CLIMATE SMART GOVERNANCE

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seeds
TECHNICAL SERVICES

SECTOR - 6

CLIMATE CHANGE AND TRANSPORTATION

TRAINING MODULE
(2017-2020)

CLIMATE CHANGE AND TRANSPORTATION

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1. TRANSPORTATION AND CLIMATE CHANGE

Transportation is uttered in terms of modes of travel, which are categorized broadly as occurring by land, air, and water. Within that broad categorization, transportation modes may also be classified in terms of the physical infrastructure that is used and include those that use rail, road, ships, and airplanes, each of which can be subdivided further (Urban Climate Change Research Network [UCCRN], 2014).

Climate change is probably damage transportation infrastructure through higher temperatures, more severe storms and flooding, and higher storm surges, affecting the reliability and capacity of transportation systems. Coastal roads, railways, ports, tunnels, and airports are vulnerable to sea level rise, which could lead to delays as well as temporary and permanent closures. Climate change impacts will likely increase the cost of the nation's transportation systems (United States Environmental Protection Agency [EPA], 2016).

1.1 Transportation contributes to climate change

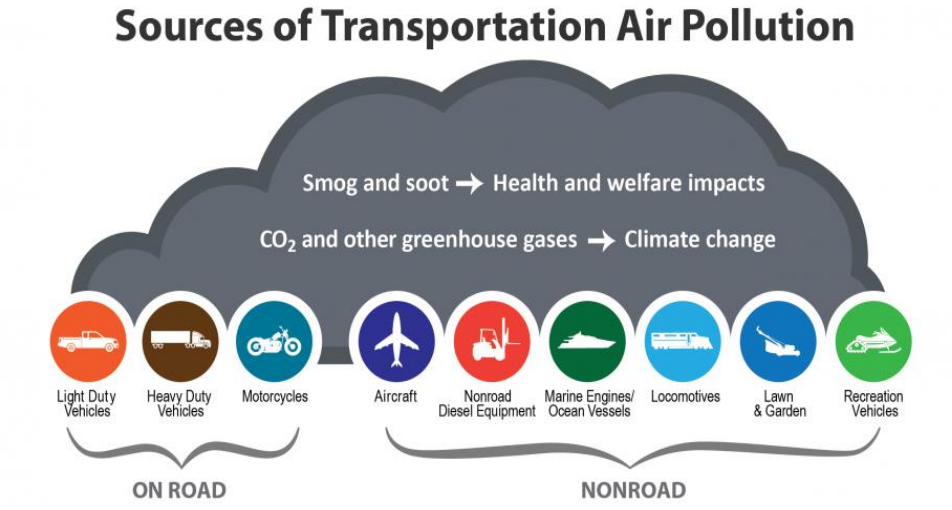

Figure 6.1: Sources of Transportation Air Pollution

Source: https://www.epa.gov/sites/production/files/styles/large/public/2016-02/learn_about_infographic_9-17-2015-01.png

Transport relies overwhelmingly on oil, with over 53% of global primary oil consumption in 2010 used to meet 94% of transport energy demand. This makes the transport sector a key area for energy security concerns and a major source of air pollutants such as ozone, nitrous oxides and particulates, as well as carbon dioxide.

Transport can be vulnerable to many different types of weather conditions, of which, some of them could be exacerbated with climate change. Many of them relate to extreme weather conditions (e.g. storms, extreme precipitations, and extreme temperatures) which on their turn may result in severe consequences for the physical environment (e.g. floods, landslides, avalanches) and represent risks for transport infrastructures and operations (Nemry & Demirel, (2012).

1.2 Climate change and its potential impacts on transportation

Transportation not only affects climate, but it is also affected by climate change. Climate change impacts will vary between transport modes and their associated infrastructure, with impacts also varying widely between and within regions. Future changes in freight and passenger traffic may reflect the relative sensitivity of different transport modes to extreme weather events and other climate change impacts. For business, this implies a need to assess supply-chain risk and build redundancy and resilience into logistics networks to account for a higher likelihood of disruption (Business for Social Responsibility [BSR], n.d).

	Operations	Infrastructures
 Heat waves	• Impact of lift-off load limits on shorter runways • Limits on periods of construction activity	• Thermal expansion of bridges • Pavement integrity and softening • Deformation of rail tracks
 Rising sea levels	• Frequent interruptions of coastal low lying road, rail and air traffic due to storm surges	• More frequent flooding of infrastructure (and potential damage) in low lying areas • Erosion of infrastructure support • Changes in harbor facilities to accommodate higher tides and surges
 Intensity of precipitation	• Increase in weather related delays and disruptions particularly road and air transport	
 More frequent hurricanes	• Frequent interruptions of air services • Frequent and extensive evacuations of coastal areas • Debris of road and rail infrastructure	• Greater probability of infrastructure failure • Greater damage to port infrastructure
 Increase in arctic temperatures	• Longer shipping season • More ice-free ports in North regions • Availability of trans-arctic shipping routes	• Damage to infrastructure because of the thawing of the permafrost • Shorter season of ice-roads

Figure 6.2: Climate change impacts on transportation

Source: The Geography of Transport Systems, (2018), https://transportgeography.org/?page_id=9427

2. NATIONAL AND INTERNATIONAL SCENARIO:

Carbon dioxide (CO_2) represents the largest proportion of the basket of greenhouse gas emissions covered by the Kyoto protocol. Over the past three decades, carbon dioxide emissions from transport have risen faster than those from all other sectors and are projected to rise more rapidly in the future Gesellschaft fur Technische Zusammenarbeit [GTZ], 2007). According to the ITF's baseline scenario, which is based on current carbon emissions rates and policies in effect today, emissions from global transportation will rise by 60% between 2015 and 2050 (Planete Energies, 2017).

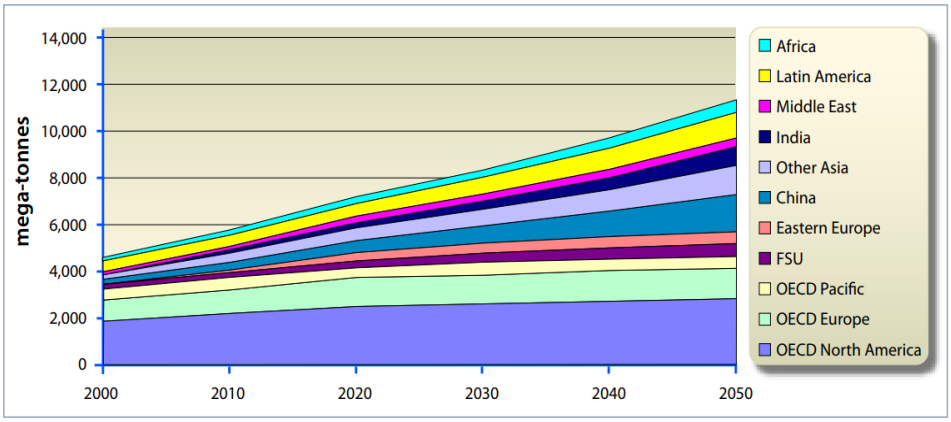

Figure 6.3: Transportation vehicle CO_2 emissions by region

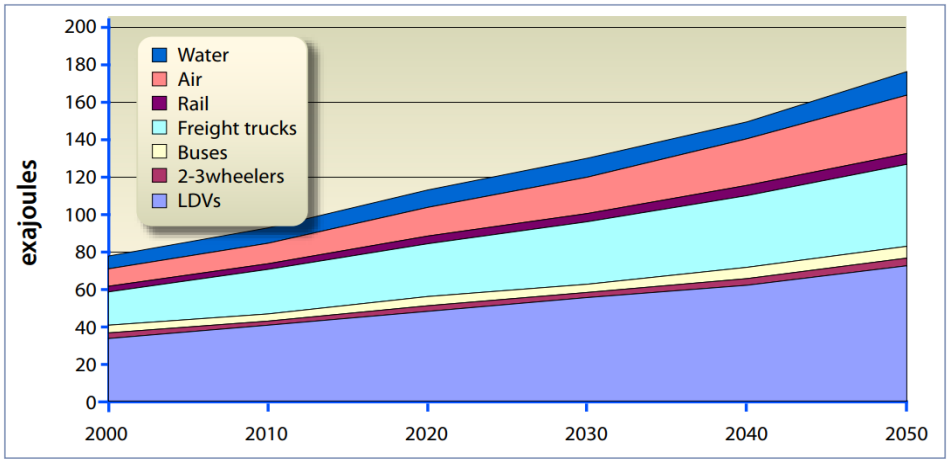

Figure 6.4: Global transport fuel use by mode

The majority of transport fuel emissions (76%) are from road transport. Light Duty Vehicles (LDVs) – i.e., four-wheeled vehicles, including cars, sports utility vehicles (SUVs), small passenger vans, and personal pickup trucks- are the most important source. Air travel produces around 12% of transport CO_2 emissions and its share is growing rapidly. Various transport modes contribute to global warming by more than their direct emissions of CO_2, e.g., via the upstream CO. emissions from oil refineries, electricity used by electric trains, etc. (GTZ, 2007).

As the transport sector will be highly exposed to climate change, it will require extensive adaptation of infrastructure, operations and service provision. It will also be indirectly affected by adaptation and decarbonisation in the other sectors that it serves (BSR, n.d).

3. SUSTAINABLE TRANSPORT

The concept of sustainable transportation promotes a balance between transportation's economic and social benefits and the need to protect the environment. It allows the individuals and societies to meet their access needs safely and in a manner consistent with the human and ecosystem health, with equity within and between generations. It make sure that transportation is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy. It also limits emissions and waste within the planet's ability to absorb them, minimizes consumption of non-renewable resources, limits consumption of renewable resources to the sustainable yield level, reuses and recycles its components, and minimizes the use of land and the production of noise.

There are three primary ways to reduce greenhouse gas emissions from transport:

- **Avoid:** (i.e., avoid or reduce travel or the need to travel)
- **Shift:** (i.e., shift to more environmentally friendly modes) and
- **Improve:** (i.e., improve the energy efficiency of transport modes and vehicle technology) (GTZ, 2007).

Without sustained action, greenhouse gas (GHG) emissions from transport will continue to rise in line with growth in GDP. However, a number of options for mitigating emissions exist through policy, infrastructure and technology advances - for example through:

- Improving fuel economy and manufacturing standards to support vehicle efficiency
- Using urban planning, technological innovations and education to reduce transport demand
- Using pricing schemes and infrastructure improvements to support modal shifts from private vehicles to mass transit systems, electric vehicles, cycling and walking
- Using incentives to business and appropriate infrastructure investments to further support modal shifts of freight from short- and medium-haul aircraft and road trucks to high-speed rail and coastal shipping (BSR, n.d).

Because climate change has the characteristics of a collective action problem at the global scale, effective mitigation will not be achieved if individual agents advance their own interests independently, even though mitigation can also have local co-benefits. Cooperative responses, including international cooperation, are therefore required to effectively mitigate GHG emissions and address other climate change issues. A variety of sustainable transport instruments can be incorporated within these strategies (Intergovernmental Panel On climate change [IPCC], 2014).

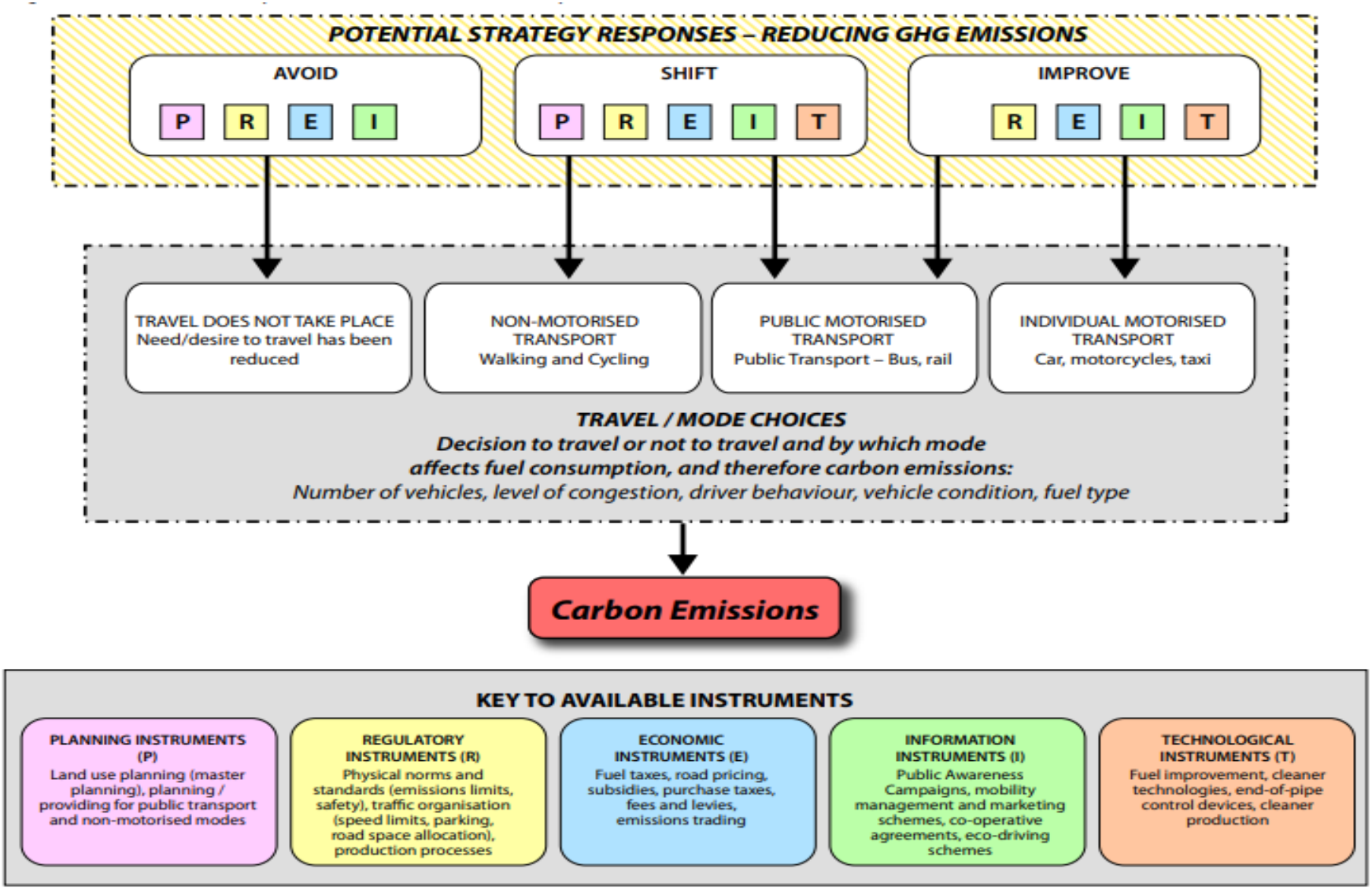

Figure 6.5: Sustainable Transport Instruments and there impacts on carbon emissions
Source: http://transferproject.org/wp-content/uploads/2014/05/GIZ-Module-5e_Transport-and-Climate-Change.pdf

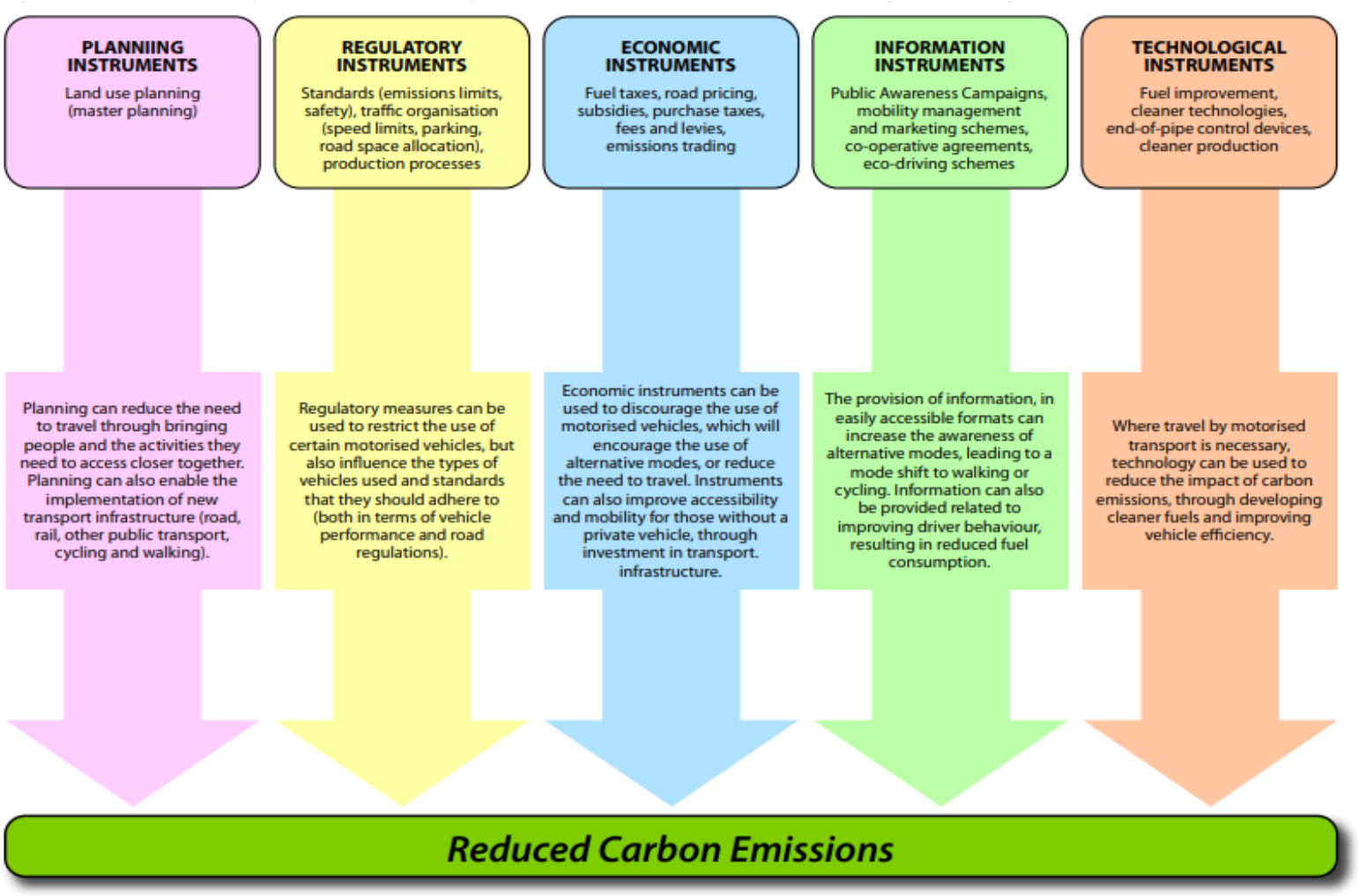

Figure 6.6: Sustainable Transport Instruments and potential contribution in GHGs reduction
Source: http://transferproject.org/wp-content/uploads/2014/05/GIZ-Module-5e_Transport-and-Climate-Change.pdf

MITIGATION MEASURES	Effect on additional objectives/concerns		
	Economic	**Social**	**Environmental**
Reduction of carbon intensity of fuel	Energy security (diversification, reduced oil dependence and exposure to oil price volatility) (*m/m*); technological spillovers (*l/l*)	Mixed health impact via increased/reduced urban air pollution by electricity and hydrogen (*r/h*), diesel (*l/m*); road safety concerns (*l/l*) but reduced health impact via reduced noise (*l/m*) of electric LDVs	Mixed ecosystem impact of electricity and hydrogen via reduced urban air pollution (*m/m*) and material use (unsustainable mining) (*l/l*)
Reduction of energy intensity	Energy security (reduced oil dependence and exposure to oil price volatility) (*m/m*)	Reduced health impact via reduced urban air pollution (*r/h*); road safety (crash-worthiness depending on the design of the standards) (*m/m*)	Reduced ecosystem and biodiversity impact via reduced urban air pollution (*m/h*)
Compact urban form and improved transport infrastructure Modal shift	Energy security (reduced oil dependence and exposure to oil price volatility) (*m/m*); productivity (reduced urban congestion and travel times, affordable and accessible transport) (*m/h*)	Mixed health impact for non-motorized modes via increased physical activity (*r/h*), potentially higher exposure to air pollution (*r/h*), reduced noise (via modal shift and travel reduction) (*r/h*); equitable mobility access to employment opportunities (*r/h*); road safety (via modal shift) (*r/h*)	Reduced ecosystem impact via reduced urban air pollution (*r/h*) and land use competition (*m/m*)
Journey distance reduction and avoidance	Energy security (reduced oil dependence and exposure to oil price volatility) (*r/h*); productivity (reduced urban congestion/ travel times, walking) (*r/h*)	Reduced health impact (for non-motorized transport modes) (*r/h*)	Mixed ecosystem impact via reduced urban air pollution (*r/h*), new/ shorter shipping routes (*r/h*); reduced land use competition from transport infrastructure (*r/h*)

Figure 6.7: Potential co-benefits (blue text) and adverse side effects (red text) of the main sectoral mitigation measures. Co-benefits and adverse side effects, and their overall positive or negative effect, all depend on local circumstances as well as on the implementation practice, pace and scale. The uncertainty qualifiers between brackets denote the level of evidence and agreement on the respective effect. Abbreviations for evidence: l = limited, m = medium, r = robust; for agreement: l = low, m = medium, h = high

Source: IPCC (2014), https://www.ipcc.ch/pdf/assessmentreport/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf

A variety of climate policy instruments have been employed, and even more could be employed, at international and regional levels to address mitigation and to support and promote adaptation at national and sub-national scales as discussed in table below:-

Policy Instruments	Transport
Economic Instruments –Taxes (carbon taxes may be economy-wide	• Fuel taxes • Congestion charges, vehicle registration fees, road tolls • Vehicle taxes
Economic Instruments –Tradable Allowances (may be economy-wide	• Fuel and vehicle standards
Economic Instruments – Subsidies	• Biofuel subsidies • Vehicle purchase subsidies
Regulatory Approaches	• Fuel economy performance standards • Fuel quality standards • Greenhouse gas (GHG) emission performance standards • Regulatory restrictions to encourage modal shifts (road to rail) • Restriction on use of vehicles in certain areas • Environmental capacity constraints on airports • Urban Planning and Zoning restrictions
Information Programmes	• Fuel Labelling • Vehicle efficiency labelling
Government Provision of Public Goods or Services	• Investment in transit and human powered transport • Investment in alternative fuel infrastructure • Investment in alternative fuel infrastructure • Low-emission vehicle procurement

Source: IPCC, (2014).

4. CASE STUDIES

Study 1: Fort Street Revival, Victoria

The City of Victoria, British Columbia, created a plan to "promote a green, clean, walkable and safe city." The plan aims to promote alternate modes of transportation, improve mobility in the centre of the city, and reduce motor vehicle pollution. The city made changes in four key areas:

- Improved bicycle safety. Creating a dedicated bike lane increased the safety of cyclists along this key bike travel route.
- Improved pedestrian safety. Pedestrian safety was improved at a signal crosswalk at Fern Street by creating a centre refuge island. Creating boulevards where possible, the city separated pedestrians from vehicle traffic. Bike lanes also buffered pedestrians from cars.
- Reduced vehicle speeds. Landscaped medians and fewer vehicle lanes means slower traffic speeds. Adding centre medians and making lanes less wide reduces collisions and vehicle speed.
- Changes to street parking. Congestion was reduced by removing limited evening parking on one side of the street. Time limited parking on both sides of Fort Street was kept to help nearby businesses.

Fort Street is one of three key streets in the city's bikeway network. Improving Fort Street for cycle traffic would help improve the bikeway network as well. Cycling, an excellent alternative to driving, is already the fastest growing mode of transportation in the city. Cycling could represent 1/5th, or 20%, of commuter trips in Victoria by 2026 (GreenLearning, 2010).

Study 2: A Shift from Private to Public Transport, South Africa

South Africa, a country that traditionally emphasized a private vehicle model of transport, has initiated new investments and policies aimed at promoting a shift from private to public transport.

Key components of the shift include:

- Bus Rapid Transit (BRT) initiatives;
- implementation of a modern commuter Gautrain;
- improved non-motorized transport facilities;
- heightened safety regulations;
- improves organization of the country's paratransit (minibus and taxi) system;
- collaboration with international agencies and civil society.

While the new systems have had a positive impact, there has been opposition over the infrastructure costs involve. Some groups, such as paratransit operators and communities through which new transit routes were proposed, have shown resistance to the project (World Health Organization [WHO], 2018).

5. GOVERNMENT POLICIES

a) National Urban Transport Policy

Ministry of Urban Development, Government of India (MoUD) issued the National Urban Transport Policy (NUTP) in 2006, to bring about comprehensive improvements in urban transport services and infrastructure. The policy focus is on moving people rather than vehicles. Eight years have passed since then and several new initiatives have been taken by MOUD to promote good mobility in cities.

The objective of this policy is to plan for the people rather than vehicles by providing sustainable mobility and accessibility to all citizens to jobs, education, social services and recreation at affordable cost and within reasonable time. This will involve:

- Incorporating urban transportation as an important parameter at the urban planning stage rather than being a consequential requirement.
- Bringing about a more equitable allocation of road space with people, rather than vehicles, as its main focus
- PT should be citywide, safe, seamless, user friendly, reliable and should provide good ambience with well-behaved drivers and conductors.
- Walk and cycle should become safe modes of UT.
- Introducing Intelligent Transport Systems for traffic management
- Addressing concerns of road safety and trauma response
- Raising finances, through innovative mechanisms
- Establishing institutional mechanisms for enhanced coordination in the planning and management of transport systems.

- Building capacity (institutional and manpower) to plan for sustainable urban transport and establishing knowledge management system that would service the needs of all urban transport professionals, such as planners, researchers, teachers, students, etc.

The objectives of this policy would be achieved through comprehensive approach include Urban Transport Planning, Infrastructure Design, Public Transport, Non-Motorized Transport, Traffic Management, Financing, Governance and Capacity Building (Ministry of Urban Development, 2014).

6. WAY FORWARD

Climate adaptation and mitigation for the transport sector poses complex challenges for policy makers, business actors and civil society due to perceived and real trade-offs between upfront costs and longer term benefits. This sector will also be indirectly affected by the adaptation and decarbonisation of the other sectors that it serves. There is a need to develop strategies for efficiency, modal shift and acceleration of the development and deployment of low-carbon fuels/vehicles in global logistics networks.

7. FURTHER READINGS

- https://www.bsr.org/reports/BSR-Cambridge-Climate-Change-Implications-for-Transport.pdf
- https://www.conserve-energy-future.com/modes-and-benefits-of-green-transportation.php

- http://www.itdp.in/wp-content/uploads/2014/11/NUTP-2014.pdf

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