobility and the link with electric mobility

SuM4All's Global Roadmap of Action toward Sustainable Mobility (GRA)[a] established solid foundations to engage with countries on a comprehensive policy agenda for sustainable mobility since its release in October 2019. It outlines a catalogue[b] of more than 180 policy measures for countries and cities to consider in order to transition toward the attainment of sustainable development goals (SDGs) and sustainable mobility across all modes of transport. SuM4All's vision for sustainable mobility is underpinned by four overarching policy goals: universal access, efficiency, safety, and green mobility (box figure I-1-1).

Box figure I-1.1. Sum4All's Sustainable Mobility Vision.

As part of SuM4All's priority to put the "GRA in Action", the initiative launched five workstreams in January 2020. While one of the workstreams focused on piloting the GRA in South Africa, the remaining four workstreams took a deep dive into specific policy recommendations of the GRA—gender, data framework, e-mobility, and energy and mobility nexus.

The policy measures in the GRA Catalogue of Measures that are oriented toward electric mobility are:

- #35 Establish electric vehicle manufacturing mandates
- #49 Support vehicle connectivity and smart charging regulations
- #57 Use public procurement to support vehicle electrification
- #92 Development of infrastructure for road transport electrification
- #94 Invest in railway electrification
- #116 Integrate new mobility solutions to existing transport
- #171 Promote public discussion on new mobility solutions
- #166 Support R&D to optimize the life cycle of vehicle batteries
- #182 Inform users about new sustainable solutions

A detailed overview of GRA connections is elaborated in Part II.

Notes:

a. GRA and its policy papers are available from URL: https://sum4all.org/gra
b. Catalogue of policy measures adapted from the GRA is available at: https://sum4all.org/data/files/cpm.pdf

This paper presents the output of the working group on the "Sustainability of the E-Mobility Model". This working group was one of five workstreams established by SuM4All and launched on January 15, 2020 to put the GRA into action and define actionable policy recommendations. Besides the e-mobility workstream, the remaining working groups dealt with the topics of "*Enabling Data Sharing for Sustainable Urban Mobility"*, *"Gender Data and Diagnostic"*, *"Energy and Mobility"* and *"Piloting the GRA"* jointly to transform the future of mobility. Due to the thematic proximity to the energy and mobility working group, this paper refers to their separate outcome document at this point for further reading.[1]

The working group on the "Sustainability of the E-Mobility Model" was created to finetune electric mobility policy and measures to make them more actionable at the national and local levels.

The 16 members of the working group are: Agence Française de Développement (AFD), Fédération Internationale de l'Automobile (FIA), FIA Foundation, German Federal Ministry for Economic Cooperation and Development (BMZ), International Association of Public Transport (UITP), International Civil Aviation Organization (ICAO), Islamic Development Bank (IsDB), International Federation of Pedestrians (IFP), International Union of Railways (UIC), KfW Development Bank (KfW), SLOCAT Partnership on Sustainable, Low Carbon Transport (SLOCAT), Sustainable Transport Africa (STA), Transformative Urban Mobility Initiative (TUMI), United Nations Economic Commission for Europe (UNECE), World Resources Institute (WRI) and the World Bank Group (WBG).

Methodology

This report is based on interviews with representatives of the SuM4All working group Members. It does not necessarily represent the positions of the individual organizations.

In a multilevel approach, all 16 group members participated in the form of bilateral interviews, which built the backbone of this paper. Focused group discussions, regular group meetings, and the use of various engagement mechanisms guaranteed a balanced and transparent production process. The methodology allowed all members to contribute their extensive knowledge efficiently in the field of e-mobility to the joint development of the paper. A stakeholder workshop with e-mobility experts from the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), organized in September 2020, allowed for additional feedback and expert validation of the findings from a broader group of stakeholders.

Paper objective and structure

This paper aims to help public policy makers at the international, national, regional, and local levels to accelerate the development of sustainable electric mobility, whenever appropriate.

- Part I introduces the concept of electric mobility, highlights its contribution to sustainable mobility, and identifies barriers to the adoption of electric mobility.
- Part II outlines seven essential building blocks of successful public policy for sustainable electric mobility.
- Part III sets out actionable public policy recommendations for international, national, and local institutions to support the scaling up of sustainable electric mobility in the short and medium term.
- While priorities must be chosen according to local circumstances, the paper aims to provide actionable public policy recommendations.

Definition of electric mobility

For the purposes of this paper, electric mobility is defined as the systems, services, and equipment that support the movement of passengers and freight by electric-powered means of transport.

Electric means of transport include all types of transport powered directly by electricity from micro mobility for example, electric scooters and pedal assisted e-bikes, and fully powered 2- and 3-wheeled vehicles such as e-rickshaws and electric cargo bikes, and also very light 4-wheelers, cars and vans to trucks, buses, trolley buses, trams, trains, aircraft and ferries.

This definition excludes hybrid electric vehicles such as cars or trains, which are powered by both internal combustion engines and electric motors.

Hydrogen-powered fuel cell electric vehicles (FCEV) are another alternative to conventional internal combustion engines (ICE), particularly for some applications that require higher levels of energy density storage. FCEV for road transport cannot yet be considered mature for immediate scale-up. The specific issues associated with the manufacture, storage, distribution, and use of hydrogen are considered questions of energy production and distribution, and are therefore not included in the scope of this paper.

Electric mobility - a pathway for sustainable mobility

Delivering on the global development agenda (UN Agenda 2030)[2] and its guiding principle of "leave no one behind" requires a global transformation of passenger and freight mobility systems so they can provide affordable, efficient, clean, safe, and low-carbon mobility for all. Transport contributes directly to SDG 3 on "Health"—increased road safety, less pollution—SDG 7 on "Energy", SDG 8 on "Decent work and economic growth", SDG 9 on "Resilient infrastructure", SDG 11 on "Sustainable cities" that is access to transport and expanded public transport, SDG 12 on "Sustainable consumption and production", and SDG 14 on "Oceans, seas and marine resources", and indirectly to the remaining ten SDGs. A large-scale transition to sustainable mobility in the next decade is necessary to achieve the SDGs.

Reducing transport greenhouse gas (GHG) emissions is also essential to achieving the objective of the Paris Agreement on climate change—and implement SDG 13 on climate change—to limit climate change to well below 2°C above pre-industrial levels and preferably below 1.5°C.[3] Already accounting for a quarter of GHG emissions, transport is the fastest growing source of emissions and without action could more than double by 2050. About 62 percent of the oil refined and transported across the globe is used to power transport.[4]

Electric mobility is viewed as one of the ways to help transform mobility in support of sustainable development objectives and decarbonization goals. However, simply replacing, for example the approximately one billion,[5] and growing, fleet of conventional ICE cars with electric cars will not allow us to meet climate targets or address pressing global mobility problems like congestion, safety, and affordability.

Mode shift and the use of smaller and cheaper individual means of transport have the potential to improve access for billions of people in a more equitable manner as well as for those who cannot afford to own a car. In many circumstances, these electric mobility solutions can be a powerful tool to shift trips to cheaper and more efficient modes such as from cars to e-bikes, and increase access to opportunities for many, often marginalized by providing more affordable mobility solutions and improving access to public transport.

Electric mobility, which has no exhaust emissions considerably improves air quality in cities. Also, in order to tackle climate change, mobility needs to be powered by low- or zero-carbon technologies. The lower the energy consumption per distance traveled—as in the case of shared and very light means of transport—the bigger is its contribution to overall emission reduction.

The challenge is to shape the development of electric mobility and harness its benefits while supporting the broader transformation to socially, economically, and environmentally sustainable mobility for all—sustainable electric mobility. Such progress, where suitable, requires accelerating the take-up of electric means of transport and shifting to the safer, more efficient electric mobility modes.

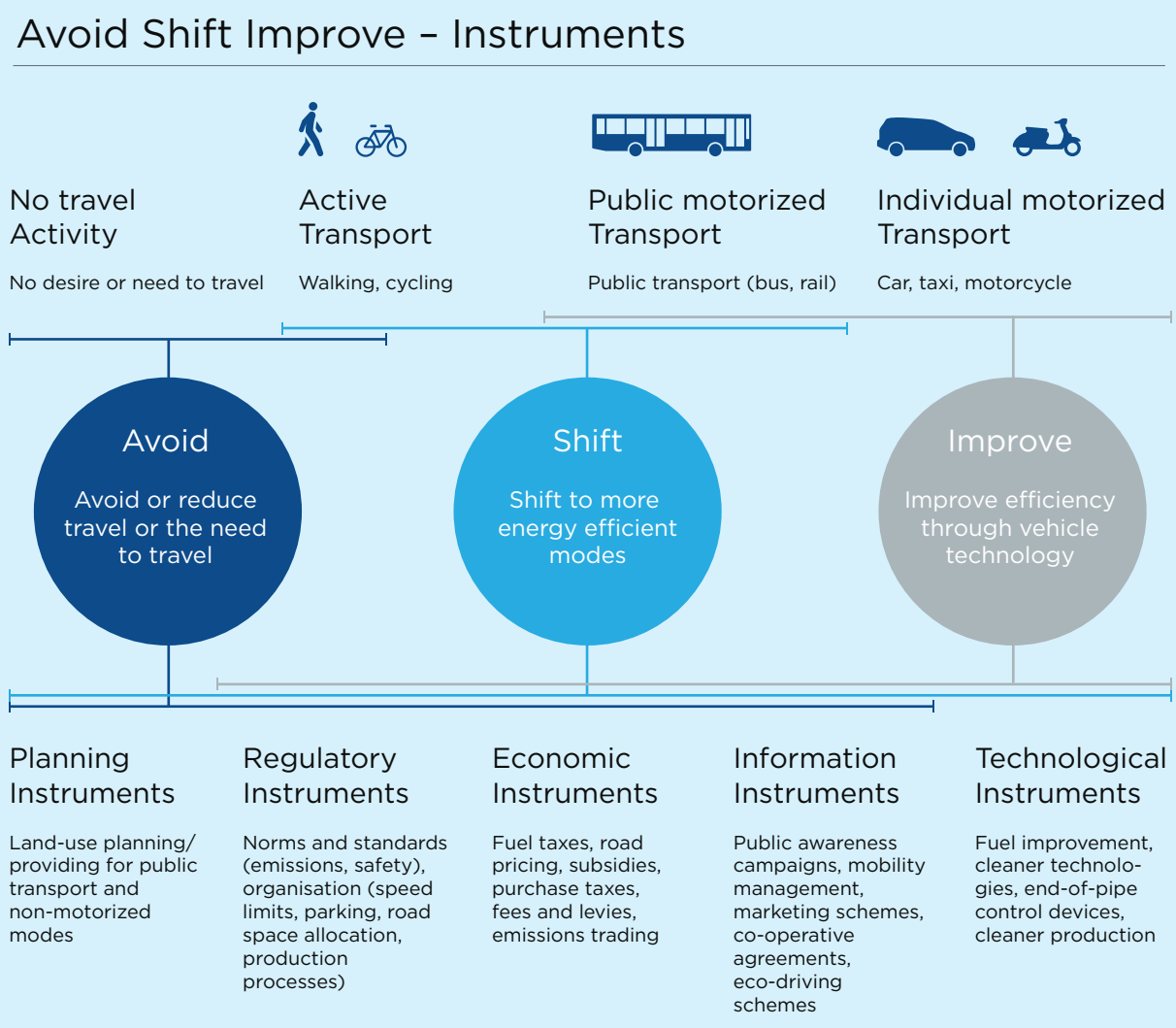
Transport has a range of local—safety, air pollution, noise, heat, space, equity, and affordability—and global impacts such as the demand for energy and other resources, and GHG emissions. Public institutions need to consider these different impacts, in the context of local circumstances and mobility, to decide what modes of electric mobility should be prioritized, if at all suitable.

The majority of trips are in urban areas, which often suffer heavily from the negative effects of transport. Tackling congestion, air quality and addressing inequality in access to transport are major drivers for cities to act on transport. Due to the high number of short trips, density of population, and limited space, cities are ideal places for implementing avoid, shift, and improve (ASI) strategies,

Box I-2. Avoid–Shift–Improve

There is a broad consensus that transforming mobility requires a balanced use of Avoid, Shift, and Improve (ASI) Strategies,[a] which focus on three prioritized strategies (box figure I-1.1) Firstly, avoiding or reducing transport demand such as efficient supply chains, online services, urban planning, and "15-minute city". Secondly, shifting transport to more sustainable modes for example, rail freight, public transport, walking or cycling integrated together in a high-quality multimodal transport system. Finally, improving the performance of transport modes through better operations such as driver training, better vehicle utilization and load factors, and better vehicles such as lighter, more efficient, and renewable energy sources.

Box figure I-1.1. ASI paradigm.



Source: TUMI.

a. Also see: Sustainable Urban Transport: Avoid–Shift–Improve (A-S-I) https://www.sutp.org/publications/sustainable-urban-transport-avoid-shift-improve-a-s-i-inua-9/

and deploying space-efficient, multimodal, active, clean, and affordable solutions (box I-2). For example, very light electrified modes like electrically assisted bikes can make important and affordable contributions to the needed mode shift, improved health, and emission reductions—all at the same time.

> *"Electric bikes are transformational. By replacing car trips by cycling trips, they make cities safer, healthier and more inviting for pedestrians, other cyclists and public transport users."*
>
> **- Geert van Waeg,**
> President, International
> Federation of Pedestrians

Importantly, transport is a complex system with infrastructure, services, pricing, and social norms influencing a multitude of actors' decisions and behavior—these system elements need to work together to deliver sustainable mobility. While much can be done at the local level where most services are provided, framework conditions are often determined at the national level for instance legal powers and funding, or at the international level with technical support, funding or emission reduction obligations; hence the need for coherent and consistent policy action across all levels.

The basic elements of a sustainable transport system—integrated and affordable public transport, safe walking and cycling facilities, car sharing, fuel economy standards, and parking management—should be pursued in parallel to investments in electric mobility.

Growing low carbon energy supply and new means of electric transport has generated great interest in the potential of electric mobility to transform mobility systems and improve transport for all. However electric mobility is not without its risks.

The lower running costs of electric cars may lead to increased use, contributing to congestion and reduced use of other modes; so, electric mobility policy and priorities must pay attention to which electric means of transport will be promoted and how. EV Policy should combine electrification of the existing fleet with promoting a modal shift toward more efficient modes such as walking, electric cycling (box I-3), and use of public transport to capture the potentially great benefits of electric mobility while maximizing its contribution to the development of sustainable mobility.

> *"Relying mainly on electrification of vehicles [cars] to reach carbon targets can have the consequence of increasing traffic congestion because of the lower cost and lower taxation of electric fuel"*
>
> **- Eyre and Killip 2019**

Box I-3. Promoting the shift to electric bikes

A large portion of all car journeys take place within a range of 15 kilometers. These are distances that seem too long for many conventional cyclists, but electric bikes are bringing these within many people's range.

Electric bike sales are booming; in the EU ten times more e-bikes were sold in 2019 than electric cars, increasing the total number of bicycles ridden, especially for commuters, many of them replacing ICE trips. However, such shifts will not happen if streets remain hostile to cycling. Providing safe bicycle infrastructure is especially relevant to attract more women to choose cycling as a mode of transport. A clear vision and policies need to be developed including speed management and enforcement, reallocation of public space, permeability of the network for active transport mode users, and the provision of adequate and secure parking and charging facilities. The creation of an efficient cycling and walking infrastructure has been shown to also increase the use of public transport.[a]

Box I-3. Promoting the shift to electric bikes *(contd.)*

E-bikes are affordable to many, are easily charged at home and bring great health benefits; e-bikes can be a key part of more car-independent lifestyles. E-cargo bicycles are also gaining in popularity across the globe and have proven to be a realistic alternative for families[b] and last-mile inner-city logistics deliveries[c] (box phots I-3.1 and I-3.2a and b). Policies should be put in place that not only make this possible but actively stimulate this mode.

Box photo I-3.1. E-cargo bicycles and inner-city deliveries.

Source: Cambridge, United Kingdom, http://cyclelogistics.eu/

The city of Lisbon, Portugal provides an example for the promotion of biking. Along with the extension of biking infrastructure by 100%, it subsidizes the purchases of e-bikes up to €350 and e-cargo bikes up to €500, compared to up to €100 for conventional bikes. The program was started in August 2020; in total, the city has set aside €3 million for bike purchase incentives [d,e].

Notes:

a. https://thepep.unece.org/sites/default/files/2020-10/Handbook%20on%20Sustainable%20Urban%20Mobility%20and%20Spatial%20Planning.pdf
b. http://cyclelogistics.eu/index.php/downloads/source-material/transporting-children-family-bike
c. http://cyclelogistics.eu/news/logistics-depot-e-cargo-bikes-opens-prague
d. https://www.lisboa.pt/programa-de-apoio-aquisicao-de-bicicletas
e. https://www.mobilize.org.br/noticias/12305/prefeitura-de-lisboa-da-500-euros-na-compra-da-bike-e-cria-novas-ciclovias.html

The ongoing digitalization of the transport sector offers various opportunities that have the power to accelerate the deployment of sustainable mobility. Intelligent transport systems (ITS) allow for more efficient routing and speed control in favor of energy efficiency, intelligent charging solutions and battery management—vehicle-to-grid (V2G), vehicle-to-everything (V2X), off-grid charging—sharing of means of transport and rides, integrated multimodal trip planning and payment like MaaS as well as access and parking management solutions allowing for the effective implementation of policies that prioritize low-carbon, light, and active modes.

A sustainable electric mobility policy must pay attention to the mobility needs of different potential user groups, especially women, disadvantaged and vulnerable groups. The potential user groups need to be identified carefully, as with ensuring access to new means of transport for these user groups. Therefore, challenges such as safety and accessibility must be factored all along the

planning and implementation process. In many countries, affordability is key; for example, in rural areas electric buses would be too expensive, both on the producer and consumer dimensions, but 2- or 3-wheel electric vehicles could be transformational.

Electric mobility priorities and investments should be carefully selected to ensure their broader benefits for society at large, and to improve the mobility of specific user groups. General investments in sustainable mobility such as bus lanes and cycle paths benefit all system users, including those powered by electricity.

Electric mobility offers a great potential to drive urban transformation, attract new actors, and trigger private investment in mobility solutions (box I-4). New electric mobility solutions also offer an opportunity to shift travel to more sustainable and multimodal mobility patterns—walking, biking, public transport, and car sharing.

Deploying electric mobility solutions in shared fleets such as city car clubs, could make electric mobility more affordable, facilitate better use of means of transports, save space, and increase mobility options for many people.

The development of sustainable electric mobility requires a locally appropriate public policy framework. This is outlined in detail in part III of this document.

Box I-4: Rail, the backbone of electric mobility

Compared to other modes of transport, the rail sector is widely electrified. In 2016, about three-quarters of global conventional passenger rail activity used electricity; up from 60% in 2000 and electrification is expected to continue at a rapid pace.[a] Virtually all urban and high-speed rail networks are electric.

Figure I-4.1a. Freight rail transport by fuel type

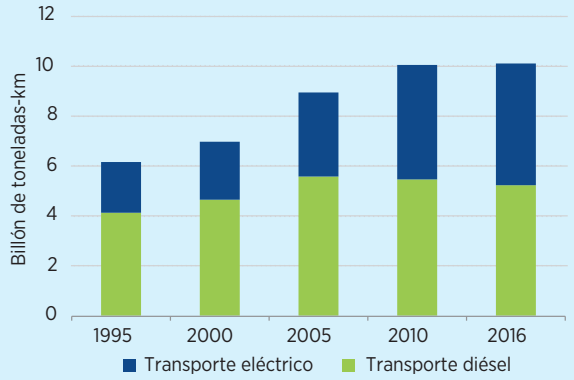
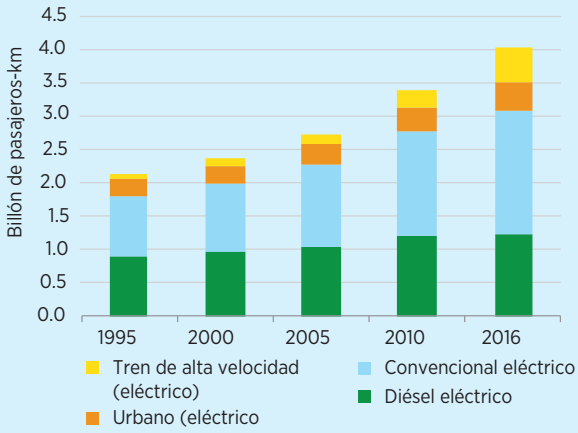


Figure I-4.1b. Passenger rail transport by fuel type



Source: The Future of Rail, IEA, 2019.

For some routes, battery or hydrogen fuel will be a more cost-effective alternative to diesel. Finding workable technical solutions, particularly for freight on nonelectrified lines, are particularly challenging due to the heavy loads and long lifespan of the locomotives, which is 30–40 years.

As the most energy efficient form of mass land transport, in many circumstances railways could be the backbone of the electric mobility revolution. A shift to rail for both freight and passengers is the quickest and most effective way to accelerate the increase of electric mobility (box figure 1-4.1a-b).

To facilitate this shift, the link to other active or electric mobility solutions must be smooth; railway stations and depots have the opportunity to act as multimodal electric mobility hubs.

Notes:

a. SuM4All Global Roadmap of Action (GRA) High Level Policy #86 – Build energy efficient rail and maritime infrastructure

Barriers to the development of sustainable electric mobility

To inform sustainable electric mobility policy, it is useful to review the barriers to its development (box I-5). These range from common challenges such as lack of evidence-based policy making and clear vision to specific technical issues, for instance, the adequacy of the power grid for reliable and consistent supply of electricity, provision of charging infrastructure and market regulation.

Depending on the local and national context, the degrees of relevance of different barriers are more or less prominent. These barriers cannot be overcome by a singular actor or measure but require a coherent set of interventions by different actors and at different levels, international, national, and local. See boxes I-5 and I-6.

Box I-5. Barriers to the development of sustainable electric mobility

Policy and legislative barriers

P1. Lack of a common and integrated long term, sustainable mobility vision across levels, sectors, stakeholders

P2. Lack of appropriate prioritization of modes—i.e., allocation of safe and secured public space, pricing and funding—of safer more efficient transport modes such as e-buses, e-bikes, and walking

P3. Lack of information on mode shift potential of electric mobility

P4. Lack of evidence-based policy making

P5. Lack of integration of informal transport sector in developing countries

P6. Lack of overall emission regulations

P7. Lack of urban access / air quality regulation or enforcement

P8. Lack of understanding of short- or long-term social and economic impacts, e.g., employment

P9. Lack of policy to restructure incumbent industries (fossil fuel, ICE)

P10. Lack of fiscal and other incentives for mode shift and electric vehicles (EVs)

P11. Lack of availability of renewable electricity

P12. Inappropriate legal framework for electricity markets

P13. Insufficient system standardization and interoperability—legal, technical and operational

P14. Inappropriate operational models for public charging infrastructure and use

P15. Insufficient provision/ standards / allocation of space for charging—public and private, new and existing developments

P16. Lack of regulation and enforcement of battery life cycle management, e.g., mining, trading, manufacture, reuse, recycling, disposal

P17. Lack of regulation of 2nd hand vehicles markets (ICE and EV)

Capacity and knowledge barriers

C1. Lack of assessment methodologies—total costs, co-benefits, lifecycle emissions

C2. Lack of charging business models or regulation

C3. Insufficient knowledge of electric mobility fleet management—depot, vehicles, routes, charging— capacity

C4. Lack of guidelines and tools for electric mobility choices

Market and Financial Barriers

M1. Higher initial capital cost of electric modes, although operational costs are lower

M2. Higher capital cost for charging infrastructure for heavier battery vehicles[a]

M3. Economies of scale and market maturity

M4. Low fossil fuel prices

M5. Tendering and procurement procedures (Capex /Opex)[b]

M6. Assessment of non-financial benefits in project evaluations—CO2, air quality, job creation, noise, health, road safety induced by modal shift, and reduced congestion

M7. Charging infrastructure provision and operation—public and private

M8. Appropriate EV offer and after sales service

M9. Consumer protection (e.g., battery warranty)

M10. Clear balanced and comparable information on ICE and EV life cycle impacts

M11. Unequal communication power of industries

Technical

T1. Batteries —design, range, weight, use, reuse, recycling

T2. EV and grid integration—management, flexibility

T3. EV charging time

T4. Equipment size, space, security and protection requirements for charging

T5. Fleet depot capacity—space, grid connection)

Notes:

a. Micro and light electric vehicles like bikes and scooters can be charged from a conventional household power socket - so do not need dedicated charging infrastructure.

b. Capex: Capital Expenditures; Opex: Operating Expenditures

Box I-6. The electrification of flying presents a major technological challenge

Short-haul electric aviation is already in its pilot phase and could be on the market by mid-decade, but long-haul flying will require new solutions such as significant improvements in battery energy density. The wide scale availability of renewable electricity is also critical to the electrification of aviation, including urban air mobility and all aviation operations. An overview of electric flying projects is available from the International Civil Aviation Organization (ICAO): https://www.icao.int/environmental-protection/Pages/electric-aircraft.aspx

The latest urban air mobility solutions and other projects focused on sustainability of aviation were presented by the stakeholders on the ICAO events in September–December 2020.[a, b, c]

Electric unmanned aircraft (drones) delivering medicine in hard-to-reach rural areas

While electric passenger aviation remains challenging, battery powered unmanned aircraft (UA) are already delivering emergency medical supplies in Africa. One company, Zipline, launched its UA by a large catapult. Once airborne and powered by twin electric motors, the UA drops the supplies by parachute and can cover a round-trip of up to 160 kilometres (box figure I-6a-b).

Box photo I-3.2a. World's first fully electric commercial aircraft[d].

Source: Newspaper, The Guardian, 11 December 2019.

Box photo I-3.2b. Unmanned aircraft dropping its cargo by parachute[e].

Source: Zipline

Notes:

a. ICAO Stocktaking Seminar on aviation in-sector CO_2 emissions reductions: (https://www.icao.int/Meetings/Stocktaking2020/Pages/default.aspx),

b. ICAO Aviation Green Recovery Seminar: (https://www.icao.int/Meetings/GreenRecoverySeminar/Pages/default.aspx)

c. Global Symposium on the Implementation of Innovation in Aviation: https://www.icao.int/Meetings/InnovationSymposium2020/Pages/default.aspx

d. World's first fully electric commercial aircraft takes flight in Canada. Photograph: Jonathan Hayward/AP. https://www.theguardian.com/world/2019/dec/11/worlds-first-fully-electric-commercial-aircraft-takes-flight-in-canada

e. https://spectrum.ieee.org/automaton/robotics/drones/zipline-emphasizes-safety-with-its-delivery-drones-in-preparation-for-us-operations

Notes

1 Forthcoming (2021). Stay tuned to www.sum4all.org for updates.

2 The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership. Read more: https://sustainabledevelopment.un.org/post2015/transformingourworld/publication

3 Each country ("party") must determine, plan, and regularly report on the domestic measures that it undertakes to mitigate global warming. https://unfccc.int/sites/default/files/english_paris_agreement.pdf

4 https://www.iea.org/data-and-statistics?country=WORLD&fuel=Oil&indicator=OilProductsConsBySector

5 International Organization of Motor Vehicle Manufacturers, https://www.oica.net/category/vehicles-in-use/

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Eyre, N., & Killip, G. 2019. Shifting the focus: energy demand in a net-zero carbon UK. Tech rep. Centre for Research into Energy Demand Solutions. Oxford, UK. 978-1-913299-00-2. https://www.creds.ac.uk/wp-content/uploads/CREDS-Shifting-the-focus-July2019.pdf

PART II.

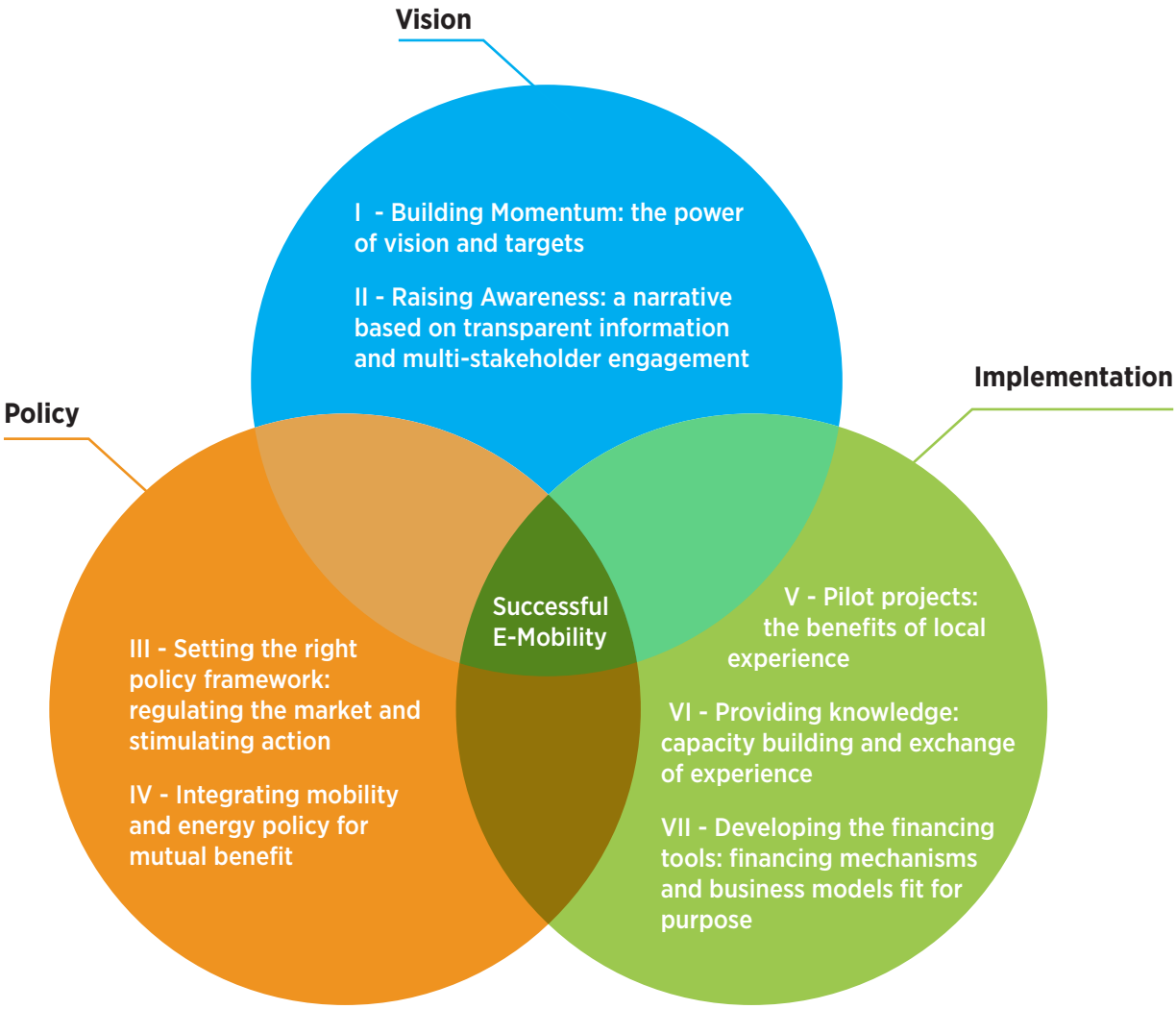
Seven essential building blocks of successful public policy for the development of sustainable electric mobility

Expert interviews with all sixteen of the SuM4All electric mobility working group Members identified seven essential building blocks for successful public policies in the field of sustainable electric mobility. The seven building blocks are interrelated and mutually supportive and need to be developed in a consistent way.

1. Building momentum: the power of vision and targets
2. Raising awareness: a narrative based on transparent information and multistakeholder engagement
3. Setting the right policy framework: regulating the market and stimulating action
4. Integrating mobility and energy policy for mutual benefit
5. Pilot projects: the benefits of local experience
6. Providing knowledge: capacity building and exchange of experience
7. Developing the financing tools: financing mechanisms and business models fit for purpose

The seven building blocks are grouped into three central fields of action—vision, policy, and implementation. These action fields provide the link to individual policy recommendations listed in Part III. The color coding of the action fields shown below is reflected in the individual policy recommendations in the following chapter (figure II-1).

Figure II-1. Successful e-mobility: Three action fields containing seven essential building blocks.

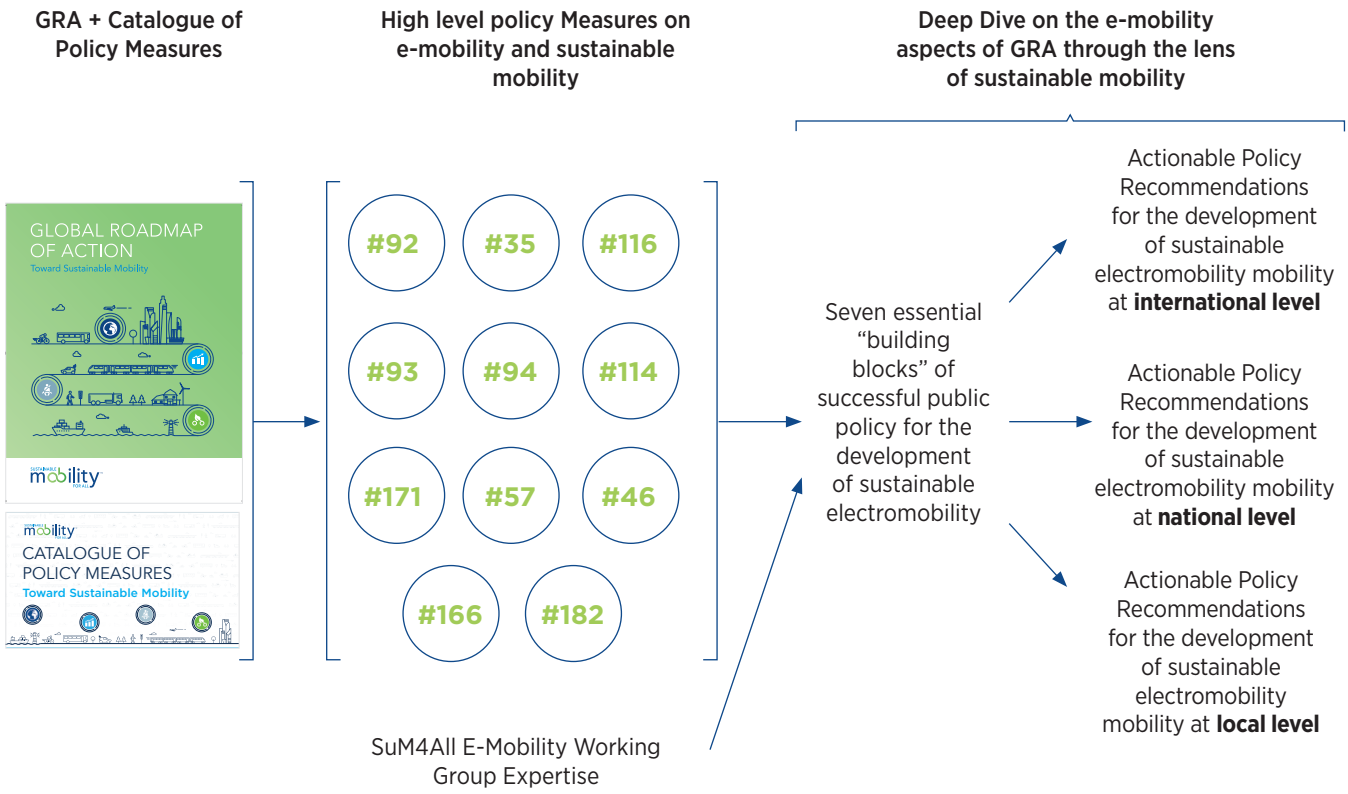


Connecting the building blocks with the GRA

The seven essential building blocks are derived from two mutually reinforcing sources. The high level GRA policy measures on e-mobility and sustainable mobility are merged with the SuM4All e-mobility working group expertise. A deep dive into the seven building blocks leads to actionable policy recommendations for three different categories of target audiences laid out in part III of the paper.

The following flow chart illustrates the process of defining actionable policy measures starting from the high level GRA policy measures (figure II-2).

Figure II-2. Process flow chart from high level GRA policy measures to actionable set of policies.



The following overview outlines the relation between the individual building blocks and the associated GRA high level policy measures to fully reflect the connections between the GRA and the action fields and building blocks[1] (table II-1).

Table II-1. Overview of building blocks and associated GRA policy measures

Building Block identified in e-mobility paper	Related high-level Policy Measure(s) in the GRA
Action field 1 - Vision	
Building Block 1 - Building momentum: the power of vision and targets	#2 – Set targets across policy goals
Building Block 2 - Raising awareness: a narrative based on transparent information and multistakeholder engagement	#168 – Consult with stakeholders during the full project cycle #169 – Use participatory planning methods #180 - Increase awareness about the real cost of mobility #181 – Share knowledge on successes and best practices
Action field 2 - Policy	
Building Block 3- Setting the right policy framework: regulating the market and stimulating action. a. Moving coherent technical standards forward b. Combining incentives and regulatory action c. Using industry and employment policy to drive change	#72 – Establish technical standards for transport infrastructure #73 - Harmonize construction standards along corridors #80 - Set and implement climate change adaptation standards #162 - Provide education programs for innovation #163 - Support innovation through regulatory incentives #164 - Provide financial incentives to R&D and Innovative Products #165 – Support R&D to reduce environmental impacts #166 – Support R&D to optimize the life cycle of vehicle batteries #167 - Develop a demand-driven research framework
Building Block 4- Integrating mobility and energy policy for mutual benefit	#21 – Implement IMO's energy efficiency framework #86 – Build energy efficient rail and maritime infrastructure #114 – Implement railway electrical smart grids #174 – Label products according to environmental performance
Action field 3 - Implementation	
Building Block 5- Pilot projects: the benefits of local experience	#142 – Conduct impact evaluation studies #153 – Support sustainable mobility impact funds at small scale
Building Block 6- Providing knowledge: capacity building and exchange of experience	#61 - Identify and empower sustainable mobility champions #62 - Build capacity across levels of government #64 - Facilitate capacity building at the international level #181 – Share knowledge on successes and best practices
Building Block 7- Developing the financing tools: financing mechanisms and business models fit for purpose	#60 - Establish a pool of technical and financial experts #138 – Evaluate long run transport infrastructure needs (financial) #148 - Apply innovative solutions financing for asset creation #149 - Set user fees to support transport infrastructure funding #150 - Mobilize public and private capital for transport finance #152 - Prioritize financial products for sustainable investment #153 - Support sustainable mobility impact funds

Building Block 1 - Building momentum: The power of vision and targets

The deployment of sustainable electric mobility requires the motivation and alignment of multiple actors—suppliers, operators, consumers, regulators, institutions. Scaling up requires policy momentum and clear market signals to attract investment. In markets, economies of scale could lead to reduced costs and further drive demand. Achieving this requires developing and communicating a clear vision for the development of electric mobility.

The electric mobility vision—as one part of a more comprehensive vision for sustainable mobility—should be articulated by a number of clear and well selected specific electric mobility targets or mandates[2] to focus efforts and measure progress (box II-1).

The national electric mobility vision and targets need to be an integral part of the broad coherent vision for sustainable mobility prioritizing strategies that simultaneously address different SDGs such as emission reduction, road safety (SDG 3.6. and 11.2), life in good health (e.g. SDG 3.4), and gender equality (SDG 5). National commitments to reduce GHG emissions are one of the most powerful drivers for action on transport emissions—the fastest growing sources of emissions. As replacing ICE cars by electric cars will not be enough to reach the commitments,[3] appropriate effort should be focused on the modal shift performance of electric mobility among others, by at least providing a level playing field for active travel modes compared to individualized motorized transport.

The vision and targets need to be informed by scientific and economic expertise and account for different actors that have different drivers, constraints, and scope for action. For example, many cities have announced bans of internal combustion engines (ICE) to improve quality of urban life. These ICE trips will be replaced with a multimodal mix of walking, conventional cycling, and electric mobility as shared mobility, public transport as well as e-cars and e-bikes. Many countries are guiding the phaseout of ICE by banning the sale of new ICE vehicles as part of their efforts to tackle climate change. These different types of measures at different levels need to be guided by coherent sustainable mobility policy.

Policies in different areas such as energy, urban planning, tax policy, subsidies, and investments must be aligned with the sustainable mobility priorities to be effective. Policy consistency is key, and investments need to support clearly stated objectives; it is not efficient to promote a vision for sustainable transport while simultaneously subsidizing fossil fuels, restricting market access for low carbon means of transport, and investing in high carbon transport infrastructure while not investing in avoid, shift, and improve (ASI) strategies.

Policy coherence is of high importance in the energy and transport sectors. The decarbonization of transport goes alongside and is enabled by the decarbonization of power supply for example, through renewable electricity generation with wind and solar.

At the local level, measures to prioritize efficient modes, allocate space to public transport, walking and cycling, and provide safe and protected infrastructure need to be consistent with sustainable electric mobility priorities.

Cooperation between international, national, and local actors is also required to ensure vertical policy consistency across institutions and instruments that may well have different priorities such as international funds focused on climate greenhouse gas mitigation and local actors focused on improving road safety. Local action on electric mobility needs to be facilitated by the appropriate national and international framework—policy, legislation, and financing.

Box: II-1. Examples of national and local electric mobility targetsa

China

Target of 2 million EVs per year by 2020 (2018).

End production and sales of ICE vehicles by 2040 (2017).[a]

Builds world's largest EV charging network with 167,000 stations (2017).

Malaysia

By 2030, 100,000 electric cars, 100,000 electric motorcycles on the road, along with 2,000 electric buses and 125,000 charging stations in the country (2017).

Norway

After 2025, all new light vehicles, new city buses and new light commercial vans should be zero emission vehicles (ZEVs). By 2030, all new heavy commercial vans, 75% of new long-distance buses and 50% of new lorries should be ZEVs. By 2030, distribution of goods should take place almost without emissions in the largest city area (2016).

Sri Lanka

Replace all state-owned vehicles with electric or hybrid models by 2025 and all private vehicles by 2040 (2017).

United Kingdom

Petrol and diesel car sales banned from 2030. Phasing out of diesel only trains by 2040.[b]

New Delhi, India

Delhi's electric vehicle policy aims for 500,000 electric vehicles by 2025, 25% of registrations to be electric by 2024, 100% of last-mile delivery to be electric by 2025 (2019).

London, United Kingdom

1,500 electric vehicle charging points to be installed across London. All taxis and private hire vehicles to be zero emission capable by 2033. All buses to be zero emission by 2037. All new road vehicles driven in London to be zero emission by 2040, and for London's entire transport system to be zero emission by 2050 (2017).

Reykjavik, Iceland

All municipal vehicles will be powered through GHG emission-free energy by 2025, modal split will consist of 58% private vehicles, 12% public transport, 30% walking and cycling by 2030, Vehicle traffic and public transport will be emission-free by 2040, long-term goal: reduce GHG emissions 73% by 2050.

Notes:

a. Targets from SLOCAT E-mobility Trends and Targets (updated) https://slocat.net/e-mobility/

b. https://www.rssb.co.uk/Research-and-Technology/Sustainability/Decarbonisation

EV policy and targets need to reflect local circumstances and priorities and must be based on local technical and economic realities while drawing on technical expertise and experience. Developing a comprehensive policy for electric mobility will take time and will evolve as circumstances and experiences change for instance, through local pilot projects and as the market develops.

But in all cases, it is essential that policy is based on solid technical analyses and economic expertise as well as an understanding of local mobility needs and affordability (boxes II-2 and II-3). Light electric modes can affordably expand individual access to public transport and electric rail is efficient for long distance freight transport.

The transition to electric mobility challenges many established industries. A sustainable electric mobility policy should directly address macroeconomic impacts such as the impacts on net employment, fuel revenue being invested in local renewable energy, and reduced fuel imports. Countries need to plan for the transition from fossil fuel-based taxation to mileage-based taxation and charges, for example.

Box II-2. Example of public transport and train station as electric mobility hub

Box photo II-2.1. Train Station of the Future

Source: Reiner Lemoine Institut

Berlin Südkreuz is one of the pilot train stations (box photo II-2.1) of Deutsche Bahn that provides travelers, among other smart services,[a] with a multimodal electric mobility offer such as an e-bus service, car sharing, and pedelecs.[b] The station is equipped with a micro smart grid powered by wind and solar energy.

Notes:

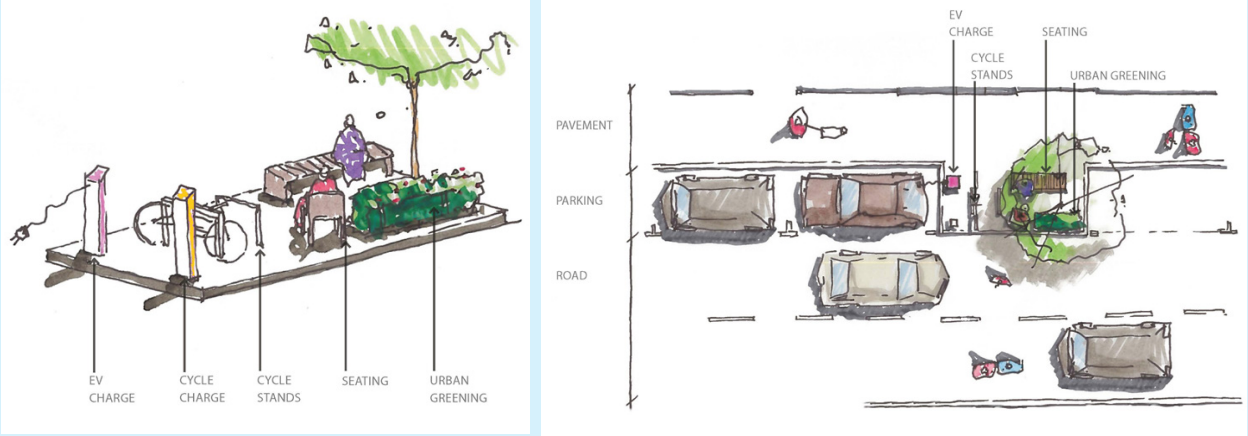
a. https://reiner-lemoine-institut.de/en/b2-intelligente-mobilitaetsstation-bahnhof-suedkreuz/

b. A pedelec (pedal electric cycle) is a type of electric bicycle where the rider's pedalling is assisted by a small electric motor; thus, it is a type of low-powered e-bike.

Box II-3. Re-charge parklets - supporting mode shift and electric mobility

The simple conversion of a street's car parking spaces to recharge "parklets" (box figure II-2.1a,b) supports mode shift and provides a visible signal about public mobility priorities. By providing seating, shade, bike parking, and tools and charging stations for electric 2-, 3- and 4-wheeled vehicles, they support walking, cycling, and electric mobility while simultaneously encouraging reflection on the common use of public space for private car parking.

Box figure II-2.1a (left) and b (right). City street car parklets.



Source: https://www.arup.com/news-and-events/arups-recharge-parklets-ensure-electric-car-points-dont-obstruct-city-walkers

Building Block 2 - Raising awareness: A narrative based on transparent information and multistakeholder engagement

Prevailing discussions show a lack of comprehensive, balanced, and accurate information about e-mobility's potential, and tends to be biased toward selling new equipment rather than on solving mobility problems and meeting people's access needs. The potential of electric mobility policy to shift modes and change mobility patterns needs equal attention to the impacts of simply replacing ICE vehicles such as cars with the same type of electric vehicles.

More effort is required to communicate, in an easily accessible manner, the advantages and persisting challenges of electric mobility as well as their positive and—if not managed—potentially negative impacts beyond the transport sector. These include subjects such as battery recycling, mining of metals in specific regions and its alternatives, localized power distribution grid impacts, and employment effects.

Up-to-date, comprehensive and impartial information about life cycle costs and benefits[4] of the different mobility solutions, including established modes like trams, trains and trolley buses, is required to create a compelling narrative on sustainable electric mobility illustrated by relevant and affordable real-world examples. Fair comparisons with other established and new technologies—ICE, FCEVs and hybrids—and modes should be provided.

A lack of understanding or knowledge is behind many of the barriers to the development of electric mobility (listed in part I). Public institutions have a duty to ensure information is complete, accurate, and fair, and not distorted by specific interests or market power.

Dedicated information campaigns and consumer portals can help address common misunderstanding about electric mobility—battery reliability concerns, range anxiety, lifecycle impacts, CO2 emissions, employment impacts—the limits of electric mobility and its potential contributions to sustainable mobility—brake and tire emissions on health and the environment and safety, regardless of the drivetrain technology—as well as the complete picture of sustainable electric mobility including its modal shift impact as part of an integrated sustainable mobility system.

Platforms to facilitate open discussion and exchange with all electric mobility stakeholders are necessary to share information and good practices[5] with different stakeholders in both the policy development[6] and implementation phases.[7] Participation of civil society is an integral part of sustainable mobility change. It is recommended to involve and enable participation of potential female users directly for instance, through involvement of local women groups, young adults, and vulnerable groups to ensure acceptance and increase knowledge among all parts of society, and to enable the creation of equitable mobility systems. This kind of open and balanced exchange of information is important both for the development of good policy and to accelerate implementation.

Incumbent actors such as ICE manufacturers and their suppliers, retailers and after sales service providers, fossil fuel supply chain actors, electric utilities as well as representatives of the different mobility modes—walking, cycling, public transport and automobile clubs—and other stakeholders need to be involved in the discussions to aid their adaptation and transition. Logistic operators are another important constituency to engage in discussions (box II-4).

Box II-4. Global electric mobility initiatives

There are a number of successful global electric mobility initiatives that can help governments and companies develop and implement electric mobility solutions. Implementation is faster and cheaper when you can benefit from international experience and support.

EV 100 (box figure II-4.1) brings together companies throughout the world committed to accelerating the transition to electric cars and vans and making them the new normal by 2030. Working with companies like Bank of America, Deutsche Post DHL, HP, and IKEA more than two million vehicles are already committed. https://www.theclimategroup.org/project/ev100

Box figure II-4.1. EV100 logo

C40 - Fossil Fuel Free Streets Declaration

Thirty-five cities (box figure II-4.2) from across the globe have signed the Fossil Fuel Free Streets Declaration to help build global policy momentum, which includes a commitment to procure only zero-emission buses from 2025, and ensuring a major area of our city is zero emission by 2030.
https://www.c40.org/other/green-and-healthy-streets

Box figure II-4.2. Logo of C40 Cities.

Global Fuel Economy Initiative (GFEI) works to achieve a more efficient global vehicle fleet through undertaking research, global advocacy, and direct support to countries. Approximately 70 countries have developed fuel economy policies with GFEI support. GFEI (box figure II-4.3) analysis confirms that a faster transition to electric vehicles is required to achieve the Paris Agreement objective of "well below" 2°C, and that an EV-dominated global fleet by 2050 is feasible. https://www.globalfueleconomy.org

Box figure II-4.3. Logo of GFEI.

The Electric Vehicles Initiative (EVI) is a multigovernment policy forum launched by the Clean Energy Ministerial (CEM) dedicated to accelerating the introduction and adoption of electric light duty vehicles, buses, and trucks worldwide. The EVI fosters information exchange workshops, meetings and events among participating countries, observers and partners to achieve EV30@30, that is 30% sales share for EVs by 2030 (box figure II-4.4). http://www.cleanenergyministerial.org/initiative-clean-energy-ministerial/electric-vehicles-initiative

Box figure II-4.4. Logo of EV30

TUMI E-Bus Mission

The TUMI E-Bus Mission (box figure II-4.5) will support 20 deep dive cities and engage 500+ cities to ensure the readiness for procurement of 100,000 e-buses worldwide until 2025. With its core group of organizations such as C40, GIZ, ICCT, ICLEI, ITDP, UITP, SLOCAT, WRI and finance organizations, the coalition will engage with a wide group of stakeholders to provide technical materials and training workshops allowing the development of additional capacities in cities that are required for further e-bus adoption.

Box figure II-4.5. Logo of TUMI.

Building Block 3 - Setting the right policy framework: Regulating the market and stimulating action

The development of sustainable electric mobility requires a suitable policy and regulatory framework to authorize and stimulate the sale and use of all types of electric means of transport, set appropriate incentives, and support the provision of charging facilities, space, and services. A clear and appropriate legal framework is essential to stimulate important private sector investment.[8,9] Regulation and funding mechanisms need to adapt to evolutions in market prices and technology of a fast-changing sector such as electric mobility (box II-5).

Box II-5. Overview of national and local policies on electric vehicles

The UN Environment programme (UNEP) has initiated a collection of national and local policies on electric vehicles with close to 1000 examples of measures. The database can be accessed via: https://www.unenvironment.org/resources/publication/global-electric-vehicle-policy-database.

Moving coherent technical standards forward

Wherever appropriate, standards for new means of transport entering the market need to be adapted to the needs of electric mobility. The rapid uptake of electric vehicles in some markets is likely to drive the international second-hand vehicle market for ICE, hybrids, and EVs. Export and import countries need to ensure regulations are in place to ensure safety, to protect the environment and the consumers, and avoid merely shifting emissions abroad.

Also prevalent are concerns about the human and environmental impacts of producing, reusing, and recycling of batteries so appropriate regulation and enforcement mechanisms need to be in place. Reusing and recycling of batteries warrant proper regulation and enforcement mechanisms.

Standards are required to ensure the interoperability of infrastructure,[10,11] charging, payment, and sharing systems to facilitate user experience. Standards for data privacy and exchange are needed to facilitate the secure deployment and the acceptability of digital solutions for efficient mode choice, vehicle use, multimodal integration, and sharing.

Combining incentives and regulatory action

Developing electric mobility requires an appropriate mixture of regulation and incentives, a push and pull, that work together to facilitate and shape the market while also supporting broader sustainable mobility objectives such as mode shift and road safety.

The most benefit can be gained by providing financial and nonfinancial incentives for the most sustainable electric mobility modes for example, e-bike and e-cargo bikes, and electric public transport. Financial incentives for purchase and use are helpful, but the most effective incentive is to prioritize the necessary infrastructure and services—public transport level of service and prioritization, safe cycle, and walking infrastructure.

Incentives need to be carefully considered to support overall mode shift objectives and desired mobility behavior, and provide financial support to those who most need it. Financial incentives in the form of purchase subsidies or tax exemptions are effective for electric light duty vehicles namely, cars and vans, to stimulate uptake of electric mobility; but such incentives need to be limited in time and reviewed as market share increases.

As a result of transport policy, investments, and behavior change the modal share of private cars is expected to decrease in developed countries.[12] Care should be taken to ensure that electric mobility policies do not undermine broader transport policy objectives and that they support the transition to inclusive, sustainable mobility.

At the initial stages of development, bonus–malus systems, also known as fee-bates, at time of purchase put additional malus charges for instance, on heavy or polluting vehicles that are used to finance bonus subsidies for less polluting means of transport. With fleets becoming cleaner, longer term alternative sources of funding need to be developed. Reductions in fossil fuel subsidies and fuel import costs can release funds for sustainable mobility or user fees based on the principle of the polluter pays as with mileage-based fees or parking charges.

The net environmental impact of new electric means of transport depends crucially on what happens to the vehicle it replaces. Second-hand vehicle export and import controls as well as vehicle scrapping schemes need to be carefully designed for maximum environmental and safety impact

in both exporting and importing countries. For some developing countries, importing second-hand vehicles may help the renewal of local fleets and improve safety and emission levels.

Using industry and employment policy to drive change

Supporting the industrial transformation necessary to transform mobility systems and capture potential economic benefits requires specific attention. Clear fleet targets—for example, all new buses will be zero emission by 2025—give confidence for private investment in production. Electric means of transport can be relatively simple to manufacture and maintain compared to conventional technologies, and consequently offer the potential to replace imports with efficient local production.

Industrial policy and research and technology development need to be realigned[13] to focus on the future challenges of electric mobility which could be effective policy delivery, digitization, and battery recycling.[14,15] Loans and grants can help develop new products and services.

The transformation of car mobility from ICE to EV has potential to create a net increase in employment in the transport sector. These positive employment impacts need to be promoted, and support schemes such as training and retraining schemes developed to help workers, regardless of gender, adjust to new roles and industries.

> *"A mandatory target of 50% of all vehicles [cars] produced in the UN Economic Commission for Europe (ECE) region16 to be fully electric by 2030 would lead to a worldwide net job creation of around 10 million jobs."*
>
> **- ILO 2020**

A joint report by UN Environment, the WHO and UNECE (UN Environment 2017) estimated that, if 56 major cities with a total of 78 million inhabitants achieved a cycling modal share of about 35 percent as has Copenhagen, 435,000 additional cycling jobs would be generated. Also, cycling projects, on average, generated more jobs than car-centric projects per dollar invested (Garret-Peltier 2011).

Labour market policies are needed to manage the sustainable mobility employment transition. Job losses are primarily expected to be in the petroleum sectors, followed by the motor vehicles manufacturing sector.

Building Block 4 - Integrating mobility and energy policy for mutual benefit

Cooperation between electric mobility and low carbon energy policy is of mutual benefit for both sectors. While the energy sector needs to adjust to provide renewable electricity to the transport sector, electric mobility can create new revenue streams that stay in country and that can be used to support the further development of low carbon energy generation and distribution. This could further strengthen independence from fuel imports with the associated macroeconomic and security benefits.

Choices about e-mobility development have important impacts on energy policy in sectors of demand, storage, revenue, and balancing services to name a few. The sectors need to work closely together to maximize the benefits. Packaging investments in both sectors, that is the transport systems and the needed renewable energy production capacities, can yield higher systemic benefits and provide a more attractive business case for investors.

The development of electric mobility depends on an electricity market that is open to producers and resellers and responsive to the opportunities and needs of EV charging such as smart grids, vehicle-to-grid, and dynamic pricing. An appropriate regulatory framework is required as well as the necessary technical prerequisites.

Collaboration with local distribution utilities, electric retailers, and bulk power operators should be initiated early on to reduce cost for charging integration to help consumers source or provide additional renewable energy or do both, and to identify optimal charging locations. Configuration of appropriate rates, intelligent pricing schemes and other incentives that will enhance grid flexibility and through the use of the battery storage capacities of large electric vehicles can be developed jointly.

Coordination with actors from the electricity sector and original equipment manufacturers (OEM) plays a vital role for the identification of optimal and future-proof charging infrastructure types for instance, with open standards and the design of local charging infrastructure deployment programs based on incentives, permits zoning ordinances, and building codes that allow for technology flexibility and vehicle-to-grid integration.

Areas with less access to production capacity and flexible grids—in developing countries and rural areas—require integrated planning of both sectors to avoid shortage of electricity or competing usage. Electric means of transport can be charged by decentralized off-grid production of renewable electricity along with other applications such as solar water pumps.

Sustainable electric mobility has multiple benefits and these benefits grow as electricity grids become greener. Whenever implemented, electric mobility should be developed in parallel to the expansion of reliable, low carbon electricity supply and grid flexibility.

The coordination of multiple public and private stakeholders should be facilitated by a specific electric mobility energy stakeholder platform to ensure the optimum and mutually beneficial development of the energy and electric mobility systems in parallel. In particular, the close cooperation across energy and transport ministries and authorities is fundamental to establish a successful e-mobility policy.

Building Block 5 - Pilot projects: The benefits of local experience

"Get started!" is a good motto for electric mobility. Pilot projects are optimum starting points for building experience, collecting local data, raising awareness, promoting debate, and building public and political acceptance. They can run in parallel to other essential building blocks and actions such as engaging stakeholders and preparing the longer-term vision and targets for sustainable electric mobility.

> *"People need to see that it works."*
>
> **- Nyaga Kebuchi,**
> Director, Sustainable Transport Africa

Funding should be made available to support feasible pilot projects as an essential first step to scaling up the deployment of electric mobility.[17]

For pilots to be credible, they need to be under real-world conditions and involve recognized independent organizations such as universities in the design, monitoring, and evaluation18 of pilots to ensure the validity and acceptance of results. Pilot projects should also consider how they could

be scaled up. Results and experience from local pilot projects should inform electric mobility policy (box II-6).

The 2020 COVID-19 crisis has stimulated a large number of emergency urban mobility measures mainly focusing on space reallocation and mode shift. This has allowed people to experience safer walking and cycling and better urban air quality, triggering a change in mindset toward more sustainable modes of transport.

Every opportunity should be taken to learn from those largely positive experiences and help cities move forward from these pilot projects to secure permanent large-scale changes and maximize the potential contribution of electric mobility as part of the post COVID-19 economic reset stimulus packages.

Box II-6. Piloting simple and robust off-road electric cargo bikes

Box figure II-6.1. Off-road electric cargo bike in rural Africa.

Source: www.anywhere.africa, manufacturer of Steel Bird.

Steel Bird is a nimble but robust off-road electric cargo bike to deliver goods and services in rural Africa where roads can be bad or even non-existent. Carrying up to 160 kg and with a 4 kW battery it has a range of up to 80 km. The bikes are designed by Anywhere, Berlin, and built in local micro factories.

Further innovative E-Mobility Solutions for Rural Sub-Saharan Africa can be found here: https://www.siemens-stiftung.org/wp-content/uploads/medien/publikationen/publication-emobility-emobilitysolutionsforruralsubsaharanafrica-siemensstiftung.pdf

Building Block 6 - Providing knowledge: Capacity building and exchange of experience

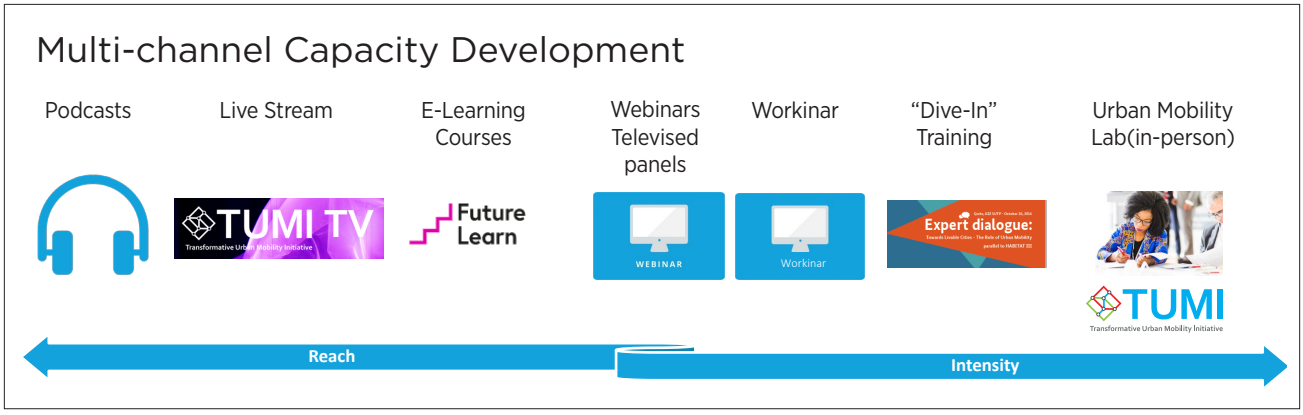
The development of sustainable electric mobility can be optimized by capacity building and exchange of experiences and best practice on technical as well as policy and strategy topics at all levels.[19] Recognizing the interdependence of integrated multimodal mobility, electric mobility and energy, capacity building should address all three topics in parallel (box II-7).

Activities can include training on technologies, fleet management, business models, life cycle assessment methodologies from cradle to grave, integrated multimodal approaches, and digital solutions facilitating the deployment of electric mobility and promotion of mode shift. Study tours to visit successful pilot projects would be valuable assets as would supporting businesses to understand the potential benefits and how to access funding.

Training on stakeholder engagement and collaboration may be necessary to facilitate the public and private sector cooperation essential for electric mobility. Expert advisory services can be provided to national and local policy communities to support them in their work. Given the many similarities between countries, there is great potential for international exchange[20] of experience, expertise, and good practice.

Especially during the global COVID-19 pandemic, avenues of how to provide knowledge have changed dramatically. Capacity development measures have mainly shifted from in-person training to new digital formats like webinars, online workshops and courses to name a few (figure II-3).

Figure II-3. Examples of multichannel capacity measures.



TUMI has been very active to produce, collect, and curate various learning formats in the fields of sustainable and electric mobility. The initiative hosts a wide array of training courses and other learning events through its 11 TUMI partners, accessible under Knowledge (transformative-mobility.org). The platform is open to feature additional events from partners in their event calendar and suggestions can be articulated at info@transformative-mobility.org.

Box II-7. Electrification of bus routes

The electrification of public bus fleets holds potential benefits beyond CO2 mitigation and many cities have started the integration of electric buses into their fleet. Careful planning and deep capacity building are essential.

"The foremost challenge surrounding electric bus deployment is the need to adapt new vehicles and related charging infrastructure to networks, while maintaining the same level of service."[a]

WRI looked at the specific barriers to the adoption of electric buses with a focus on the Global South. The findings are presented in "Barriers To Adopting Electric Buses" https://wrirosscities.org/sites/default/files/barriers-to-adopting-electric-buses.pdf.

For Europe, The ZeEUS project (Zero Emission Urban Bus System) coordinated by UITP on behalf of the European Commission tested innovative electric bus technologies. Its reports present the cases of more than 60 European cities and technology solutions of close to 30 original equipment manufacturers (OEMS). https://zeeus.eu/uploads/publications/documents/zeeus-ebus-report-internet.pdf.

The steps for successful e-bus adoptions, from pilot projects to scaling up, are presented in the World Resources Institute's (WRI) publication "How To Enable Electric Bus Adoption in Cities Worldwide". https://files.wri.org/s3fs-public/how-to-enable-electric-bus-adoption-cities-worldwide.pdf.

TUMI offers an actionable "E-Bus Checklist" for the Introduction of electric buses. The checklist provides a step by process, helping key stakeholders in cities with their e-bus project implementation. https://www.transformative-mobility.org/campaigns/e-bus-checklist.

Notes:

a. Electric Mobility & Development - An Engagement Paper from the World Bank and the International Association of Public Transport, 2018, p.27.

Building Block 7 - Developing the financing tools: Financing mechanisms and business models fit for purpose

Established funding methodologies and business models need to be adapted to the different characteristics of electric mobility.[21] In many cases the total cost of ownership (TCO) of electric vehicles is lower than comparable conventional vehicles and continues to fall.

With like-for-like replacement of vehicles, the initial capital costs of electric models are high, and uncertainty over future costs—energy prices, batteries and second-hand vehicle value—act as a barrier to action. Modes with long amortization periods, for instance of 30–40 years, require urgent attention to avoid investments that lock in high carbon impacts. However, when shifting to other means of transport—for example, from vans to e-cargo bikes—as part of a broader change in mobility behavior can bring substantial cost savings. Nonfinancial benefits—less air pollution, improved road safety, and active health—also need to be considered.

Procurement and tendering procedures need to be adapted to focus less on initial capital investments and more on the long-term operational cost savings. Procurement processes should also evaluate the multiple nonfinancial local and global lifecycle benefits, beyond CO_2 mitigation, like reduced air and noise pollution.

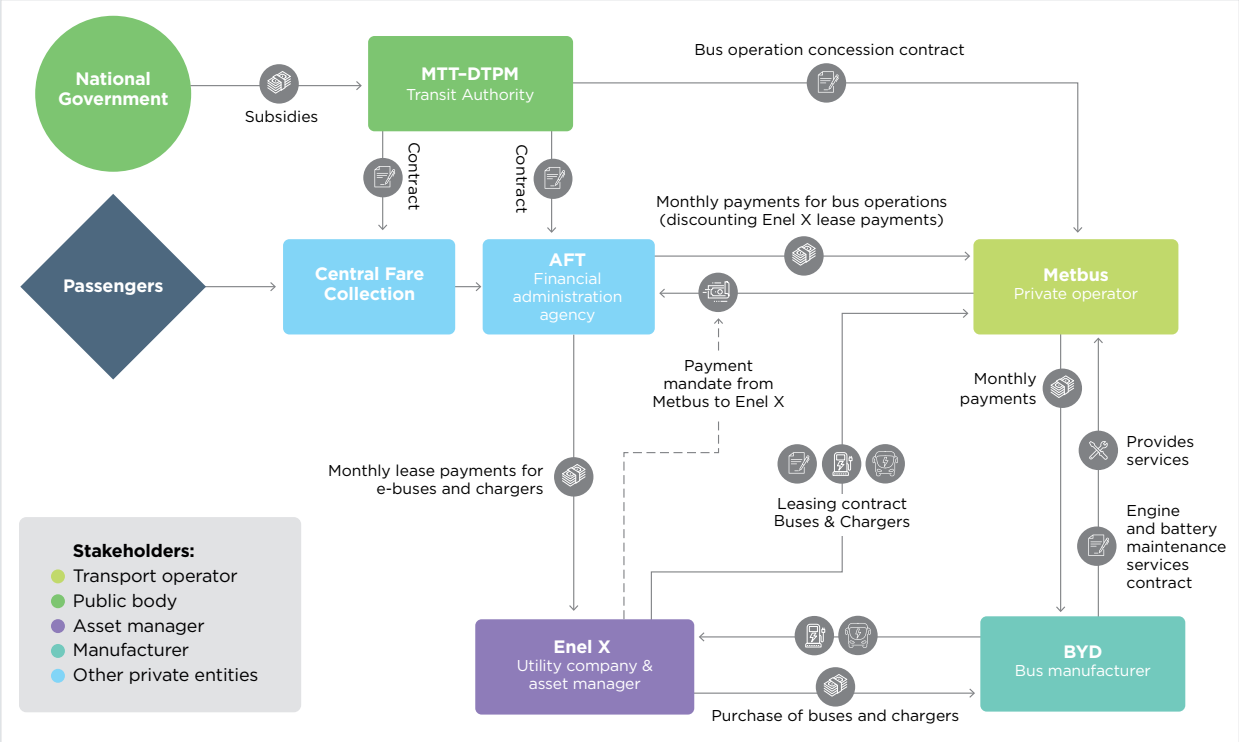
Banks have a role to play in adapting financing mechanisms to support electric mobility in line with public policy objectives—green reset, climate finance, sustainable development—through reducing risk and funding initial capital investment and leveraging private investment even though prices are expected to fall even further in the next years.

New public and private partnerships and business models[22] are required to invest, power, operate and maintain fleets, allowing specialization, sharing, multimodality, and help share the different risks of electric mobility such as second-hand vehicle values and battery performance (box II-8).

Box II-8. Example of an e-bus operational model in Santiago, Chile

The e-bus operational model deployed in Santiago, Chile is an innovative example of how the different stakeholders—national government, transport authority, e-bus manufacturer, public transport operator, energy provider—can collaborate in financing, operation management, and risk sharing that factor the specificities of electrified public transport fleet (box figure II-8.1).

Box figure II-8.1. Model of stakeholders collaborating in electric mobility.



Source: Case study: Metbus Pioneering E-Bus Deployments in Santiago. ZEBRA, 2020. page 2.

While new financing mechanisms are under way, especially in the case of public transport and commercial fleets, new methodologies and financing instruments for the large-scale financing of light, efficient electric means of transport like electric bikes need to be developed.

The introduction of e-mobility should be accompanied by a professionalization of transport authorities and operators. This should include formalizing the public transport systems, ensuring a solid and long-term financial basis for operations and the integration of different transport modes.

Nevertheless, it is inadvisable to wait to develop electric mobility until the mentioned points are implemented, but rather use the momentum of e-mobility to bring the whole sector forward in sustainable and professional operation.

International financial assistance should support countries to develop and implement clear policy frameworks and locally appropriate electric mobility priorities, and align funding and support with local mobility needs and priorities. The switch away from large scale funding of new car infrastructure to supporting integrated multimodal mobility services and systems is an important challenge for many international public financial institutions.

In many markets 2- and 3-wheel electric vehicles can make a major contribution to transforming access on account of their affordability, lower purchase price, high range, and that they do not require dedicated charging infrastructure.

Focused investments in research and technology development throughout the supply chain can further reduce costs and increase project viability. Technological developments in one electric mobility sector, for example, increased battery capacity of electric vehicles, can bring benefits to other sectors—for instance, improvements in battery technology can facilitate the application in larger and longer-range electric aircraft.

Notes

1 GRA and its policy papers are available from URL: https://sum4all.org/gra
2 SuM4All Global Roadmap of Action (GRA) High Level Policy measure #2 – Set targets across policy goals
3 Milovanoff, A., Posen, I.D. & MacLean, H.L. Electrification of light-duty vehicle fleet alone will not meet mitigation targets. Nat. Clim. Chang. (2020). https://doi.org/10.1038/s41558-020-00921-7
4 SuM4All Global Roadmap of Action (GRA) High Level Policy measure #180 - Increase Awareness about the Real Cost of Mobility
5 SuM4All Global Roadmap of Action (GRA) High Level Policy #181 – Share Knowledge on successes and best practices
6 SuM4All Global Roadmap of Action (GRA) High Level Policy measure #168 – Consult with Stakeholders during the full project cycle
7 SuM4All Global Roadmap of Action (GRA) High Level Policy measure #169 – Use participatory planning methods
8 SuM4All Global Roadmap of Action (GRA) High Level Policy measure #150 - Mobilize Public and Private Capital for Transport Finance
9 The United Nations World Forum for Harmonization of Vehicle Regulations (WP.29) proposes a range of regulatory text harmonized globally on the safe and environmentally-friendly deployment of electric vehicles, such as UN GTRs Nos. 13, 20 and 21 or UN Regulations No. 100, 134 and 154, among others
10 SuM4All Global Roadmap of Action (GRA) High Level Policy measure #72 – Establish technical Standards for transport infrastructure
11 SuM4All Global Roadmap of Action (GRA) High Level Policy measure #73 - Harmonize Construction Standards along Corridors
12 International Transport Forum (ITF). 2017. ITF Transport Outlook 2017 (Paris).
13 SuM4All Global Roadmap of Action (GRA) High Level Policy measure #164 - Provide Financial Incentives to R&D and Innovative Products
14 SuM4All Global Roadmap of Action (GRA) High Level Policy measure #166 – Support R&D to optimize the life cycle of vehicle batteries

15 SuM4All Global Roadmap of Action (GRA) High Level Policy measure #165 – Support R&D to Reduce Environmental Impacts
16 56 countries mainly European countries but also from North America and Eurasia.
17 SuM4All Global Roadmap of Action (GRA) High Level Policy measure #153 – Support Sustainable Mobility Impact Funds at small scale
18 SuM4All Global Roadmap of Action (GRA) High Level Policy measure #142 – conduct impact evaluation studies.
19 SuM4All Global Roadmap of Action (GRA) High Level Policy measure #62 - Build Capacity Across Levels of Government
20 SuM4All Global Roadmap of Action (GRA) High Level Policy measure #64 - Facilitate Capacity Building at the International Level
21 SuM4All Global Roadmap of Action (GRA) High Level Policy measure #148 - Apply Innovative Solutions Financing for Asset Creation
22 Electric Mobility & Development - An Engagement Paper from the World Bank and the International Association of Public Transport, 2018. https://openknowledge.worldbank.org/bitstream/handle/10986/30922/eMobility_and_Development.pdf?sequence=8&isAllowed=y

References

Garret-Peltier, H. 2011. Pedestrian and bicycle infrastructure: A national study of employment impacts. Amherst, Massachusetts: Political Economy Research Institute, University of Massachusetts.

ILO. 2020. Jobs in green and healthy transport: Making the green shift, United Nations Economic Commission for Europe, International Labour Organisation, Geneva 2020, p.35-37 https://thepep.unece.org/sites/default/files/2019-10/Informal%20document%2008%20Study%20on%20green%20and%20healthy%20jobs%20in%20transport.pdf

UN Environment. 2017. Riding towards green economy: Cycling and green jobs – A joint report by UN Environment-WHO-UNECE, p.46.

PART III.

Public policy recommendations for the development of sustainable electric mobility

Comprehensive and coherent policy is a prerequisite of successful development of sustainable electric mobility comprising seven essential elements that frame compatible and complementary action at international, national, and local levels.

Although much can be achieved at the local level, the right national frameworks such as energy policy, regulation, and financing are essential to enable local action.

The vehicles' and charging equipment market are international; coordinated action will help attract investment, accelerate technological development, build market volume, strengthen supply chains, and reduce costs. International actors also have a key role in developing sustainable electric mobility.

The following public policy recommendations have been selected as pragmatic, no-regret actions that are generally valid. But local circumstances vary and that will influence the choice of electric mobility priorities (box III-1).

Box III-1 Questions for identifying national and local quick wins for electrification

Depending on their specific national and local context, countries and cities, the electrification of different segments—different means of transport and types of users—comes with different benefits and challenges. When choosing which segments to prioritize, decision makers should look at different factors.

Scale

- Does electrifying this segment also improve access and encourage modal shift?
- What CO2 mitigation potential does the electrification of the segment have?
- What local noise and air pollution reduction can I achieve?
- What is the motorization rate in this mode?
- Will I replace or retrofit old ICE vehicles e.g., trains or add new ones?

Target group or activity

- What is the purpose, frequency, length of the trip?
- What is the purchasing power and income available for transport needs? What are mobility preferences?
- Can the mode of transport be chosen freely or is the target group bound to certain limitations (cost, social perceptions, gender roles etc.)? What effect does electrifying this segment have on modal preference or use?

- What is the effect of the infrastructure provided on transport mode preference?

Operations

- What is the daily and annual mileage?
- What is the load carried?
- What is the runtime and potential charging time?

Setting

- How does temperature, slopes and distance influence my choice of priority segments?
- Can incentivizing a certain electric mobility segment at the same time reduce congestion, free up land and improve road safety?
- Can I develop certain segments without the need for vast public charging infrastructure?
- Does the density of my area allow for efficient public charging infrastructure deployment?
- Does my area have adequate road infrastructure and maintenance services for the specific segment?

Capacity

- Is funding available or can it be raised?
- Do I have capacity to implement required changes in legislation and regulation; and for its enforcement, do I need planning consents?
- Do I already have management and operational capacity for the electrification of this mode?
- Is there capacity and skills to deploy electric mobility infrastructure?

Industry

- Are these means of transport available on my market?
- Can production take place locally?
- Do I need to transform an existing ICE automotive industry?

Energy and electricity

- What will grid capacity and flexibility allow for in the short term?
- What green electricity sources can I integrate with electric mobility in the short run?
- Does my electricity market currently limit my choices of charging business model?
- How does the cost of electricity impact the electrification of this mode?
- What is the potential of increasing energy independence?
- What is the cost I can save from replacing fossil fuel modes by electric modes?

Support

- For which segment do I have, or can I mobilize political support?
- For which segment is public opinion most likely to be in favor?

The following public policy recommendations address three specific target audiences to support the scaling up of sustainable electric mobility in the short- and medium-term:

1. International development community
2. National public policy community
3. Local public policy community

Policy recommendations for electric mobility as essential part of sustainable mobility in the short- and medium-term

Electric mobility is viewed as one of the ways to help transform mobility in support of sustainable development objectives and decarbonization goals (UN Agenda 2030). Electric mobility can be powered by low carbon electricity and has no exhaust emissions at the point of use. In some circumstances, the potential of e-mobility to help shift to safer, more efficient modes of transport can make a major contribution to tackling transport challenges like congestion, road safety, and health.

The challenge is to shape the development of electric mobility and harness its great benefits, while supporting the broader transformation to socially, economically, and environmentally sustainable mobility for all.

While the priorities for the development of electric mobility depend on local circumstances, mobility needs international, national, and local policy together to provide a coherent and consistent locally appropriate public policy framework to catalyze the development of sustainable electric mobility.

Seven essential building blocks of successful public policy for the development of sustainable electric mobility

The working group identified seven essential mutually reinforcing building blocks of successful public policy for the development of sustainable electric mobility (see part II).

The Sustainable Mobility for All working group on "Sustainability of the E-Mobility Model" developed public policy recommendations in 2020 (table III-1) for three broad categories of stakeholders and actors.

1. Public policy recommendations for the international development community

These public policy recommendations are addressed to the international development community such as bilateral and multilateral development organizations, international finance institutions, United Nations programs and agencies as well as international think tanks and NGOs working on sustainable transport.

The role of the international development community in the development of electric mobility

Faced with multiple challenges, many countries lack the capability to develop sustainable mobility alone. International support can help countries act early to develop and implement good policy, and so avoid the high costs and negative effects of unsustainable transport.

Even though solutions need to adapt to the specific context, countries, companies, and cities face similar challenges when addressing electric mobility; learning from international experience can save time and money. Compatible action across the globe sends clearer signals to investors and the private sector, which in turn spurs more action and further reduces costs.

International financial institutions are very heavy investors in transport; therefore, it is important to ensure that the right policy is in place to support good investments.

Climate change, road safety, health, and accessibility are high priorities for the international development community, and in some circumstances, sustainable electric mobility has a key role in tackling the rapid rise in transport greenhouse gas emissions and delivering healthier and safer mobility for all.

Recommendations

Table III-1 lists the international policy recommendations (IR) grouped by the three action fields vision (IR 1–6), policy (IR 7–10), and implementation (IR 11–22) (also see figure II-1).

Table III-1. Recommendations from SuM4All's working group on policy for international development on e-mobility.[a]

IR1	Support the visibility and alignment of national, local, and corporate electric mobility targets and vision.
IR2	Support the widespread interest in and uptake of successful global electric mobility initiatives e.g., EV100, EVI 30@30.
IR3	Use the powerful voice of international actors, with governments, to raise awareness and promote sustainable electric mobility.
IR4	Support research and analysis of the macroeconomic impacts of sustainable electric mobility—employment, energy independence, and industrial development.
IR5	Provide and maintain an international overview of transport subsidies and taxes.
IR6	Coordinate and harmonize action of the international development community.
IR7	Support national or urban policy makers in developing a clear and appropriate policy for sustainable electric mobility as part of a broader shift to sustainable mobility for all.
IR8	Support the integration of transport and energy policy making.
IR9	Support the development of international standards for regulation and enforcement of the international second-hand vehicle market, exports and imports, for internal combustion engine and electric vehicles.
IR10	Keep policy under regular review in light of changing prices and technological developments.
IR11	Support the development of harmonized carbon accounting frameworks.
IR12	Support the establishment of national and local electric mobility stakeholder forums.
IR13	Develop and support the implementation on recommendations on battery life cycle regulation and enforcement.
IR14	Support the sound digitization of the transport sector through the development and promotion of international data privacy and data security standards
IR15	Support and maintain balanced, comparable information on the costs and benefits of different types of electric mobility.

IR16	Support knowledge products and communication activities providing accurate and balanced information about electric mobility to tackle common myths or misconceptions. Target national policy makers in countries with high electric mobility potential.
IR17	Provide tools and resources to assist actors identify and prioritize the appropriate electric mobility modes and means of transport according to local and national circumstances.
IR18	Facilitate and showcase pilot projects and their results.
IR19	Support the identification, dissemination and uptake of best practices for the development of electric mobility for example, guidance documents, standards, procurement procedures, infrastructure deployment, operations, capacity building, financing tools, energy market reform, and energy interface with electric mobility.
IR20	Create a platform for sharing up to date, balanced and reliable information on sustainable electric mobility for example, case studies, experience, and knowledge.
IR21	Orient funding and policy-based loans to support electric mobility projects as part of broader sustainable mobility transformation for all.
IR22	Support the development of local production facilities for electric means of transport and batteries, integrating the local economy.

Note:
a. Color code representing action fields: Vision Policy Implementation (also see figure II-1.)

Box III-2. Challenges and opportunities for electric mobility deployment in low- and middle-income countries

Low- and middle-income countries have both advantages— such as low car ownership, younger populations—as well as disadvantages—for example, lower purchasing power, weaker electricity grids—when it comes to developing electric mobility. In some circumstances, sustainable electric mobility can make a major contribution to increasing access for all and national economic and social development.

The following considerations need particular attention:

- Affordability of electric mobility solutions
- Mode shift to walking, cycling, and public transport
- Potential of 2- and 3-wheel electric passenger and freight solutions
- Integrating of informal modes
- Benefits of energy independence
- New revenues for development of own distributed renewable energies (solar, wind)
- Economic development opportunities of manufacturing own equipment (for example, electric cargo 3-wheelers) and reduced imports
- Control of imported vehicles
- Potential for leapfrogging in policy and technology; optimizing investments and avoiding high costs of unsustainable transport
- Air quality and road safety
- Supply and demand for electricity
- Opportunities in rural areas

Box III-3. Electric three wheelers and female entrepreneurship in Kathmandu, Nepal

Kathmandu's Safa Tempo fleet has a women force of 775 out of the total 1,302 full- and part-time drivers employed in its operation, that is Kathmandu's fully electric three-wheeler public transport vehicles. Of this group, 210 women own and run their own Tempo business (box photo III-3.1). The involvement of women in the operation and ownership of Safa Tempos began in the late 1990s and grew in parallel with the growth of electric mobility. Originally, a group of seven women bought and ran their own Safa Tempos at a cost of approximately US$ 5,000 per vehicle. Later, this was extended to 16 additional women with a Swiss-funded (Helvetas, Nepal) project providing free training to women operators and entrepreneurs. Safa Tempo drivers earn an average of roughly NPR 12,000 (US$ 1,200) per month—a good income by local standards.

Most of the female drivers who operate Safa Tempos report being primary earners in their households. The World Bank conducted a study on gender and public transport in Kathmandu that analyzes the situation of the city's public transport. During this study, women also reported a preference for using Safa Tempos to make public transport trips as the face-to-face seating arrangement for a Safa Tempo's 12 passengers provides for greater personal security.

Box photo III-1.1. An electric 3-wheeler and its female driver.

Source: Electric Mobility and Development, the World Bank and UITP, 2018.

2. Public policy recommendations for the national electric mobility public policy community

The Sustainable Mobility for All working group on 'Sustainability of the E-mobility Model' developed some policy recommendations that support national public policy in 2020.

These policy recommendations are addressed to the national policy community such as national governmental ministries and agencies as well as think tanks and NGOs working on national sustainable transport policy.

In some countries, subnational actors, states, or provinces have a significant role in transport policy, and depending on their competences, the national, or local policy recommendations may also be relevant (box III-2).

The role of national public policy in the development of electric mobility

National policy—through legislation and funding—has a strong influence on the development of electric mobility. Importantly, national rules define what cities can and cannot do. Legal frameworks determine what means of electric transport can be sold, imported, and used. National funding is needed to implement priorities, tax rules, and subsidies to influence behavior.

It should be noted that what are normally national policies in some countries and regions may have been delegated to regions—for example, the Province of Québec in Canada or the Balearic Islands of Spain—or pooled with other countries as in the case of common rules for new vehicles throughout the European Union. In those cases, recommendations for international or local actions may also be relevant.

Recommendations

Table III-2 lists the national policy recommendations (NR) grouped by the three action fields vision (NR 1–6), policy (NR 7–20), and implementation (NR 21–27) (also see figure II-1).

Table III-2. Recommendations from SuM4All's working group for national policy on e-mobility[a]

NR1	Develop and maintain a coherent vision, priorities and targets or mandates for example, number of 2-, 3- and 4-wheel vehicles of different types and ICE phase out for electric mobility as an essential part of a coherent national approach to shift and improve modes for all. Where possible, align with international peers' electric mobility targets, definitions and vision to help build momentum and reduce costs.
NR2	Speak up for the discussion and support for sustainable electric mobility in relevant international forums such as UNFCCC, UNECE, UNEP, ITF, and G20.
NR3	Facilitate entry of global electric mobility good practice—information, webinars—and initiatives like the EV100, CEM 30@30 to maximize benefit from experience elsewhere.
NR4	Set transport sector targets as part of national commitments to reduce greenhouse gas emissions.
NR5	Ensure tax policy and subsidies align with sustainable transport vision; consider revenue neutral bonus–malus system. Plan for potential declining revenues from fossil fuel and conventional vehicle taxes with alternative fair-user fees such as variable fees-based "polluter pays".
NR6	Coordinate support of international organizations for electric mobility for instance, an international donors electric mobility roundtable.
NR7	Consider temporary purchase subsidies to incentivize early uptake of selected electric means of transport on the first- and second-hand market, prioritizing more sustainable and more active electric mobility segments as defined in national vision and targets.
NR8	Consider an economically efficient and environmentally effective scrapping scheme.
NR9	Provide a suitable framework for the deployment of electric mobility and mode shift—vehicle access regulation, speed limits, infrastructure planning, service—by national, regional, and urban authorities as part of National Urban Mobility Policies and Programmes.
NR10	Ensure an efficient and open electricity market legal framework, coordinate and facilitate exchange between energy actors and the electric mobility sector for mutual benefit.

NR11	Revise new vehicle emissions standards to encourage electric mobility.
NR12	Regulate and enforce battery life cycling, from mining to reuse, recycling, and disposal
NR13	Ensure an appropriate framework—homologation, taxes—for imported electric means of transport.
NR14	Develop and enforce second-hand vehicle export–import rules for example, emission and safety standards, and their enforcement.
NR15	Provide a suitable framework—policy, rules, funding—for the sale and use of micropersonal electric mobility.
NR16	Revise building and construction standards to ensure appropriate infrastructure for all modes such as e-bikes, e-cars, and micro modes a safe space, and secure parking and charging facilities in public and private areas, particularly factoring the safety perceptions and needs of women and vulnerable groups.
NR17	Target lighter public and commercial fleets for early action for example, taxi, car and bike share and rental fleets.
NR18	Review public procurement rules to incentivize electric mobility.
NR19	Prioritize modes looking at energy efficiency: rail over flight, public transport, walking and cycling over private car use, and shared use over individual use.
NR20	Keep electric mobility policy under regular review in light of changing prices and technological developments.
NR21	Electrify state fleets—freight, services trips and staff travel.
NR22	Develop electrification of rail – easy, quick win for many countries.
NR23	Provide incentives for the use of low carbon freight such as electric rail freight, and e-cargo bikes.
NR24	Provide incentives and support for electric mobility pilot projects and their scale-up.
NR25	Support capacity building for the development, operation and maintenance of electric means of transport and their integration with the mobility system.
NR26	Facilitate an open and balanced national electric mobility stakeholder platform to foster debate and exchange.
NR27	Support the communication of comprehensive and balanced information on sustainable electric mobility and its benefits which include myth busting, energy independence, clean jobs, and air quality.

Note:

a. Color code representing action fields: Vision Policy Implementation (also see figure II-1.)

b. A National Urban Mobility Policy or Investment Programme (NUMP) is a strategic, action-oriented framework for urban mobility, developed by national governments, enacted to enhance the capability of cities to plan, finance and implement projects and measures designed to fulfil the mobility needs of people and businesses in cities and their surroundings in a sustainable manner. It builds on existing policies and regulations and aims at harmonizing relevant laws, norms, sector strategies, investment and support programs towards an integrated approach for the benefits of cities and their inhabitants. It takes due consideration of participation and evaluation principles. Link: https://www.partnerschaften2030.de/wp-content/uploads/2017/11/171011_MYC_NUMP.pdf

3. Public policy recommendations for local electric mobility public policy community

These policy recommendations are addressed to the local public policy community such as city or regional authorities and agencies as well as think tanks and civil society organizations working on local sustainable transport policy.

In some countries subnational actors—states or provinces—have a significant role in transport policy and depending on their competences, a mixture of the national and local policy recommendations may be relevant.

The role of local public policy in the development of electric mobility

Local actors have the most direct influence over sustainable mobility through decisions over space use and service provision. Cities suffer the most from unsustainable mobility such as access inequality, congestion and poor air quality. Also, as most trips are short and local; it is where potential for avoiding trips and shifting modes is highest.

The "15-minute" city concept where citizens have local access to the majority of goods and services within 15 minutes reduces transport demand, stimulates modes shift—for example, from car to e-bike—and improves quality of urban life. City authorities have a key role to develop 15-minute cities through land use planning, space allocation, transport and other service provisions, and financial incentives (also see box III-3).

Recommendations

Table III-3 lists the local policy recommendations (LR) grouped by the three action fields vision (LR 1–3), policy (LR 4–11), and implementation (LR12–20) (also see figure II-1).

Table III-3. Recommendations from SuM4All's working group for national policy on e-mobility

LR1	Agree on clear policy and measures for electric mobility as part of broader sustainable mobility transformation. Integrate electric mobility in the sustainable urban mobility planning process. Look for opportunities for electric mobility to support avoid and shift strategies.
LR2	Facilitate a local electric mobility stakeholder platform.
LR3	Engage with the national government to ensure the right national frameworks are in place to catalyze local action.
LR4	Reallocate existing street space for electric 2-,3- and 4-wheel vehicle parking and charging, avoiding conflicts with pedestrians, cyclists, and local deliveries.
LR5	Revise urban vehicle access regulations and space allocation to encourage modal shift to walking, cycling, and public transport use.
LR6	Revise procurement procedures to encourage electric mobility in the procurements of goods and services.
LR7	Develop public and private partnerships with the energy sector to develop electric mobility —risk sharing, use of public space, energy supply, provision of charging facilities and services, and funding.
LR8	Revise building and construction standards to ensure appropriate infrastructure for all modes such as e-bikes, e-cars, and micromodes, safe space, and secure parking and charging facilities in public and private areas.
LR9	Adjust urban access regulations to stimulate use of locally prioritized sustainable modes
LR10	Apply mode- and pollution-sensitive access and space policies.
LR11	Keep policy under regular review in light of changing prices and technological developments.
LR12	Electrify municipal fleets—freight, services trips and staff travel—and municipally regulated fleets such as taxis.
LR13	Electrify suitable bus routes.
LR14	Expand established electric modes such as rail, tram, and trolley bus.
LR15	Initiate pilot projects to address selected local mobility problems for instance, light modes to help tackle congestion.

LR16	Provide incentives for electric mobility—free parking, priority lanes, access charge discounts—but plan for the longer term as electric mobility develops.
LR17	Integrate microelectric mobility to support public transport—joint promotion, parking, and integrated ticketing.
LR18	Develop an inclusive communication plan to highlight the benefits and opportunities for the local community.
LR19	Work with retailers and logistic operators to exploit the potential of light 2-, 3- and 4-wheel electric vehicles for local deliveries; evaluate silent electric vehicles for deliveries at night.
LR20	Reach out to international initiatives that can provide experience, advice and support.

Note:

a. Color code representing action fields: Vision Policy Implementation (also see figure II-1.)

Appendixes

Appendix A: Recommended Reading on Electric Mobility

A Handbook on Sustainable Urban Mobility and Spatial Planning Promoting Active Mobility, UNECE https://thepep.unece.org/sites/default/files/2020-10/Handbook%20on%20Sustainable%20Urban%20Mobility%20and%20Spatial%20Planning.pdf

Barriers to Adopting Electric Buses, WRI. https://wrirosscities.org/sites/default/files/barriers-to-adopting-electric-buses.pdf

Clean air and reduced greenhouse gas emissions with electric two and three wheelers https://www.unenvironment.org/explore-topics/transport/what-we-do/electric-mobility/electric-two-and-three-wheelers

E-Mobility Trends and Targets, SLOCAT Partnership on Sustainable, Low Carbon Transport, (constantly updated). https://slocat.net/e-mobility/

Electric Mobility & Development - An Engagement Paper from the World Bank and the International Association of Public Transport, 2018, https://openknowledge.worldbank.org/bitstream/handle/10986/30922/eMobility_and_Development.pdf?sequence=8&isAllowed=y

Electrification for Sustainable Mobility https://www.transformative-mobility.org/campaigns/tumivolt

Five things you know about EVs that aren't exactly true, ICCT. https://theicct.org/cards/stack/explaining-electric-vehicles

Global EV Outlook 2020, IEA. https://www.iea.org/reports/global-ev-outlook-2020

How to Enable Electric Bus Adoption in Cities Worldwide, A Guiding Report for City Transit Agencies and Bus Operating Entities, WRI. https://files.wri.org/s3fs-public/how-to-enable-electric-bus-adoption-cities-worldwide.pdf

Jobs in green and healthy transport: Making the green shift, United Nations Economic Commission for Europe, International Labour Organisation, Geneva 2020. https://thepep.unece.org/sites/default/files/2019-10/Informal%20document%2008%20Study%20on%20green%20and%20healthy%20jobs%20in%20transport.pdf

Renewable Energy Pathways in Road Transport. REN21. 2020. https://www.ren21.net/decarbonise-transport-sector-2020/

Renewable Energy Pathways in Road Transport. REN21 and FIA Foundation. https://www.fiafoundation.org/connect/publications/renewable-energy-pathways-in-road-transport

"The Electric Assist: Leveraging e-bikes and e-scooters for more livable cities" by ITDP. ITDP.org/publication/electric-assist

The Future of Rail - collaboration between International Union of Railways (UIC) and International Energy Agency (IEA) Handbook on Energy Consumption and CO2 Emissions, 2018. https://www.shop-etf.com/en/the-future-of-rail

The Global Electric Vehicle Policy Database, United Nations Environment Programme, https://www.unenvironment.org/resources/publication/global-electric-vehicle-policy-database

Vehicle Efficiency and Electrification: A Global Status Report, GFEI https://www.globalfueleconomy.org/data-and-research/publications/vehicle-efficiency-and-electrification-a-global-status-report

ZeEUS eBus Report - An overview of electric buses in Europe https://zeeus.eu/uploads/publications/documents/zeeus-ebus-report-internet.pdf


SUSTAINABLE
mobility
FOR ALL