

Digital Toolkit for Energy and Mobility



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Digital Toolkit for Energy and Mobility



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List of Abbreviations

AFD	Agence Française de Développement
ASI	Avoid, Shift, and Improve Strategies
BMZ	German Federal Ministry for Economic Cooperation and Development
BRT	Bus Rapid Transit
CARB	California Air Resources Board
CPM	Catalogue of Policy Measures
EEG	Energy and Economic Growth
EV	Electric Vehicles
FCDO	UK Foreign Commonwealth and Development Office
GCF	Green Climate Fund
GHG emission	Greenhouse gas emission
GRA	Global Roadmap of Action toward Sustainable Mobility
HVT	High Volume Transport
IEA	International Energy Agency
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
IRF	International Road Federation
IsDB	Islamic Development Bank
ITDP	Institute for Transportation and Development Policy
MaaS	Mobility as a Service
NGO	Nongovernmental Organization
OSCT	Open Streets Cape Town
PIARC	World Road Association
PPMC	Paris Process on Mobility and Climate
PV	Photovoltaic
SDG	Sustainable Development Goals

SEforALL	Sustainable Energy for All
SLOCAT	Partnership on Sustainable, Low Carbon Transport
SuM4All	Sustainable Mobility for All
TCO	Total cost of ownership
TUMI	Transformative Urban Mobility Initiative
UIC	International Union of Railways
UITP	Union Internationale des Transports Publics
UN	United Nations
UNDESA	United Nations Department of Economic and Social Affairs
UNECE	United Nations Economic Commission for Europe
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNFCCC	United Nations Framework Convention on Climate Change

Foreword

Sustainable Mobility for All (SuM4All) is the premier advocacy platform for international cooperation on transport and mobility issues. It brings together more than 50 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'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 formed four 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 third of five papers that will be published in 2021 under the [GRA in Action series](#). This paper unpacks three GRA's policy measures and analyzes their applicability in relation to energy and mobility in form of toolkit. It assesses the relevance of each of these policy in four areas and employs five categories of resources. It will help planning officials and policy makers access useful resources and contacts on measures selected toward sustainable mobility through the integration of energy and mobility planning, that to date, have not been well integrated. Furthermore, the toolkit outlines three key recommendations under each selected policy measure. The content of this toolkit is also integrated in the broader [Policy Decision-Making Tool for Sustainable Mobility 2.0](#).

We thank the Sustainable Energy for All (SEforALL) and UK Foreign Commonwealth and Development Office (FCDO), through High Volume Transport (HVT), 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)
April 2021, Washington, D.C**

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Executive Summary

Given the strong commitment of achieving the Paris Agreement goal of global 2-degree carbon budget¹, total transport emissions will need to decline to 3 billion tonnes of carbon dioxide equivalent (CO₂eq) by 2050. Instead, they are projected to increase to 12 billion tonnes of CO₂eq by 2050. The energy and mobility sectors could yield high impacts in helping to meet sustainable development goals (SDGs), including SDG 13 “Climate Action” supporting the Paris Climate Agreement, in particular, SDG 7 “Ensure access to affordable, reliable, sustainable and modern energy for all” and SDG 11 “Make cities and human settlements inclusive, safe, resilient and sustainable”.

Bridging the gap between the transport and energy sectors is crucial when seeking to achieve a universal, efficient, safe, and green mobility while developing sustainable, and energy-efficient transport projects. The interconnections between energy and mobility, although widely recognized, have seldom been explored in detail and their potential has not been fully developed. Even within energy and transport sectors themselves, silos exist, so it is perhaps not inconceivable that silos also exist between these two different sectors.

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 three policies and global experience available to act on the nexus between the transport and energy sector. This includes: “Promote Public Discussion on New Mobility Solutions”; “Expand Public Transport Infrastructure”; and “Plan for Integrated Multimodal Transport Networks”—measures 171, 87, and 5 in the CPM respectively.

The energy and mobility working group selected the three measures of the GRA and identified four practical and easy-to-use steps, namely: set the baseline, identify targets, use strategy and tools available, and explore further resources in a global discussion of the energy and mobility nexus. Planning officials and policy makers can use these steps to enable access to useful resources and contacts that have not been well integrated between the measures selected toward sustainable mobility through the integration of energy and mobility planning.

The toolkit acts as a multiplier of some of the best practices to achieve energy efficiency in transport. It also adopts the avoid, shift, and improve framework (ASI), which aims to reduce carbon emissions by:

- **Avoiding** the need to travel through better urban planning, land use control, location-based subsidies, and improved e-communications reinforced by transport demand management.
- **Shifting** travel by the cleanest and most efficient mode: typically moving people toward nonmotorized transport, mass public transport options, or sustainable individual or shared solutions.
- **Improving** the efficiency of transport options through technological improvements—often driven by tighter emissions standards—traffic flow management, or subsidies and taxes to promote low emission vehicles and fuel switching.

The content of this toolkit is also integrated in the broader [Policy Decision-Making Tool for Sustainable Mobility 2.0](#). It is a call to action for policy makers and planning officials in transport at the national and municipal levels to plan and implement new low carbon mobility solutions for both passenger and freight transportation. The practical steps and strategies provided in this paper aim to support these solutions.

Notes

- 1 Maximum quantity of carbon which can be released to maintain a 50 percent probability of global average temperature rise remaining below two-degrees Celsius

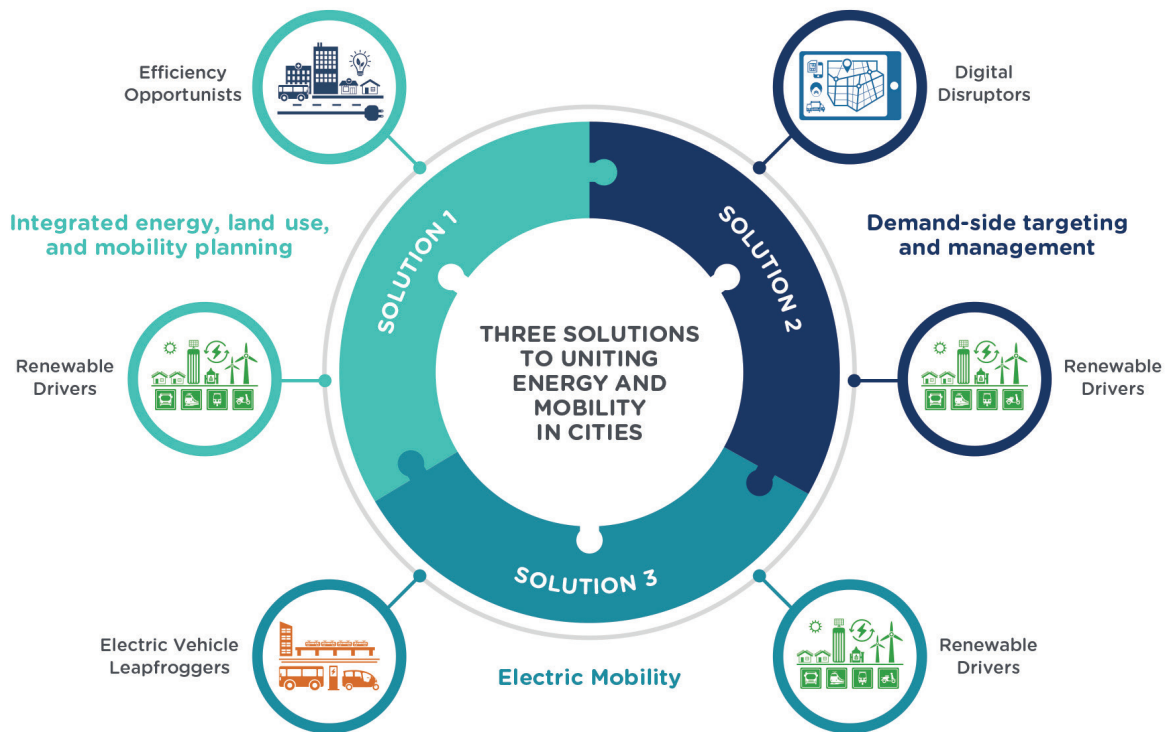
PART I.

Introduction

The Global Roadmap of Action Toward Sustainable Mobility (GRA) was launched in October 2019 and included more than 180 policy measures tested around the world. But how did the energy sector feature here, if at all? Throughout the report, the word “energy” appears 42 times, and relates mostly to energy efficiency and electric mobility. From an energy supply perspective, the report notes that “Transport accounts for 30 percent of the total final energy demand, but less than 5 percent of that energy comes from renewable sources.” This is not an issue, but it opens room for further discussion and analysis, as being done here, on the link between energy and mobility. The report therefore concluded, “The two perspectives of transport and energy have yet to be tied in.”

It is important, therefore, to consider incorporating discussion of two important factors that affect transport-energy analysis. First, the potential co-benefits of resource-efficient travel modes, which consume less energy, land and money.¹ Second, a discussion of how land use development patterns affect per capita vehicle travel, energy consumption, and emissions;² specifically, compact urban development can significantly reduce per capita energy consumption and emissions through reducing overall energy demand by promotion of active mobility such as walking, cycling, and other nonmotorized forms of transport.³

Figure 1-1. The energy and mobility nexus in cities.



Source: SEforALL.

Collaboration between energy and mobility sectors can yield high impacts in meeting SDGs (figure 1-1). Of particular relevance for sustainable transport and energy are: SDG 7 “Ensure access to affordable, reliable, sustainable and modern energy for all”; SDG target 3.6 “By 2020, halve the number of global deaths and injuries from road traffic accidents”; SDG target 9.1 “Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human wellbeing, with a focus on affordable and equitable access for all”; and SDG target 11.2 “By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations: women, children, persons with disabilities and older persons”.

Why a Toolkit?

This toolkit addresses the energy and mobility nexus and helps bridge the gap between the transport and energy sectors when developing sustainable, green, and energy-efficient mobility projects. The interconnections between energy and mobility, although widely recognized, have seldom been explored in detail, and their potential has not been fully developed. Silos characterize how each of the two sectors function internally and that compartmentalization is replicated between the two different sectors as well.

This toolkit aims to provide a set of content and capacity development tools to enhance three measures of the [GRA](#). This includes: (i) “Promote Public Discussion on New Mobility Solutions”; (ii) “Expand Public Transport Infrastructure”; and (iii) “Plan for Integrated Multimodal Transport Networks”. The content is the output of work by the energy and mobility working group of SuM4All in 2020, working closely with the other working groups including one on electric mobility.

While a wide range of tools and publications exists, this toolkit is designed as a handy, bite-sized resource that planning officials and policy makers can use to enable access to sustainable mobility through the integration of energy and mobility planning. The focus is on low-income countries, but experiences are drawn from around the world.

Three GRA policies and global experience in the energy-mobility nexus are discussed in this toolkit.

Promote Public Discussion on New Mobility Solutions: “New mobility solutions” can be an elusive term, and in this context it is used for both movement of persons and goods and refers to the convergence of new technologies and business models as they relate to many different modes and solutions, for people and freight.⁴ Thanks to digitalization and innovative business models, new mobility solutions have emerged such as bicycle-sharing systems or mobility as a service (MaaS), but they are only as effective as the land use context permits and when embraced by the wider population. It is essential that we do not see the solutions as silver bullets, but rather as enablers of sustainable mobility requiring significant public discussion and buy-in to ensure their most efficient and safe use such as consolidated urban freight delivery or ensuring charging with renewable electricity in the case of electric sidewalk or kick scooters, electric bicycles, electric moped-style scooters, and ride hailing and car-sharing services using electric vehicles. Technology aside, it is important to address underappreciated topics systematically such as fiscal transformation, health, and behavioral sciences; they must be given the importance they deserve in steering change. For this reason, the role of universities—as trustworthy sources of information and debate—should be highlighted to unlock ongoing public debates.

Expand Public Transport Infrastructure: It is worth noting that the high quality public transport needed to attract discretionary travelers—people who might otherwise drive—and provide a catalyst for transit-oriented development often requires investment from other sources such as national budgets or international private entities. When trying to attract finance for efficient and sustainable public transport infrastructure, one main challenge is to capture its efficiency benefits, such as in the case of electric buses with renewable-based charging infrastructure, which might have a lower

total cost of ownership (TCO) and significant long-term benefits, but higher upfront costs, which are prohibitively expensive for public transit authorities. Innovative financing to bridge this gap is being pioneered around the world, including by a diverse set of players in the energy sector from private utilities to government-owned energy service companies.

Plan for Integrated Multimodal Freight Transport Networks: The freight sector receives less policy attention than the passenger sector, yet according to the Intergovernmental Panel on Climate Change (IPCC 2014), freight emissions—including road, air, rail, and shipping—equal 42 percent of total transport emissions. To comply with our global 2-degree carbon budget,⁵ total transport emissions will need to decline to 3 billion tonnes of CO₂eq by 2050. Instead, they are projected to increase to 12 billion tonnes of CO₂eq by midcentury, with freight's share increasing to 60 percent of total transport emissions (McKinnon 2016). Among the different modes of freight, road freight is the largest emitter on a cumulative basis, accounting for nearly 7 percent of global energy-related CO₂ emissions, more than twice that of total aviation emissions (Kaack et al. 2018). Freight transport is one of the most difficult players of the economy to decarbonize, as it is almost entirely dependent on fossil fuels. For this reason, while alternative fuels need to be deployed, efficiency is an essential first-step strategy, and one related measure is multimodality in line with the avoid-shift-improve (ASI) approach. While technology can help enable this policy measure, bringing the right energy and mobility players together will be complex and will require investments in capacity and regulatory changes.

The Scope

The momentum has gained to integrate energy efficiency and climate action with other UN sustainable development goals. Figure 1-2 below comes from a report *Switching Gears: Enabling Access to Sustainable Urban Mobility* released earlier in 2020 by SEforALL, which found that at least 10 of the 17 SDGs were considered high impact in the energy and mobility nexus.⁶ This is an opportunity to implement win-win emission reduction strategies that help achieve other important co-benefits.⁷

Figure 1-2. Sustainable energy and sustainable mobility and their links to achieving the SDGs.



Source: SEforALL

In other words, collaboration between energy and mobility sectors could yield high dividends in meeting the SDGs and is thus highly relevant with potential for SDG synergies. These concern SDG 7 “Ensure access to affordable, reliable, sustainable, and modern energy for all” and SDG 11 “Make cities and human settlements inclusive, safe, resilient and sustainable”, in particular. This working group primarily addresses issues related to the energy and mobility nexus.

To illustrate this nexus, when a public transit agency plans to purchase electric buses, they should consider the entire energy system. One path offers co-benefits; another, missed synergies, lock in to carbon, and resulting inefficiencies. A best-practice scenario would bring in a systematic approach ensuring that energy supply is considered early in the process, which would likely involve a local utility as well as the energy ministry, and which would help join and improve the overall strategic planning process, both in time and money. Joint planning would also address issues such as where to place electric vehicle charging stations and whether the pertinent substations are close enough or need to be upgraded to potentially higher voltage. This example demonstrates the potential of interconnecting energy and transport as a requirement from the outset, with resulting positive land use, mobility, and energy impacts.

Another example concerns the supply of energy and the demand from the mobility sector. If we take the freight sector, planning an integrated multimodal transport network with low-emitting fuels will yield many co-benefits. For example, in a region with natural gas electricity generation, it may be more economical and resource efficient to use natural gas-powered trucks. These benefits can only happen if both sides are brought to the table from the outset. This type of thinking applies to several situations including hydrogen supply and its potential use in trucks and buses.

This is a period of transformational change in both transportation and energy systems. Many transportation agencies are encouraging mode and vehicle fuel shifting, from gasoline to electricity, while electric systems are shifting to renewable energy sources. Lithium-ion battery prices dropped by approximately 90 percent between 2010 and 2019,⁸ prompting vehicle fleets to electrify, while solar photovoltaic (PV) prices declined by a similar amount.⁹ Integrated energy and mobility planning can ensure that solar energy capacity increases to meet the power demands of a growth electric vehicle fleet.

Also, it is a timely issue due to rapid urbanization. An increasing share of the world’s population is moving to cities, which is putting pressure on cities to develop spatial efficiency, a path the world is far from being on. According to the World Resources Institute, 80 percent of cities between now and 2030 will grow in land area, which could have negative implications for related indicators such as traffic congestion, local air pollution, and travel time.¹⁰ This points to another critical nexus that we cannot ignore concerning the shape of cities and the impacts of energy and mobility.

Cities offer many economic, social, and environmental benefits, including improved accessibility, increased economic productivity and opportunity, energy savings and emission reductions.¹¹ By reducing local noise and air pollution, electrifying urban vehicle fleets can make cities healthier and more liveable, supporting efficient urbanization.

Given these pressures and the overall demand for integration of energy and mobility, why does it not happen on its own? And how can we structurally create conditions to make sure energy and mobility organizations work together from the beginning? And finally, how can governments and lending institutions and private investors work together and break down silos, especially considering financial aspects? These are the key guiding questions that we explore in this paper.

Notes

- 1 <https://ledsgp.org/wp-content/uploads/2015/10/transport-co-benefits-guideline.pdf>
- 2 <https://journals.openedition.org/sapiens/914>
- 3 <https://journals.open.tudelft.nl/index.php/abe/article/view/1092>
- 4 https://theicct.org/sites/default/files/publications/New-mobility-landscape_ICCT-white-paper_27072017_vF.pdf
- 5 For a better than even chance of limiting global warming to 2°C above pre-industrial levels, annual GHG emissions must not exceed 20 billion tonnes CO₂eq by 2050 (IPCC, 2014).
- 6 www.seforall.org/publications/switching-gears-enabling-access-to-sustainable-urban-mobility
- 7 Todd Litman (2021), Win-Win Transportation Emission Reduction Strategies, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/wwclimate.pdf.
- 8 www.utilitydive.com/news/battery-prices-fall-nearly-50-in-3-years-spurring-more-electrification-b/568363.
- 9 www.greentechmedia.com/articles/read/solar-pv-has-become-cheaper-and-better-in-the-2010s-now-what
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- 11 Phillip Rode, et al. (2019), *National Transport Policy and Cities: Key policy interventions to drive compact and connected urban growth*, Coalition for Urban Transitions, New Climate Economy (<http://newclimateeconomy.net>); at: <http://newclimateeconomy.net/content/citiesworking-papers>.

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PART II.

Digital Toolkit for Energy and Mobility

This section examines three policies in detail—promote public discussion on new mobility solutions; expand public transport infrastructure; and plan for integrated multimodal freight transport networks— in a global discussion of the energy and mobility nexus from four perspectives.

This toolkit—which includes three illustrative infographics—is aimed to advance in this direction with four practical and easy-to-use steps.

- Where are we now? → Set the baseline
- Where are we going? → Identify targets
- How do we get there? → Use strategy and tools available
- What do we need? → Explore further resources and tools available

It is not aimed to be exhaustive, but rather to act as a multiplier of useful resources and contacts that have not been well integrated between the measures selected.

Promote Public Discussion on New Mobility Solutions

Objective

This measure seeks to enable policy makers across all levels of decision making promote public discussion with other stakeholders—including the private sector and civil society to generate new ideas, innovations, and tools—on new mobility solutions by providing a four-step approach (figure 2-1) using tools gathered that comprise essential background information, data, tools, trainings, case studies, and additional resources.

Background

Governments should develop a long-term vision for new mobility alternatives in connection with stakeholders and civil society—NGOs, companies, and professional bodies—in tune with policy frameworks for green mobility.

Public discussions must be observed in urban areas where new mobility solutions emerge rapidly. Free-floating bikes and scooters outpaced regulation in many cities and imposed a new business model, requiring public actors to adapt while maintaining their goals to promote modal shifts. In the development of regulations related with new mobility solutions, the civil society must be involved and be consulted.

When making transport policy decisions and evaluating new mobility solutions, it is critical that policy makers raise awareness to the public, and that both energy and mobility considerations are well communicated and easily understood. Switching to more energy-efficient modes such as switching from conventional powered two-wheelers to electric equivalents, ensuring charging with renewable electricity, and relying on shared mobility can save energy and help decrease emissions. With increasing awareness for local and global air pollution, along with concomitant risks and health effects, it is now more important than ever to bridge the divide between the two sectors and to present how both sectors can help enhance livability (figure 2-1).

Three Key Recommendations for Promoting Public Discussion on New Mobility Solutions

- Be solutions driven, not only technology driven, highlighting diverse user benefits.
- Engage end users in the decision-making process. Identify their demands and concerns.
- Involve different public and private actors—as well as universities—from the energy and mobility sectors at the outset to ensure buy-in and a higher success in enabling access to sustainable urban mobility.

Figure 2-1. Four essential steps that promote public discussion on new mobility solutions.

PROMOTE PUBLIC DISCUSSION ON NEW MOBILITY SOLUTIONS



3.3% Share of renewable energy of total final energy consumption in transport (3.0% biofuels, 0.3% renewable electricity); transport accounts for 32% of total final energy consumption (2017)*

800 Number of smart cities' programs pilot programs being planned in China; India has 100 smart cities**

- LEGEND
- Data
 - Tools
 - Case Studies
 - Training

*Source: REN21, IEA Data
 **Source: China's Smart Cities Development, U.S.-China Economic and Security Review Commission, 2020; Smart Cities Mission; <http://smartcities.gov.in/>



Data

Data underpin the measurement, baseline setting, and progress tracking of sustainable energy and mobility. The following resources provide both the data as well as the necessary context for understanding and utilization (table 2-1).

Table 2-1. Selected data resources for promoting public discussion on new mobility solutions.

Short description	Key Resource for Infographic Step(s) #	Link
Energy Progress Report - Provides a global dashboard to register progress on energy access, energy efficiency, renewable energy, and international cooperation to advance SDG 7.	Step 1: Define a baseline for modal and trip overview. Step 2: Create a roadmap of new mobility solutions.	https://trackingsdg7.esmap.org/
Global Infrastructure Map - Data and data visualization platform. It showcases geospatial data on energy, transport, and digital infrastructures.	Step 1: Define a baseline for modal and trip overview.	https://maps.worldbank.org/?infraToolkit=globalLayer
International Energy Agency (IEA) data on Transport - Global data on transport carbon emissions, electric vehicles (EV) deployment, and energy utilized.	Step 1: Define a baseline for modal and trip overview. Step 2: Create a roadmap of new mobility solutions.	www.iea.org/topics/transport
SuM4All global tracking framework - Data and indicators across four objectives: Universal Access, Efficiency, Safety, Green Mobility	Step 1: Define a baseline for modal and trip overview. Step 2: Create a roadmap of new mobility solutions.	https://www.sum4all.org/global-tracking-framework
Renewable Energy Pathways in Road Transport (FIA Foundation and REN21) - Background on technology solutions, market trends, policy frameworks, challenges, and pathways for decarbonization.	Step 1: Define a baseline for modal and trip overview. Step 2: Create a roadmap of new mobility solutions. Step 3: Use best practice case studies to engage with stakeholders	www.ren21.net/2020-re-pathways-in-road-transport/
Renewables in New Mobility Services (REN21) - Brief overview of use of renewable electricity in new mobility services—in the larger context of renewable energy trends in transport.	Step 1: Define a baseline for modal and trip overview.	www.ren21.net/gsr-2020/chapters/chapter_01/chapter_01/#sidebox_2
Transport and Climate Change Global Status Report (SLOCAT) Trends on all modes of transport, as well as emissions reduction pathways.	Step 1: Define a baseline for modal and trip overview. Step 2: Create a roadmap of new mobility solutions. Step 3: Use best practice case studies to engage with stakeholders	https://slocat.net/tcc-gsr/

Short description	Key Resource for Infographic Step(s) #	Link
Global SDG indicators database	Step 1: Define a baseline for modal and trip overview.	https://unstats.un.org/sdgs/indicators/database/
IRF World Road Statistics - Covers road and transport sector-related data for over 200 countries and 100+ metrics split into 11 themes.	Step 1: Define a baseline for modal and trip overview. Step 2: Create a roadmap of new mobility solutions.	https://worldroadstatistics.org/
Sustainable Mobility: Policy Making for Data Sharing (SuM4All)	Step 1: Define a baseline for modal and trip overview. Step 2: Create a roadmap of new mobility solutions. Step 3: Use best practice case studies to engage with stakeholders Step 4: Identify capacity gaps and raise capacity to meet challenges.	https://www.sum4all.org/publications/gra-action-series



Tools

High quality and standard-setting tools enable sustainable energy and mobility reap the benefits of successful implementation (table 2-2).

Table 2-2. Selected tools for promoting public discussion on new mobility solutions.

Short description	Key Resource for Infographic Step(s) #	Link
GRA online tool - SuM4All (2019) - Tool to enable better policy decisions on sustainable mobility in countries around the world based on: Mobility performance data Up-to-date knowledge on most effective policy measures Algorithm to prioritize actions.	Step 1: Define a baseline for modal and trip overview. Step 2: Create a roadmap of new mobility solutions. Step 3: Use best practice case studies to engage with stakeholders. Step 4: Identify capacity gaps and raise capacity to meet challenges.	www.sum4all.org/online-tool
A Toolkit for Preparation of Low Carbon Mobility Plan (2016)	Step 2: Create a roadmap of new mobility solutions.	https://c2e2.unepdtu.org/kms_object/a-toolkit-for-preparation-of-low-carbon-mobility-plan/
GHG Protocol and GHG Protocol for cities - GHG Protocol establishes comprehensive global standardized frameworks to measure and manage greenhouse gas (GHG) emissions from private and public sector operations, value chains, and mitigation actions.	Step 2: Create a roadmap of new mobility solutions.	https://ghgprotocol.org/

Short description	Key Resource for Infographic Step(s) #	Link
<p>MaaS Maturity Index - MaaS Maturity Index (MMI) assesses the readiness of metropolitan areas for the implementation of MaaS. The calculator can be used to demonstrate what improvements are needed to make a city ready for MaaS.</p>	<p>Step 1: Define a baseline for modal and trip overview.</p> <p>Step 2: Create a roadmap of new mobility solutions.</p> <p>Step 3: Use best practice case studies to engage with stakeholders.</p>	<p>www.maaslab.org/maasindex</p>
<p>2030 Connect - United Nations online technology platform for the SDGs (Technology Facilitation Mechanism).</p>	<p>Step 4: Identify capacity gaps and raise capacity to meet challenges.</p>	<p>https://tfm2030connect.un.org/</p>
<p>2030 Agenda Partnership Accelerator</p>	<p>Step 4: Identify capacity gaps and raise capacity to meet challenges.</p>	<p>https://sustainabledevelopment.un.org/PartnershipAccelerator</p>
<p>TOD Implementation Resources and Tools - Global Platform for Sustainable Cities; World Bank.</p>	<p>Step 2: Create a roadmap of new mobility solutions.</p> <p>Step 3: Use best practice case studies to engage with stakeholders.</p>	<p>http://hdl.handle.net/10986/31121</p>
<p>UIC's EcoPassenger Tool compares the energy and emissions impact of different mobility choices.</p>	<p>Step 2: Create a roadmap of new mobility solutions.</p> <p>Step 4: Identify capacity gaps and raise capacity to meet challenges.</p>	<p>http://ecopassenger.hafas.de/bin/query.exe/en?L=vs_uic&</p>
<p>UNFCCC Climate Action Pathways and Action Table</p>	<p>Step 1: Define a baseline for modal and trip overview.</p> <p>Step 2: Create a roadmap of new mobility solutions.</p> <p>Step 4: Identify capacity gaps and raise capacity to meet challenges.</p>	<p>https://unfccc.int/sites/default/files/resource/Action_table_Transport_.pdf</p> <p>https://unfccc.int/climate-action/mar-rakech-partnership/reporting-and-tracking/climate_action_pathways</p>



Case Studies

The nexus of energy and mobility is not new, but rather its importance has only increased over time. For this reason, it is critical to assess rapidly what went right and what could have been improved across cases from around the world. What follows are case studies that help illuminate and inspire a path forward for others looking to implement sustainable energy and mobility (table 2-3).

Table 2-3. Selected case studies on promoting public discussion on new mobility solutions.

Short description	Key Resource for Infographic Step(s) #	Link
Institute for Transportation and Development Policy (ITDP) - Case studies on how low cost, flexible interventions like temporary cycle lanes and car-free streets used to alleviate crowding on public transport can provide more space for physically distanced recreation while improving safety on the street for pedestrians and cyclists—with relevance for COVID-19.	Step 3: Use best practice case studies to engage with stakeholders. Step 4: Identify capacity gaps and raise capacity to meet challenges.	www.itdp.org/publication/from-pilot-to-permanent/
Mapaton developed by the Mexico City Data Lab - Case study on public involvement in diagnostic support for mobility problems.	Step 3: Use best practice case studies to engage with stakeholders. Step 4: Identify capacity gaps and raise capacity to meet challenges.	https://www.oecd.org/gov/innovative-government/embracing-innovation-in-government-mexico.pdf
Chennai Smart City Planning - Case study on development of vision or objectives for mobility programs and policies.	Step 3: Use best practice case studies to engage with stakeholders. Step 4: Identify capacity gaps and raise capacity to meet challenges.	https://cscl.co.in/about-us
ITF work on Shared Mobility	Step 1: Define a baseline for modal and trip overview. Step 3: Use best practice case studies to engage with stakeholders. Step 4: Identify capacity gaps and raise capacity to meet challenges.	https://www.itf-oecd.org/itf-work-shared-mobility



Training and Capacity Development

There is no shortage of trainings in the energy and mobility sectors, but there are few opportunities to get a good overview of capacity development resources. Table 2-4 lists those trainings that are virtual and available.

Table 2-4: Selected training and capacity development resources for promoting public discussion on new mobility solutions.

Short description	Key Resource for Infographic Step(s) #	Link
Transformative Urban Mobility Initiative (TUMI) Catalogue of training and capacity development (2018).	Step 3: Use best practice case studies to engage with stakeholders. Step 4: Identify capacity gaps and raise capacity to meet challenges.	www.transformative-mobility.org/assets/publications/TUMI_CapDev_Catalogue_2018.pdf
Library of SDG academy online courses - Online academy with courses covering all SDGs.	Step 3: Use best practice case studies to engage with stakeholders. Step 4: Identify capacity gaps and raise capacity to meet challenges.	https://sdgacademylibrary.mediaspace.kaltura.com/home



Additional Resources (Websites and Publications)

1. [Sustainable Electric Mobility: Building Blocks and Policy Recommendations](#) opines that supporting a sustainable electric mobility development will require clear and coherent policies in both the transport and energy sectors. The paper lays out a solid basis to inform decision-makers about effective policy measures that will catalyze their efforts to transition to electric mobility. If implemented well, electric mobility can support accessible, efficient, safe, and green mobility for all.
2. [Global Roadmap of Action Toward Sustainable Mobility – Universal Urban Access Policy Paper \(2019\)](#)
3. [Mobility as a Service: A New Ambition for Public Transport Authorities](#)
4. [General Transit Feed Specification \(GTFS\) best practices: Recommended practices for describing public transportation services in the GTFS.](#)
5. [Transport Operator Mobility-as-a-service Provider \(TOMP\) API for mobility as a service: Create a standardized language for the technical communication between Transport Operators and MaaS Providers within the MaaS ecosystem by means of an API \(Applicable Programming Interface\).](#)
6. [General Bikeshare Feed Specification](#): Known as GBFS, it is the open data standard for bikeshare. GBFS will make real-time data feeds publicly available online in a uniform format so that map and transportation-based apps can easily incorporate this data into their platforms.

7. [Renewable Energy Policies in a Time of Transition \(IEA, IRENA, REN21\)](#) includes chapters on transport and sector coupling.
8. [Preparing a National Transport Strategy: Suggestions for Government Agencies in Developing Countries](#)
9. [Sustainable Recovery - World Energy Outlook Special Report \(IEA\)](#): Encouraging consumer purchase of more efficient new vehicles, urban infrastructure, and high-speed rail.
10. [Decarbonising Transport by 2050 \(TDA\)](#) — A manifesto on how to reach net zero emission mobility through uniting countries, cities, regions, and companies
11. [Global Macro Roadmap \(PPMC\)](#) — Focuses on identifying a balanced package of actions in the main sustainable transport paradigm with ASI strategies.
12. [Deep Decarbonization Pathways \(IDDRI\)](#) — Helps governments and nonstate actors make choices that put economies and societies on track to reach a carbon neutral world by the second half of the century.
13. [Mobilise Your City](#) - A partnership that offers cities and countries to improve mobility for their residents and decarbonize transport to fight the global climate crisis.
14. [The Global Transport Knowledge Partnership \(gTKP\)](#) - A comprehensive resource center to fast-track access to knowledge, experience, learning resources and good practices on COVID-19 and transport.
15. [Electric road systems: a solution for the future?](#) State-of-the-art review and feasibility study of ERS concepts and implementation from the perspective of a road administration.

Expand Public Transport Infrastructure

Objective

Expanding the public transport network is meant to meet demand requirements, with an emphasis on equitable access while considering the most appropriate modes in each context, including bus, rail, demand-responsive service, cable-propelled transport, and ferry transport. The objective of the toolkit is to support policy makers expand public transport infrastructure by providing a four-step approach using tools gathered—essential background, data, tools, case studies, training and additional resources.

Background

The mainstream approach in urban planning for many cities across the globe continues to give greater emphasis to low density and sprawled urban areas, greater investment, and street space for individual motorized traffic, and lower investments—and institutional care or consideration—for public transport, cycling, and walking. An expansion of public transport networks is one solution to reverse this trend in which it provides reduced air pollution, reduced traffic congestions, increased fuel efficiency, and more safety on the roads, and encourages healthier habits and benefits communities financially.

Expanding the public transport network must be done considering demand requirements, with an emphasis on equitable access and focusing on the most appropriate modes in each context, including bus, rail, demand-responsive service, cable-propelled transport, and ferry transport. Provision of public transport should be enhanced with compact and mixed-use urban development

that favors sustainable transport modes, including active modes such as cycling and walking, and micromodes such as e-bikes and e-scooters.

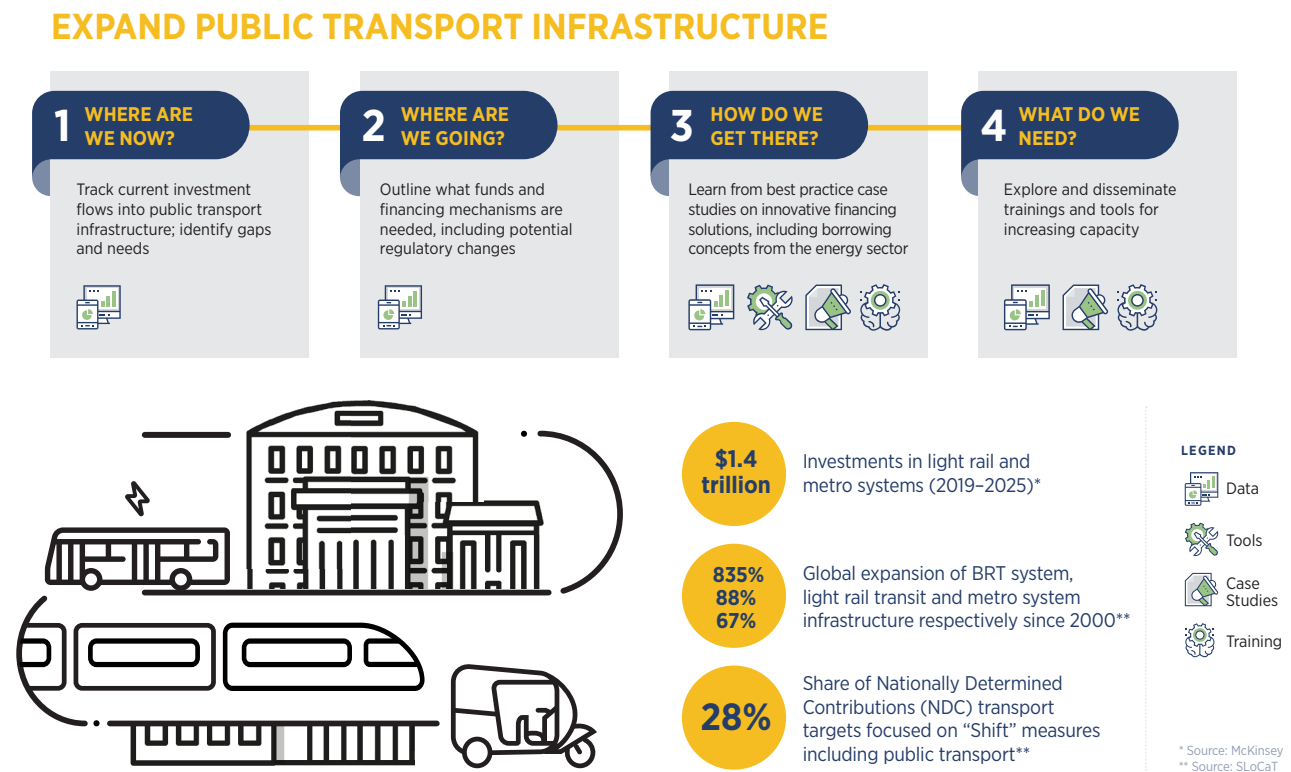
High quality public transport provides resource-efficient urban mobility, basic mobility for physically, economically, and socially disadvantaged groups, and can be a catalyst for more compact, multimodal development. Expanding public transport helps cities contain their energy transport consumption and emissions. Public transport and fleets relying on renewable energy can mean financial savings on fuel and increased energy security and resilience, as well as decreased emissions and associated public health benefits.

These immediate and long-term benefits to the local populations served as well as the economic benefits can help make the case for policy makers to opt for renewably powered public transport when considering investments. Recent years have seen dramatic cost reductions in electric vehicles and batteries for public transport, and for this reason electric public transport has appeal and potential (figure 2-2).

Three Key Recommendations for Expanding Public Transport Infrastructure

- Consider cost effective and high-impact energy and mobility project financing together at the outset by bringing stakeholders from both sides, and collecting data on energy and mobility, as well as leveraging financial solutions from one sector to another.
- Look across the energy and mobility nexus for innovative financing ideas including green bonds and pay-as-you-go models and land value capture. Engage the private sector to help access said funds.
- Investment in capacity development is critical for successful and efficient project preparation linking it to walking and cycling infrastructure, as well as transit-oriented development and best practices from the COVID-19 pandemic in hygiene practices.

Figure 2-2. Steps to expand public transport infrastructure.





Data

Data underpin the measurement, baseline setting, and progress tracking of sustainable energy and mobility. The following resources provide both the data as well as the necessary context for understanding and utilization (table 2-5).

Table 2-5: Selected data resources for expanding public transport infrastructure.

Short description	Key Resource for Infographic Step(s) #	Link
Data tracking all bus rapid transit (BRT) worldwide.	Step 1: Track existing investment flows.	https://brtdata.org/
Organisation for Economic Co-operation and Development (OECD) transport infrastructure investment data.	Step 1: Track existing investment flows.	https://data.oecd.org/transport/infrastructure-investment.htm
Investment in transport infrastructure - European Environment Agency (EEA).	Step 1: Track existing investment flows.	www.eea.europa.eu/data-and-maps/indicators/infrastructure-investments/assessment-3
International Association of Public Transport (UITP) Mobility in cities database.	Step 1: Track existing investment flows.	www.uitp.org/publications/mobility-in-cities-database/
DigitalTransport4Africa – an open resource center for mapping public transport across Africa.	Step 1: Track existing investment flows.	https://digitaltransport4africa.org/
General Transit Feed Specification (GTFS) – Recommended practices for describing public transportation services.	Step 1: Track existing investment flows.	https://gtfs.org/best-practices/
Sustainable Urban Transport Index by United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP).	Step 1: Track existing investment flows.	www.unescap.org/sites/default/files/SUT1%20Data%20Collection%20Guideline.pdf
Renewables in Cities Global Status Report (REN21) – Overview on latest energy trends in the transport sector in an urban context with a section on transport in almost every chapter.	Step 1: Track existing investment flows. Step 4: Disseminate training and tools to increase capacity.	www.ren21.net/cities
Transport and Climate Change Global Status Report (SLOCAT) – Trends on all modes of transport as well as emissions reduction pathways.	Step 1: Track existing investment flows. Step 2: Outline the funding mechanisms needed. Step 3: Learn from best practice studies on innovative financing solutions.	https://slocat.net/tcc-gsr/
IIRF World Road Statistics Covers road and transport sector-related data for more than 200 countries and 100+ metrics split into 11 themes.	Step 1: Track existing investment flows. Step 2: Outline the funding mechanisms needed.	https://worldroadstatistics.org/



Tools

High quality and standard-setting tools enable sustainable energy and mobility reap the benefits of successful implementation (table 2-6).

Table 2-6: Selected tools for expanding public transport infrastructure.

Short description	Key Resource for Infographic Step(s) #	Link
Vehicle Energy Consumption (buses).	Step 3: Learn from best practice studies on innovative financing solutions.	https://ec.europa.eu/clima/policies/transport/vehicles/vecto_en
Transport System Analytical Tools – United States Department of Energy (DOE).	Step 3: Learn from best practice studies on innovative financing solutions.	www.energy.gov/eere/vehicles/transportation-system-analytical-tools
Urban Transport Data Analysis Tool - Energy Sector Management Assistance Program (ESMAP), World Bank.	Step 3: Learn from best practice studies on innovative financing solutions.	www.esmap.org/node/55341
Better Electric Solutions for public Transport (BEST) - Italian National Agency for New Technologies, Energy and the Sustainable economic development (ENEA).	Step 3: Learn from best practice studies on innovative financing solutions.	www.enea.it/en/ateco/schede/best-2013-better-electric-solutions-for-public-transport
Tool to manage mobility and public transport data.	Step 3: Learn from best practice studies on innovative financing solutions.	https://nacto.org/managingmobilitydata/
Evaluating public transportation local funding options.	Step 2: Outline the funding mechanisms needed. Step 3: Learn from best practice studies on innovative financing solutions.	www.nctr.usf.edu/wp-content/uploads/2014/03/JPT17.1.pdf
A Handbook on Sustainable Urban Mobility and Spatial Planning – Promoting Active Mobility (UNECE).	Step 2: Outline the funding mechanisms needed. Step 3: Learn from best practice studies on innovative financing solutions.	https://thepep.unece.org/sites/default/files/2020-10/Handbook%20on%20Sustainable%20Urban%20Mobility%20and%20Spatial%20Planning.pdf
World Bank TOD Implementation Resources and Tools, Global Platform for Sustainable Cities, World Bank.	Step 2: Outline the funding mechanisms needed. Step 3: Learn from best practice studies on innovative financing solutions.	http://hdl.handle.net/10986/31121



Case Studies

The nexus of energy and mobility is not new, but rather its importance has only increased over time. For this reason, it is critical to assess rapidly what went right and what could have been improved across cases from around the world. What follows are case studies that help illuminate and inspire a path forward for others looking to implement sustainable energy and mobility (table 2-7).

Table 2-7: Selected case studies on expanding public transport infrastructure.

Short description	Key Resource for Infographic Step(s) #	Link
Transport Economic publications by UITP - With specific case studies and guidance materials.	Step 3: Learn from best practice studies on innovative financing solutions.	www.uitp.org/search-tool/?types=&topics=transport-economics&regions=&tags=&all=resources
Sustainable Urban Mobility: A global perspective on the future of electric public transportation (2020).	Step 3: Learn from best practice studies on innovative financing solutions.	www.enelfoundation.org/content/dam/enel-found/navigant/navigant/Sustainable%20Urban%20Mobility_1702_final.pdf
Comparative Case Studies of Three IDB-supported Urban Transport Projects (2015).	Step 3: Learn from best practice studies on innovative financing solutions.	https://publications.iadb.org/publications/english/document/Comparative-Case-Studies-of-Three-IDB-supported-Urban-Transport-Projects.pdf
Final report on innovative ways of sustainably financing public transport (2018).	Step 3: Learn from best practice studies on innovative financing solutions.	www.eltis.org/discover/news/final-report-innovative-ways-sustainably-financing-public-transport
Sustainable Urban Transport Financing from the Sidewalk to the Subway: Capital, Operations, and Maintenance Financing (2016).	Step 3: Learn from best practice studies on innovative financing solutions.	https://openknowledge.worldbank.org/handle/10986/23521
EU database on case studies for infrastructure including roadmaps.	Step 1: Track existing investment flows. Step 3: Learn from best practice studies on innovative financing solutions.	https://trimis.ec.europa.eu/stria-roadmaps/infrastructure
Bus charging using solar power in Jinjiang's Binjiang Business District (Fujian Province, China). Many other charging stations that use solar PV and energy storage have been developed in China since 2017.	Step 3: Learn from best practice studies on innovative financing solutions.	http://en.cnesa.org/latest-news/2019/11/29/et8hrtqdeblp7knrz3rjl6bg4ohjt
Delhi Metro Rail and Indian Railways using solar PV to power operations.	Step 3: Learn from best practice studies on innovative financing solutions.	www.delhimetrorail.com/renewable.html https://cleantechnica.com/2020/07/13/indian-railways-accelerates-toward-a-solar-future-with-new-tenders/

Short description	Key Resource for Infographic Step(s) #	Link
Dutch railway company NS achieved its 100% renewable electricity target in 2017.	Step 3: Learn from best practice studies on innovative financing solutions.	https://biofuels-news.com/news/18-new-biodiesel-fuelled-trains-coming-to-the-netherlands/
Renewables in Cities Global Status Report (REN21) – Overview of the latest energy trends in the transport sector in an urban context with a section on transport in almost every chapter, and includes case studies on bioenergy-fueled buses, renewable-based electric buses and rail, and renewable-based fuel cell buses, among many other examples.	Step 1: Track existing investment flows. Step 2: Outline the funding mechanisms needed. Step 3: Learn from best practice studies on innovative financing solutions.	www.ren21.net/renewables-in-cities-2019-gsr/#:~:text=We%20are%20pleased%20to%20announce,accelerating%20the%20sustainable%20energy%20transition.



Training and Capacity Development

There is no shortage of trainings in the energy and mobility sectors, but there are few opportunities to get a good overview of capacity development resources. Table 2-8 lists those trainings that are virtual and available at this time).

Table 2-8. Selected trainings and capacity development resources for expanding public transport infrastructure.

Short description	Key Resource for Infographic Step(s) #	Link
UITP Academy: A list of trainings by the international public transport association.	Step 3: Learn from best practice studies on innovative financing solutions.	www.uitp.org/trainings/



Additional Resources (Publications and Websites)

- [Sustainable Electric Mobility: Building Blocks and Policy Recommendations](#) opines that supporting a sustainable electric mobility development will require clear and coherent policies in both the transport and energy sectors. The paper lays out a solid basis to inform decision-makers about effective policy measures that will catalyze their efforts to transition to electric mobility. If implemented well, electric mobility can support accessible, efficient, safe, and green mobility for all.
- [Global Roadmap of Action Toward Sustainable Mobility – Universal Urban Access Policy Paper \(2019\)](#) — Access to opportunities goes beyond providing access to transport alone; what are the trade-offs?
- [Understanding the Value of Transport Infrastructure \(2013\)](#) — Guidelines for macrolevel measurement of spending and assets.
- [International Union of Railways call for proposals on door-to-door travel](#), addressing issues concerning the first or last-mile problem.
- [Renewable Energy Policies in a Time of Transition \(IEA, IRENA, REN21\)](#) — It provides policy makers with a better understanding of the broad range of policy options for an increased renewable energy deployment.
- [Working Party on Pollution and Energy \(UNECE\)](#) — Regulatory proposals on pollution and energy efficiency.
- [The Global Transport Knowledge Partnership \(gTKP\)](#) — A comprehensive resource center to fast track access to knowledge, experience, learning resources and good practices on COVID-19 and transport.

Plan for Integrated Multimodal Freight Transport Networks

Objective

Policy makers plan for the optimal location of transport corridors, linear facilities, and hubs from a multimodal network perspective based on the analysis of freight origins and destinations including a rail network development plan. A four-step approach using tools gathered—the essential background, data, tools, trainings, case studies, and additional resources—supports policy makers in planning integrated multimodal freight transport networks.

Background

Transport systems comprise a collection of corridors, linear facilities, and hubs, made up of different modes and put together as a network. The location of these network components must optimize supply, demand, and multimodal service availability of road, rail, air, and waterborne transport networks. An analysis of existing freight origins and destinations by mode of transport is an early step to understanding demand. The plan should be complete and consistent to cover the relevant territory, minimize missing links, and avoid overbuilding. Network plans for the transport system will be informed by an integrated national transport plan and integrated land use and transport planning.

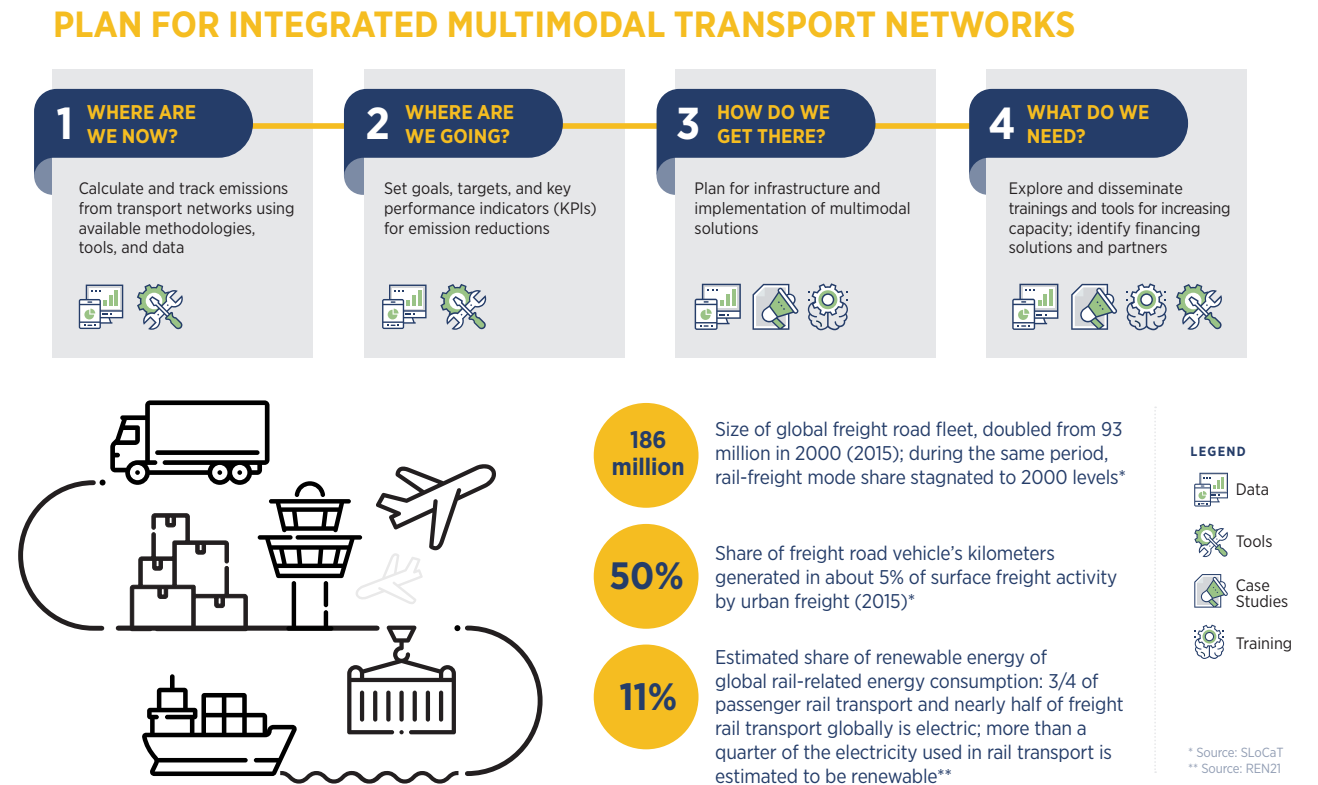
Network plans necessarily assume an expected level of performance from the modal network components. Plans need to be realistic but also strive to implement high-performing elements and characteristics. This can be enhanced through technological and regulatory innovation. Plans need to incorporate resilience and adaptation to climate change.

Freight transport efficiency is essential to optimize global supply chains and trade, and one related measure is multimodality in line with the avoid-shift-improve approach. Similarly, fuel sources need to be factored in this alignment, considering the sector relies almost entirely on fossil fuels—the primary reason behind the sector’s high emissions—despite existing alternatives such as sustainable biofuels and electrification or hybridization as well as increasing attention to newer green alternatives such as green hydrogen and renewable e-fuels (figure 2-3).¹

Three Key Recommendations for Planning for Integrated Multimodal Freight Networks

- Consider efficiency first for multimodal transport networks, and also alternative fuel sources.
- Involve the private sector such as the insurance industry to give confidence for a successful multimodal delivery chain.
- Engage in stakeholder discussions upfront to secure long-term success.

Figure 2-3. Plan for integrated multimodal transport networks.





Data

Data underpin the measurement, baseline setting, and progress tracking of sustainable energy and mobility. The following resources provide both the data as well as the necessary context for understanding and utilization (table 2-9).

Table 2-9: Selected data resources for planning for integrated multimodal freight transport networks.

Short description	Key Resource for Infographic Step(s) #	Link
Freight modal split in the EU.	Step 1: Calculate and track emissions.	https://ec.europa.eu/eurostat/statistics-explained/index.php/Freight_transport_statistics_-_modal_split
ITF materials relevant to transport, especially on the freight side for policies.	Step 4: Disseminate training to increase capacity and identify financing solutions and partners.	www.itf-oecd.org/
Energy and emissions from the freight sector by mode, including a focus on trucks.	Step 1: Calculate and track emissions.	www.iea.org/topics/transport
Transport and Climate Change Global Status Report (SLOCAT) - Trends on all modes of transport, as well as emissions reduction pathways and specific sections included on freight.	Step 1: Calculate and track emissions. Step 2: Set goals, targets and KPIs. Step 3: Plan for infrastructure and to implement multimodal solutions.	https://slocat.net/tcc-gsr/
Renewable Energy Pathways in Road Transport (FIA Foundation and REN21) - Background on technology solutions, market trends, policy frameworks, challenges, and pathways for decarbonization.	Step 1: Calculate and track emissions. Step 2: Set goals, targets and KPIs. Step 3: Plan for infrastructure and to implement multimodal solutions.	www.ren21.net/2020-re-pathways-in-road-transport/
IRF World Road Statistics Covers road and transport sector-related data for more than 200 countries and 100+ metrics split into 11 themes.	Step 1: Calculate and track emissions. Step 2: Set goals, targets and KPIs.	https://worldroadstatistics.org/



Tools

High quality and standard-setting tools enable sustainable energy and mobility reap the benefits of successful implementation (table 2-10).

Table 2-10: Selected tools for planning for integrated multimodal freight transport networks.

Short description	Key Resource for Infographic Step(s) #	Link
GHG Protocol and GHG Protocol for cities - GHG Protocol establishes comprehensive global standardized frameworks to measure and manage greenhouse gas (GHG) emissions from private and public sector operations, value chains, and mitigation actions.	Step 1: Calculate and track emissions.	https://ghgprotocol.org/
GLEC Framework for Logistics Emissions Accounting and Reporting (methodology, reporting template and emission factors for all freight modes and logistics sites, and a basis for new ISO 14083) - Smart Freight Centre and Global Logistics Emissions Council (GLEC).	Step 1: Calculate and track emissions.	www.smartfreightcentre.org/en/how-to-implement-items/what-is-glec-framework/58/
Ex-ante assessment investment of logistics projects - CE Delft and Fraunhofer IMB for European Bank for Reconstruction and Development.	Step 1: Calculate and track emissions.	www.cedelft.eu/en/publications/2236/methodology-for-ex-ante-ghg-assessment-of-logistics-investment-projects
EcoTRANSIT - GHG and air pollutant emissions from all freight modes and logistics sites, conform to EN16258 and GHG Protocol.	Step 1: Calculate and track emissions. Step 2: Set goals, targets and KPIs.	www.ecotransit.org/
Green router - GHG and air pollutant emissions from all freight modes and logistics sites.	Step 1: Calculate and track emissions. Step 2: Set goals, targets and KPIs.	www.greenrouter.it/
Green Freight Transport - Provides various documents on sustainable freight transport policies.	Step 2: Set goals, targets and KPIs. Step 3: Plan for infrastructure and to implement multimodal solutions.	https://slocat.net/1637-2
ICLEI EcoLogistics Principles - Provides specific guidance for developing sustainable urban freight.	Step 1: Calculate and track emissions. Step 2: Set goals, targets and KPIs.	https://sustainable-mobility.iclei.org/ecologistics-principles
Transport - Science-based setting Guidance (passenger and freight transport across all modes) - Science Based Targets (SBTI) 2018.	Step 1: Calculate and track emissions. Step 2: Set goals, targets and KPIs.	https://sciencebased-targets.org/resources/legacy/2018/05/SBT-transport-guidance-Final.pdf

Short description	Key Resource for Infographic Step(s) #	Link
Network for Transport Measures (NTM).	Step 1: Calculate and track emissions. Step 4: Disseminate training to increase capacity and identify financing solutions and partners.	www.transportmeasures.org/en/
ForFITS Model - Assessing Future CO2 Emissions (UNECE).	Step 1: Calculate and track emissions. Step 2: Set goals, targets and KPIs. Step 3: Plan for infrastructure and to implement multimodal solutions.	https://unece.org/forfits-model-assessing-future-co2-emissions
Estimating Fuel Efficient of Heavy-Duty Trucks - Global Fuel Economy Initiative (GFEI) Working Paper.	Step 1: Calculate and track emissions. Step 2: Set goals, targets and KPIs.	https://www.globalfuel-economy.org/data-and-research/publications/gfei-working-paper-14



Case Studies

The nexus of energy and mobility is not new, but rather its importance has only increased over time. For this reason, it is critical to rapidly assess what went right and what could have been improved across cases from around the world. What follows are case studies that help illuminate and inspire a path forward for others looking to implement sustainable energy and mobility (table 2-11).

Table 2-11. Selected case studies on planning for integrated multimodal freight transport networks.

Short description	Key Resource for Infographic Step(s) #	Link
Roadmap toward Zero Emission Logistics 2050 - <i>ALICE</i> (includes an overview of multimodal solutions on pages 21 and 22 of its hyperlinked PDF file).	Step 1: Calculate and track emissions. Step 2: Set goals, targets and KPIs. Step 3: Plan for infrastructure and to implement multimodal solutions.	www.etp-logistics.eu/?p=3152
Options for moving garment from Lao PDR across various modes.	Step 1: Calculate and track emissions. Step 4: Disseminate training to increase capacity and identify financing solutions and partners.	https://core.ac.uk/download/pdf/207761513.pdf
A clear set of steps and methodologies for the case of the U.S. state Florida.	Step 1: Calculate and track emissions. Step 2: Set goals, targets and KPIs. Step 3: Plan for infrastructure and to implement multimodal solutions. Step 4: Disseminate training to increase capacity and identify financing solutions and partners.	www.fsutmsonline.net/images/uploads/mtf-files/MTF_Freight_Data_Subcommittee_Brochure_(web).pdf

Short description	Key Resource for Infographic Step(s) #	Link
Journal article on the capacity development of multimodal professionals in Thailand case study.	Step 1: Calculate and track emissions. Step 2: Set goals, targets and KPIs.	www.ijtef.org/vol8/540-EM0022.pdf
National policies for multimodal freight transport and logistics.	Step 2: Set goals, targets and KPIs. Step 3: Plan for infrastructure and to implement multimodal solutions.	https://www.piarc.org/en/order-library/31319-en-National%20Policies%20forMulti-Modal%20Freight%20Transport%20and%20Logistics



Training and Capacity Development

There is no shortage of trainings in the energy and mobility sectors, but there are few opportunities to get a good overview of capacity development resources. Table 2-12 lists those trainings that are virtual and available at this time.

Table 2-12: Selected trainings and capacity development resources for planning for integrated multimodal freight transport networks.

Short description	Key Resource for Infographic Step(s) #	Link
Open Lecture Series at Kühne Logistics University.	Step 1: Calculate and track emissions.	www.the-klu.org/faculty-research/open-lecture-series/
Archived online training series of efficient maritime operations.	Step 1: Calculate and track emissions.	www.onthemosway.eu/category/training-knowledge-center/



Additional Resources (Publications and Websites)

- [Sustainable Electric Mobility: Building Blocks and Policy Recommendations](#) opines that supporting a sustainable electric mobility development will require clear and coherent policies in both the transport and energy sectors. The paper lays out a solid basis to inform decision-makers about effective policy measures that will catalyze their efforts to transition to electric mobility. If implemented well, electric mobility can support accessible, efficient, safe, and green mobility for all.
- [Carbon RoadMap: A multicriteria decision tool for multimodal transportation](#) — A web-based application that allows a decision maker to browse through the set of Pareto-optimal paths, display them on a map to support the selection of the desired optimum solution by weighting the three criteria.

- [A literature review of multimodal freight transport planning](#) — Traditional strategic, tactical, and operational levels of planning, where we present the relevant models and their developed solution techniques.
- [Modeling Multimodal Freight Transportation Network Performance under Disruptions](#) — a modeling framework for evaluating and optimizing freight flows on a multimodal transportation network under disruption.
- [Developing a Sustainable Urban Freight Plan: a guide](#) - Smart Freight Centre. Considerations in good freight planning.
- [Developing a Sustainable Urban Freight Plan: a review of good practices](#) - Smart Freight Centre. A review of worldwide policy good practice with 5 supporting case studies.
- [Roadmap towards Zero Emission Logistics 2050](#) - ALICE (includes an overview of roadmaps by for different regions, modes and sectors on pages 8-10)
- [A literature review of multimodal freight transport planning](#) - Strategic, tactical and operational levels of planning.
- [Electrifying EU City Logistics](#) - An analysis of energy demand and charging cost.
- [TK'Blue Accreditation and Rating Platform](#) — Andrew R. Goetz and Serena Alexander (2019), *Urban Goods Movement and Local Climate Action Plans: Assessing Strategies to Reduce Greenhouse Gas Emissions from Urban Freight Transportation*, Mineta Transportation Institute at San Jose State University.
- [The Global Transport Knowledge Partnership \(gTKP\)](#) — A comprehensive resource center to fast track access to knowledge, experience, learning resources and good practices on COVID-19 and transport.

Notes

- 1 Hybridization of trucks and buses is already economical and quickly pays for itself with fuel savings, however, fully electric heavy-duty vehicles are still more expensive. Other alternative renewable fuels include biofuels, synfuels or low-carbon liquid fuels produced from agriculture crops or waste, and biomethane. Other propulsion systems that are reaching commercial viability include hydrogen fuel cells, electric and hybrid vehicles, and electric roads (electric-powered vehicles where the energy source is external, e.g., through overhead wires).

Appendixes

Appendix A: Literature Review and Best Practices Case Studies

This annex presents the lessons from existing best practice in implementing three policies identified as important contributors to a shift to sustainable mobility. It borrows heavily from the literature review paper *“Critical elements in the planning and implementation of low-carbon transport systems: the cases of multi-modal freight, public transport and the fostering of public dialogue on new mobility solutions”* by the Applied Research Programme on Energy and Economic Growth (EEG) on behalf of the energy and mobility working group of the SuM4All initiative. The literature review essentially looked for examples of these three policy areas being implemented in practice. Additionally, the paper used the concept of avoid, shift, and improve strategies (ASI) as a way to order discussion of material under each of the policy measures in this appendix.

Promote Public Discussion on New Mobility Solutions

a. Avoid-Shift-Improve strategies

Avoid: There is need to foster public dialogue around avoid strategies. Strategies to avoid and reduce the need for motorized transport are often integrated into regional and urban development initiatives—for example, Smart City planning, new housing development projects, overarching urban mobility plans, transport management plans—all which may have their own set of public engagements.

Shift: Strategies can be deployed to engage citizens to shift to new mobility options. These range from direct engagement through public meetings to online platforms to gauge citizen preferences for new mobility options. Advocacy groups can be used to facilitate faster shift to new mobility options.

Improve: The government can introduce policies promoting electric vehicles to reduce dependence on oil, decrease greenhouse gas emissions, and reduce air pollution. Public dialogue in this case will be driven by the intention of increasing the uptake of electric mobility solutions, which will be achieved through raising awareness of the benefits, cost savings, and capabilities. A range of advocacy tools can be used to raise consumer awareness and education actions can be implemented.

b. Examples of successful public discussions on new mobility solutions

The capital of Colombia, Bogotá, included bicycling in its sustainable transportation efforts and attained a remarkable increase in bike ridership from 0.58% in 1996 to 9.10% in 2017. Though the city already had a latent bicycle culture, the successful uptake was closely linked to the use of advocacy groups (Rosas-Satizábal and Rodríguez-Valencia 2019).

Metro cable, the cable car linking disadvantaged neighborhoods to the city center in Medellín, Colombia, is a striking example of a successful citizen engagement policy in South America. The public was involved in the transition from the outset of the diagnostic phase until after the construction phase was finished, and was encouraged to follow the work's progress and to share opinions about new cable lines (Milan and Creutzig 2017). A wide variety of participation tools were used: tours, committee meetings and other public meetings, workshops and training processes, censuses, interinstitutional coordination activities, open calls, home visits, dissemination and promotion campaigns, conferences, and social events (Milan and Creutzig 2017). Medellín's case also inspired neighborhoods in other areas such as Ciudad Bolívar to start social mobilization and advocacy efforts for cable cars, snowballing into collective action that proved vital for the approval of the local budget for a similar project (Sarmiento et al. 2020).

Cape Town's citizens have been experiencing the negative impacts of a car-dominated culture. To counter issues around congestion, Open Streets Cape Town (OSCT), a nongovernmental organization focused on increasing sustainable urban mobility, conducted regular activities including advocacy campaigns, interventions, street closures, and public dialogues. OSCT has also actively promoted investments in sidewalks, cycle lanes, dropped curbs and bicycle storage to make commuting by walking or cycling easier and safer; 32 projects were completed between 2011 and 2016, with roughly 440 kilometers of cycle lanes in place as of 2017.

Expand Public Transport Infrastructure

a. Avoid-Shift-Improve strategies

Avoid: Avoid policies, which would include better urban planning, transport demand management, and vehicle restricting policies such as road pricing and parking charges, can be used to implement low carbon transport policy as was used in the ASEAN countries of Indonesia, for example. (Bakker et al. 2017).

Shift: Shift strategy relates to moving people from private cars to either public transport or nonmotorized transport, notably cycling, or walking. This process is generally incentivized through pull strategies such as making public transport more efficient and reducing journey times, or creating separate infrastructure to make cycling or walking safer, or push strategies that mitigate against private cars for example, increased parking charges or road pricing, or a combination of both. Growth in bus rapid transit (BRT) helps lower operating costs, reduces travel times, and mitigates emissions since they can carry up to ten times more people than a road full of cars (Albuquerque 2015). Strategies shifting people to make use of the BRT systems, will therefore be key.

Improve: Improve strategies involve reducing GHG emissions by fuel switching or increasing the efficiency of transport options. Electrified rail with sustainable sources of electricity for instance will incentivize energy efficiency and encourage innovations and investments increasing production of clean energy. Policies can also be used to encourage shift to cleaner fuels and purchase of electric vehicles

b. Financing public transport

Capital costs of BRT systems are high and those of metro rail systems even higher. Sources of finance are varied and could include public finance from the national and municipal governments, fees charged on vehicles—parking, road charges, gasoline tax—can also be used to expand

existing services as in, for example, Seattle (Peterson 2017), Amsterdam (Carran-Fletcher et al. 2020) and Bogotá (Centre for Public Impact 2016), but not to cover initial construction costs. Operational costs of BRTs and subways are fully covered by ticketing revenue in some cases such as in Bogotá (Sabation 2017). Other forms of green finance can be used as was the case in the city of Johannesburg in South Africa where a green city bond worth US\$143 million was issued in June 2014, with maturity set at 10 years. The bond was issued to fund a variety of low carbon projects including dual-fuel buses (Junghans and Dorsch, 2015). The Green Climate Fund (GCF), set up by the UNFCCC in 2010, is also a potential source of finance for low carbon transport. Multilateral development bank climate financing also plays a critical role in financing transport. However, public funding will continue to play a significant role in financing modal shifts and improvements in public transport.

c. Case study

The TransMilenio BRT in Bogotá is a good example of a success story. The system was conceived in 1999 to address poor public transport in the city for a rapidly growing population. Low quality, privately owned buses, an oversupply of bus seats resulting from competition between owners, uneven service routes, lax safety standards, and heavy congestion all discouraged the use of public mass transportation and led to heavy air pollution (Sabation 2017). The TransMilenio system was developed to address these issues. It covers 112 kilometers of routes and serves more than 2.2 million passenger journeys a day using 1,500 buses. Accounting for about 25 percent of all transit trips in the Columbian capital city, TransMilenio is credited with reducing average travel time by 32 percent, reducing traffic accidents by 50 percent, increasing property values by 20 percent along main line (Tran, Marcela, and Contreras 2018) and leading to a 40 percent reduction in air pollutants in the city (Sabastian 2017). Factors influencing its success included:

- **Political commitment:** TransMilenio was given a very high priority in urban planning by the city authorities and Mayor's office, as the main component of the city's mobility strategy.
- **Evidence-based design:** The BRT system in Bogotá draws on the structures used in Curitiba, Brazil, and Quito, Ecuador, and so is based on learning from peers and a proven business plan.
- **Financial feasibility:** At US\$340 million, the capital cost was relatively low—nearly 10 percent of the budgeted costs of the previously planned, but not implemented, heavy rail transit project. Public sector finance for the project came from a fuel tax (46%), local revenues (28%), a credit from the World Bank (6%), and grants from the national government (20%). Half of the 25 percent gasoline tax levied in Bogotá is used for the continued expansion of TransMilenio (Urban Sustainability Exchange 2019)

The TransMilenio system runs as a public-private partnership without any operational subsidies. The public sector provided the infrastructure investments outlined above, while the private sector manages its bus fleets, fares, and ticketing systems within an agreed framework. Although frequently cited as a success story, TransMilenio has had its fair share of challenges, with public protests and rioting in response to overcrowding on the system in 2012 (Jaffe 2012) and ongoing issues with sexual harassment and security issues for women (Moloney 2017; Kash 2019).

Plan for Integrated Multimodal Freight Transport Networks

a. Avoid-Shift-Improve strategies

Avoid: Freight activity could be avoided by reducing the overall demand for freight or by optimizing vehicle use and load to avoid excess trips. However, care should be taken with reducing overall demand for freight as it could have adverse economic effects (Kaack et al. 2018). A shift to a circular economy could also help avoid unnecessary travel. Avoiding freight activity by optimizing the use and load of each vehicle and thereby reducing the number of vehicle-kilometers required also holds a lot of potential. However, care should be taken as overloading trucks can result in damages to vehicles and roads and has a significant implication on road safety and the environment.

Shift: GHG emissions from freight activity can be substantially reduced by shifting freight to low carbon intensity modes (Kaack et al. 2018). The amount of emissions produced per kilometer of freight depends largely on whether it is transported by air, road, rail, or ship, but this varies depending on factors such as the age of fleet, average payload, and fuel type used.

- Radiative-forcing impacts of aviation emissions are thought to be more problematic than CO₂ emissions due to chemical interactions at high altitudes, as indicated by IPCC. This makes per capita emissions from air travel one of the highest in comparison to various other modes of transport.
- Shifting freight onto less polluting modes, particularly from road to rail and inland waterways, can lead to significant reductions in GHG emissions

Improve: GHG emissions can be reduced through technical improvements such as increasing the efficiency of freight vehicles or by switching to lower carbon fuels. The IEA estimated that improvements in energy efficiency combined with alternative fuels could lead to a 34 percent reduction in energy intensity of road freight and a 75 percent reduction in direct CO₂ emissions by 2050. Energy efficiency of trucks should also be improved through improvements to diesel engines and shifts to hybrid-electric engines. Full electrification could also be achieved through improved batteries, hydrogen fuel cells or electrified roadways (IEA 2017). Biofuels, including bioethanol and biodiesel, also offer lower carbon alternatives.

- Electrified rail freight offers a lower carbon alternative to road transport if the source of electricity is clean.
- Inland water freights also have a lower carbon intensity than road shipments.

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