

# **Regional Climate Ambition in Transport**

Insights of the Regional Peer Network Sessions in Asia



On behalf of:



Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

of the Federal Republic of Germany

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### **Project Context**

The 'NDC Transport Initiative for Asia' (NDC TIA) project is funded by the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety's, International Climate Initiative. In each partner country, the project supports sectoral contributions to achieve their Nationally Determined Contributions (NDCs) and promotes long-term climate strategies to reach the 2025 NDC milestone with clean transport policies: e-mobility, urban mobility and fuel economy. NDC TIA feeds into other international cooperation projects run by the Government of Germany.

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We would especially like to express our sincere gratitude to our peers from the Regional Peer Network on Transport and Climate Change Africa who have made the exchanges. Thank you for sharing your own experiences so honestly. We'd also like to thank our international guest speakers, who shared their expertise and helped stimulate such interesting discussions. Last but not least, thank you to the team of move2change, that was in charge of the preparation and facilitation of the exchanges.

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# List of Acronyms and Abbreviations

ADB	Asian Development Bank			
APAN	Asian Pacific Adaptation Network			
ATO	Asian Transport Outlook			
BEV	Battery electric vehicle			
3MU German Ministry for the Environment, Nature Conservation and Nu Safety				
BRT	Bus Rapid Transit			
CO2	Carbon dioxide			
COP26	26th United Nations Climate Change conference			
DPDHL	Deutsche Post DHL			
e2W	Electric two-wheelers			
e3W	Electric three-wheelers			
EIB	European Investment Bank			
EUR	Euro			
EV	Electric vehicle			
G20	Group of Twenty			
GDP	Gross Domestic Product			
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH			
GHG	Greenhouse gas			
HEV	Hybrid electric vehicles			
ICE	Internal combustion engines			
ICEV	Internal combustion engine vehicles			
IPCC	Intergovernmental Panel on Climate Change			
IsDB	Islamic Development Bank			
LTS	Long Term Strategy			
M&E	Monitoring & Evaluation			
NDC	Nationally Determined Contributions			
NUMP	National Urban Mobility Policy and Investment Programme			
OECD	Organisation for Economic Co-operation and Development			
PHEV	Plug-in hybrid electric vehicle			
PIANC	ANC The World Association for Waterborne Transport Infrastructure			
PV	Photovoltaics			
SLOCAT	Partnership on Sustainable, Low Carbon Transport			

SUMP	Sustainable Urban Mobility Plan
ТСО	Total cost of ownership
UIC	International Union of Railways
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
USD	US-Dollar
WMO	World Meteorological Organisation
WRI	World Research Institute



1. Introduction

In early 2021 and in a joint effort, the three IKI-financed GIZ projects "Advancing Transport Climate Strategies", "NDC Transport Initiative for Asia" and "Moving Chile" initiated regional networks of transport and environment officials in Africa, Asia, and Latin America. For each region, a dedicated "Peer Network" was set up, and representatives from ministries of environment and ministries of transport from across the region were invited to participate. The networks provided a space for officials from national transport and environment ministries of about 10 countries per region to meet, learn and exchange experiences on similar challenges, and to link and align transport and climate policy on the national level.

Each network hosted a series of thematic sessions on transport and climate relevant topics, where peers came together to learn from international guest speakers, to present their own countries' experiences, and to discuss challenges and solutions in interactive working groups. The topics are based on the six action recommendations to enhance climate ambition in transport:



#### Figure 1: Six Action Recommendation for Policymakers

This paper provides an accumulation of insights of the Regional Peer Network sessions in the Asian region between May 2021 and January 2022. In accordance with the action recommendations from the publication "Enhancing Climate Ambition in Transport" (GIZ 2020) the six focus topics include 'Climate targets' (27.05.21), 'Electrification of transport' (08.07.21), 'National urban mobility policies and investment programmes (NUMPS)' (26.08.21), 'Enhancing freight systems efficiency' (21.10.21), 'Sustainable transport infrastructure investment' (09.12.21) and 'Adaptation and resilience in transport systems' (20.01.22). Each chapter of this publication explains the relevance of the topic for transforming transport, recommends action steps for a successful implementation and sets the Asia region in context with the topic. Additionally, resources and tools are suggested, that may support the execution of the recommended measures for developing sustainable transport systems.



# 2. Climate Targets

(Status of Peer Exchange Meeting on 27.05.21)

#### Why climate targets are essential for sustainable transport development

At present, the transport sector depends almost completely on fossil fuels. This makes the sector the least diversified energy end-use sector, with dramatic consequences for our climate. Globally,  $CO_2$  emissions from transport account for about 23% in the case of the total man-made  $CO_2$  emissions worldwide. There is widespread agreement that  $CO_2$  emissions from transport need to be at least halved by 2050 at the latest (UNECE 2021).

In comparison to all other economic sectors, transport activity is the fastest growing source of emissions. Without participation of all sectors of the global economy, however, the challenges of climate change mitigation will not be met, and it will prove impossible to limit global warming to well below 2°C as stated in the Paris Agreement (see Figure 2).



Figure 2: Transport CO2 emissions scenarios

Source: Axsen, J., Plötz, P., Wolinetz, M. (2020)

Ambitious climate targets are essential to put the world on track. Hence, the Paris Agreement requires all countries to prepare, maintain, implement and communicate national climate targets for the mid- and long-term (the Nationally Determined Contributions, NDC, as well as long-term low GHG emission development strategies, LTS), according to their specific circumstances and level of development. But so far, transport is underrepresented in most national climate strategies (GIZ 2022).

Beyond the reduction of GHG emissions, climate policies and targets pose an important opportunity for African countries to avoid negative effects from fossil-fuel based motorization, and to adopt sustainable transport policies that reduce inequalities and congestion while improving energy efficiency, air quality, road safety and access. Furthermore, sustainable transport plays a pivotal part in enabling overall sustainable development and investments, economic growth and employment. For these reasons, shifting the paradigm toward zero-carbon targets it essential.

#### Five focus areas for setting and achieving climate targets in transport

The following areas are central to increasing transport climate action.

#### Focus area I - Transport climate mitigation - Targets

A comprehensive long-term approach is necessary and requires a combination of Avoid, Shift and Improve strategies for passenger and freight transport. Moving away from the marginal reduction of emissions and towards the creation of a zero-carbon transport system is essential for reaching global climate goals – and for making transport more equitable, sustainable and safe.

Clear time bound targets are necessary for communicating ambition, aligning multiple actors, focusing resources and monitoring progress. Concrete sector targets for GHG mitigation allocate a clear carbon budget to each sector. This enables sectoral planning and monitoring of climate policies. The more refined those targets are – e.g. through transport mode targets – the easier it gets for all relevant actors to plan for the future and allocate investments in the most efficient way.

Global campaigns and partnerships such as the Marrakech Partnership for Global Climate Action promote target-based breakthroughs in transport climate action that shift the paradigm towards decarbonization of the sector.

#### Focus area II - Transport climate mitigation - Avoid and Shift Strategies

Avoid and Shift strategies encompass measures that aim at reducing the need to travel overall (avoid energy consumption and emissions through reduced travel needs and activity) or shift the choice of transport mode towards more energy efficient and less carbon-intense ways of travel.



#### Figure 3: Avoid, Shift, Improve Framework

Source: TUMI (2019)

Figure 3 shows that Avoid and Shift measures aim at changing the transport user's behavior by eliminating the need to travel overall or through increasing or decreasing the attractiveness of certain modes. One example of an avoid-measure is the 15-minute city in which daily urban necessities are within a 15-minute reach on foot or by bike. Examples for shift strategies are the promotion of public transport instead of private vehicles and the shift of transporting freight goods from road to rail.

#### Focus area III - Transport climate mitigation - Improve Strategies

The third important pillar to decarbonize transport is the efficiency improvement of vehicles and fuels (see Figure 2). Potential for improvement lies also in higher occupancy rates, better maintenance of vehicles, lowered costs of operation and maintenance, lighter materials, more efficient transport systems overall as well as the use of energy sources with low carbon intensity, e.g. by introducing electric vehicles that use energy from renewable energy sources only.

#### Focus area IV - Climate targets and stakeholder engagement

The large-scale transformation of the transport sector requires the support of a wide range of stakeholders and close collaboration between the public and private sectors. Improved dialogue between the domains of urban and spatial planning, finance, business and energy under the rubric of climate protection will help decision-makers to design more effective policy instruments and address the challenges that accompany ambitious change, including negative impacts to existing business models and jobs.

### Focus area V - Climate targets and the Sustainable Development Goals

The 2030 Agenda's SDGs state that "sustainable transport systems, along with universal access to affordable, reliable, sustainable and modern energy services, quality and resilient infrastructure, and other policies that increase productive capacities, would build strong economic foundations for all countries". In other words, the transformation towards a climate-friendly transport system through climate targets and policies presents opportunities for benefits beyond climate change mitigation, such as improved health through less air and noise pollution, improved road safety, economic growth and more equal access to transport services for all parts of the population.

#### The Asian context for climate targets in transport

Historically, Asia's contribution to global transport emissions has seen a steady and continuous increase. Over the last twenty years it has seen the highest absolute growth in transport CO2 emissions of all regions of the world. Between 1990 and 2018, transport CO2 emissions increased by 243% (Asian Transport Outlook, 2020). Based on latest data from the Asian Transport Outlook, the region is now responsible for 27% of global sector emissions, up from only 14% in 1990 (Asian Transport Outlook, 2020). The large increase in transport emissions is closely correlated with economic and population growth. Between 2000 and 2016, the GDP of Asian countries grew 106% and the general population equalled 4.48 billion in 2017. This growth led to increasing demand in passenger vehicle ownership, with China and India seeing a growth of 1300% and 300% between 2000 and 2016 respectively. Without broad interventions and investments into public transport, cars will account for 40% of all vehicles in Asia by 2050. Such a development would not be on track with the required decarbonisation pathways.

Per capita emissions in Asia grew at the fastest rate in the world between 2000 and 2016 (61%). With increasing urbanisation, population growth, and transport demand, Asian cities have seen stark increases in sprawl, local air pollution, and traffic congestion and accidents. In order to enable access to mobility, Asia must set the course for the implementation of sustainable and climate-friendly transport systems, to channel investments to future-proof solutions that avoid sunk cost, and to support economic growth and employment opportunities along the value chains of sustainable mobility. Green recovery funds that have been put in place to soften the economic repercussions of the ongoing Covid-19 pandemic could foster this further. It is paramount to ensure that recovery investments are fostering a decarbonisation of the transport sector in a sustainable and just manner instead of perpetuating carbon-intensive growth.

As of today, 12 Asian countries have handed in their new or updated NDCs, with only four of these containing some form of quantitative target in the transport sector, all related to electric and/or hydrogen vehicle. Three countries – Japan, the Republic of Korea and Singapore – have submitted long-term strategies to the United Nations Framework Convention on Climate Change (UNFCCC). Japan and Singapore include comprehensive strategies to avoid, shift and improve with clear related targets. The Republic of Korea sets the overall economic target to become climate neutral but does not break this down into individual targets for sectors or modes and focuses more on shift and improve strategies (Dalkmann, 2020; Republic of Korea, 2020). Furthermore, China announced to become carbon neutral by 2060, but has not yet submitted a LTS to the UNFCCC (Climateworks Foundation, 2020). In other words, there is still a lot of potential for stronger and more ambitious Asian NDCs and LTS, backed by measurable targets.

Another opportunity for Asian governments to commit to stronger decarbonisation targets in the transport sector is the Environmentally Sustainable Transport Forum (EST), which is developing its new Declaration until to 2030 under the headline "Making Transport in Asia Sustainable – Sustainable Transport Goals for achieving universally accessible, safe, affordable, clean and net-zero-passenger and freight transport in Asia".

#### **Resources and tools**



#### Tracker of Climate Strategies for Transport

**GIZ** in cooperation with **SLOCAT** developed a Tracker that enables the reader to get a clear picture of ambition, targets and policies in NDCs and Long-Term Strategies by countries to support sustainable transport. The Tracker is constantly being updated.

https://changing-transport.org/tracker/

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# 3. Electrification of Transport

(Status of Peer Network Meeting on 08.07.21)

#### Why electrification is essential for sustainable transport development

At present, the transport sector depends almost completely on fossil fuels (98%). This makes the sector the least diversified energy end-use sector, with dramatic consequences for our climate and public health. Avoid allows us to refrain from unnecessary motorised travel, while at the same time ensuring accessibility. Together with Shift strategies which promote more efficient transport modes, transport and energy demand can be reduced. As a third pillar, Improve strategies which aim to increase the efficiency of vehicle and fuel technology are equally important to ensure the essential transport demand can be met as efficiently and carbon neutral as possible.

A core component of a sustainable transport sector is the electrification of road transport. Electric mobility plays a key role, as electric vehicles (EVs) can enable substantial GHG (greenhouse gas) emission reductions, especially when powered by electricity from low-carbon sources. Regardless of the power source and potential GHG reductions, EVs offer several more advantages. They are significantly more energy efficient than internal combustion engine vehicles (ICEV) and play an important role in reducing local air and noise pollution, as they emit near-zero local air pollutants at the "tailpipe" and are much quieter at low speeds than ICEV (GIZ, 2020).

### What is electric mobility?

The term *electric vehicle* is used to refer to different vehicle technologies that use electric propulsion (mainly consisting of a battery and an electric motor among others) as part of their powertrain. The main types of EVs are the plug-in hybrid electric vehicle (PHEV) and the full battery electric vehicle (BEVs). While non-plug-in hybrid electric vehicles (HEV) are sometimes included in the EV category, here HEVs are considered as a fuel economy improvement – efficiently reusing kinetic energy from braking – rather than a transformational technology. As PHEVs still partly rely on fossil-fuels, BEVs are widely regarded as the way forward to reap the full efficiency and pollution benefits.

Electric mobility does not only include cars but refers to many modes of transport including the electrification of the rail sector, electrifying two- and three-wheelers, as well as the bus sector and commercial vehicles. While electric passenger cars get most of the media attention, sales of electric busses and electric bikes are transforming cities and improving access for millions of people worldwide. Sales of e-bikes are booming across the world outselling cars 10:1 in most markets and provide a real opportunity to transform transport (BloombergNEF 2021).

#### Status quo and outlook

Currently, the initial investment costs for EVs are higher compared to ICEV, while operational and maintenance costs are on average lower. From the perspective of total cost of ownership (TCO), EVs are already competitive in many use cases. The last years have seen a sharp proliferation of EVs worldwide, with the 10 million mark for sold passenger car EVs hit in 2020 (43% increase in sales from 2019). This effect is expected to carry on even stronger over the next decade. Considering economies of scale resulting from the increasing deployment of EVs, prices of vehicles and batteries will further come down. The near-term outlook for electric two-wheelers (e2W), three-wheelers (e3W), electric cars and light duty vehicles is very promising. This cannot be said for heavy duty vehicles as EV solutions are expected to take until the end of the decade to be economically viable for long distance transport of heavy goods.

Figure 4 (below) shows the strong rise of EV fleets in the last five years and forecasts an even steeper growth for the five years to come.



#### Figure 4: Market evolution for different EV segments

Source: BNEF. Note: Two-wheelers includes mopeds, scooters and motorcycles, excludes e-bikes.

**Global EV fleet by segment and market** 

#### Source: BloombergNEF (2021)

However, electrification of vehicles does not respond to all challenges of the current transportation system: space use, congestion, and road safety need to be addressed through other levers. Using electrification to limit the proliferation of cars or to induce mode shift to, e.g., lighter modes such as e-bikes holds important potential.

Figure 5 (below) shows the importance and steps necessary to adopt a comprehensive framework towards electric mobility, including the essential role governments have (especially at a national level) to build momentum and raise awareness as well as the necessary element to build an electric mobility vision, policy and/or roadmap.



Figure 5: Sustainable Electric Mobility: Building Blocks and Policy Recommendations.

Source: SUM4all (2021)

#### The Asian context for sustainable electric mobility

Looking at the current status of Asian nationally determined contributions (NDCs), 16 countries have a general electric mobility measure, four countries include EV charging infrastructure, five countries have EV purchase incentives, and one country (Singapore) has an ICE and diesel ban target (GIZ, 2022).

In terms of electric vehicle adoption, China is the clear forerunner with approx. 45% of the worldwide EV stock, which is mainly accrued to 2Ws and electric buses. India matches China's efforts regarding the 3Ws on their respective road and is heavily investing in electric buses.

Many Asian cities are struggling with poor air quality and EVs have the potential to improve this. Beyond the reduction of local air and noise pollution as well as GHG emissions, electric mobility presents an opportunity to capture parts of a burgeoning sustainable mobility value chain, from software platforms that help consumers find charging stations to assembly and production of e2W, e-buses and e-cars (e.g. in India or Vietnam). Furthermore, from an economic point-of-view, countries in Asia can reduce their oil dependency by using locally produced renewable electricity to charge the highly energy efficient EVs. Asian electricity grids are currently very carbon intensive, which represents a major hurdle towards achieving the climate goals and must be addressed as soon as possible, in parallel to the EV roll out.

The roll out of EVs requires a lot of upfront investment and it needs to be considered that the purchasing power / person (affordability) in Asia is lower in comparison to the other frontrunners USA and Europe. The proven track record of the Asian sharing economy (especially regarding the use of smartphone apps) can provide a potential solution for private households. For bus operators, business cases and financing instruments need to be developed in order to facilitate the adoption of electric mobility. The NDC Transport Initiative for Asia is going to explore promising opportunities for this in India in China.

#### Five focus areas for accelerating transport electrification with renewable energy

### Focus area I - Policy Framework for Sustainable Electric Mobility

A comprehensive long-term public policy framework is necessary to foster the development of sustainable electric mobility to secure the potentially significant benefits for cities, users, the economy and the environment. Such an approach must not only support Improve strategies, but also Avoid (electric car share clubs - fostering less car independent lifestyles) and Shift (e.g., to e-bikes) in order to enable this policy framework, fiscal support mechanisms are essential, including considerations of customs and import tariffs, financing mechanisms, as well as general mapping of funding flows.

Consideration of the interaction between different strategies is important, for example, when considering infrastructure requirements for electrification of the rail sector and where they may be synergies for necessary substation upgrades. Electric mobility roadmaps are a useful tool for governments and cities to synthetize the broad spectrum of possibilities and strategically pave the path for EV adoption.

#### Focus area II - Energy and Resources

The energy sector provides the power to move EVs forward, but given how cross-cutting electric mobility is, the energy sector requires a much more holistic approach and strong engagement for electric mobility to succeed.

The electricity generation is one side of the coin and the more carbon neutral it is, the better. The adaptation and stability of the power grid is another key lever and while capacity numbers may look enough on a national level, it is often equally, if not more important to understand the energy infrastructure requirements at a local level, even neighbourhood-by-neighbourhood. In the coming years, technological advances in smart charging and vehicle to grid (V2G) technology will give EVs an important role as key contributors to a stable future energy system.

On the resources side, rapid advances are taking place in the battery sector, currently a key limitation factor of EVs in terms of driving range and longevity of the vehicles. Research and industry are driving several battery solutions, which do not only focus on vehicle performance but also consider material sourcing as well as disposal, recycling or second life uses.

#### Focus area III - Electric Two- and Three-Wheelers

Electric two- and three-wheelers (e2Ws and e3Ws) are the main vehicle mode by number in many countries, and are growing fast across Latin America, Africa, and especially Asia. Their low weight implies a high efficiency benefit by going electric, and given their small spatial footprint, there is a certain appeal in considering the mode for congested cities. Nevertheless, the mode fits into a broader context and often mixed traffic, which means that policymakers are often hesitant to promote this mode. However, the mode itself exists and will exist, and therefore it is imperative to take into consideration in the context of decarbonization.

#### Focus area IV - Electric buses

When investing into the electrification of transport, Electric buses are not only key to the Improve approach but also to the Shift approach. They overcome the local emission problem that ICE buses have while also addressing transport challenges such as space use and congestion which e2W, e3W and electric cars do not. The adoption of electric buses is striving yet there remain challenges in fleet renewal programmes, mainly in the area of financing, operation and maintenance. Electric buses already are available in many different sizes and for multiple applications, presenting no clear disadvantages in the inner-city use in comparison to ICE buses.

### Focus area V - Freight sector electrification

According to one estimate by Clean Air Asia, 12% of vehicles in Asia are freight vehicles yet account for half of all local air pollution. This highlights the disproportionate impact of the freight sector in terms of local air pollution and congestion, but also presents an opportunity in the context of electric mobility. Intensely used vehicles, such as urban delivery vehicles, can displace a large share of emissions if electric. Other areas of freight include meeting the requirements of net zero supply chains as well as relatively overlooked areas prime for electrification including maritime electrification e.g. ports, canal boats, and ferries.

It is projected that battery electric trucks of all segments will achieve total cost ownership (TCO) parity within this decade. The forerunners being battery electric dump trucks, which are already available at a cost advantage relative to diesel trucks. Successful policy interventions (such as road toll incentive, fuel/utility incentive, etc) could shift the cost parity point to 2-4 years earlier.

### Resources and tools



A critical Review – Smart Charging Strategies and Technologies for Electric Vehicles

The report focuses on Electric Vehicles (EV) smart charging strategies and approaches, related policy and regulatory measures, technical aspects, grid integration of EVs, and the way forward for smooth EV adaption in the Indian EV ecosystem.

https://changing-transport.org/publication/smartcharging-strategies-and-technologies-for-ev

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# 4. National Urban Mobility Policies and Investment Programmes (NUMP)

(Status of Peer Network Meeting on 26.08.21)

#### Why national urban mobility policies are necessary

According to UN Habitat, cities consume 78 per cent of the world's energy and produce more than 60 per cent of greenhouse gas emissions. Yet, they account for less than 2 per cent of the Earth's surface. An added challenge is the projection, in a UN report, that another 2.5 billion people will reside in urban areas by 2050; nearly 90 per cent of them in cities in Asia and Africa (UN 2021). Cities are home to a growing majority of the world's population and provide access to economic, cultural and social opportunities. Urban mobility is a key ingredient of urban life.

However, urban mobility across the world is hampered by road congestion. It is also a major and growing source of air pollution and greenhouse gas emissions. To address these problems and meet international greenhouse gas mitigation commitments countries need to develop comprehensive urban mobility policies.

On the one hand, action to address urban transport challenges and to provide economically viable and socially inclusive mobility are to be taken at the local level; on the other hand, a local authorities operate in economic and legal contexts set by national governments, e.g. the right to introduce road charging. Local mobility systems also need to be integrated with the national transport network, e.g. trains, freight terminals, airports etc. Harmonised or compatible approaches e.g., standards and access regulations for vehicles to enter low emission zones in cities across the country facilitate access for users such as freight operators or drivers.

Because every city and region are different, "one size fits all" solutions do not work. Still, suitable national urban mobility regulatory and investment frameworks to empower local actors in driving locally appropriate solutions (e.g. through a local Sustainable Urban Mobility Plan) and deliver on agreed policy objectives. Without a nationwide approach some cities will move ahead, and others will be left behind - only by progressing together can we address local and global challenges of urban mobility effectively. Also, experiences from one city can inform policy and action in others.

National governments in Brazil, India, Mexico and the European Union have set up national frameworks to guide (and in some cases oblige) cities to follow a more strategic approach to urban mobility planning.

#### What are National Urban Mobility Policy and Investment Programmes (NUMP)?

National Urban Mobility Policies and Investment Programmes are strategic, action-oriented frameworks for urban mobility, developed by national governments. They enhance the capability of cities to plan, finance and implement projects and measures designed to fulfil the mobility needs of people and businesses in cities and their surroundings in a sustainable manner. A NUMP builds on existing policies and regulations and aims at harmonizing relevant laws, norms, sector strategies, investment, and support programs towards an integrated approach for the benefits of cities and their inhabitants. It takes due consideration of participation and evaluation principles (MobiliseYourCity 2020).

NUMP can also provide a framework and selection criteria for providing the support (e.g. capacity building, financial resources) cities need to address urban mobility challenges.

#### NUMPs and SUMPs - different levels, complementary tools

SUMPs - Sustainable Urban Mobility Plans - designate a city's specific sustainable urban mobility plan. SUMPs are designed to satisfy the mobility needs of people and businesses in a city and its surroundings. Based on the current situation, it formulates a long-term vision, objectives, development strategies, actions for implementation, and a monitoring process. SUMPs are elaborated in a participative manner and integrated with other levels of governments. On the national level, they can, at the same time, inform the need for shaping NUMPs and also need to be aligned with existing NUMPs.

#### **Examples of NUMP**

**Colombia**: The national policy Política Nacional de Movilidad Urbana Y Regional (Government of Colombia 2020) aims to develop bus rapid transits (BRT) for integrated mass transit systems in large cities, system integration for public transport strategic systems in medium-sized cities and public transport re-organisation and traffic management measures in smaller cities. Grants for technical studies and investment projects are offered by the Programme. Grant funding from the national budget is up to 70%, with a minimum share of 10% of private investment

**India:** The National Urban Transport Policy (Government of India 2014) promotes improvements in public transport services and infrastructure to ensure accessibility and sustainability in urban areas. It has a budget of over USD 20 billion to fund 35% to 90% of all types of urban infrastructure and rolling stock projects in large cities and cities with specific importance provided they are part of the city's mobility plan.

**Tunisia:** During the Council of Ministers meeting held on May 7, 2020, the Tunisian government approved its Tunisian National Urban Mobility Policy. The NUMP has identified and calculated the cost for a number of measures ranging from the creation of structures at the local scale for urban mobility planning and management to capacity building for the managerial staff. Among other results, the Tunisian NUMP is expected to decrease the number of road accidents by 80% and will potentially reduce GHG emissions by a total of -3 300 000 tCO2 eq over ten years (GIZ 2019)

**Germany**: The national policy supports public transport in general and low-carbon technologies in particular. In Germany, regional and local authorities are in charge of planning and financing public transport projects. Until 2018, they could apply for national funding support for new projects over 50 million EUR, with a max. funding of 60%. In 2018, the Ministry of Transport updated this national policy: national funding is accessible for projects over 30 million EUR already, can reach 75%, and can be used for new projects or maintenance measures as well. In parallel, the Ministry of Environment established Guidelines for Promoting the Purchase of Electric Buses for Public Transport. The guidelines specify harmonized selection criteria and funding rates for the acquisition of low-carbon busses with different technologies. A budget of 300 million EUR for the period 2018-2022 is available.

#### **NUMP Added value**

- NUMPs enable cities to prosper in a sustainable manner
- NUMPs facilitate investment in sustainable urban mobility
- NUMPs contribute to achieve national and international policy objectives

- NUMPs secure stakeholder commitment for transforming the urban mobility system
- NUMPs improve policy coordination (horizontally and vertically)

#### **NUMP Process**

Based on experience from across the world, the MobiliseYourCity Partnership<sup>1</sup> proposes the following steps for developing NUMP:





Source: MobiliseYourCity (2020)

#### **NUMP Guiding Principles**

- Prioritising people and quality of life
- Long-term vision with a clear focus on short and mid-term action
- Multi-sector and policy coordination approach
- Institutional cooperation and transformation
- Participatory and multi-stakeholder approach

By supporting nationwide action on sustainable urban mobility, NUMPs are a key tool to enable countries to deliver on international policy obligations such as the Paris Agreement on Climate Change, Agenda 2030 (including the Sustainable Development Goals), and Habitat III's New Urban Agenda.

<sup>&</sup>lt;sup>1</sup> The MobilizeYourCity Partnership supports cities and countries to improve urban mobility for their citizens and decarbonise transport to fight the global climate crisis. More information on www.mobiliseyourcity.net

# What can national governments do to support nationwide action on sustainable urban transport?

- 1. Set-up comprehensive support mechanisms.
- 2. Provide technical guidance & vocational offers on urban mobility planning.
- 3. Incentivise investments in sustainable mobility projects (e.g. through co-funding programs).
- 4. Create supportive regulatory mechanisms (including finance).
- 5. Ensure access of local governments to sufficient staff and financial resources.
- 6. Provide recommendations, guidelines or norms on road & infrastructure design, public transport operation, transport demand management, cycling & walking, road safety, etc.
- 7. Support linkages to international support facilities
- 8. Create spaces for exchange in between cities
- 9. Support collection of and access to data to inform local decision-making

#### The Asian context for NUMPs

- Mandates: As in many countries, also in Asia transport may not be the sole responsibility of a single ministry but influenced by multiple national authorities (such as land-use planning, regional development, environment etc), which may increase the complexity for NUMP development, especially when it is not linked to land-use plans.
- A NUMP might be an option setting a comprehensive framework for local authorities on planning goals and allowing them to plan independently according to these goals.
- Systematic cooperation across different local and provincial authorities unleashes efficiency gains in delivering public infrastructure and services. The cooperative approach of the NUMP allows provide for such cooperative frameworks.
- **Funding:** The often prevailing predict and provide approach of local transport planning often results deprioritising funding for sustainable modes, such as public transport but the comparatively inexpensive non-motorised modes. NUMPs can strategically elevate the funding needs of low carbon transport modes through guidance and selection criteria for developing and receiving support for urban mobility projects, so resources are used in the most efficient way. On a long-term basis, sustainable modes often turn out even less expensive per person kilometre than building roads for cars. NUMPs may establish the strategic vision with guiding principles and financial realism for the implementation of sustainable mobility
- **Planning:** In many countries, urban development planning is often characterised by detailed land-use zoning and infrastructure provision. Cities lack the technical, legal capacities, and financial resources to systematically access resulting additional trips and integrate according public transport planning. With NUMPs national governments may support their capabilities and allow for creating a list of projects with a realistic financial assessment which allows greater reliability of implementation, a key concern of potential investors.

- Equity: For business development as well as personal income, access to transport is key. Particularly disadvantaged groups are highly dependent on reliable transport options as they are less likely to have access to personal motorised vehicles. NUMPs can support the participation of women, children, elderly and persons with disabilities in society setting strategic goals for prioritising good and inexpensive transport options such as public transport and active mobility.
- There is a preference for high-profile or prestigious projects which can lead to decisionmakers are building roads and flyovers which are not necessarily the most effective solution for solving transport challenges. NUMPs may establish a planning framework which encourages evidence-based planning based on scrutinising available data and using planning models.

### Resources and tools



#### NUMP Toolkit

Planning and development of sound urban mobility systems is (in most countries) the responsibility of local governments. Nevertheless, many countries all over the world recognise that urban mobility is not merely a local concern; it is of national interest. National Urban Mobility Policies and Investment Programmes (NUMPs) are an opportunity for national governments to effectively enabling cities to tackle urban mobility challenges while achieving national economic, environmental and social objectives.

https://changing-transport.org/toolkits/nump/

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# 5. Enhancing Freight Systems Efficiency

(Status Peer Network Meeting on 21.10.21)

### The importance of freight and logistics

Freight transport is integral to modern economies, but it also accounts for 40% of all transport emissions, causes air and noise pollution and congestion, and leads to road safety issues. With growing economies in Africa and elsewhere, global demand for freight is expected to triple by 2050, leading to a doubling of emissions and an intensification of the aforementioned problems.

The decarbonization of freight is challenging for several reasons. For one, the freight and logistics industry is very fragmented. The industry consists of many different players such as huge numbers of small and medium-sized enterprises that manoeuvre only a limited number of vehicles, a few large corporations managing very big vehicle fleets, public and private cargo owners who hire transport services and a multitude of other logistic service providers. Market forces like profits, prices and competition thus play a much stronger role than in passenger transport. In addition, the freight sector tends to be overlooked by policymakers – despite its importance both for socio-economic development as well as for climate change mitigation. Hence, regulatory responsibilities are often dispersed across several agencies and ministries such as those responsible for transport, trade or industry, without a clear lead. As trade and industrial development are key drivers for freight transport activity, interagency coordination is vital for policy development in the sector.

To shape efficient, multi-modal and low-carbon freight systems, a majority of those actors – enterprises of all sizes as well as relevant ministries and agencies, need to collaborate. Whilst infrastructure expansion or improvement often depends on public or private-public investments, private actors take a strong role in providing freight transport services. These include cargo-owners, transport and infrastructure operators of different modes and platforms, freight forwarders; the vehicle-industry, and insurance companies.

Multi-modal infrastructure development is to be assured across government levels (cross-border, national, local) to enhance connectivity, resilience, and speed of value chains; public services (e.g., customs procedures) need to be efficient and regulatory frameworks set forth by national and local governments must provide conditions that are supportive to efficient and sustainable freight operations (e.g., access to the profession and training, labour rights, taxation and pricing, etc.).

#### Examples of pledges for zero emissions logistics

Net zero emission<sup>2</sup> commitments for 2050 by countries, regions, cities and companies already cover 68% of the global GDP (Oxford-ECIU, 2021). Hence, all countries and companies that want to be part of the future low carbon global economy need to decarbonize transport in the next decades. However, the most recent climate strategies that determine countries national contributions (NDC) to the goals of the Paris Agreement largely neglect the freight sector. Only 12% of transport measures included in new and updated NDCs refer to freight explicitly.

Some companies are a bit more advanced and state clear pledges on freight and logistics in their company strategies. The US retail company Walmart, one of the world's largest companies, has set a target of "zero emissions across the company's global operations by 2040". Deutsche Post DHL (DPDHL) is one of the world's largest logistics companies, with over 500,000 employees and operates in almost every country. DPDHL announced they "will reduce all logistics-related emissions to zero by the year 2050." The company's targets include a 50% improvement in emissions efficiency by 2025 and emitting less than 29 million tonnes of CO2 by 2030. To achieve this, they will invest 7 billion Euro by 2030, scale up the use of sustainable aviation fuels and build a fleet of 80,000 electric vehicles.

<sup>&</sup>lt;sup>2</sup> Net zero emissions refers to achieving an overall balance between greenhouse gas emissions produced and greenhouse gas emissions taken out of the atmosphere.

#### Freight and logistics mitigation measures

The *Avoid, Shift and Improve* framework can be deployed for both passengers and freight. Options to avoid freight transport are the reduction of distance (e.g. by selecting local suppliers), reduction of the volume/mass transported (e.g. by transporting concentrates, or better packaging design), and the more efficient use of transport capacity (e.g. avoid empty haulage).

*Shift* measures involve making use of modes with less energy consumption and less emissions per tonne-km<sup>3</sup>, such as waterborne transport (inland or coastal shipping) or rail freight that are usually less carbon intensive than road freight transport. Shifting to 2- or 3-wheeled vehicles can improve efficiency and reduce emissions particularly for "first mile" - (the connection from the initial location of the freight, e.g., a farm, a company's depot to the larger (high-capacity) transport network) and "last mile" (the connection from the last hub, e.g., a port, a logistics platform, to the freight owner or customer, e.g., a company or an individual receiving home delivery) in both rural and urban settings.

*Improve* measures can include vehicle selection, aerodynamics, and fuel efficiency. Also, driver behaviour and vehicle maintenance play an important role. Finally, the fuels that power freight transport need to become zero carbon. Hydrogen, electricity and ammonia are promising fuels for different modes of freight transport.

# What can national governments do to support nation-wide action on decarbonising freight transport?

- 1. Set clear freight transport decarbonisation targets in national climate strategies and include freight transport mitigation measures (*Avoid Shift Improve*) in national climate and transport strategies.
- 2. Develop comprehensive multimodal investment plans to improve sector efficiency and stimulate mode shift. Invest in rail or waterborne transport infrastructure and provide incentives for use.
- 3. Establish dialogue platforms with freight transport industry representatives (supply and demand side) and cities to improve understanding, identify barriers and develop and implement plans and solutions in a joint and coordinated manner.
- 4. Provide financial incentives to fleet owners for the purchase of low or zero emission vehicles, e.g. via tax breaks, targeted subsidies or toll-road discounts for clean trucks and set ambitious standards for fuel economy and fuel quality.
- 5. Introduce policies (planning, fiscal) that encourage local production, consumption, and recycling.
- 6. Facilitate pilot projects to test new solutions and technologies, e.g. microdepots combined with cargo-bikes for the last mile.
- 7. Develop urban logistic plans and platforms (Urban Consolidation Centers), engaging cargo-owners, receivers, and operators.
- 8. Introduce urban vehicle access regulations that encourage shift to lower carbon vehicles.
- 9. Exploit the potential of information and communication technologies to improve trip planning, load factors and vehicle maintenance and operations.

<sup>&</sup>lt;sup>3</sup> Freight is measured in how many metric tonnes of cargo are moved over what distance, i.e. tonne-kilometers.

10. Establish capacity building programmes to improve skills and professionalise the logistics and transport sector, e.g. training truck drivers and ecodriving courses.

#### The Asian context for freight transport

Compared to the global ratio of CO2 emissions from passengers (ca. 60%) and freight (ca. 40%), Asian economies have an above-average share of CO2 emissions from freight of 58%, with road freight accounting for 31% of emissions, and urban freight for another 12%. This indicates the large potential and urgency for mitigation measures in these areas.

Note: ATO stands for Asian Transport Outlook, countries covered are 42 member countries of the Asian Development Bank.



#### Figure 7: Asian Transport Outlook (ATO) Economies

Source: Asian Transport Outlook (ATO) Presentation TCCW2021 (Gota, S., Huizenga, C.)

The freight sector in Asia is chiefly characterized by:

- Accounting for a large share of global goods (>33%)
- Having 12% of its vehicle fleet be freight, yet accounting for more than 50% of local air pollutants
- Having a high potential for shifting goods to inland waterways and/or short-sea-shipping wherever feasible
- Densely populated regions and cities and therefore high demand for urban and cross-border freight transport as key role during the Covid-19 pandemic

On an urban level, there is widespread proliferation of powered two- and three-wheelers providing a range of freight and delivery services. In China, for example, electric two-wheelers are a mainstay for food delivery as well as parcel services. In Thailand, the iconic "tuk-tuk" – similar to the autorickshaw in India – not only provides taxi services but is also used to transport goods short distances in congested and sometimes hard-to-navigate cities.

On a national level, there is a heavy reliance on trucking, with freight rail hardly existing outside China and India. There is however large potential in inland waterways and Vietnam has started to tap into this solution, but it requires careful coordination, a national platform for providers, and connections to dry ports and multimodal logistics providers.

On a regional level, there is progress with regional organizations such as Green Freight Asia and UNESCAP helping to facilitate the cross-border movement of goods. Singapore is a global trade hub and is a valuable case study in exploiting ICT for enhancing freight system efficiency. Bolstering regional cooperation, ASEAN adopted a regional strategy on sustainable land transport in 2015 with a focus on freight and logistics.

#### **Resources and tools**



#### **Truck Ecodriving Toolkit**

This toolkit is a comprehensive guide to ecodriving programmes, at company-level as well as for governmentor even city-driven initiatives. It provides experiences from around the world, offers tools for planning and implementation and makes training materials available. Many of the materials in this toolkit go beyond the scope of truck ecodriving as they either include either vehicle categories like busses and cars or as they looks into further road freight mitigation options as well.

https://changing-transport.org/toolkits/ecodriving/

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# 6. Sustainable Transport Infrastructure Investments

(Status Peer Network Meeting on 09.12.21)

### Sustainable Transport Infrastructure

Transport infrastructure investments are typically high, ranging from approximately 1% to 5% of a country's GDP (ITF, OECD 2020), and have long lifespans. Infrastructure decisions today will define transport demand and operations for decades to come. Investing in projects that are not future proof can lead to sunk costs, much higher expenses for adaptation, and high insurance payments for the infrastructure project (e.g. harbours, etc).

Beyond direct climate related damage and repair, failing infrastructure can also have significant broader economic and social costs, e.g., disruption of supply chains, access to work, medical services or school, etc. such as the melting roads in India during the heat wave in 2015 (ABC News 2015) or the roads and bridges that got washed away by heavy rainfall in Ghana in 2021(FloodList 2021). Investments in sustainable, future-proof transport infrastructure, on the other hand, can not only avoid such negative externalities but also ensure that countries will be able to partake in the global low carbon economy of the future.

Sustainable Transport Infrastructure has four essential characteristics:

- 1. Contributor to an integrated, low-carbon transport system: It supports access and the shift towards a low-carbon and sustainable transport system by linking transport modes efficiently and prioritizing the most efficient and equitable ones.
- 2. Adapted to climate change impacts: Sustainable transport infrastructure considers the impacts of a changing climate such as rising sea-levels, changing rainfall patterns and extreme heat, for example in choice of location (avoids high-risk areas), design (can cope with heavy rainfall), construction (use resilient materials) and in operations (preventive maintenance).
- **3.** Resilience during extreme events: It can stay operational in times of environmental shocks (flooding, extreme heat, high winds) and support emergency response and recovery.
- 4. Efficient and sustainable in construction: It uses sustainable construction techniques, e.g., taking into account water shortage, erosion etc., and material, e.g., local and recycled materials.

This chapter focuses on the first essential characteristic for sustainable transport infrastructure. The second to fourth characteristics will be addressed in more detail in chapter 6 on Adaptation.

### Sustainability in planning, design and operating transport infrastructure

**1. Long term, system wide perspective:** Transport infrastructure drives transport demand as well as supply. Its planning has historically been driven by modelling (i.e., predicting) vehicle flows of individual projects or links. Consequently, transport infrastructure investments often focus on moving vehicles rather than on moving people and goods. However, the more road infrastructure is provided for car use and with a short-term focus to address increased demand, the more vehicles will actually travel - often on short, local journeys. This leads to these investments often not delivering the desired improvement in services.

Planning, design, and operations of sustainable transport infrastructure need to be guided by a long term, inclusive and system wide approach with the objective to provide an integrated multimodal system of connected infrastructure and services for people and goods. It starts with an understanding of the mobility needs, i.e. "who needs to go where". The focus is on satisfying these needs in the most efficient and affordable way.

**2. Supporting mode shift:** Sustainable infrastructure planning and operations for people and goods need to support a mode shift towards most sustainable modes - high-volume, public transport, walking, cycling, shared motorized modes. This can be achieved by providing more connections, more space, and dedicated lanes for public transport as well as more and safe space for walking and cycling. The focus of sustainable infrastructure investments should be to make sustainable modes the preferable choice for users. If good affordable options are made available - they will be used.

**3. Efficient use of infrastructure:** Efficient infrastructure operations can avoid building additional infrastructure in the first place and reduce spending as well as the use of particularly valuable urban space. Measures comprise:

- re-allocating road space, e.g., from cars to public transport, freight, cycling lanes and pedestrians
- efficient sharing of infrastructure capacities between people and goods, and over time (day/night/seasonal)
- transport demand management through road user charges (tolls, parking fees), access regulations (e.g., by time, vehicle weight, emissions)
- subsidies to high-volume modes, public transport, shared vehicle use, very light modes, and biking - which reduce costs to society.
- improved traffic management systems, e.g., signalling, responsive speed regulations, ramp metering etc.
- 4. Connection to industry policy: Infrastructure planning and operations for freight must be closely linked to industry policies. This includes connecting zones of concentrated production and demand ideally through high-volume modes such as rail and waterways (inland and coastal).
- 5. Connection to energy policy: To achieve transport decarbonization, transport projects have to be planned along also with energy policy, i.e., low-carbon energy supply and its infrastructure, e.g., charging networks, catenary cables, and other energy carriers such as hydrogen or ammonia.



Figure 8: Sustainable Infrastructure Investments focusing on rail in Malaysia

Source: Ministry of Transport, Malaysia 2021

### Investment needs and priorities

Globally, in 2022, 1.7 trillion USD need to be invested in overall transport infrastructure, with 1.2 trillion USD going to road infrastructure. However, needs for transport infrastructure investments far exceed available funds (Oxford Economics 2017)<sup>4</sup>. Consequently, there are three priorities:

- 1. Investment should focus on maximising access for all and be shifted away from road construction for private cars (which have low return on investment) towards investments in public transport, walking and cycling, waterborne transport, and rail.
- 2. Investments need to be assessed thoroughly with regards to their sustainability, especially for the economic, social, and environmental aspects, and their contribution to a low-carbon transport sector.
- 3. Public spending and loan-giving must be used to leverage and de-risk private spending.

### A rapidly changing investment climate

Currently, trillions of dollars are being withdrawn from the fossil fuel sector; this will define the transport sector's future. Transport infrastructure projects are increasingly evaluated with respect to climate impacts e.g., accounting for a project's total CO<sub>2</sub> mitigation potential.

<sup>&</sup>lt;sup>4</sup> The G20 Global Infrastructure Outlook covers 56 countries, out of which 13 are African countries

For instance, in 2020 the European Investment Bank (EIB) set out its strategy to support the transition to a carbon-neutral Europe by 2050 and in line with the objectives set out in the Paris Agreement. The EIB is now reviewing its Transport Lending Policy, to align transport investments (20% of its portfolio) with climate. Other multilateral financial institutions will rapidly follow. In a joint declaration during COP26 (EIB 2021a), 9 multilateral development banks announced to "align our financing flows with the Paris Agreement". Soon, only sustainable infrastructure projects will be capable of securing funding and eligible for insurances. Infrastructure planning needs to take this into account, otherwise the costs will increase dramatically, and projects are becoming uninsurable.

#### The Asian context for infrastructure investments

It is estimated by the Asian Development Bank (ADB) that the region will need \$1.7 trillion in total infrastructure investments in order to meet climate-adjusted needs per year by 2030. Until then, the transport sector alone will require \$8.4 trillion in total for the 2016-2030 period. However, to date 98% of all transport infrastructure spending has gone to roads, which has enabled passenger mobility and freight transport, but simultaneously led to significant pollution and congestion. A more balanced approach targeting efficiency is essential to meet climate goals and grow the economy in tandem.

#### **Resources and tools**



#### Capacity Assessment Tool for Infrastructure

The Capacity Assessment Tool for Infrastructure (CAT-I) is a new tool developed by the United Nations Office for Project Service (UNOPS) to help countries facilitate better infrastructure development. The tool is designed to help governments identify gaps in the capacity of their enabling environment to plan, deliver, and manage their infrastructure systems.

https://cati.unops.org/



### Climate Finance Toolkit for Low-Carbon Transport

The toolkit is a set of knowledge material intended to give an overview of existing climate finance sources for lowcarbon transport. The publications listed in this toolkit explore both public and private financing and funding sources at the domestic

and private financing and funding sources at the domestic level as well as international development finance and climate funds that are eligible for sustainable transport.

https://changing-transport.org/toolkits/climate-financefor-low-carbon-transport/

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### Climate Change and Adaptation: Introduction and Terminology

The climate crises and its impacts affect humankind globally at different scales. It manifests for example in the flooding of coastal areas and river deltas or in floods with mud slides, as it happened in Germany 2021 (see before and during the flood picture below). Other regions are facing scarcity of water, extreme heat, stronger and more frequent **storms**, and seasonal shifts. Hazards such as sea level rise, increasing temperatures and changes in rainfall patterns pose various challenges to transport systems, material and equipment and often affect marginalized and vulnerable groups most.

Climate risk is systemic. A system is only as resilient as its weakest point. This is true for physical risk and the organisational capabilities for managing the physical risks. Due to interdependencies of transport with other sectors, such as power supply for rail or access to industry logistics hubs for freight transport, a systemic approach to climate risk assessment and adaptation planning is needed. Transport forms part of a country's critical infrastructure. A climate resilient transport system is the backbone of a sustainable urban life and a well-functioning economy. In addition, a transport system's resilience is essential for emergency response and recovery (e.g., mobility of emergency workers, access to hospitals, functioning of evacuation routes).

Both **slow onset changes** and **extreme events** impact transport systems and its users. The **vulnerability** of a transport system is defined by its **sensitivity** to a hazard, (i.e. how quickly does the system fail) and its level of **exposure**, (i.e. the frequency of the hazard). Adaptation refers to all activities that increase a transport system's resilience to face the changes, e.g. the infrastructure, keeping services operating, etc.: Resilience is the ability of a system to absorb, withstand and bounce back after an adverse event in short and long-term perspective. For transport systems, increasing climate resilience means to

- Identify and assess climate risks for the specific transport system, such as bus operations, or a particular infrastructure, such as a bridge or road.
- Plan for adaptation and identify appropriate adaptation options,
- Implement adaptation choices.
- Monitor the performance of chosen measures and the adaptive capacity of transport planning and transport agencies, where adaptive capacity refers to a systems or organisations ability to cope with and respond to climate hazards.



Figure 9: Climate risk management in transport planning Source: GIZ (2021a)

### Transport adaptation in the NDCs

The good news: 42% of submitted NDCs (54 countries) mention adaptation measures for the sector, compared to only 22% in the first generation NDCs. 15% of submitted long-term strategies also include adaptation measures. This is encouraging, but there is still a long way to go (GIZ 2021b).





Source: GIZ (2021c)

### **Preparing for Adaptation**

Adaptation is most effective when it is an integral part of **early-stage decision-making and design** processes for a transport system. The **later** adaptation is considered, the **more complicated** and **expensive** it becomes. Investments in transport must factor in adaptation upfront to avoid system failures under future climatic conditions and associated sunk costs. Preparing for adaptation requires data, awareness about the risks faced and the

availability of opportunities to respond, technological solutions and financial resources, but perhaps most of all the openness to introduce new processes and new behaviours, as well as the integration of a multitude of stakeholders under a strong governance structure. It is important to understand which stakeholders influence the organisation's adaptation, and what capacity you have to support and influence them. This ensures that decisions enable effective adaptation.

### **Risk Assessments for Infrastructure Projects and Transport Systems**

Risk assessments analyse the existing and future degree of **climate hazard**, the transport system's **vulnerability** (sensitivity, exposure), and its **adaptive capacity** for one country or specific location. For conducting this, weather data and climate models are key in **analysing climate hazards** to which a transport system is exposed. Several public and private organisations have developed new tools that can support a preliminary assessment of climate hazards, e.g., the World Bank's Climate Screening Tool.

When **analysing the vulnerability** of a specific transport system, climate impacts can be distinguished between:

- impacts on transport infrastructure and rolling stock, e.g., rail tracks lose stability due to erosion, rolling stock got flooded with permanent damage, etc.
- impacts on operations and services, e.g., operations are suspended because mudslides have blocked the infrastructure, power supply was cut, etc.
- **impacts on mobility behaviour**, e.g., riders shift away from public transport due to unreliability in heavy weather conditions, etc.

Typically, vulnerability is analysed under different **climate scenarios**, **risk levels** (probabilities) of certain hazards to occur and considering **interdependencies** with other potentially failing elements of an environment (e.g., energy and building sectors).

The adaptive capacity of a transport system is then determined by:

- the design capacity, i.e., the technical limits of the system within which the system still operates;
- the **financial capacity** to adapt the system, i.e., the funds that can be mobilized to retrofit, perform preventive maintenance, react immediately or plan ahead;
- the organisational capacity, i.e., the extent to which humans and organizations can respond to and mitigate climate risks for transport systems.

#### **Planning Adaptation and Identifying Options**

With climate hazards, vulnerabilities, and adaptive capacities identified, it is possible to **plan adaptation** for increasing resilience and to **prioritize measures** and **budgets**. The planning process requires the definition of a **clear objective**, the involvement of **stakeholders**, the **identification** of adaptation **options**, and a **sequencing** of implementation. Options can be manifold and should be chosen based on the prior assessments, and in line with objectives and budgets. Figure 2 provides an exemplary set of adaptation options to one specific climate hazard "increased flooding risk" and a transport infrastructure's vulnerability "deterioration of pavement".

<u>Climate Hazard:</u> Increased Flood Risk	nate Hazard: reased Flood Risk Vulnerability: Deterioration of pavement and road foundations, increasing repair costs and decreasing service life of infrastructure	<u>Ac</u> •	daptation Options: Use pavement that are better and less susceptible to moisture
		•	Increase base strength (thickness and/or quality) to increase protection of subgrade layers
		•	Alter selection of subgrade materials to withstand higher moisture contents;
		•	Use hydraulic binding agents in road foundation
		•	Conduct more frequent maintenance
		•	Seal cracked and distressed areas
		•	Have traffic management plans in place to reduce damage with minimised disruption to affected communities

Figure 11: Exemplary adaptation plan

Source: Own illustration, based on GIZ (2021a)

### Implementing and Monitoring & Evaluation (M&E) Measures

The set-up and the validation for the successful implementation of adaptation measures depends on its planning and a robust M&E system. In many cases, different stakeholders, agencies and offices have to work together towards the same objective, making **an effective governance structure**, **capacity**, and **sharing of information** key factors for success. Knowledge, long-term planning and learning from experience is key.

### The Asian Context for Adaptation

Already today, extreme weather and climate events kill thousands of people, affecting 50 million people in 2020, costing Asia's economies billions of dollars (WMO 2021). In some Asian countries, the cost of climate events is already above five percent of annual GDP (e.g., Cambodia and Lao PDR) (WMO 2021). Asia's megacities are particularly vulnerable given their often-costal locations, and today five out of the world's top 10 most vulnerable cities to coastal flooding are in Asia. It is projected that by 2070 it will be nine out of 10 (IPCC 2022). As the IPCC AR 6 has shown, regional specific events as the monsoon are expected to change dramatically, so are rain patterns; flood levels are expected to increase (APAN 2022).

While regional learning events are quickly ramping up to better understand the scale of the challenge, the transport sector must do more to account for climatic risks. There is no national adaptation plan (NAP) in Asia which covers transport, and this should be a priority. While the transport sector is underrepresented in NAPs, it does appear increasingly in NDCs as well as development projects, including coastal protection for transport infrastructure in the Maldives, coastal line transportation in Viet Nam as well as road rehabilitation efforts in Cambodia (Huizenga et al. 2015). Nonetheless, adaptation measures for transport are only considered in ca. 12 updated NDCs by Asian countries. While ADB has found that several technologies exist ready-for-implementation in Asia, especially for roads and ports infrastructure, there is little progress to date in part due to capacity constraints, but also due to funding limitations (ADB 2014).

### **Resources and Tools**



### Adapting Urban Transport to Climate Change Sourcebook:

**GIZ** in cooperation with the **Islamic Development Bank** developed a sourcebook for adaptation in the urban context, targeted at policymakers in developing countries. The second edition of the sourcebook was released in October 2021 and includes updates as well as case studies and new concepts. The sourcebook can be downloaded here:

https://changing-transport.org/publication/sourcebook-onadapting-urban-transport-to-climate-change/

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