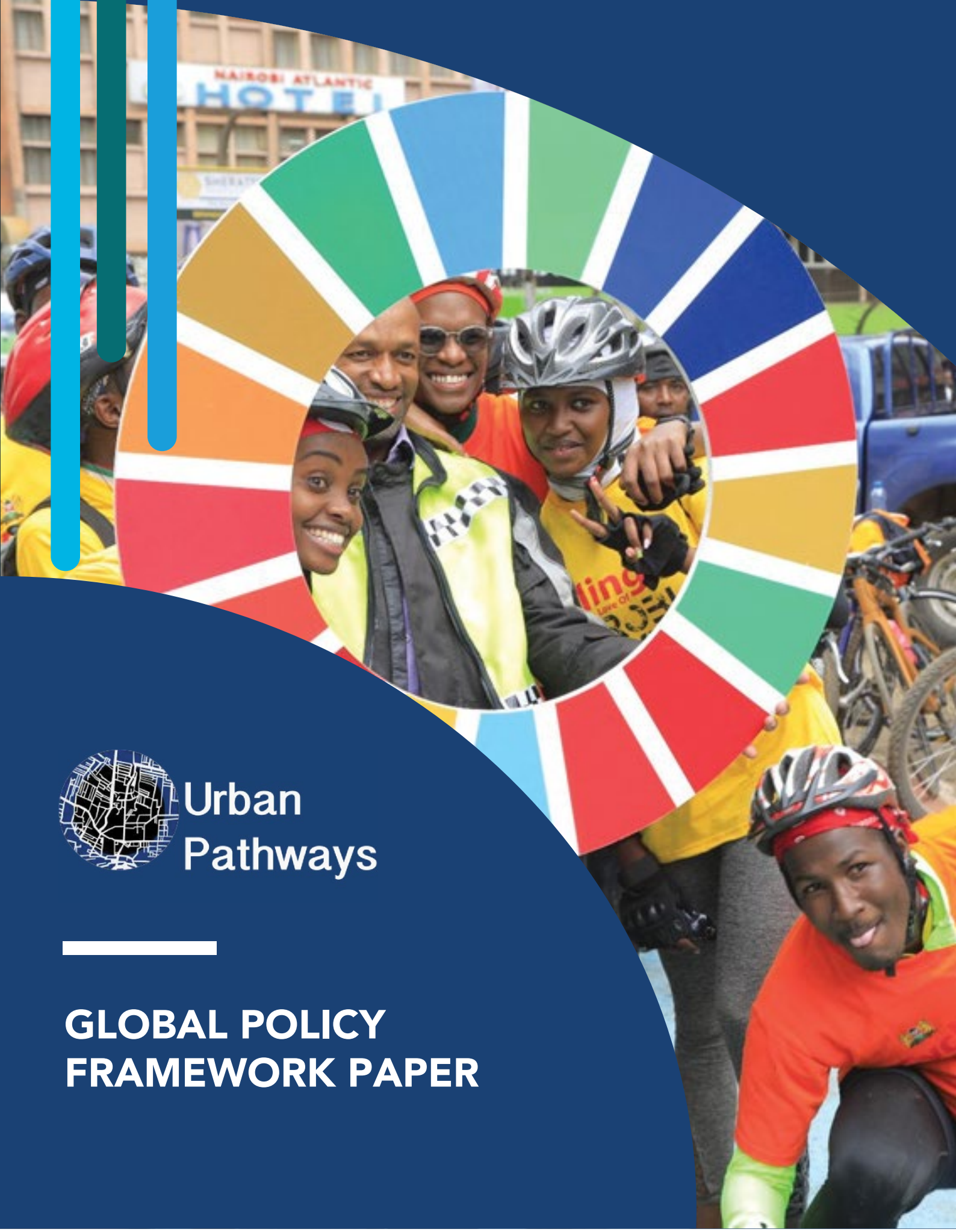

Urban Pathways

GLOBAL POLICY FRAMEWORK PAPER

UN-HABITAT
FOR A BETTER URBAN FUTURE

Wuppertal Institut

UN environment programme

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INTERNATIONAL
CLIMATE
INITIATIVE

Urban Pathways

The Urban Pathways project helps delivering on the Paris Agreement and the NDCs in the context of the New Urban Agenda and the Sustainable Development Goals. It has established a facility in close cooperation with other organisations and networks active in this area to support national and local governments to develop action plans and concrete implementation measures to boost low-carbon urban development. This builds on UN-Habitat's role as "a focal point on sustainable urbanisation and human settlements including in the implementation and follow-up and review of the New Urban Agenda". The project develops national action plans and local implementation concepts in key emerging economies with a high mitigation potential. The local implementation concepts are being developed into bankable projects, focusing on the access to urban basic services to create a direct link between climate change mitigation and sustainable development goals.

The project follows a structured approach to boost Low Carbon Plans for urban mobility, energy and waste management services that deliver on the Paris Agreement and the New Urban Agenda. The project works on concrete steps towards a maximum impact with regards to the contribution of urban basic services (mobility, energy and waste management) in cities to global climate change mitigation efforts and sustainable and inclusive urban development. This project makes an active contribution to achieve global climate change targets to a 1.5°C stabilisation pathway by unlocking the global emission reduction potential of urban energy, transport and resource sectors. The project will contribute to a direct emission reduction in the pilot and outreach countries, which will trigger a longer term emission reduction with the aim to replicate this regionally and globally to make a substantial contribution to the overall emission reduction potential.

This project implements integrated urban services solutions as proposed in the New Urban Agenda providing access to jobs and public services in urban areas, contributing to equality and social coherence and deliver on the Paris Agreement and the Sustainable Development Goals.This is the first dedicated implementation action oriented project, led by UN-Habitat, to deliver on inclusive, low-carbon urban services. Securing sustainability and multiplier effect, the project aims to leverage domestic and international funding for the implementation projects that will follow from this initiative. This Global Policy Framework Paper is a reflection derived from the implementation of the Urban Pathways project and provides policy recommendations and best practice actions while proposing indicators for governments to inspire the achievement and integration of low carbon urban basic services.

Contents

Chapter 1:

Low carbon urban basic services are key for achieving the Sustainable Development Goals

Already the Rio Declaration stated in 1992 "Human beings are at the center of concerns for sustainable development - they are entitled to a healthy and productive life in harmony with nature", emphasizing the combination of the sustainability concept and human development. The Sustainable Development Goals (SDGs), as adopted in a UN resolution in 2015, formalize sustainable development in 17 goals and 169 targets. As such the SDGs go beyond a pure development framework and address both, developing and developed countries. The SDGs represent the 2030 agenda "to transform the world by ensuring, simultaneously, human well-being, economic prosperity, and environmental protection" (Pradhan et al., 2017). In contrast to the human development index (HDI) which is restricted to "Long and healthy life", "Knowledge", and "A decent standard of living", the SDG indicators adopted in 2017 cover the full range of SDG goals and targets. Last but not least, "human development, in turn, co-evolves with the growth of cities" (Akuraju et al., 2020).

1.1 SDG interactions (synergies and trade offs)

However, the SDGs, SDG 11 in particular, and their progress are facing a set of challenges. Analyzing the available SDG indicators it was found that some develop in parallel while others develop in opposite directions (Pradhan et al., 2017). Progress in some contexts often comes along with regress in another context. In other words, while some groups of targets can be achieved together (synergies), others require compromises (trade-offs) (See Figure 1.1). For instance, SDG 1 (No Poverty) exhibits synergistic development with SDG 4 (Quality Education), SDG 5 (Gender Equality), or SDG 10 (Reduced Inequalities). Contrarily, SDG 12 (Responsible Consumption and Production) requires trade-offs with SDG 10 (Reduced Inequalities), SDG 1 (No Poverty), or SDG 6 (Clean Water and Sanitation). This means, based on past experience, it is unlikely to achieve all goals and targets at the same time (Pradhan et al., 2017).

In Figure 1.1, each node indicates an SDG target, colored according to the respective SDG. The node size reflects the SDG target's "eigenvector centrality", emphasizing the structural significance of nodes in the network. Edges indicate synergistic (solid line) or impeding (dashed line) interactions between a pair of targets. The edge's thickness and color reflect the share of synergies and trade-offs, emphasizing structural significant interactions in the network.

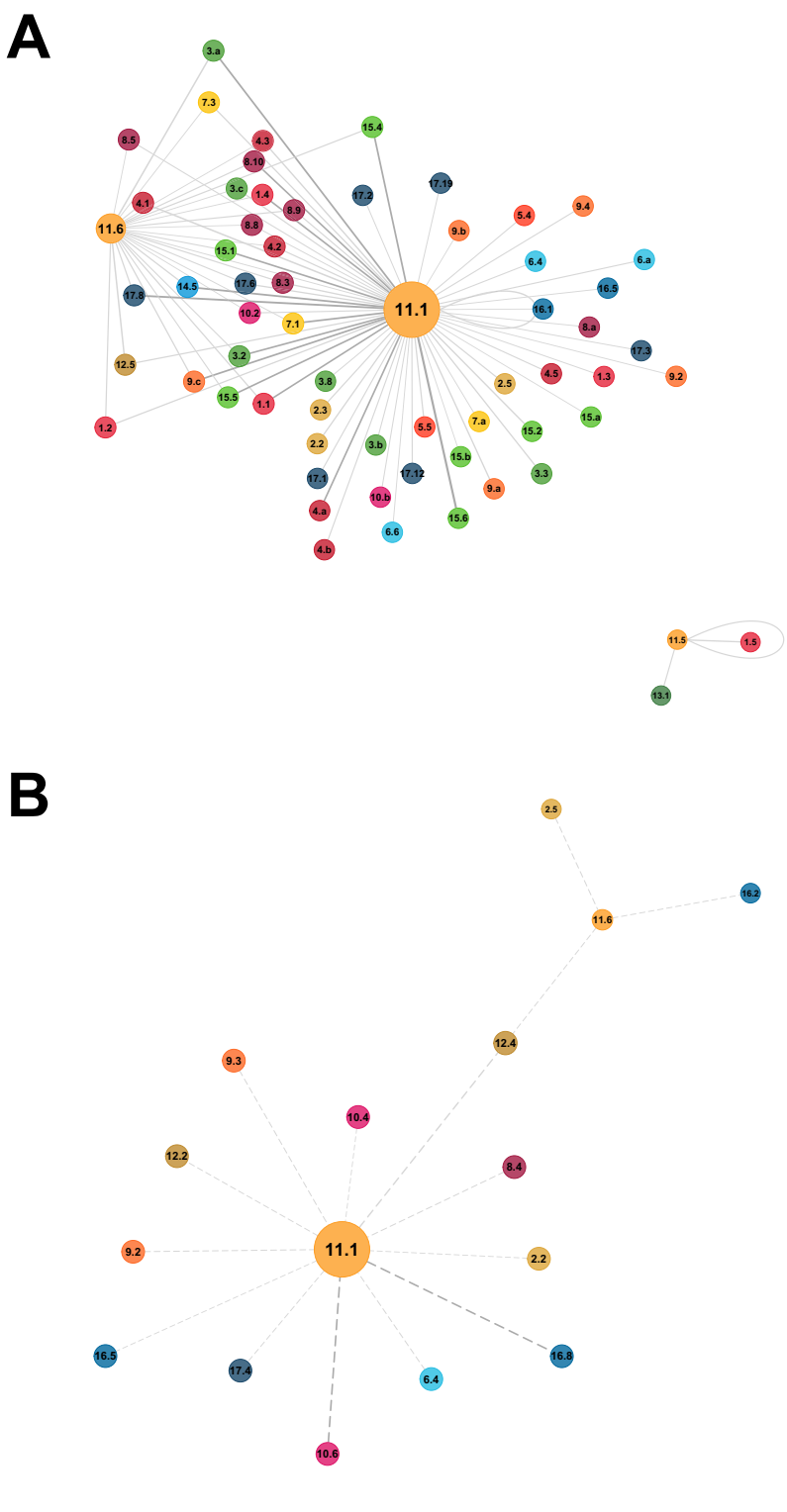


Figure 1.1: SDG 11 Interactions: Sustainable Development Goal (SDG) 11 target network for (A) synergies and (B) trade-offs based on the unified SDG database.

Source: (Warchold et al., 2021; Rybski et al., 2022).

1.2 Procrastination

While a few countries make good progress in attaining the development goals, many other countries are struggling. For the second year in a row, the world in general is no longer making progress on the SDGs (Sachs et al., 2022). This is certainly related to the perpetuating crises (COVID-19, conflicts and others) but even before, countries were "not on track to meet the 2030 Agenda for Sustainable Development ... SDGs have had a limited transformative impact" (Pradhan, 2022). Countries do make progress on some targets but fail on others – there is no transformative progress and opposing development persists (see above). Rich countries export their burden ("negative international spillovers") via unsustainable consumption (Sachs et al., 2022). This behavior is best known in the climate change context, where high-income countries import carbon intensive products and thereby export their emissions (production-based vs. consumption-based emissions). It is worth mentioning that SDG monitoring is still challenging and despite some progress, serious data gaps persist in SDG monitoring (Jensen et al., 2022). SDG 11 (Sustainable cities and communities) has less than 40% data coverage (Jensen et al., 2022, p.4).

SDG 11 covers housing, (public) transport, (participatory) planning, heritage sites, (natural) disasters, environmental protection (pollution, waste), and public (green) space. These are important dimensions but have an almost exclusive focus on local conditions. Global sustainability is only included indirectly (an implicit argument could e.g. be: "public transport is more carbon-efficient, accordingly public transport should be enhanced"). Moreover, SDG 11 does not distinguish the construction of cities and their operation. SDG 11 focuses on the operation of cities and their conditions, but the construction of urban infrastructure requires large amounts of resources, including cement (associated carbon emissions conflicting with SDG 13 [Climate action]). However, they are also linked since "rapid and poorly planned urbanization leads to many challenges" (Jensen et al., 2022).

1.3 Urban Pathways project & SDGs

The Urban Pathways project contributed via various means to the SDGs. First, living labs and project interventions have successfully been implemented in various pilot cities. The measures mostly address SDG 11.2 (access to public transport), SDG 11.6 (waste) and SDG 11.7 (public space). For instance, Zones 30 have been created in Belo Horizonte, accompanied with physical modifications such as urban furniture, which had a measurable improvement on public space perception and road safety. As such the interventions have been effective but similar interventions need to be replicated in various neighborhoods to have a large-scale effect. Replication also has to be embedded in improved policy frameworks on the local and national level to ensure wider uptake and adequate financial resources for these interventions. Secondly, the Urban Pathways project contributed to the monitoring efforts of SDG 11.2 (access to public transport) and SDG 11.6 (waste). The efforts described later in this chapter represent an important contribution and datasets should be expanded to ensure global representation.

The following pages describe the concrete contributions that the Urban Pathways project made towards the achievement of various SDG targets:

SDG 3: Ensure healthy lives and promote well-being for all at all ages

- **Target 3.6**: By 2020, halve the number of global deaths and injuries from road traffic accidents

- **Indicator 3.6.1:** Death rate due to road traffic injuries

Current status & monitoring

(Extract from: Global SDG Data & Indicators at Year Five - Indicator Analysis)

Definition: Death rate due to road traffic injuries as defined as the number of road traffic fatal injury deaths per 100,000 population.

Concepts: Numerator: Number of deaths due to road traffic crashes. Absolute figure indicating the number of people who die as a result of a road traffic crash. Denominator: Population (number of people by country)

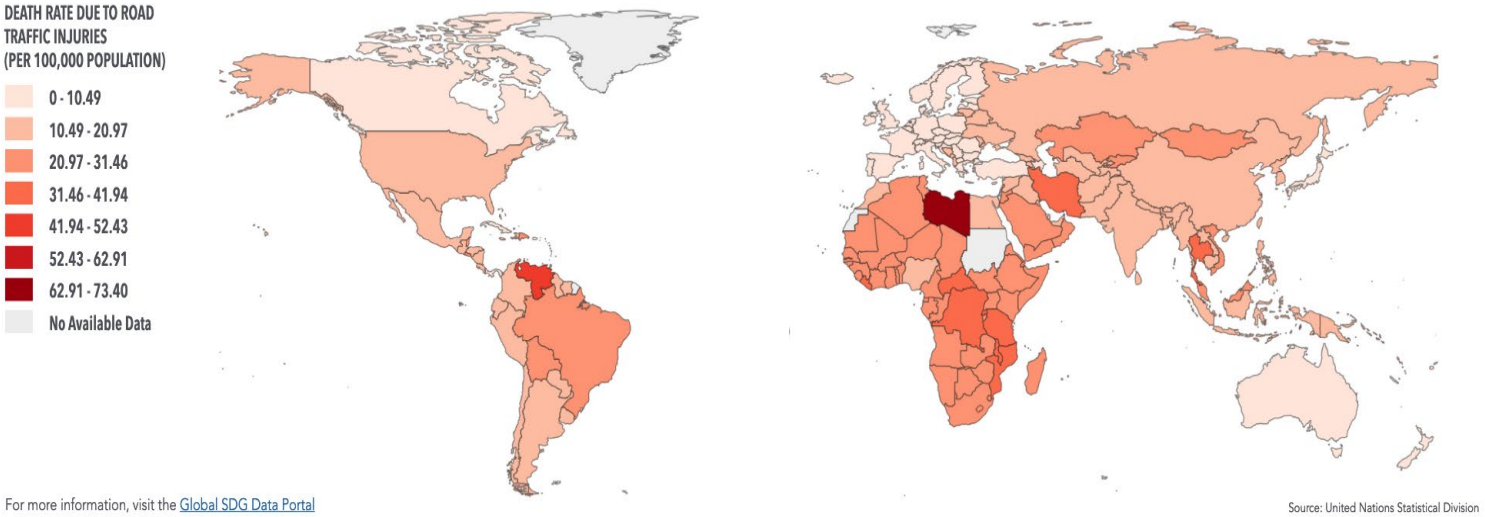
Limitations: There are no vital registration data for all countries to make comparison against the data received on the survey. The United Nations Statistical Division published only confidence intervals for countries that have poor completeness of vital registration data. Also, the UN Statistical Division cannot collect road traffic data every year using this methodology outlined in the Global Status Report.

Urban Pathways contribution

Urban Pathways has supported active mobility projects in Belo Horizonte, Brazil (through the Zone 30 and Ecozone projects) as well as in Nairobi, Kenya (through the pedestrianization project at Luthuli Avenue). Besides promoting strategies and actions on low carbon transport, these projects simultaneously improved road safety. With the help of these projects, Urban Pathways strongly promoted mixed use, compact neighborhoods focusing on proximity through active mobility to achieve co-benefits across different target areas. Building on these projects and partnerships, Urban Pathways supported the development of 3 project proposals that were successfully submitted for funding to the UN Road Safety Fund, targeting countries in Africa incl. Ethiopia, Kenya, Mozambique, Rwanda and Guinea as well as the setting up of a Global Alliance of Cities for Road Safety, in collaboration with UN Environment (UNEP). In addition, the Urban Pathways partnership, coordinated by Technical University of Berlin, secured funding from the European Commission for the Transforming Road Safety in Africa (TRANS-SAFE) project that aims to promote radical transformation towards road safety improvement in Africa, through tested and validated road safety solutions, with a high level of scalability and replicability. The project started in September 2022 and will take forward some of the foundation laid by Urban Pathways in Africa.

Figure 1.2: Death Rate due to road traffic injuries (Per 100,000 population)

Source: Global SDG Data & Indicators at Year Five - Indicator Analysis (UN, n.d.)



For more information, visit the Global SDG Data Portal

Source: United Nations Statistical Division

Urban Pathways

Further reading:

Transformation of Downtown Nairobi

Promoting Safe School Environments in Belo Horizonte

Low Speed Low Carbon Policies - An Assessment Report of Three 30km/h Zones implemented in Belo Horizonte, Brazil

UNRSF project "Scaling Up Safe Streets in Ethiopia"

UNRSF project "Reclaiming Streets for Pedestrians and Cyclists - Building on the global momentum of COVID-19"

- **Target 3.9**: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
- **Indicator 3.9.1**: Mortality rate attributed to household and ambient air pollution

Current status & monitoring

(Extract from: Global SDG Data & Indicators at Year Five - Indicator Analysis)

Definition: The mortality attributable to the joint effects of household and ambient air pollution can be expressed as: Number of deaths, Death rate. Death rates are calculated by dividing the number of deaths by the total population (or indicated if a different population group is used, e.g. children under 5 years).

Evidence from epidemiological studies have shown that exposure to air pollution is linked, among others, to the important diseases taken into account in this estimate: Acute respiratory infections in young children (estimated under 5 years of age); – Cerebrovascular diseases (stroke) in adults (estimated above 25 years); – Ischaemic heart diseases (IHD) in adults (estimated above 25 years); – Chronic obstructive pulmonary disease (COPD) in adults (estimated above 25 years); and – Lung cancer in adults (estimated above 25 years).

Rationale: As part of a broader project to assess major risk factors to health, the mortality resulting from exposure to ambient (outdoor) air pollution and household (indoor) air pollution from polluting fuel use for cooking was assessed. Ambient air pollution results from emissions from industrial activity, households, cars and trucks which are complex mixtures of air pollutants, many of which are harmful to health. Of all of these pollutants, fine particulate matter has the greatest effect on human health. Polluting fuels include wood, coal, animal dung, charcoal, and crop wastes, as well as kerosene. Air pollution is the biggest environmental risk to health. The majority of the burden is borne by the populations in low and middle-income countries.

Limitations: In the case of air pollution, there are some limitations to estimate the joint effects: limited knowledge on the distribution of the population exposed to both household and ambient air pollution, correlation of exposures at individual level as household air pollution is a contributor to ambient air pollution, and nonlinear interactions (Lim et al, 2012; Smith et al, 2014). In several regions, however, household air pollution remains mainly a rural issue, while ambient air pollution is predominantly an urban problem. Also, in some continents, many countries are relatively unaffected by household air pollution, while ambient air pollution is a major concern. If assuming independence and little correlation, a rough estimate of the total impact can be calculated, which is less than the sum of the impact of the two risk factors.

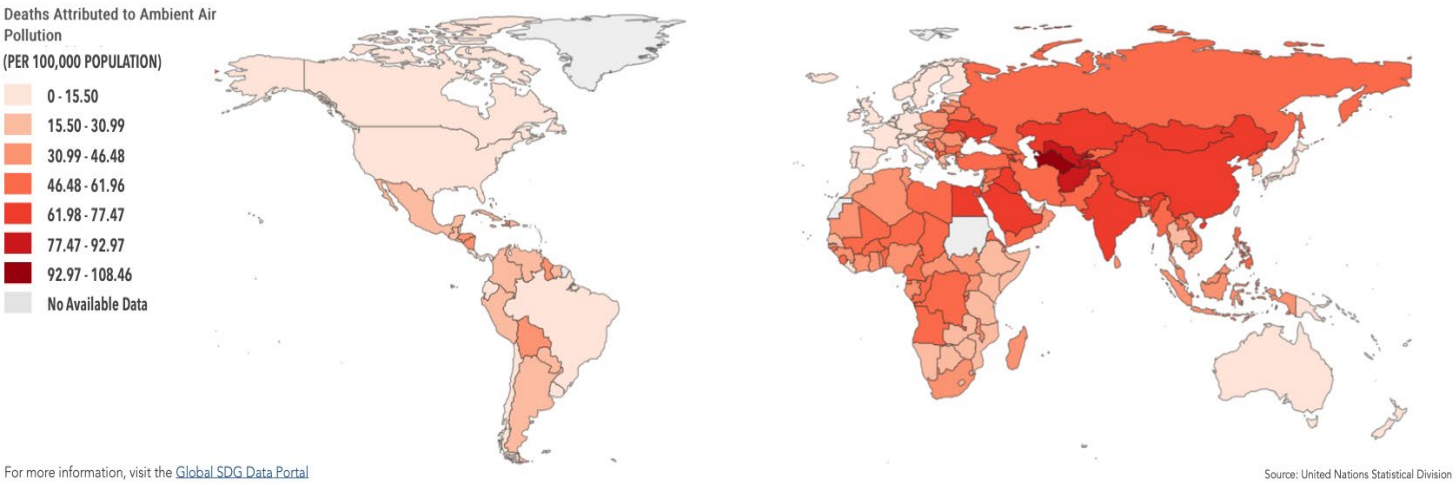


Figure 1.3: Deaths attributed to ambient air pollution (per 100,000 population)

Source: Global SDG Data & Indicators at Year Five - Indicator Analysis (UN, n.d.)

Urban Pathways contribution:

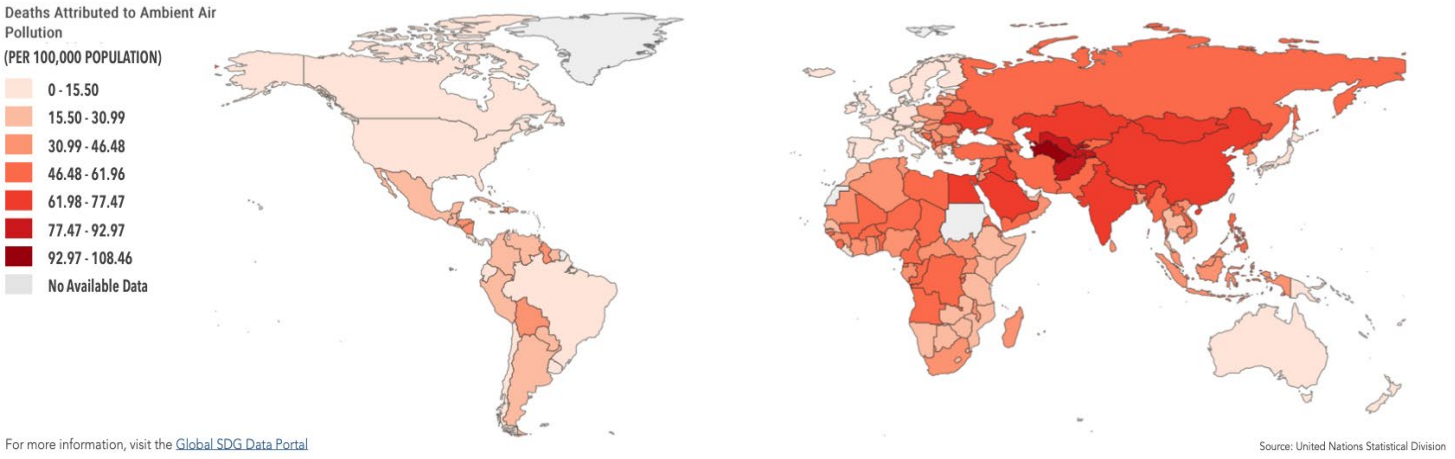
Urban Pathways has supported air quality monitoring in various cities around the world. Through the EnvironMENTALISE initiative, Urban Pathways has supported awareness raising and capacity building activities on-site (through car-free days, tactical urbanism interventions, among others) and online (webinars) with cities in Latin America, Africa and Asia. Air pollution monitoring devices ("Smart Citizen Kit") were handed out to cities to enable them to track impact on environmental and health issues achieved by the pilot projects in the sectors of mobility, energy and waste. In collaboration with UNEP, Urban Pathways supported the development of the Urban Air Action Platform that showcases real-time exposure to air pollution in cities around the world. The project assisted cities incl. Nairobi, Kenya; Kampala, Uganda; Addis Ababa, Ethiopia; Lima, Peru; San José, Costa Rica, Kigali, Rwanda, Kathmandu, Nepal and Quito, Ecuador in their air quality monitoring and modelling efforts through training and the deployment of air quality sensors. Urban Pathways, through the collaboration with UNEP, also contributed to policy development on the issue of air quality incl. the Nairobi City County Air Quality Policy 2020, the Nairobi City County Air Quality Bill 2021 as well as the Addis Ababa City Air Quality Management Plan 2021-2025.

Further reading:

High impact low cost sensors and citizen science for urban air quality management

Know the air you breathe: Mapping Air Quality in Kigali

Modelling air quality to support the decision-making of urban leaders in Kigali, Kathmandu and Quito

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SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all

- **Target 7.a**: By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology

- **Indicator 7.a.1**: International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems

Current status & monitoring

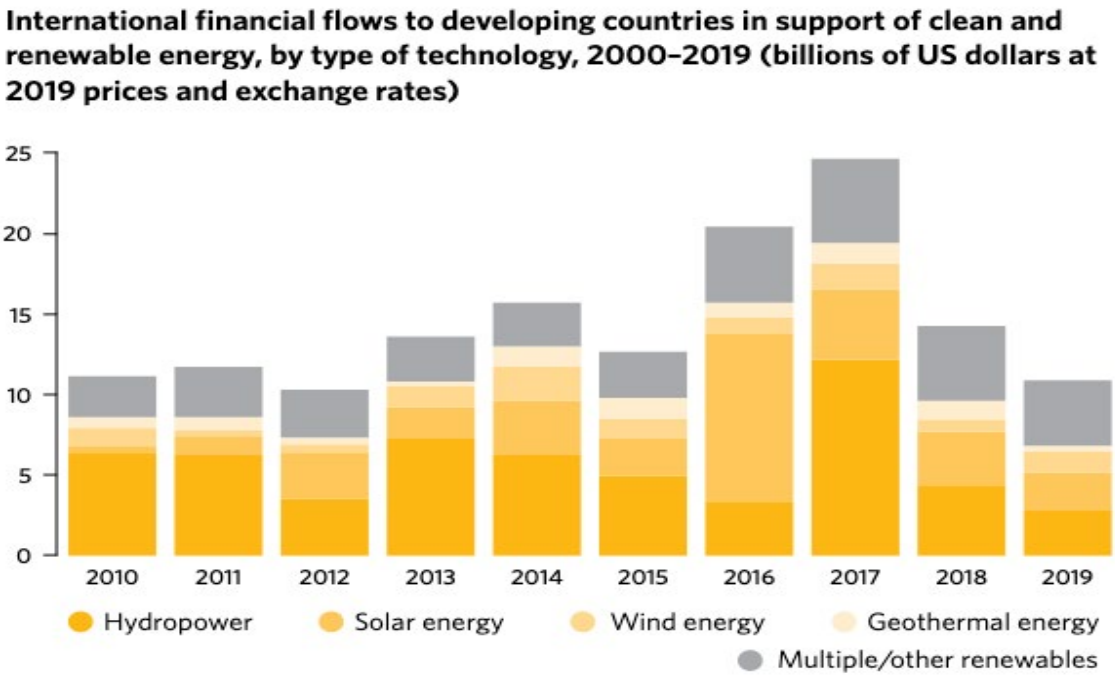
(Extract from: Sustainable Development Goals Report 2022)

International public financing for renewable energy had already slowed before the pandemic, despite the growing urgency of climate change. They amounted to $10.9 billion in 2019, down by nearly 24 per cent from the previous year. The five-year moving average also decreased for the first time since 2008, from $17.5 billion in 2014 –2018 to $16.6 billion in 2015 –2019. The impact of the COVID-19 pandemic may mean another drop in 2020.

Loans captured over 52 per cent of commitments in 2019. Grants comprised almost 17 per cent, signaling an increase in debt-free instruments to support developing countries. Another up-and-coming instrument is shares in collective investment vehicles, such as investment funds, which grew to $191 million in 2019, up by 91 per cent from 2018. LDCs received 25.2 percent of commitments in 2019 compared with 21 per cent in 2018, but the amount decreased from $3.0 billion to $2.7 billion.

Figure 1.4: International financial flows to developing countries in support of clean and renewable energy, by type of technology, 2000-2019 (billions of US dollars at 2019 prices and exchange rates)

Source: The Sustainable Development Goals Report 2022 (UN, 2022)



Urban Pathways contribution

Urban Pathways has supported the development of an EU funded child project "Smart Energy Solutions for Africa (SESA), which aims to support leapfrogging sustainable energy solutions while substituting fossil-fuel-based energy. Embracing a cross-sectoral, interdisciplinary and collaborative approach, the target is to mitigate climate change and avoid lock-in situations while improving access to sustainable energy under affordable, reliable conditions. To do so, the project supports solutions that harness the sustainable and promising opportunities already present on the African continent, such as the highest solar radiation in the world.

The solutions include decentralized renewables (solar photovoltaics), innovative energy storage systems including the use of second-life electric vehicle batteries, smart microgrids, waste-to-energy systems (biomass to biogas), climate-proofing, resilience and adaptation, rural internet access.

The SESA project builds on the relationships established as part of the Urban Pathways project in Kenya, resulting in the launch of a living lab in Western Kenya. The concepts tested initially in the living lab in Kenya, will then be validated in Ghana, Morocco, Malawi and South Africa and replicated in Tanzania, Nigeria, Rwanda and Namibia. Project website: SESA

Urban Pathways has additionally supported the UN-Habitat's urban energy program with the development of guidebooks and technical notes to assist countries in reducing their energy bills, as well as the development of five integrated resource recovery facilities to generate wealth (energy) and reduce to minimum waste going to dumpsites, a project that will begin in 2023. Urban Pathways has also supported the prototype of the tiny house, which promotes the optimization of energy use through sustainable building practices and incorporates renewable energies, water savings and reuse/recycling.


UN-HABITAT

SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable

- **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

- **Indicator 11.2.1**: Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities

Current status & monitoring

(Extract from: Sustainable Development Goals Report 2022)

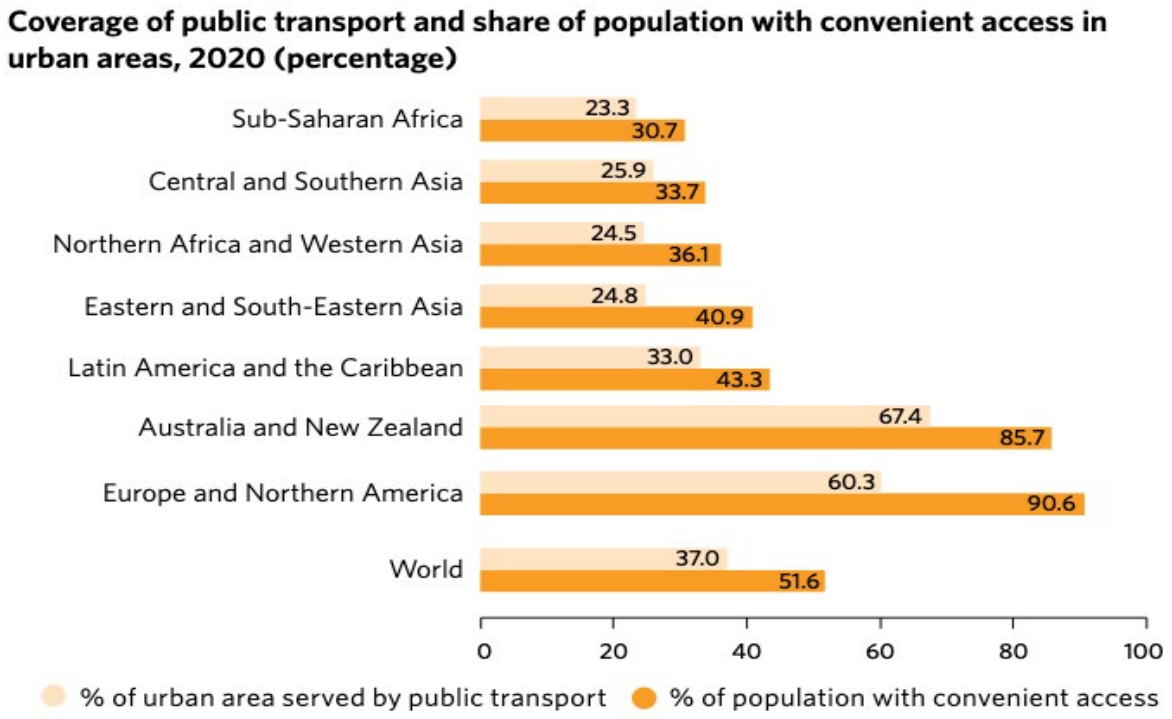
Only about half the world's city dwellers have convenient access to public transportation.

Between 2015 and 2030, annual passenger traffic globally is projected to increase by 50 per cent, and the number of cars on the road is likely to double. Public transportation systems that are well-designed and effective can promote mobility and enable people to access education, health care, employment and markets, while also reducing traffic congestion and pollution. They improve the efficiency, inclusivity and safety of urban areas, while also helping to battle poverty and climate change.

According to 2020 data from 1,510 cities around the world, only about 37 per cent of urban areas are served by public transport. Due to variations in population density within cities, this translates to 52 per cent of the urban population with convenient access to public transport (meaning that they reside within 500 meters walking distance of low-capacity transport systems – such as bus stops or trams – or within 1,000 meters of high-capacity systems, such as trains and ferries). City governments still have a massive task ahead of them in seeking to enhance the availability and use of accessible, inclusive, safe, reliable and efficient public transport systems.

Figure 1.5: Coverage of public transport and share of population with convenient access in urban areas, 2020 (percentage)

Source: The Sustainable Development Goals Report 2022 (UN, 2022)



Urban Pathways contribution:

Urban Pathways assisted with the refinement of the SDG 11.2 monitoring framework, the so-called metadata methodology, to measure status and progress of this target. Through various expert consultations, the tool was refined and submitted to the UN Statistical Division. Since then, Urban Pathways supported the data collection efforts in cities around the world and contributed to the Urban Indicators Database, an open access data platform coordinated by UN-Habitat.

Through various pilot initiatives, ranging from a pedestrian zone in Nairobi (Kenya), Ecozones in Belo Horizonte (Brazil), to electric mobility projects in Kochi (India), Hanoi (Vietnam), Pasig (Philippines), Dar es Salaam (Tanzania), Kigali (Rwanda), Quito (Ecuador) and Montevideo (Uruguay) and Kathmandu (Nepal), Urban Pathways assisted cities in their transition to low carbon mobility, while ensuring co-benefits on other development agendas such as road safety or air quality. With the support of Urban Pathways, more than 40 Mio. EUR additional funding was catalyzed for mobility related projects. These include the EU funded SOLUTIONSplus and "TRANS SAFE - Transforming Road Safety in Africa" projects, as well as the upcoming IKI project titled "ACCESS - Accelerating Access to Low Carbon Urban Mobility Solutions through Digitalization", among others.

In addition, Urban Pathways was key in building the capacity of national and local decision-makers on the topic of low carbon mobility, i.e. by setting up the annual training event titled "Academy of Sustainable Urban Mobility" or through the organization of city to city exchanges that were facilitated to learn from inspiring examples of urban transport solutions.

Further reading:

Walking and cycling in Africa - Evidence and Good Practice to Inspire Action

Streets for Walking and Cycling - Designing for Safety, Comfort and Accessibility in African cities

Integration is key - the role of electric mobility for low carbon, sustainable cities

Index for Sustainable Public Transport Evaluation

- **Target 11.6:** By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management

- **Indicator 11.6.1:** Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities

Current status & monitoring

(Extract from: Sustainable Development Goals Report 2022)

As urbanization increases, the world's cities and metropolises are struggling to cope with the mounting problem of municipal solid waste. When such waste is not collected and managed responsibly, it can become an incubator for infection and a source of plastic pollution and greenhouse gas emissions. In 2022, an average of 82 per cent of municipal solid waste globally was being collected and 55 per cent was being managed in controlled facilities. Municipalities in sub-Saharan Africa and Oceania have an average collection rate of less than 60 per cent. In Asia and in Latin America and the Caribbean, cities have relatively higher collection rates, ranging from 70 to 85 per cent. In Central and Southern Asia, the gap between the collection rate and controlled management rate is larger than in other regions, suggesting that many cities still rely on open dumpsites. Significant investment is needed in the development and maintenance of waste management infrastructure, especially in low- to middle income countries. This must be accompanied by improved policy interventions and strengthened environmental law enforcement for controlled management of municipal solid waste.

Cities are facing converging challenges, including migration and population growth, changes in family structure and social cohesion, increases in informal settlements, vulnerability to climate change and

disasters, exclusion, rising inequality and rising insecurity. With the growth of the middle class in cities, emissions and wastes are likely to increase unless there is change in production and consumption patterns.

This indicator measures the share of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated.

Examples of other indicators monitored at a national level are:

- Municipal solid waste (kg/capita/day),
- Electronic waste (kg/capita),
- Non-recycled municipal solid waste (kg/capita/day),
- Exports of plastic waste (kg/capita)

Urban Pathways contribution

In the context of Urban Pathways, the concept of EcoZones was promoted in various cities around the world as a multi-functional framework to be implemented on a neighborhood level, towards a circular approach for six key elements within cities: local development, social cohesion, sustainable mobility and public space, waste management, urban nature-based solutions and COVID-19 adaptation. The objective of the framework is to be a practical tool, with a staged-implementation approach and which can be customized according to different cities and regions priorities, focusing on inclusiveness, where the shift to a circular economy considers the environmental, cultural, economic, political and social dimensions of different regional contexts.

Urban Pathways has also supported UN-Habitat's Waste Wise Cities Programme, as well as the development of the Waste Wise Cities Tool, a step by step guide to assess a city's municipal solid waste management performance through SDG indicator 11.6.1 monitoring. To facilitate learnings among the participating cities, various city-to-city exchanges on solid waste management were facilitated with support from Urban Pathways.

Figure 1.6: Municipal solid waste collection and management in controlled facilities, 2022 (percentage)

Source: The Sustainable Development Goals Report 2022 (UN, 2022)

- **Indicator 11.6.2**: Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)

(Extract from: Global SDG Data & Indicators at Year Five - Indicator Analysis)

Definition: The mean annual concentration of fine suspended particles of less than 2.5 microns in diameters (PM2.5) is a common measure of pollution. The mean is a population-weighted average for urban population in a country, and is expressed in micrograms per cubic meter..

Rationale: Air pollution consists of many pollutants, among other particulate matter. These particles are able to penetrate deeply into the respiratory tract and therefore constitute a risk for health by increasing mortality from respiratory infections and diseases, lung cancer, and selected cardiovascular diseases.

Limitations: Urban/rural data: while the data quality available for urban/rural population is generally good for high-income countries, it can be relatively poor for some low- and middle income areas. Furthermore, the definition of urban/rural may greatly vary by country.

Urban Pathways contribution

The Urban Pathways partnership, through the United Nations Environment Programme (UNEP), together with UN-Habitat and IQAir, a Swiss air quality technology company, launched the world's largest air quality data platform during the 10th World Urban Forum in Abu Dhabi in February 2020, bringing together real-time air pollution data from more than 4,000 contributors, including citizens, communities, governments and the private sector, to work towards healthier and more sustainable cities.

The Urban Air Action Platform aims to sustain and grow the world's foremost air quality data bank. The data, shared on a single, UN-coordinated platform empowers governments to improve policy, allows citizens to make more informed health choices and demand action from their governments, while giving businesses the ability to make investment decisions that promote a cleaner, greener environment.

Platform website: Urban Air Action Platform

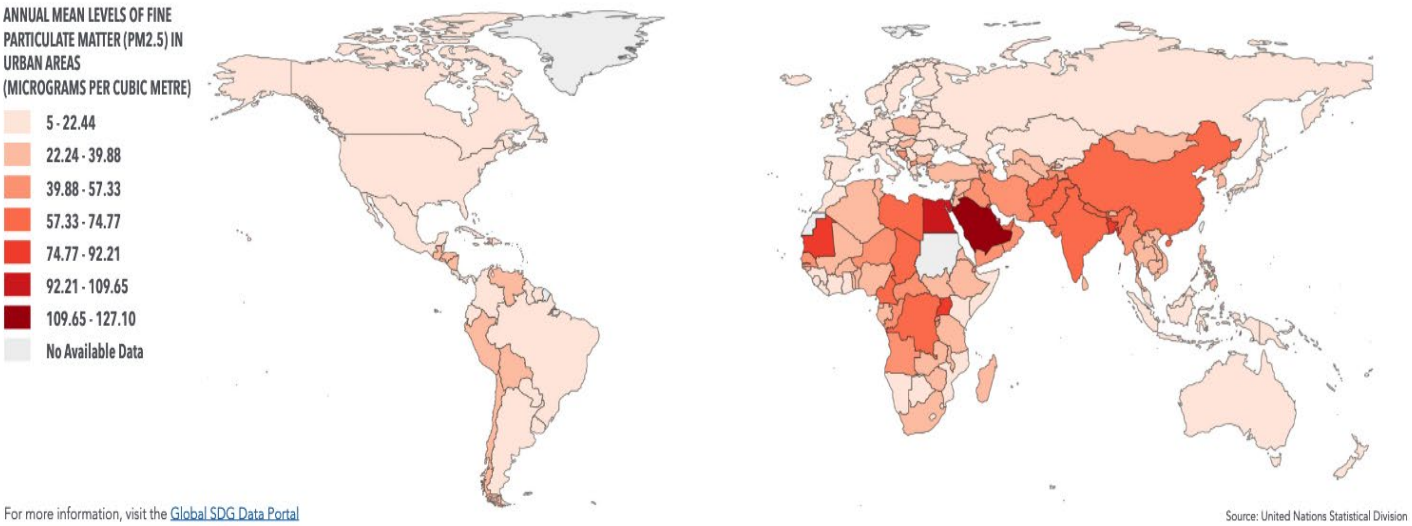


Figure 1.7: Annual mean levels of fine particulate matter (PM2.5) in urban areas (micrograms per cubic meter)

Source: Global SDG Data & Indicators at Year Five - Indicator Analysis (UN, n.d.)

"Punto Verde" - Collection point for recyclable waste in Buenos Aires, Argentina (source: Urban Pathways)

SDG 13: Take urgent action to combat climate change and its impacts

- **Target 13.2**: Integrate climate change measures into national policies, strategies and planning

- **Indicator 13.2.1**: Number of countries with nationally determined contributions, long-term strategies, national adaptation plans and adaptation communications, as reported to the secretariat of the United Nations Framework Convention on Climate Change

- **Indicator 13.2.2**: Total greenhouse gas emissions per year

Current status & monitoring

(Extract from: Progress Towards Sustainable Development Goals- Report of the Secretary-General)

Despite the temporary reduction of CO2 emissions in 2020, global energy-related CO2 emissions rose by 6.0 per cent as demand for coal, oil and gas rebounded with the economy in 2021. Based on current national commitments, global emissions are set to increase by almost 14 per cent over the current decade, which could lead to a climate catastrophe unless Governments, the private sector and civil society work together to take immediate action.

As at 31 December 2021, a total of 123 countries had reported the adoption of national disaster risk reduction strategies, an increase from 55 countries in 2015. The number of countries with disaster risk reduction strategies that promote policy coherence with the Sustainable Development Goals and the Paris Agreement has reached 118, compared with only 44 in 2015. The COVID-19 crisis highlighted a further accelerated global effort and an approach to disaster risk reduction strategies that is more systemic and more multi-hazard in nature.

By April 2022, 193 parties (192 countries plus the European Union) had communicated their first nationally determined contribution under the United Nations Framework Convention on Climate Change and 13 parties had submitted their second nationally determined contribution. The nationally determined contributions attest that countries are articulating more quantified targets and indicators for adaptation and identifying links between adaptation and the Sustainable Development Goals and other frameworks.

As at 31 March 2021, 125 of 154 developing countries were taking measures related to national adaptation plans and prioritizing formulation and implementation of national adaptation plans in their adaptation efforts. Six of the least developed countries (including three small island developing States) and an additional four small island developing States had completed a national adaptation plan. More of the least developed countries had prepared a draft national adaptation plan and were on track to complete and submit it in line with the vision of all least developed countries having their national adaptation plan by 2021.

Urban Pathways contribution

Urban Pathways, through the implementation of demonstration projects, managed to directly reduce GHG emissions of more than 3700t CO2 eq. Concrete scale up plans of the pilot initiatives in Belo Horizonte (Brazil), Nairobi (Kenya) and Quito (Ecuador), illustrate a GHG reduction potential of more than 8300t CO2 eq.

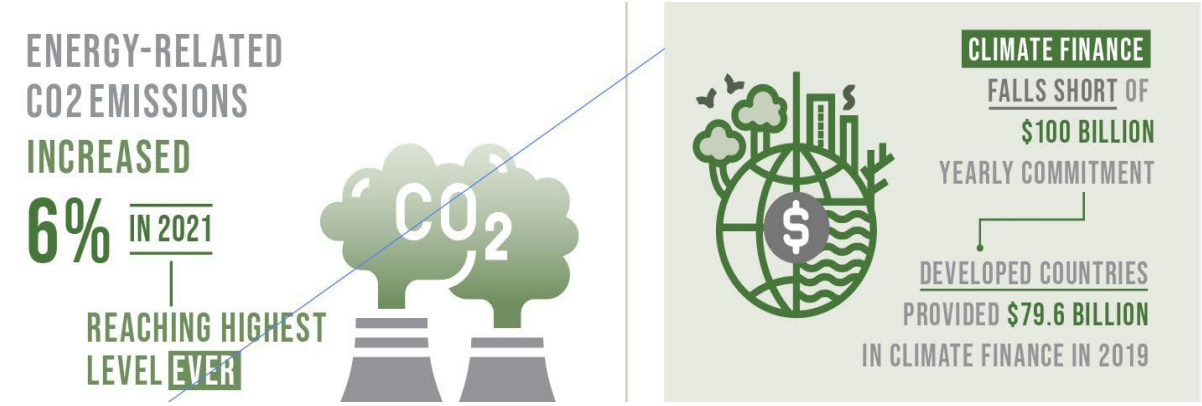
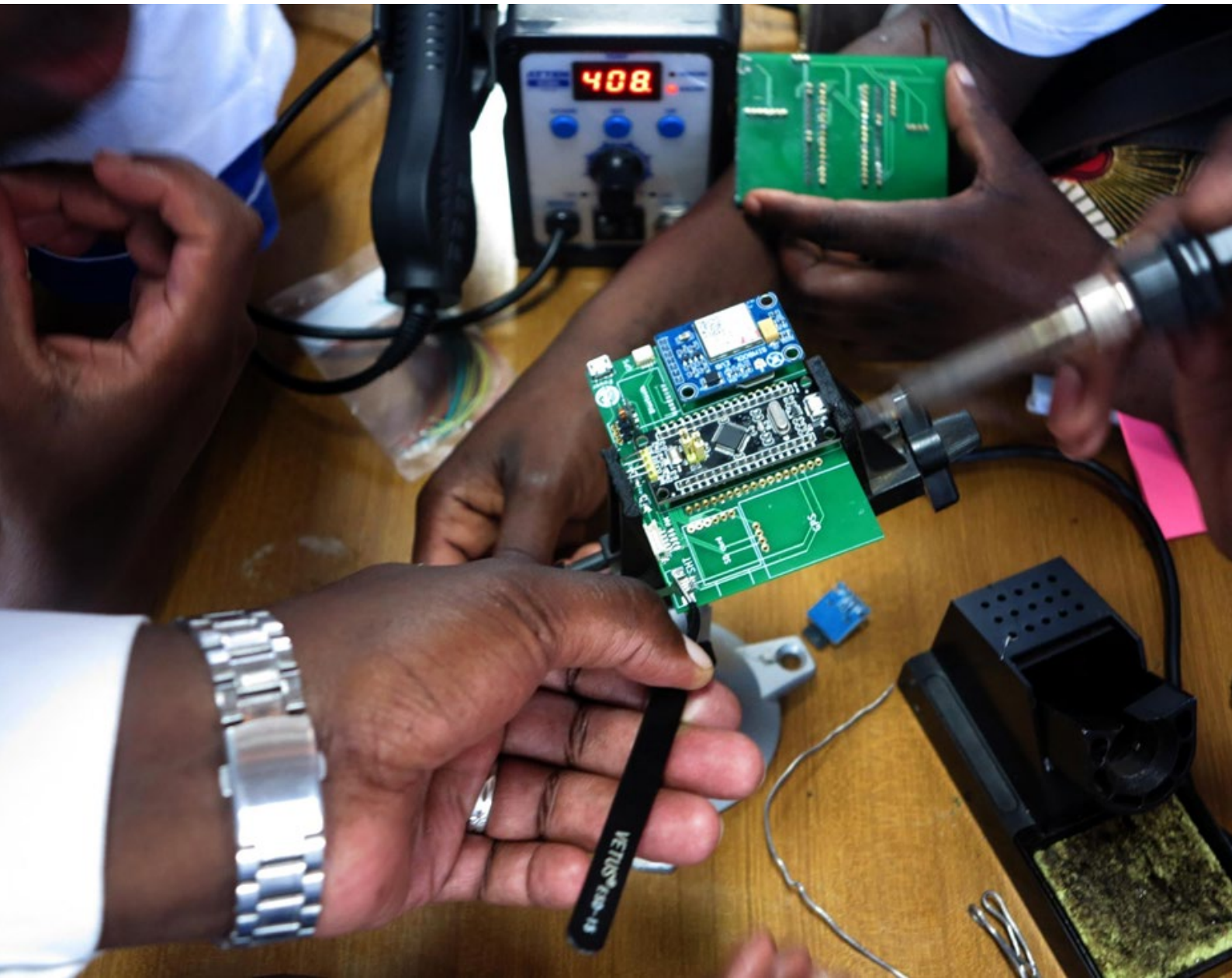


Figure 1.8: Overview of the global energy situation

Source: The Sustainable Development Goals Report 2022 (UN, 2022)



1.4 Final Reflection

With the various man-made and natural crises impacting the world over the last few years, it is becoming evident that after the crisis is before the crises. "Strengthening the preparedness and resilience of cities, including through high-quality infrastructure and universal access to basic services, is crucial in the recovery phase and in our ability to respond to future crises" (Jensen et al., 2022). Cities need to accept the normality of the exceptional.

To do so, cities, their organization, and their operation need to be well planned. Two situations can occur. (i) Cities simply do not know how to do the planning and its implementation. In such case capacity building is key to successful planning (capacity building for well planned urbanization). (ii) City authorities know what to do but do not have the financial means. In this case, fiscal reforms can increase the tax revenues to cities. Overall, cities need to have the planning and implementation means to cope with often rapid urbanization. Thus, local administration needs to be strengthened financially and institutionally – but not without taking participatory processes into account (Rybski, 2022).

Whether urban development is poorly or well planned, is at first not obvious. The assessment of the "urban performance" requires monitoring. Apparently, the coverage of monitoring at the city level is insufficient, as illustrated by the example of SDG 11 (see above). Consequently, data collection and monitoring efforts need to be expanded, which again relies on sufficient institutional capacity and financial resources. Funding "statistical development must be a priority for national governments and the international community" (Jensen et al., 2022). Alternative forms of monitoring could be realized at the interface of data collection and monitoring participation and citizen science.

Chapter 2:

Low carbon Urban Basic Services in the New Urban Agenda

The New Urban Agenda (NUA) was adopted at the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) in Quito, Ecuador, on 20 October 2016. It was endorsed by the United Nations General Assembly at its sixty-eighth plenary meeting of the seventy-first session on 23 December 2016.

The New Urban Agenda represents a shared vision for a better and more sustainable future. If well-planned and well-managed, urbanization can be a powerful tool for sustainable development for both developing and developed countries.

Access to urban services, such as water, energy, waste management and transportation, enables social and economic development, vital to realizing the 2030 Agenda for Sustainable Development and the Sustainable Development Goals, and should therefore be considered a fundamental human right (UN, 2017). The availability of opportunities for self-determined living in urban environments depends to a large extent on these urban services. Moreover, accessibility is key for vulnerable populations, as it promotes equal opportunities in cities and, together with inclusion, is necessary to alleviate poverty. Therefore, equal access to basic services for all should be granted, focusing on accessibility and security so that everyone can benefit from fundamental services, especially the most vulnerable and those who depend on these services to live in dignity (UN , 2017).

Last but not least, urban service delivery requires ensuring coordinated action through a human-centered, inclusive and multi-level governance approach, integrated urban development, appropriate legislative frameworks and enforcement mechanisms. To this end, increasing capacity and fostering intra- and inter-city learning can accelerate the adoption of sustainable solutions (UN , 2017).

2.1 Land Use and Urban Mobility in the NUA

"Compact, dense and inclusive urban design, mixed land use, as well as the integration of transport and land-use planning, should be promoted. The goal should be to reduce the distances traveled to enjoy and take advantage of urban opportunities. This includes controlling and reversing urban sprawl and prioritizing urban development in areas already served by public transport services. Wherever new urbanization is to be implemented, the concept should include public transport and non-motorized mobility."

"The quantity, quality and integration of sustainable transport options in urban areas should be improved. This includes three different elements: (a) Investment in infrastructure dedicated to public transport services, walking and cycling and other upcoming forms of moving as well as improving facilities for non-motorized travel modes; (b) The promotion of a more efficient use of existing infrastructure, exploiting the potential of digitalization of urban mobility as well as shared mobility; (c) Improving sustainable travel options, making the travel experience by collective and public transport modes a seamless alternative to private car travel."

"The demand for private motorized travel should be managed and urban transport rebalanced in favour of people rather than vehicles. Priority should be given to sustainable travel modes which reduce the cost of transport for the community and the negative externalities of urban transport."

(Policy Priorities derived from the United Nations Conference on Housing and Sustainable Urban Development, Habitat III Policy Papers: Policy Paper 9 Urban Services and Technology (2017))

Ongoing expansion of walkways in Nairobi's City Center, Kenya (source: Urban Pathways)

Global implementation progress

Extract from: Progress in the implementation of the New Urban Agenda report of the Secretary-General (UN, 2022)

Progress in urban mobility has been unequal. Many cities face serious congestion and display low shares of public transport. Globally, only around half of urban residents have access to public transport within a 500 meter walking distance. Indonesia, Kenya, Mexico, Turkey and the United States have made national investments in sustainable mobility infrastructure, with the United States and the European Union integrating mobility into their pandemic recovery plans. Finland and the World Bank are pursuing integrated approaches that link mobility infrastructure with urban densification, for efficiency gains and economic viability.

The pandemic has underlined the role of public space in public health and, in response, many cities have developed temporary solutions that have translated into longer-term action on mixed-use neighborhoods, alternative mobility and urban regeneration (notably Barcelona, Milan, Nairobi, New York and Paris). Public spaces contribute directly to local development, social cohesion, climate mitigation and economic recovery. Considerable progress has been made since 2018 on public space reclamation, greening and inclusive use, including through gender-sensitive design. Design and management of public spaces have become more participatory and the legally required urban green area per capita has increased in many countries, including Bahrain and Turkey.

Technology has transformed sustainable transportation in urban areas. In Abidjan (Côte d'Ivoire), IBM has used anonymized data from mobile phone users to determine the most frequented bus routes and the city has introduced 65 network improvements, reducing passengers' travel time by 10 per cent. Electric scooters, bikes and motorcycles are changing mobility patterns and electric mobility sharing platforms are expanding rapidly. Integrated ticketing in Iskandar (Malaysia), for example, is incentivizing the use of public transportation. Urban Pathways has made a significant contribution towards the achievement of the New Urban Agenda by supporting the cities of Nairobi (Kenya), Belo Horizonte (Brazil), Kochi (India), Hanoi (Vietnam), Pasig (Philippines), Dar es Salaam (Tanzania), Kigali (Rwanda), Quito (Ecuador) Montevideo (Uruguay), and Kathmandu (Nepal), in their transition to low carbon urban mobility through pilot projects.

2.2 Urban Energy in the NUA

"Energy efficiency and access to renewable energy sources needs to be achieved with a focus on the synergy of various areas. The key objective is the decarbonization of energy production, distribution and consumption. Central and decentralized energy systems should be integrated, and two- way energy networks should be efficiently used. When more fluctuating power supply is increasing (solar, wind), it is extremely important to ensure efficient demand side measures and smart control systems. In addition, long- and short-term energy storages are gaining significance."

"It is essential to manage the transition to sustainable energy supply and delivery. The challenge lies in managing the increasing energy demand while enhancing access to household energy among the poor at the same time."

(Policy Priorities derived from the United Nations Conference on Housing and Sustainable Urban Development, Habitat III Policy Papers: Policy Paper 9 Urban Services and Technology (2017))

Global implementation progress

Extract from: Progress in the implementation of the New Urban Agenda report of the Secretary-General (UN, 2022)

Currently, under the auspices of the Global Covenant of Mayors for Climate and Energy, more than 10,000 cities across the world have committed to reducing carbon dioxide emissions by 24 billion tons by 2030. Most of the cities are developing renewable energy systems, adopting energy- and resource-efficient approaches, promoting green buildings, reducing their use of fossil fuels, and transitioning to cleaner, inclusive public mobility systems.

Innovative instruments offer opportunities to increase financing for climate action. In 2020, Egypt issued "green bonds" for the first time to finance infrastructure projects,38 following in the footsteps of Johannesburg. The State of Lagos in Nigeria has been issuing bonds for infrastructure development since 2010, improving ist residents' living standards. Many low-income countries have not made full use of sustainable financing, however, citing concerns about hindering productivity, economic growth and job creation owing to the conditionality of renewable energy technologies, which they consider premature.

Urban Pathways made a significant contribution to achieve the energy related targets in the New Urban Agenda by assisting cities such as Nairobi (Kenya) and other African cities in enhancing their energy efficiency of buildings or mobility systems, as well as improve access to renewable energy sources (through the sister project SESA).

2.3 Solid Waste Management in the NUA

"Access to decentralized waste management systems needs to be provided, and alternatives to unregulated and inappropriate forms and locations of unregulated disposal of waste (open burning, landfilling without groundwater protection) must be pursued."

"Waste needs to be treated as a resource, and "circular economy" mechanisms have to be established. Decent work among a formalized waste collection and recycling system and informal waste workers and recyclers, ensuring a coherent, efficient and dignified system for waste collection, recycling and disposal are a prerequisite for the acceptance of a coherent waste policy."

(Policy Priorities derived from the United Nations Conference on Housing and Sustainable Urban Development, Habitat III Policy Papers: Policy Paper 9 Urban Services and Technology (2017))

Global implementation progress

Extract from: Progress in the implementation of the New Urban Agenda report of the Secretary-General (UN, 2022)

Municipalities in low-income countries spend about 20 per cent of their budgets on waste management on average, yet over 90 per cent of waste in low-income countries is still openly dumped or burned. Cost-effective means of adapting landfill sites to reduce

emissions and improve safety, such as the Fukuoka method, are increasingly applied in Africa, including in Rwanda, Kenya and Ethiopia.

After a large private waste management company in Norway declared bankruptcy, 13 municipalities in that country decided to re-municipalize waste collection for improved equity and fostering of knowledge within the community.

Participants during City Exchange on Solid Waste Management in Buenos Aires (source: Urban Pathways)

Chapter 3:

The need for integrated delivery of urban basic services

There is urgent need for stronger integration of urban basic service delivery. Integrated models need to be identified, designed and implemented in multi-stakeholder partnerships that can sustainably secure access to services such as transport, energy, waste management or water in a resource-efficient, environmentally-friendly manner. Very often policies, programmes and projects still follow sectoral approaches, which miss out on opportunities around integration, synergies and co-benefits. This can be showcased with the example of the nexus between mobility and energy. According to the World Bank, currently, only 3.3% of transport is powered by renewable energy and the sector is responsible for roughly one quarter of global energy-related GHG emissions.[1] However, If policymakers can link the two sectors together, they can achieve greater benefits by:

- Promoting less travel through better integration of land use, transport, and energy planning (avoid)
- Having the opportunity to shift to more energy efficient modes of transportation, such as walking, cycling, and public transport (buses, bus rapid transit, rail)
- Improving available technology through technology (fuel economy standard, tires, fuel switching, electric vehicles, taxes and incentives, scrappage, feebates) and behavioral policy (eco-driving, congestion charging).

Leveraging synergies between transport and energy can improve energy efficiency in transport and mitigate their climate impact. With various countries transitioning to electric mobility, it is equally important to provide clean, renewable energy sources to further reduce the carbon footprint of mobility systems.

Critical preconditions for the delivery of integrated urban services are a human-centered, inclusive and multi-level governance approach, integrated urban development, applying the principle of subsidiarity and appropriate legislative frameworks and enforcement mechanisms and ensure coordinated action. To support this, intra- and inter-city learning and capacity building can help to leap-frog to sustainable and integrated solutions.

International efforts to implement the New Urban Agenda need to focus on all levels of governance and decision-making, to ensure that all multilateral and bilateral organizations, local authorities as well as national governments are aligned with and adopt the Urban Agenda. The New Urban Agenda stressed the point that access for everyone to all urban basic services is an essential precondition to enable the achievement of the Sustainable Development Goals.

Consensus and coalitions

Energy, climate and urban development policies generally require a consensus on the need for policy intervention and a strategic, coherent, and stable operating environment. Policy interventions that help deliver on the New Urban Agenda, such as taxation of fuel and electricity use, are highly visible and politically sensitive. They require a strong political commitment to appear on the policy agenda and to remain in place as they rely on investments that are only cost-effective over the medium to long-term (IPCC, 2014).

Developing consensus can be difficult because urban development is complex and multifaceted and policy interventions can have unintended consequences. Linking and packaging policies is vital to generate synergies and co-benefits between measures can help align objectives of different political, institutional and societal actors. An integrated policy approach that creates consensus and coalitions among diverse stakeholders and interests can help to overcome implementation barriers, minimize rebound effects, and motivate people, businesses, and communities. This type of integrated policy approach is especially critical because current GHG reduction measures alone can make important contributions but cannot achieve

1 https://blogs.worldbank.org/transport/bridging-gap-between-transport-and-energy-achieve-sustainable-mobility

the levels of reduction needed to shift to a 1.5 C pathway (IPCC 2014).

Many policy and planning decisions have synergistic effects, meaning that their impacts are larger if implemented together. It is therefore generally best to implement and evaluate integrated programs rather than individual strategies. The combination of various policy objectives that can be addressed by an integrated multi-level policy and governance approach provides a solid basis for durable policies that can have long-lasting impacts. For example, by itself a public transport improvement may cause minimal reductions in individual motorized travel, and associated benefits such as congestion reductions, consumer savings and reduced pollution emissions. However, the same measure may prove very effective and beneficial if implemented with complementary incentives, such as compact and mixed use city planning, and efficient road and parking pricing, so travelers have an incentive to shift away from individual car travel (Lah, 2015).

Sticking to the example of urban transport interventions, the most effective mobility programs tend to include a combination of qualitative improvements to alternative modes (walking, cycling, ridesharing and public transit services), incentives to discourage carbon-intensive modes (e.g. by efficient road, parking and fuel pricing; marketing programs for mobility management and the reduction of commuting trips; road space reallocation to favor resource-efficient modes), plus integrated transport planning and land use development, which creates more compact, mixed and better connected communities with less need to travel.

Several studies emphasize that an integrated approach is vital to reduce greenhouse gas emissions cost-effectively in urban areas (IPCC 2014). While emissions reductions can be achieved through several means, such as modal shift, efficiency gains and a shift to renewable energies, it is apparent that the combination of measures is a key success factor to maximize synergies and reduce rebound effects.

Inter-sectoral Collaboration

Key prerequisite for the delivery of integrated low carbon basic services is inter-sectoral and inter-departmental collaboration. A qualitative study conducted by Hendriks et al. (2015) analysed local government views on intersectoral collaboration. The results show that capability for collaboration "was found to be determined by the ability to share policy goals, and was more likely to increase when officials had greater motivation to continue learning." The interviewees also mentioned that flatter organizational structures and coaching of city officials by managers could improve inter-sectoral collaboration opportunities.

The implementation of the Urban Pathways project additionally revealed that the use of non-technocratic language and the simple framing of goals in non-sector's terminology can also support inter-sectoral communication and thus collaboration.

Governance and institutions

Policy agenda setting and policy continuity is affected by political consensus, which is a result of political and institutional relationships. These relationships, including the interactions between different levels of government (e.g. local, state, federal, supra-national) and acknowledgement of scientific consensus on climate change policy, vary greatly between key political and societal actors in different countries.

Political stability greatly affects the ability of governments to deliver on policy objectives. Policy environments and the exposure to volatility varies between countries and changes over time, which affects implementation of sustainable urban development and climate change mitigation measures and results in significant differences between countries' progress reducing GHG emissions. Changing political environments means that policy environments are also influenced by a level of uncertainty. Hence, a shared set of methods and values are generally considered vital for setting the policy agenda, usually delivered through knowledge communities.

The political and institutional context in which policies are pursued is a vital factor for the success or failure of implementation. Institutional aspects, such as the presence/ absence of an environment ministry at the national level or environment department on the local level, and their respective roles in the process are likely to have an effect on the implementation of climate related urban basic services measures. The legal power, budget and political influence of these agencies are equally important (Jänicke, 2002).

As a measure for continuity and to support broad societal coalitions, participation of diverse political and public stakeholders can be vital for the long-term success of policy and infrastructure decisions. The policy environment, or context in which decisions are made, is as important as the combination of policy decisions and infrastructure investments that make up a low-carbon development strategy (Justen et al., 2014). This policy environment includes socio-economic and political aspects of the institutional structures of countries. These structures help build coalitions but can also increase the risk that a policy package fails because one measure faces strong opposition (Sørensen et al., 2014). A core element of success is the involvement at an early stage of potential veto players and the incorporation of their policy objectives in the agenda setting (Tsebelis and Garrett 1996).

See more at Pathways for Urban Development: Key Issues for Low-carbon Cities

Chapter 4:

Policy recommendations towards low-carbon urban basic services

Reducing greenhouse gas emissions in the transport, energy and waste sectors is a significant challenge. The situation is very disparate from country to country, but it is apparent that policies are the vital element that can explain these differences. Policy packaging and integration is a vital element of the (relative) successes. If applied in isolation, measures are unlikely to achieve their stated goals of reducing overall emissions.

This chapter shows a compilation of policy recommendations derived directly from the Urban Pathways project and the work in the pilot countries, as well as from research work conducted as part of the project. The aim is not to provide a comprehensive list, but rather highlight these recommendations that came out strongly in the duration of the project.

The chapter provides support to policy makers in the development and upscaling of low-carbon urban services (mobility, energy and waste management, as well as integrated concepts such as living labs and EcoZones).

4.1 Sustainable Mobility

Emissions from the transport sector are a major contributor to climate change. In terms of transport modes, 72% of global transport emissions come from road vehicles, which accounted for 80% of the rise in emissions from 1970-2010 (WRI, 2019). An integrated approach in line with the Avoid-Shift-Improve principle (see Figure 4.1) that avoids unnecessary travel through compact and polycentric urban design, shifts trips to low-carbon modes, and improves the efficiency of the vehicle fleet is vital to move towards a low-carbon development pathway and generate broader sustainable development benefits (Figueroa et al., 2013, MobiliseYourCity Partnership). Therefore, the transition to a low-carbon transport sector depends on cities enabling modal shift and avoiding travel and providing incentives for the uptake of improved fuel efficiency and changes in urban design that encourage walkable cities, non-motorized transport and shorter commuter distances. It is important to note that the Avoid-Shift-Improve approach follows a hierarchy: "avoid" measures should be implemented first, secondly "shift" and finally the "improve" measures.

Cities pursuing sustainable transport benefit from reduced air pollution, congestion and road fatalities, and are able to leverage the relationship between transport systems, urban form, urban energy intensity and social cohesion. Yet, there are a number of barriers to fully utilize this potential that require policy action to regulate the efficiency of the vehicles, steer consumers towards more efficient vehicles, and encourage more efficient use of vehicles. Beyond the design and implementation of single policies, a combination of measures is vital for their success in avoiding rebound effects and to foster the contribution of low-carbon mobility to sustainable development. This requires a mutually enforcing set of policy and infrastructure measures at the national and local level.

Electrification is an important part of the solution to the challenge of growing transportation sector emissions because it eliminates tailpipe emissions and harnesses the potential to decarbonize the power grid. However, for cities to fully benefit from the transition to electric mobility, these efforts need to be implemented in the overall context of better and more compact urban planning with a focus on accessibility and urban liveability.

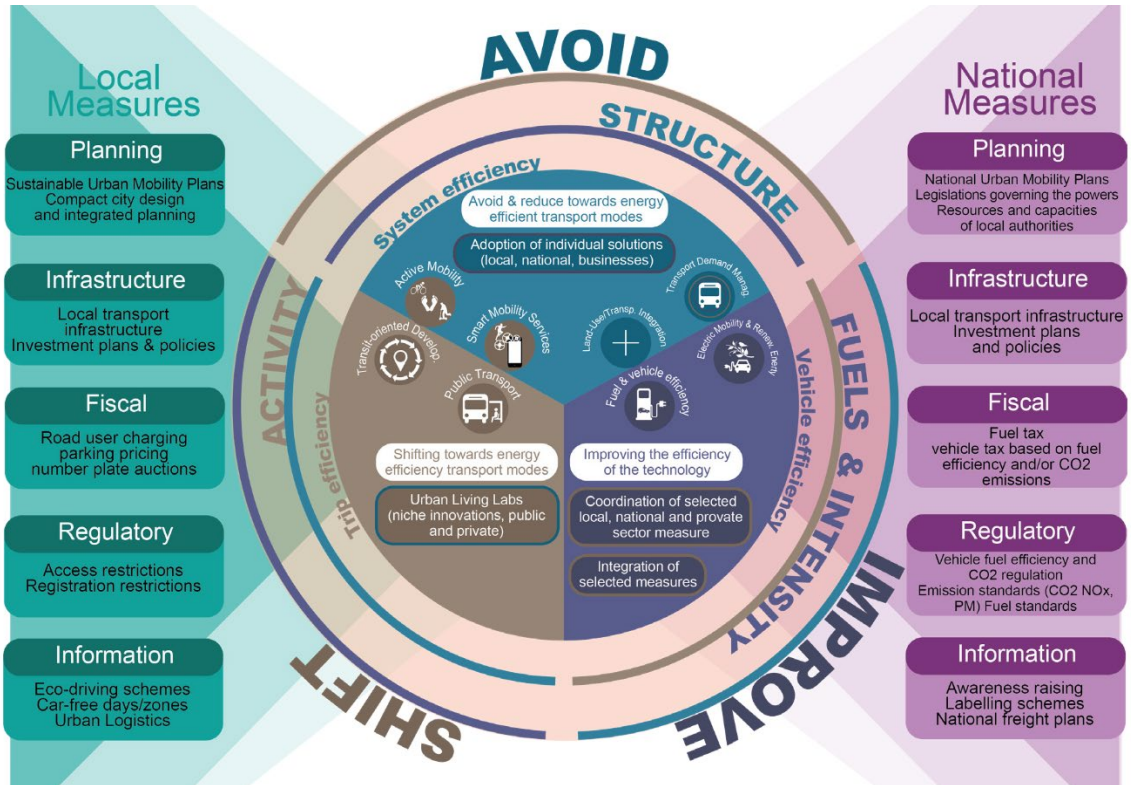


Figure 4.1: Key measures in a comprehensive mobility transition strategy (UEMI 2020)

In short, compact city planning and the provision of low-carbon transport modal alternatives, such as public transport, walking, and cycling, are vital components of a low-carbon transport strategy.

We need to find ways of moving less, or move without creating emissions. This means that more countries need to include a specific target for reducing transport emissions in their NDCs. So far, many countries strongly focus in their NDCs on Improve measures (more than half of all measures). However, according to SLOCAT's Transport and Climate Change Report, the Avoid and Shift strategies can account for 40-60% of transport emission reductions, and they can be implemented at lower costs than Improve strategies.

The Urban Pathways project supported cities in the development and implementation of sustainable urban mobility pilot projects with a strong focus on active and electric (public and shared) mobility embedded in enabling local policy frameworks with a high potential of being replicated in other areas of the cities. Based on the lessons learnt in the project, Urban Pathways advises cities on the following recommendations:

4.1.1 Design compact, mixed use neighborhoods

Compact cities provide the opportunity for shorter travel distances and can avoid unnecessary travel. Higher population densities provide the basis for mass-transportation modes and can enable the integration of public transport and non-motorized transport infrastructure (Hymel et al., 2010). Combined with mixed use, these factors can reduce travel distances, and improve accessibility and efficiency of public transport (UN-Habitat 2013). While the development of urban form and transport infrastructure are long-term processes, there is a large potential that sustainable urban planning can influence cities that are small to medium size and rapidly growing as is the case today in many developing countries (United Nations 2010; Amekudzi et al. 2011).

Further reading

Rethinking Multimodal Urban Mobilities_I, Multimodal corridor Quito

Rethinking Multimodal Urban Mobilities_II, E-mobility light hubs Pasig City

Factsheet: Big Data for Mobility Planning

Factsheet: Transit Oriented Development

Factsheet: Low Carbon Neighbourhood

4.1.2 Improve livability of streets and urban spaces - Tactical Urbanism

A livable neighborhood is a neighborhood in which streets and public spaces invite people to stay, sit, roam and play, e.g. on park-like elements or pedestrianized zones, and where walking and cycling (active mobility) is encouraged. It is now increasingly being recognized that attractive, active, well-functioning streets and public spaces help revitalize communities and jumpstart economic development. The New Urban Agenda emphasizes the so-called placemaking, a collaborative process of shaping the public realm in order to maximize shared value (UN Habitat 2015). A central element of placemaking is organizing joint activities and activating the community, while experimenting with new ways of how to use and regain public space from car-centered infrastructures (e.g. temporary blocking of a street around a festival to promote active mobility). Factsheet "Liveable neighbourhood 1" summarizes different placemaking activities, its benefits and favorable framework conditions.

While many of the placemaking activities can be conducted with relatively little costs and short-term, they can plant the seeds for longer-term, more permanent physical interventions. It is important to understand that placemaking does not focus only on enhancing already existing (maybe under-used) streets and public spaces (plazas), but also on creating new public spaces out of existing infrastructure, e.g. carving out a little plaza by re-design of a street or crossing.

There is, however, no clear distinction between placemaking activities (say: the community-based experimenting and piloting of ideas) and the rather formal / official re-design of existing infrastructure; instead many times the latter builds on the testing and adapting that is made possible with placemaking activities. One well-known example is the pedestrianization of New York Times Square, which in 2009 was introduced as a temporary placemaking-measure (setting up chairs & removable bollards to ban cars) and in 2014 was made permanent (reshaping the entire plaza).

Compact cities, mixed use neighborhoods and walkable streets do not only have positive impacts on lowering emissions and local air pollution but are also measures to achieve various co-benefits in the area of road safety and public health. Road traffic is not only the 10th leading cause of death worldwide, but also the leading cause of death of children aged 10 to 19 in developing countries. This means that roads are a dangerous place for all, but especially for children and adolescents. The inter-sectoral benefits of compact and walkable neighborhoods place them among the most impactful interventions of transport planning.

In this context, Urban Pathways supported projects in several cities around the globe to improve walkability, road safety and public space, with a strong focus on school surroundings, such as in Belo Horizonte, Brazil. A tactical urbanism approach was used with the goal of reclaiming the space from cars to pedestrians and cyclists and providing them with safer spaces for walking and cycling, but also with the aim of raising awareness among children and adolescents about the environmental, health, social and economic benefits of non-motorised transport. As a result, several cities were supported to implement Zones 30 and Low Emission Zones (LEZ), as well as to carry out various actions during the Mobility Week, the Car-free Day and the Day of Walking and Cycling to School.

Zone 30 in Belo Horizonte, Brazil (Source: Urban Pathways)

Tactical Urbanism in Aguascalientes, Mexico (source: Urban Pathways)

Further reading

Factsheet: Liveable Neighbourhood – re-design of existing infrastructure to improve liveability of urban space

Liveable Neighbourhood – activities to regain public space and foster social cohesion

Transformation of Downtown Nairobi

Additional resources

Webinar: Fundamentals of Tactical Urbanism

Webinar: Adopting Tactical Urbanism in Cities

4.1.3 Promote and celebrate active mobility

Walking and cycling are healthy and pollution-free forms of mobility that are fundamental to life. However, people walking and cycling are often seen as having a lower time value than car users, which generates widespread disrespect and a sense of irrelevance to the "aspirational" transportation system of the future (UNEP & UN-Habitat, 2022). Moreover, particularly in many developing and emerging economies, there is a misconception that people walk or cycle only because they are poor. Very often, the infrastructure for pedestrians and cyclists is of poor quality, unsafe and incomplete in terms of a city-wide network. This is why it is critical that cities promote, celebrate and fund active mobility.

In order to guarantee pedestrian and cyclists safety, it is crucial to keep vehicle speeds low. People hit by vehicles traveling at high speeds are much more likely to die than those hit by vehicles traveling at lower speeds (UN-Habitat & ITDP, 2018). Drivers can observe their surroundings and identify any potential collisions with pedestrians, cyclists or other motor vehicles much more easily when traveling at speeds below 30 km/h (19 mph) (See Figure 4.2).

High speed not only increases the likelihood of collisions, but also reduces the driver's field of vision (Figure 4.3) which reduces his or her ability to react to changing road conditions - like a child running into the street. In addition, slower moving vehicles provide pedestrians with a sense of safety which allows them to relax as they make their way to their destinations (UN-Habitat & ITDP, 2018).

Belo Horizonte during the Zone 30km/h celebrations (source: BHTrans)

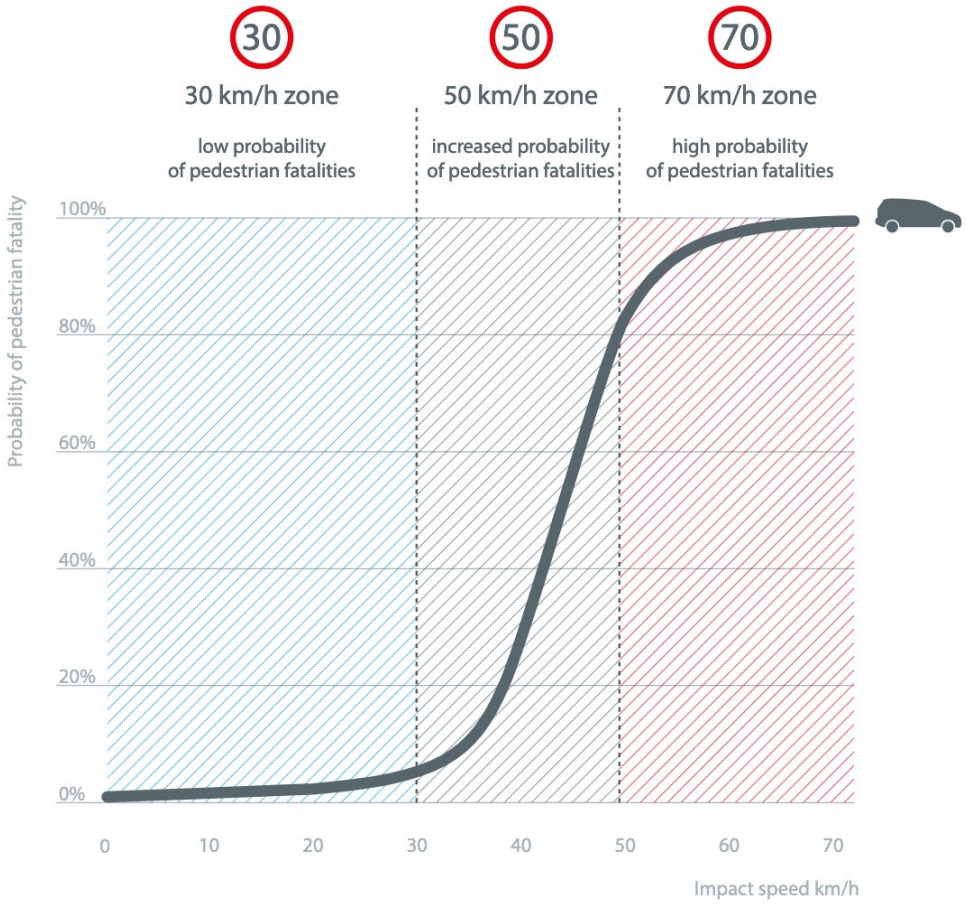


Figure 4.2: Chance of Fatality by Impact Speed

Source: TUMI (2019)

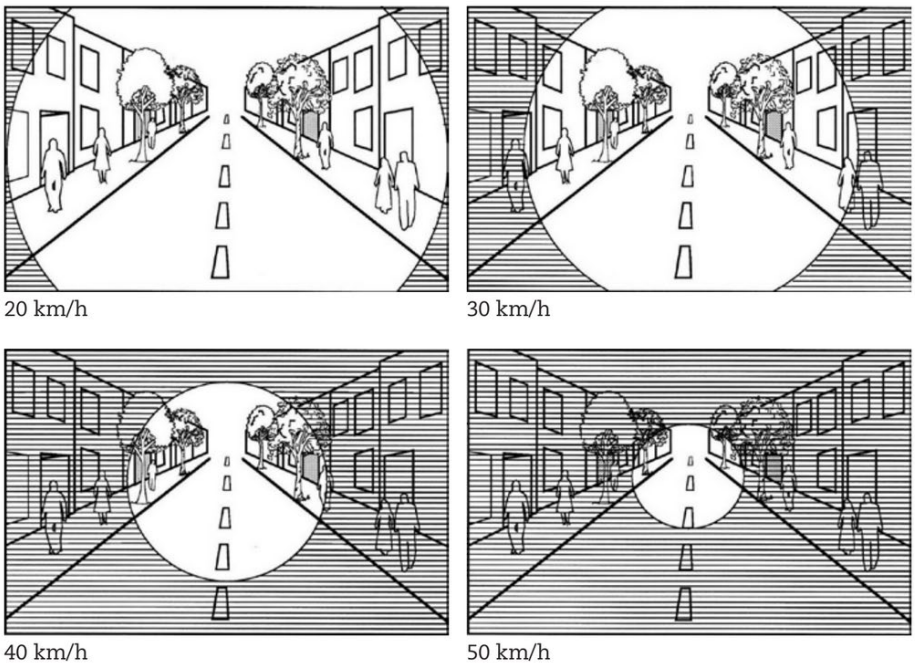


Figure 4.3: Driver's field of vision at different speeds

(Source: UN-Habitat & ITDP, 2018)

Making non-motorized modes of transport viable and convenient requires rebalancing street space so that it caters to all modes of transport. Complete streets should be encouraged as a design approach to enable safe, convenient and comfortable travel and access for users of all ages and abilities regardless of their mode of transportation.

Well planned footpaths provide continuous space for walking. It is possible to provide a continuous space for walking while allowing for other activities, such as waiting at bus stops and street vendors, without affecting pedestrian mobility, by adequately constructing pedestrian walkways. See how to design a successful walkway by integrating multiple elements in Streets for walking & cycling.

Walking and cycling infrastructure along with measures such as bike sharing schemes and bike parking facilities provide modal alternatives and also act as feeder to the public transport system. Long-term master plans for the promotion of walking, cycling and public transport, such as those developed by the cities of Freiburg (Germany) and Odense (Denmark), led to an increase of cycling in the modal share to 26% (1999 Freiburg) and 35% (2001 Odense) (Figueroa et al. 2014).

Further reading

Low speed, low carbon policies - an Assessment Report of Three 30km/h Zones implemented in Belo Horizonte, Brazil

Ruas de Estar - A Guide to Livable Streets

Promoting Safe School Environments in Belo Horizonte

Why Infrastructure matters: Active Mobility, Public Transport and Economic Growth in African Cities

Streets for Walking and Cycling - Designing for Safety, Comfort and Accessibility in African cities

Additional resources

Webinar: Caminando y Pedaleando por Barrios más seguros, Amigables y Verdes

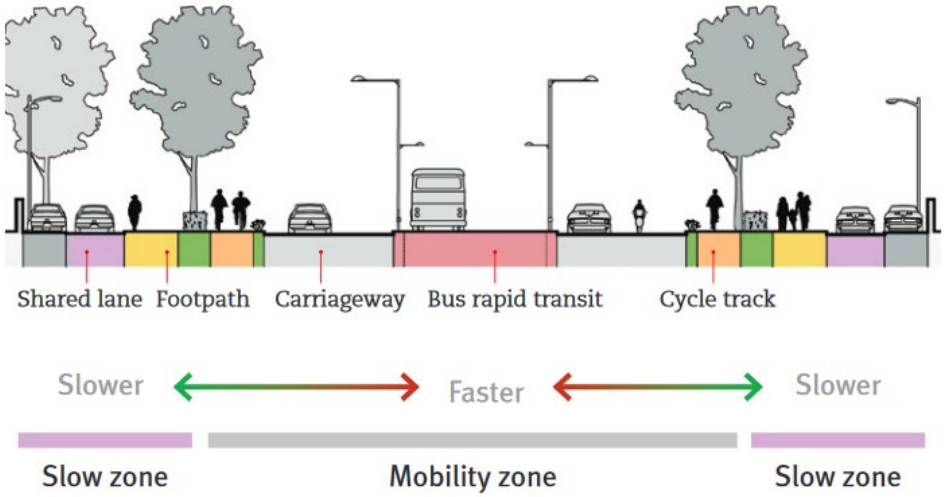


Figure 4.4: Complete Street Design catering for all transport modes.

(Source: UN-Habitat & ITDP, 2018)

Children designing streets in Belo Horizonte, Brazil (source: Urban Pathways)

4.1.4 Improve and promote public transport

Another vital aspect for low-carbon and accessible transport is the provision of high-quality public transport infrastructure and services as well as integrated with walking and cycling facilities. (Small and Verhoef 2007). Cities that invest considerably in public transport and in walking and cycling infrastructure tend to achieve higher shares of these modes, which increases the economic efficiency of transport and reduces public health and environmental impacts as well as congestion (UN-Habitat 2013).

Metro system (MRT), Lightrail (LRT) and Bus Rapid Transit (BRT), provide options for high capacity and high average speed mass transit options, which can provide highly cost-effective alternatives to individual motorized transport, at least over the long-term. Figueroa et al. (2014) suggests that doubling the market share of public transport, walking and cycling could yield cumulative savings of over US$100 trillion over a 40 year period. Therefore, investing in high-quality public transport systems in developing cities across the world can help meet the growing mobility needs of residents.

Passengers waiting for the BRT in Dar es Salaam (Source: Urban Pathways)

Further reading

Factsheet: Bike sharing and public bicycle system

Factsheet: Integrated Fare system

Factsheet: Bus Rapid Transit System

Factsheet: Tram Systems

Gender Sensitive Mini-Bus Services & Transport Infrastructure for African Cities: A Practical Toolkit

Evaluation Model for Public Transport System in Latin American Cities in the context of the NUMPS in Uruguay and Ecuador

Major bus manufacturers - an overview of their flagship models

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4.1.5 Electrify the transport

As a result of the pressing need to reduce air and noise pollution levels, to address the growing greenhouse gas (GHG) emissions from conventional vehicles, and other factors, the use of electric vehicles is increasing in many cities around the world. Electrification of transport can simultaneously contribute to sustainable urban mobility by improving the energy efficiency of vehicles and supporting the shift towards public transport and active mobility. Moreover, electrification can stimulate investments in environmentally friendly public transport and new fleets, which in turn can make public transport more attractive by using more modern and quieter vehicles.

Individual initiatives and technologies can contribute to change, but the transition to a net zero emission transport system will only be possible with an integrated and systemic transformation that affects not only the transport sector but also the energy and resource sectors (Teko E. and Lah O., 2022). For this transition to take place, several challenges need to be overcome including the lack of or inadequate cross-sectoral coordination and collaboration between the public and private sectors, political will, policy and regulatory frameworks, technologies, stakeholder commitment and acceptance of innovative solutions, as well as to overcome the reluctance of local companies, cumbersome maintenance (and availability of spare parts), difficulties in the battery supply chain and battery materials, limited technology maturity, reluctance of public authorities on decreasing fuel tax revenues, among others (Teko E. and Lah O., 2022).

Although policies on electric mobility are increasing and there is progress on the ground, financial and technical barriers persist. There are several factors limiting the adoption of electric mobility initiatives, such as the high upfront costs of vehicles and infrastructure, the perception that electric vehicles are not as competitive as traditional vehicles and, that transport operators and their representative associations receive less recognition as key players in the transition to electric mobility compared to start-ups and public authorities (Galuszka et al., 2021).

On the policy side, according to Galuszka et al. (2021), if policymakers do not take socio-economic issues into account when designing climate change and electric mobility policies, there is a risk of a spontaneous contention over a specific solution. This can become entangled in political agendas (e.g. the "Yellow Vests" protests against fuel taxation in France and in Metro Manila against technology standards imposed on the electrification of jeepneys). Therefore, the development of policies that support the integration of various systems, including co-production practices and hybrid systems, could increase the acceptance of e-mobility and technological advancements.

Disruption of supply chains and the reallocation of budgetary sources to priorities that arose from the pandemic are likely to hinder the transition. Therefore, transition processes should prioritize addressing concerns of social justice, informal solutions, workers' rights, and other issues. Moreover, social and economic issues should be considered as important as technological adequacy or regulatory mechanisms when integrating e-mobility solutions into local contexts (Galuszka et al., 2021).

There is a need to establish a principle of transparency in policy- and decision-making, allowing for a structured participation of the transport sector. As an initial step, public authorities should consult transport providers aiming for co-production strategies that consider their requirements and expectations. Especially when organizational and financial solutions have been identified that might facilitate the transition and lessen the budgetary limitations on transport providers (e.g. leasing or rental models, pay-as-you-go) (Galuszka et al., 2021).

Regarding infrastructure, urban planning plays a key role in improving connectivity between transport modes based on the availability and good design of charging infrastructure (Galuszka et al., 2021). In this sense, the transition depends on the vast network of charging options and consistent availability of charging stations for e-mobility services as much as on the availability of a high-quality infrastructure for walking, cycling and public transport (Teko E. and Lah O., 2022).

When it comes to electric vehicles, they must be resource and energy efficient, properly integrated with other mobility services and infrastructures, and created with mobility as a service and universal access in mind. Vehicle size and power must be reduced, as this improves cost-effectiveness and energy efficiency (Teko E. and Lah O., 2022). Moreover, it is important to consider batteries throughout their entire life cycle, applying a circular economy strategy, taking advantage of "reuse, reuse and recycle" opportunities, and eliminating any hazards to the environment or human health while recycling batteries. For instance, repurposing the batteries from electric cars into energy storage devices can make it easier to integrate intermittent renewable energy sources into power grids.

Electric auto-rickshaw in Kochi (source: KMC)

Other technological advances, such as automation, should focus on improving public transport networks and avoid competing with non-motorized transport. The provision of on-demand mobility services in rural locations where conventional public transportation options are unfeasible may be an area where automation has the potential to thrive (Teko E. and Lah O., 2022).

Finally, access to transparent information on the cost, time, safety and other relevant aspects of available mobility solutions and vehicles can guide users towards safer and more efficient modes and vehicles (Teko E. and Lah O., 2022).

The Urban Pathways project prepared a large electric mobility sister project titled "SOLUTIONSplus - Integrating Urban Electric Mobility Solutions in the Context of the Paris Agreement, the Sustainable Development Goals and the New Urban Agenda" - and supported the implementation of e-mobility pilot initiatives in 8 cities around the world.

Further reading

Integration is key: The role of electric mobility for low-carbon and sustainable cities

East Africa´s Policy and Stakeholder Integration of Informal Operators in Electric Mobility Transitions - Kigali, Nairobi, Kisumu and Dar es Salaam

Economic viability for electric buses in two corridors in Quito and Montevideo

Major bus manufacturer - and overview of their flagship models

Scenarios of potential reduction of emissions by different bus technologies

Transportation Strategies for a 1.5C world: A comparison of four countries

Design - The starting point for a circular battery value chain

Factsheet: Electric Three Wheeler

Factsheet: Implications of Autonomous vehicles on Urban Planning

Factsheet: Electric Handcarts

Factsheet: E-Mobility Solutions: Electric Urban Delivery Trucks

Factsheet: Electric Mobility in Belo Horizonte

Factsheet: Last mile urban deliveries with cargo cycles

Additional resources

Courses:

Asia Regional Training on E-Mobility

Electric Vehicles for cleaner cities

Webinars:

Lithium-ion EV battery: e-waste, electric mobility and energy nexus

E-Scooters, Challenges and Opportunities of New Mobility Modes

4.1.6 Improve vehicle fuel efficiency

There is an immediate need to improve vehicle fuel efficiency from an economic, societal and environmental perspective. Doing so harbors considerable potential for co-benefits if the efficiency technology is advanced enough to be introduced cost-effectively (Leinert et al. 2013; Viguié and Hallegatte, 2012). Vehicle fuel efficiency technologies are, however, substantially underutilized; while some countries have made noticeable progress in this area, others have largely failed to do so (IEA, 2013).

The investment barrier is still the most prevalent obstacle to the widespread market penetration of energy efficient products (Sorell et al., 2009). Several studies show that GHG reduction measures in transport have quite favorable abatement costs but require higher capital intensity than many measures in other sectors (McKinsey and Company 2009; Shalizi and Lecocq 2009). While these investments result in considerable economy-wide benefits over the lifetime of a vehicle, they may not create sufficient payback rates for the particular individuals responsible for vehicle purchasing decisions. Rebound effects may, however, undermine some of the efficiency gains, further complicating the collective action problem.

An additional issue affecting energy efficiency measures is the rebound or take-back effect. The effect refers to the tendency for total demand for energy to decrease

less than expected after energy efficiency improvements are introduced, due to the resultant decrease in the cost of energy services (Gillingham et al. 2013). Ignoring or underestimating this effect whilst planning policies may lead to inaccurate forecasts and unrealistic expectations of the outcomes, which, in turn, lead to significant errors in the calculations of policies' payback periods (WEC 2008).

While from a climate change mitigation perspective vehicle efficiency and low-carbon fuels may provide the biggest potential, this does not fully reflect a broader sustainable transport perspective. A multimodal and integrated policy approach can minimize rebound effects, overcome split-incentives and achieve a higher level of socio-economic co-benefits (Givoni 2014). Energy efficiency and low-carbon fuels have a key role to play in decarbonizing the transport sector. However, other strategies, in particular avoiding travel through compact city design and shifting to low-carbon modes (Avoid, Shift) are the measures that might yield the more substantial opportunities to contribute to sustainable development.

Some of the main aspects vital for a low-carbon vehicle fleet are: vehicle efficiency standards, fuel tax and differentiated vehicle taxes. These measures together with the provision of modal choices and compact city design are considered to reduce transport activity, shift towards a more efficient transport structure, improve the energy intensity of fuels and foster the uptake of low-carbon fuels. Only this integrated approach can generate the co-benefits needed to create coalitions among national and local stakeholders, which is necessary to overcome the barriers to fuel efficiency (split incentives between individual-cost and economy-wide benefits, the rebound or take-back effect, collective action that includes personal motivation and political will).

4.1.7 Establish vehicle fuel efficiency standards

Fuel efficiency standards aim to ensure a supply of efficient vehicles and, even more importantly, aim to limit the level of fuel consumption throughout the vehicle fleet. For policy-makers, the key benefit of this measure compared with other mechanisms is the need to deal with only a relatively small number of car manufacturers, whereas other policies usually target a vast number of individuals.

The provision of long-term efficiency targets offers certainty to vehicle manufacturers; crucial to them in order to make investments in new technologies (Schipper, 2008). To ensure equal conditions for all manufacturers, standards should apply to all vehicles entering the fleet, whether locally produced or imported. Furthermore, efficiency targets should be combined with demand-side policies in order to ensure the supply of more efficient vehicles matches consumer demand.

However, there is also a debate about whether fuel economy standards alone are the most effective way of reducing transport fuel consumption and GHG emissions. While the major manufacturing countries have standards in place, they have failed to create substantive progress in lowering vehicle fleet carbon emissions, particularly in Canada, Australia and the USA. This is consistent with the observation that only integrated policy packages, including standards and fiscal measures, will achieve substantial results.

One of the key shortfalls of standards as the sole policy measure to reduce fuel consumption is related to the rebound effects they can initiate (Skinner et al. 2010; Van Dender 2009; IEA 2009; Santos et al. 2010). Vehicle efficiency standards reduce the cost of driving and hence promote increased travel (Plotkin 2009). However, increased travel associated with more stringent standards is not considered a strong argument against them, because the increased travel decreases as income grows (Small and Van Dender 2004). Furthermore, the rebound effect can be minimized by appropriate fuel pricing, as discussed below. From a societal perspective, individuals do not act responsibly when making purchasing decisions. Consumers rarely evaluate the trade-off between higher initial cost for efficient vehicles and the benefit of fuel saved as previously mentioned. The gap between private and societal discount rates

can be mitigated to some extent by policies, one of which can be vehicle standards.

4.1.8 Tax fuel

Fuel taxes and excise duty rates should be set at a level, which internalizes external costs (e.g. from GHG emissions) (Barker et al. 2007 ; Litman 2008). Doing so directly affects both travel demand and the vehicle technologies used and, in turn, fleet fuel consumption and CO2 emissions. Also, fuel prices can have a significant impact on vehicle ownership rates. The impact of fuel price changes on consumption is defined as its price-elasticity. In the short-term, there is little change in demand in response to price changes (WEC 2009), e.g. a 10% fuel-price increase results in only 0.11%-0.6% lower demand (Goodwin et al. 2004; Graham/Glaister 2004; Small/Van Dender 2007), i.e. fuel demand is inelastic in the short term. However, more sustained fuel price increases, e.g. from taxation, result in considerable energy demand reductions: a 10% fuel price increase will result in a 2.5% to 3% energy use decrease in the first year and up to 6% after 5 years (Goodwin et al. 2004). Fuel prices not only affect energy demand, but also vehicle choice. A 10% petrol price increase would lead to a fleet-average CO2 emissions reduction of ≈0.5 g/km in the first year, and up to ≈2.8 g/km in the longer term (Ryan et al. 2009). Goodwin et al. (2004) estimate the vehicle efficiency improvement generated by a 10% fuel price increase to be 11% over the long-term.

4.1.9 Differentiate vehicle taxation

Differentiated vehicle registration, purchase taxes and/or feebate schemes can guide consumer demand and help mitigate split incentives between individuals and society. These schemes have to respond to changes in the vehicle fleet to ensure sufficient demand for more efficient vehicles and to maximize cost-effectiveness (TIS 2002; Nemry et al., 2009). Circulation/ownership taxes are a recurring charge (typically yearly), which can be used to encourage purchasing more efficient cars by setting the charge according to cars' fuel economy, either directly or by proxy (CO2 emissions, engine size or power-to-weight ratio).

Linking taxes to greenhouse gas and harmful emissions in this way is a well established and studied policy measure, and has proven to be more cost-effective than enforcing direct controls (Baumol and Oates 1988). Ryan et al. (2009) analyzed fiscal instruments' influence on individual purchasing decisions, finding that vehicle and fuel taxes have a considerable influence on the efficiency of vehicles entering the fleet. A 10% increase in vehicle circulation taxes could result in a short-term fleet CO2 emissions decrease of 0.3 g/km, increasing to 1.4 g/km in the long term (Ryan et al. 2009).

Where differentiated taxes already exist, adding a CO2 emissions dependent element provides smaller, but still significant reductions. Under a feebate system, the rate of progression is being increased over time, and thus leading to even greater CO2 emissions reduction, but significant savings also could be achieved by increasing the differentiation of existing taxes. By imposing higher taxes on the purchase of less efficient vehicles, registration taxes influence consumer behavior directly at the point of vehicle sale. Purchase or registration taxes are highly visible, which is very helpful in steering buyers' decisions towards more efficient vehicles and may also result in lower car ownership rates: a 10% increase in car registration taxes would reduce car ownership in European cities by about 1.4% (Smokers et al. 2006), which would, in turn, result in lower overall car use and a higher share of more efficient modes in urban areas.

However, there may be negative welfare or equity implications (Gross et al., 2009). Taxes imposed at the time of the first registration may also delay the renewal of the vehicle fleet, as car owners may keep their vehicles longer and may prefer to replace current vehicles with other used rather than new ones. An ex-post assessment of the Netherland's feebates estimated the scheme saved approximately 0.6-1m tonnes of CO2 per annum (Harmsen et al., 2003), approximately 2-3% of the Netherland's total transport sector CO2 emissions. The Dutch system's provision of direct incentives to buy very efficient cars has had a measurable effect on purchasing decisions, with the market share of cars from

the highest efficiency class increasing from 0.3% to 3.2%, and that for the second highest class increasing from 9.5% to 16.1% in 2002 (VROM, 2003). Following the government's decision to discontinue the feebates, efficient cars' market share dropped almost instantly, although it stayed higher than before the scheme's introduction (Smokers et al., 2006).

Further reading

On a pathway to decarbonization: A comparison of a new passenger car CO2 emission standards and taxation measures in the G20 countries

Factsheet: Compressed Natural Gas (CNG) or Liquefied Petroleum Gas (LPG) Taxis

Scenarios of potential reduction of emissions by different bus technologies - Case Studies of Quito, Ecuador and Montevideo, Uruguay

4.1.10 Develop a National Urban Mobility Policy (NUMP)

In most nations, the policy framework for urban mobility has developed, but it frequently falls short of the SDGs' ambitious goals, is not always robust enough, and often ignores the unique demands of cities. Urban mobility interventions have to extend beyond the technicalities of increasing speed and improving the efficiency of transport systems. Demand-oriented measures (e.g. promoting safe walking and cycling, and reducing the need to travel by compact city planning and mixed land uses) have to be introduced. Accessibility has to be placed at the core of urban mobility – and any assessment should address these concerns to pave the way to a progressive National Urban Mobility Policy (NUMP).

Understanding that the effective support from the national to the city level, such as technical and financial resources, is crucial to improve the investment environment and to bring urban mobility systems on a sustainable low carbon path, Urban Pathways supported the National Urban Mobility Policies & Investment Programmes – Guidelines (MobiliseYourCity Partnership, 2020).

The NUMP Guidelines provide practical guidance to policy makers along the 4 Phases for each of the 15 Steps of the NUMP Cycle to facilitate the process of developing a new or strengthening an existing NUMP, highlighting the importance of financial availability, monitoring and reporting systems, as well as inter-ministerial, national and local level coordination (See Figure 4.4).

By definition a NUMP or Investment Program is "a strategic, action-oriented framework for urban mobility, developed by national governments, enacted to enhance the capability of cities to plan, finance and implement projects and measures designed to fulfill the mobility needs of people and businesses in cities and their surroundings in a sustainable manner. It builds on existing policies and regulations and aims at harmonizing relevant laws, norms, sector strategies, investment and support programs towards an integrated approach for the benefits of cities and their inhabitants. It takes due consideration of participation and evaluation principles" (MobiliseYourCity Partnership, 2020).

The NUMPs are based on: prioritizing people and quality of life, taking transport as a means to development and not an end in itself, having a long-term vision with short and medium-term actions, with multi-sectoral coordination and institutional cooperation including a participatory and multi-stakeholder approach with the objective of contributing to international commitments (e.g. Paris Agreement, SDGs, New Urban Agenda). Therefore, NUMPs can enable cities to prosper in a sustainable manner, facilitate investing in sustainable mobility, improve policy coordination and contribute to achieve national and international policy objectives (MobiliseYourCity Partnership, 2020).

Figure 4.5: The NUMP Cycle – 4 Phases and 15 Steps

Source: MobiliseYourCity Partnership (2020).

4.1.11 Develop a Sustainable Urban Mobility Plan (SUMP)

A SUMP is a strategic plan, designed to satisfy the mobility needs of people and businesses in cities and their neighborhoods for a better living standard. It provides a blueprint to create an urban transport system that addresses mobility needs of people in cities in a smart and sustainable way and it identifies the transport challenges within a city, and lays out a strategic roadmap of how conditions can be transformed if a city adopts a sustainable transport approach (Rupprecht Consult, 2019).

The SUMP is developed based on current situations and future phenomena with a detailed process of integration of mobility and accessibility using all modes of transport. Its main objective is to improve urban accessibility while ensuring excellent and reliable urban mobility and transportation. It promotes the idea of a functioning city and decision-making based on facts and a long-term vision for sustainable transportation. This requires, among

other things, a comprehensive assessment of the current situation and expected trends, a broadly shared vision with strategic objectives and an integrated package of regulatory, promotional, financial, technical and infrastructural measures to achieve the objectives, which should be implemented together with methodical monitoring and evaluation.

A SUMP is useful to a city in many ways, such as improving accessibility and developing sustainable mobility to meet the needs of the population, and it can help cities: (1) reduce air pollution by shifting from private vehicles to mass transit or public transport options. (2) Improve public health by advocating active mobility, especially for short trips. (3) Improve social cohesion by creating convenient environments for social gathering and promoting walking and cycling. (4) Improve urban attractiveness by advocating a well-connected street network along with tree shading, adequate pedestrian and cycling spaces, connecting neighborhoods, a sustainable public transportation system, and efficient land use. (5) Improve intermodal integration through the creation of different platforms such as transportation hubs or stations, bicycle parking areas, park-and-ride lots, among others. (6) Improve overall quality of life.

4.1.12 Adopt an exnovation approach

The mobility transition depends on national policies (NUMPs), as well as local policies (SUMPs), that support both innovation ('pull measures') and exnovation ('push measures') approaches. However, Graaf et al. (2021), argued that although both national and municipal authorities place a high priority on supporting innovation, the phasing out of unsustainable technologies and practices is often overlooked. Policy makers often believe that providing and financing alternatives to private motorized transport is more politically feasible than applying 'push measures', such as the revocation of privileges. Moreover, dependent on the automobile industry and their electorate, city representatives are reluctant to enact anti-car regulations, focusing instead on innovation or 'pull measures'.

Nevertheless, the mobility transition depends on exnovation strategies that attempt to destabilize unsustainable regimes by reconfiguring important components of the system. Exnovation can play a crucial role in steering innovation towards solutions that take a broader societal view and support mobility as a service rather than a product. In order to achieve this, it is necessary to (1) implement "old regime" control policies (such as prohibitions and taxes), (2) enforce significant changes in regime laws (such as shifting policy priorities), (3) reduce support for dominant regime technologies (by eliminating subsidies and R&D funding), and (4) institutionalize social network changes and replace key actors (e.g., creation of new committees with specialized actors) (Graaf et al., 2021).

Graaf et al. (2021), suggest that exnovation processes should establish clear phase-out targets (early but long-term processes), form broad coalitions with different stakeholders to legitimize phase-out measures and lessen the socio-economic effects for the workforce through special policy instruments that help adaptation. To this end, cross-sectoral linkages (mobility, environment, health, energy, economy) can be a strong driver to end unsustainable practices and eliminate obsolete technologies. Furthermore, fiscal and regulatory exnovation policies can be used as tools to promote innovation towards more resource- and energy-efficient vehicle concepts.

By experimenting with the temporary pedestrianization of streets and the conversion of on-street parking into public spaces, city representatives can delegitimize unsustainable system elements and promote narratives that contain positive images of non-motorized transport. This can exemplify how to make neighborhoods more livable with low-cost interventions, especially in resource-constrained cities. Graaf et al. (2021), argue that when these low-cost measures are implemented in the city center, they can have symbolic importance, but at the

same time also difficulties and resistances that hinder political support and public acceptance. Therefore, local authorities should focus not only on the city center, but on the whole city, starting with the peripheral neighborhoods, where interventions could be more appreciated.

Last but not least, applying the exnovation approach does not imply ignoring innovation; rather, the two should be linked (e.g. prohibiting access for personal combustion vehicles while strategically promoting e-mobility options like electric bicycles).

Further reading

Factors of Change: The influence of policy environment factors on climate change mitigation strategies in the transport sector

The Other Side of the (Policy) Coin: Analyzing Exnovation Policies for the Urban Mobility Transition in Eight Cities around the Globe

The Barriers to Low-carbon Land-transport and Policies to overcome them

Diffusing Sustainable Urban Mobility Planning in the EU

Continuity and Change: Dealing with Political Volatility to Advance Climate Change Mitigation Strategies—Examples from the Transport Sector

National Urban Mobility Policies & Investment Programmes

URBAN MOBILITY IN NATIONAL URBAN POLICIES A checklist for Promoting Sustainable Urban Mobility: Vertical Integration, Horizontal Coordination and National Urban Policies

Factsheet: Transport Authorities had Institutional Set-Up

Factsheet: Public Participation in Urban Transport

Urban Mobility in National Urban Policies

Additional resources

Courses:

Data Management for Sustainable Urban Mobility

Funding and Financing of Sustainable Urban Mobility Measures

Building Small and Medium local authorities' capacity to introduce innovative

Public Procurement for Sustainable Urban Mobility Measures

Webinars

Air Quality Sensing Powered by Citizen Science – Webinar Series

4.2 Urban Energy

Global energy consumption grew by 2.3% in 2018, which is almost twice the average growth rate since 2010. This is driven by an increasing global economy and higher energy demand for heating and cooling in some parts of the world. Energy efficiency across the global economy seemed to improve but the improvement rate is slow (IEA, 2018). The study by IEA (2018) also indicates the impact of fossil fuel use on global temperature increase over 0.3°C of the 1°C increase in global average annual surface temperatures above pre-industrial levels. Cities have the potential to reduce energy through efficient technology development and use, integrated urban planning and enabling policies. Urban Pathways developed various factsheets and webinars on topics such as building energy efficiency, the use of renewable energy, improved vehicle efficiency (EVs) and waste to energy generation.

Regarding pilot activities in the energy sector, Urban Pathway addressed energy issues in a broader perspective, focusing on improved vehicle efficiency (EVs) and reducing energy efficiency through building energy efficient housing. For the latter, a demonstration project on low-cost housing (tiny house) was developed and implemented. Its design measures included passive measures (proper heating/cooling, lighting and natural ventilation) and installed PVs that saves operational energy use, as well as use of sustainable local materials contributing to reduced total life cycle energy cost. It is built on a self-build construction concept, supporting and increasing local capacities.

In the energy context, Urban Pathways would like to share the following recommendations with governments:

Energy Efficient Tiny House, Nairobi, Kenya (source: Urban Pathways)

4.2.1 Improve the urban energy situation through renewables

A sustainable urban energy system will need low carbon technologies on the supply side, and efficient distribution infrastructure as well as lowered consumption on the end-user side. Cities therefore need to shift from the current unsustainable fossil fuel energy generation towards using renewable energy sources, not only because of looming resource depletion but also to curb the negative externalities such as pollution and greenhouse gas emissions. At the same time, energy consumption must be reduced by changing consumption patterns and adopting energy saving techniques.

Lastly, because energy is paramount to revenue generation, its distribution needs to become more inclusive and fair to foster universal development, especially for the urban poor. Although renewable energy technologies (RET) such as wind, water, solar, and geothermal are becoming more accessible -- and already cover the energy demands of some neighborhoods if not whole cities in certain areas -- intermittence of supply and high upfront costs are the main deterrents of a wider adoption. Nevertheless, benefits in the long run will outweigh the initial challenges, both from an environmental and economic perspective.

For instance, once a renewable energy generation system is in place, future running costs are usually very low due to an inexpensive and abundant supply of the energy source. Cities also need to assess their meteorological and geographical specificities to best transform the surrounding natural resources into power. To tackle intermittency, several renewable energy sources should be combined to overcome source-specific shortages, such as solar at night, or wind during doldrums. Solutions can also come from waste and heat recovery technologies that can be used to bridge supply gaps.

Smart grids – electric grids that harmonize supply and demand – provide another solution for the intermittent power supply by helping to balance variable power generation and end-user needs. These grids are also more efficient in transmission and distribution, thus reducing energy loss. Machine shifts can be automated to run during hours of the day when there is enough power to meet demand.

4.2.2 Lower the energy consumption

The major change, however, needs to come from the end-users – residents, businesses, industries – who must control their consumption. The less energy that is used, the less needs to be produced. Technology can also assist in optimizing energy use. Smart grids can be paired with smart appliances or even a whole smart home or building, which respond to varying electricity supply and prices. Households, offices, and factories can program smart meters to operate certain appliances when power supplies are plentiful. For example, a washing machine can be set up in such a way that it will only start operating when there is enough power in the grid or when the price is under a certain threshold. Buildings themselves have huge energy saving potential if they embrace green or low-energy building concepts and passive design principles.

Savings can be made by integrating efficient heating, cooling, insulation, lighting, and water distribution systems in new or rehabilitated buildings that will increase energy retention. Likewise, on site alternative energy sources such as solar panels on a roof can supplement power from the grid. The use of recycled, reused, or low energy building materials will also contribute to a better energy balance. To cut fossil fuel use for transportation needs, cities need to develop attractive public transport systems and must increase the share of non-motorized transport in developing specific infrastructure (such as cycling lanes and walkways), and optimize delivery of goods, (for instance by promoting the use of rail for cargo transport). Cities can also opt to introduce electric mobility to lower their emissions from transport (see chapter 4.1.5 Electrify the transport). However, for cities to fully benefit from the transition to electric mobility, these efforts need to be implemented in the overall context of better and more compact urban

planning with a focus on accessibility and urban liveability. For electric mobility to have an impact on emissions, this electricity has to come from renewable energy sources such as hydro, geothermal, wind and solar. Inter-sectoral collaboration between energy and transport is required to make electric mobility a success.

Food production and water distribution are huge energy consumers. Curbing food and water waste will therefore also contribute to lowering overall energy use. Besides reducing energy on the production and delivery side, cities also need to promote urban agriculture, such as rooftop farming (it is estimated that 30% of urban spaces could be covered). Consumption habits need to change, residents should be encouraged to use more local produce and to take on prosumption, the production of one's own food. The same reasoning can be extended to consumption habits in general, with residents adopting more sustainable consumption habits and recycling concepts. Cities need to ensure that industries pool their resources in order to create synergy effects. This can be achieved by establishing eco-industrial parks, where waste and by-products of one industry serves as the raw material of another, thereby improving material and energy efficiency and decreasing environmental emissions. From an economic perspective, this would also make companies more competitive, as better waste management results in cost savings and a higher environmental and business performance.

4.2.3 Optimize energy through sustainable building

Buildings account for almost 30% of global CO2 emissions. Promoting energy efficient buildings (new building and retrofitting existing buildings) and environmentally friendly building techniques that aim at reducing energy demand for cooling, heating and lighting, is an essential approach to reach municipal climate goals (Hatch 2017). The initial approach to minimize energy (and resource) use in buildings is to focus on sufficiency, energy efficiency with passive design strategies and then to incorporate efficient active technologies including renewable energy. These passive and active measures to enhance building energy efficiency are:

- 'Passive strategy' includes a building design that is adapted to climate zones (hot and humid, hot and arid, temperate and cold climate). Basic design strategies for any energy efficient building include optimizing its form and shape, its orientation and building envelope technologies (e.g. glazing and insulation) in order to achieve/maintain indoor thermal comfort.

- 'Active strategy' intends to reduce or limit non-renewable energy use in buildings through efficient heating, ventilation, and air conditioning (HVAC), lighting and the use of building automated systems and increase the use of renewable energies. The construction of energy efficient buildings provides environmental benefits (lessen carbon footprint) to the city and social and economic benefits to the citizens with lower life cycle cost in the long run, higher sales and rental value, and good indoor environment quality. The factsheet on "Energy Efficient Buildings" shows examples of different standards for assessing the energy efficiency of buildings, as well as the technical, financial, institutional and political considerations to be taken into account.

Sustainable building optimizes energy use and incorporates renewable energies, saves water and ensures its reuse/recycling, uses efficient means of transport and reduces distances, undertakes site planning and biodiversity conservation, improves indoor environmental quality and occupant's health with thermal comfort, reuses and recycles materials and manages waste effectively - aiming at the reduction of the environmental footprint of buildings (see also factsheet on 'Green Building'). In order to demonstrate this, a prototype of a sustainable living unit in the Tropics was designed and executed by the Urban Energy Unit of UN-Habitat in May 2019, partly supported by the Urban Pathways project. The prototype of the sustainable living unit "Tiny house" is an affordable house provided with all basic services including: clean energy, food production, onsite waste management, natural lighting and ventilation and many

more sustainable design principles (UN-Habitat, 2019). Within the floor area of 56m2, the tiny house has all the basic needs in an ecological and affordable manner.

The Tiny house prototype (See Factsheet: Sustainable living unit "Tiny house") shows that an eco-house can be built efficiently and affordably. It aims to meet shelter needs through low-carbon pathways. Passive design features of natural daylight and ventilation reduces the need for extra appliances to cool or heat the room, which saves energy and gives a pleasant thermal environment. The locally available materials or recycled materials used in the building contribute to less environmental footprint. The renewable energy use, rainwater harvesting, food production within the building makes the house self-sufficient with clean energy (for lighting and partly cooking), saved water and fresh vegetables consumption respectively. The Tiny house also minimizes waste generation and separates waste at the source. The prototype supports raising awareness on eco-housing to various stakeholders (planner, designer, and citizen).

4.2.4 Improve cooking energy

Biomass is any organic matter that may and can be used as an energy source - these include wood, crops, yard and animal waste products. Easily available in the natural environment, biomass has aided human civilization as total primary energy (TPE) since humanity's origins. Populations in rural areas, especially in developing countries, continue to rely on biomass for TPE – mostly for cooking and heating purposes. An estimated 2.7 billion people globally - 40% of the world's population - depend on traditional biomass, such as fuel wood, charcoal or crop residues, for cooking, heating and other purposes. Worldwide, an estimated 1.06 billion people do not have access to electricity, and 3.04 billion people still rely on solid fuels and kerosene for cooking and heating (World Bank, 2017). An estimated 530 million people in sub-Saharan Africa will still not have access to electricity by 2040. Moreover, people living in sub-Saharan Africa and South Asia spend a large part of their productive hours collecting biomass, and less time on education or other developmental priorities (World Bank, 2017). Population growth and the non-existence of proactive policies could see a global rise of people relying on biomass, which would contribute to increases in several negative health effects, especially in women and children and adversely contribute to environmental change. Smoke and its related toxic components from the burning of biomass used in cookstoves, especially in the developing world, is inhaled by people – which directly causes a range of chronic and acute health effects. These range from and include pneumonia, lung cancer, chronic obstructive pulmonary disease, heart disease, and low birth weights in children born to mothers whose pregnancies are spent breathing toxic fumes from open fires (Kaur et al.,2016).

Clean cooking refers to improved cookstoves that offer safer and healthier cooking options for households – moving households away from the toxic fumes inhaled from the use of biomass fuels used in traditional cookstoves. Its use positively impacts on families by reducing indoor air pollution and relies on alternative fuel sources. Clean Energy technologies/solutions in the form of improved cook Stoves (ICS) which allow biomass (wood fuels, charcoal etc.) to be burnt more efficiently and of solar powered lanterns, which are not dependent on fossil fuels, help to address and improve socio-economic challenges and health issues Greenhouse gas (GHG) emissions from biomass such as wood fuels, for example, amount to a Gigaton of CO2 per year, an estimated 1.9 to 2.3% of global emissions (World Bank, 2017). The "biomass" factsheet shows a case study in Kenya on solar cookstoves and the impact of cookstoves around the world.

4.2.5 Partner with Energy Service Companies (ESCOs) to achieve your energy efficiency goals

Energy efficiency holds untapped potential for energy savings and cost savings for cities' budgets. Technical energy efficiency measures, however, often require upfront investments and cannot be implemented due to tight public budgets. Municipalities and public authorities also often lack the technical and financial know-how for designing and implementing energy

efficiency projects, especially when it requires considerable infrastructure upgrade, and associated operation and maintenance (O&M). Market based solutions such as Energy Service Companies (ESCOs) bridge this gap by providing wide range of services, such as conducting energy audits, identifying appropriate energy efficiency measures, assessing project's technical and financial feasibility, implementing retrofitting measures, and supervising O&M (Polzin et al., 2016). ESCOs can be private, public, or non-governmental organizations.

The target sectors for most ESCOs are street lighting; deep energy retrofit of buildings including energy efficiency improvements in building envelope, indoor lighting, boilers, heaters, and chillers, heating, ventilation and air-conditioning systems, domestic hot water systems; and pumping systems and motors etc. (Bertoldi & Boza-Kiss, 2017; Smith et al., 2016). The factsheet "Implementing energy efficiency through Energy Service Companies (ESCOs)" shows contract models appropriate for municipalities, and also for other public or private entities, to implement energy efficiency measures.

4.2.6 Adopt an appropriate financing model

Energy efficiency holds an untapped potential for cities' budgets to be more cost effective. Modern and technologically advanced developments have improved measures for energy efficiency, such improvements include lighting systems, heavy electrical equipment such as hydroelectric pumps, transport systems, and power plants. Realizing this potential often requires large upfront costs that would then only benefit city administrations in the long run. Constrained by service delivery expectations and political support, city administrations most often have to find funding mechanisms to cover upfront costs necessary to implement technical efficiency in energy consumption. Grant and non-grant financing models can be used by city administrators to raise the financial capital investment so that they are able to, in the short term, implement the roll-out of long-term energy efficiency measures that would save municipalities recurring costs. The factsheet on "Financing measures for energy efficiency" shows in detail some examples of financing models, as well as the technical, financial, institutional and political considerations to be taken into account when selecting an appropriate financing model.

4.2.7 Regulate and drive change in collaboration with the private sector

Cities need to establish strong policies and standards to develop sustainable urban energy systems and to reduce the use of unsustainable technologies and practices. Governments must not only institute legislation to regulate energy use and consumption, but must also set up incentive measures that promote research, innovation, and, most importantly, the adoption of greener and more efficient technologies. Sound collaboration and mutual understanding between the private sector -- which runs most of the world's energy systems -- and overseeing authorities is therefore paramount for short-term commercial interests not to overshadow long-term environmental concerns and sustainable development opportunities.

Governments should also pursue collaboration between local and international partners in order to enable local companies to strengthen their knowledge, expertise, and market reach. Governments of developing countries should consider private-public partnerships to develop their energy systems, as current costs cannot be carried by a country alone. For each city to be able to adapt to its own local particularities, authorities need to design decentralized energy systems and infrastructure, and also be permitted to have specific legislation and tax systems to either promote the use of sustainable energy, or to curb and dissuade the use of polluting, inefficient technologies and consumption habits.

Further reading

Factsheet: Build Green

Factsheet: Sustainable living unit "Tiny house"

Factsheet: Financing measures for energy efficiency

Factsheet: Implementing energy efficiency through Energy Service Companies

Factsheet: Feed-in Tariffs

Factsheet: Energy Efficient Buildings

Factsheet: Net energy metering

Factsheet: Biomass

4.3 Waste Management

Current global Municipal Solid Waste (MSW) generation levels are approximately 1.3 billion tons per year and are expected to increase to approximately 2.2 billion tons per year by 2025. It is estimated that 1.6 billion tons of CO2e were generated from the treatment and disposal of waste in 2016 – representing about 5% of global emissions. The largest source is landfill methane (CH4). There are large uncertainties concerning direct emissions, indirect emissions and mitigation potentials for the waste sector. These uncertainties could be reduced by consistent national definitions, coordinated local and international data collection, standardized data analysis and field validation of models.

GHG emissions from waste are directly affected by numerous policy and regulatory strategies that encourage energy recovery from waste, restrict choices for ultimate waste disposal, promote waste recycling and reuse, and encourage waste minimization. A wide range of mature technologies is available to mitigate GHG emissions from waste. Therefore, the mitigation of GHG emissions from waste relies on multiple technologies and practices, whose application depends

River clean-up exercise during the Nairobi Placemaking Week 2022 (source: UN-Habitat)

Participants during a plogging exercise in Nairobi (Source: UN-Habitat)

Managing waste properly is essential for building sustainable and livable cities, but it remains a challenge for many developing countries and cities. Effective waste management is expensive, often comprising 20%–50% of municipal budgets. Operating this essential municipal service requires integrated systems that are efficient, sustainable, and socially supported.

Therefore, within the area of resources management, the Urban Pathway Project focused on the need to implement and improve waste management services in partner cities. The project supported cities in their data collection efforts with the help of the Waste Wise Cities Tool. This helped cities such as Nairobi in Kenya to gain insights into their current level of solid waste management.

Further, the Urban Pathways project supported activities included facilitating the exchange between cities to catalyze partnerships focused on technical issues and funding mechanisms – according to each municipality's needs; and capacity building in regard to implementing comprehensive waste management strategies on the municipal level, taking into account the informal sector and the need to integrate formal and informal waste management activities.

In order to increase separate collection and recycling of solid waste - and implement a circular economy approach - the Urban Pathways project supported local-level awareness raising programs and neighborhood-based pilot projects. These pilots ranged from community-based programs that promoted the recycling of waste, or engagement of public schools on waste segregation, composting and urban gardens - as children play a critical role on awareness raising as young multiplying local agents. Based on the experience of the implementation of the Urban Pathways project, the following recommendations towards improved solid waste management can be derived:

4.3.1 Monitor and assess your city's municipal Solid Waste Management Performance

Evaluating and monitoring SDG indicator 11.6.1 provides key information for cities and countries to develop better waste and resource management strategies. Globally, especially in low- and middle-income country cities, there is a shortage of current reliable statistics and information on the generation and management of municipal solid waste. Where data is available, it is frequently created based on global comparisons without being verified in the local setting.

There is a need to increase the accessibility and availability of waste statistics, as well as training for data collection and capacity building on the ground.

Due to the lack of sufficient evidence-based data, it is difficult to design waste management strategies and make investment decisions for infrastructure and service expansion, leaving many nations with inadequate or non-existent MSW management services. Poor MSW management and collection result in air and water pollution as well as serious dangers to public health.

The use of the Waste Wise Cities Tool - Step by Step Guide to Assess a City's MSWM Performance through SDG indicator 11.6.1 Monitoring can help cities assess the environmental performance of a municipal solid waste management (MSWM) system (SDG 11.6.1), food waste generation (SDG 12.3.1) and resource recovery systems (SDG 12.5.1). It can also help cities and countries improve resource management based on available data and evidence, and thereforemitigate and prevent environmental pollution, create business opportunities, employment and livelihoods, and transition to a circular economy. The monitoring methodology for SDG indicator 11.6.1 outlines ladders for MSW collection services and control level of waste management facilities, with the aim of standardizing terminology, definitions, and methods for gathering MSW data.

The Waste Wise Cities Tool (WaCT) consists of seven steps (see Figure 4.6) to guide cities on how to collect data on MSW

generated, collected, and managed in controlled facilities. The tool provides a household survey guide for estimating total MSW generation, a questionnaire to investigate the MSW recovery chain and criteria to check the environmental control level of waste management facilities in the city. In the last step, onward linkages to other SDG indicators are elaborated and an assessment using a Waste Flow Diagram (WFD) is introduced. The WFD is a separate but complementary methodology to the Waste Wise Cities Tool. It uses rapid and observation-based assessment for mapping waste flows and quantifying plastic leakage from MSW management systems (GIZ et al., 2020).

4.3.2 Manage construction and demolition waste

Urbanization and population growth leads to a massive increase in construction activities for housing, offices, industry and infrastructure. The exploitation of raw materials (gravel, sand, etc.) causes environmental impacts (land use, impacts on water bodies and GHG emissions), specifically when transport distances for construction materials increase due to local shortages in rapidly urbanizing areas (CPCB, 2017).

At the same time, the amount of construction and demolition (C&D) waste is increasing due to urban redevelopment and constitutes a problem of disposal. In many countries, C&D waste is the most important waste stream (by mass) and space for disposal is limited. A high share of this waste stream is disposed of in landfills or illegally dumped on public land, along roads, or along river banks. On the other hand, C&D waste could be reused or recycled as a source of secondary raw material when possible, or otherwise safely disposed of. C&D waste management serves as a crucial link in achieving circular economy and sustainable development goals related to sustainable cities and communities (SDGs 11.6,11.C) and resource consumption and production (SDGs 12.2, 12.1, 12.2, 12.4, 12.5, 12.7) among others.

Processed C&D waste can replace up to 20% of primary material in structural constructions such as buildings or bridges (CPCB, 2017). Roads or other non-structural projects can – in theory – completely be built from recycled content. Systematic dismantling, demolition, and recycling of C&D waste increases the availability of raw materials; saves locally scarce resources such as gravel, sand, or rocks; reduces transport distances and fuel consumption from the exploitation of building materials; and avoids land conversion and interference with groundwater bodies from extraction activities. Moreover, the amount of C&D waste that uses scarce landfill space or is dumped uncontrolled on private or public land is also reduced. Selective dismantling and treatment of C&D waste is labor intensive and thus creates urban employment opportunities too. (See more in the "Construction and demolition waste management" factsheet)

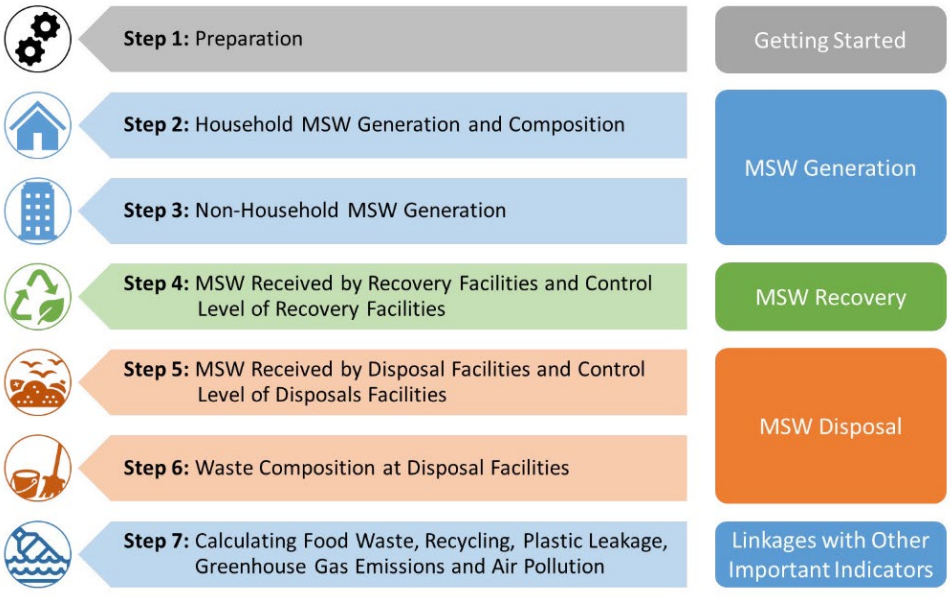


Figure 4.6: Waste Wise Cities Tool's 7 Steps

Source: Waste Wise Cities Tool (WaCT)

Further reading

Factsheet: Construction and demolition waste management

Factsheet: Green buildings

4.3.3 Treat organic waste appropriately

Food and green waste comprise more than 50 percent of waste in low- and middle-income countries. In high-income countries the amount of organic waste is comparable in absolute terms but, because of larger amounts of packaging waste and other non-organic waste, the fraction of organics is about 32 percent. At an international level, the largest waste category is food and green waste, making up 44 percent of global waste (Figure 4.6). Waste composition varies considerably by income level. The percentage of organic matter in waste decreases as income levels rise.

Methane, generated from decomposing organic waste, is the solid waste sector's largest contributor to GHG emissions. It is many times more potent than CO_2. Composting and anaerobic digestion are organic waste treatment options that prevent the generation of methane or its release into the atmosphere. Where landfills are used, the associated methane gas can be captured and flared, converted to power, used to heat buildings, or utilized to serve as fuel for vehicles. Waste-to-energy incinerators, which are relatively more complex and expensive, can reduce GHG emissions while generating electricity or thermal energy when operated effectively and to environmentally sound standards.

Landfills are the most common final disposal method in middle-income countries and are generally anticipated to continue being so. Improvements in recycling and in organics management are increasing. For recycling, sorting plants that involve manual or some form of automated sorting are becoming more common. Primarily because of problems with the availability of land, large metropolitan cities in middle-income countries are looking at ways to avoid the development of large sanitary landfill sites, often far away from the city center, and to develop waste-to-energy incineration schemes instead. High land prices and often-elevated levels of electricity

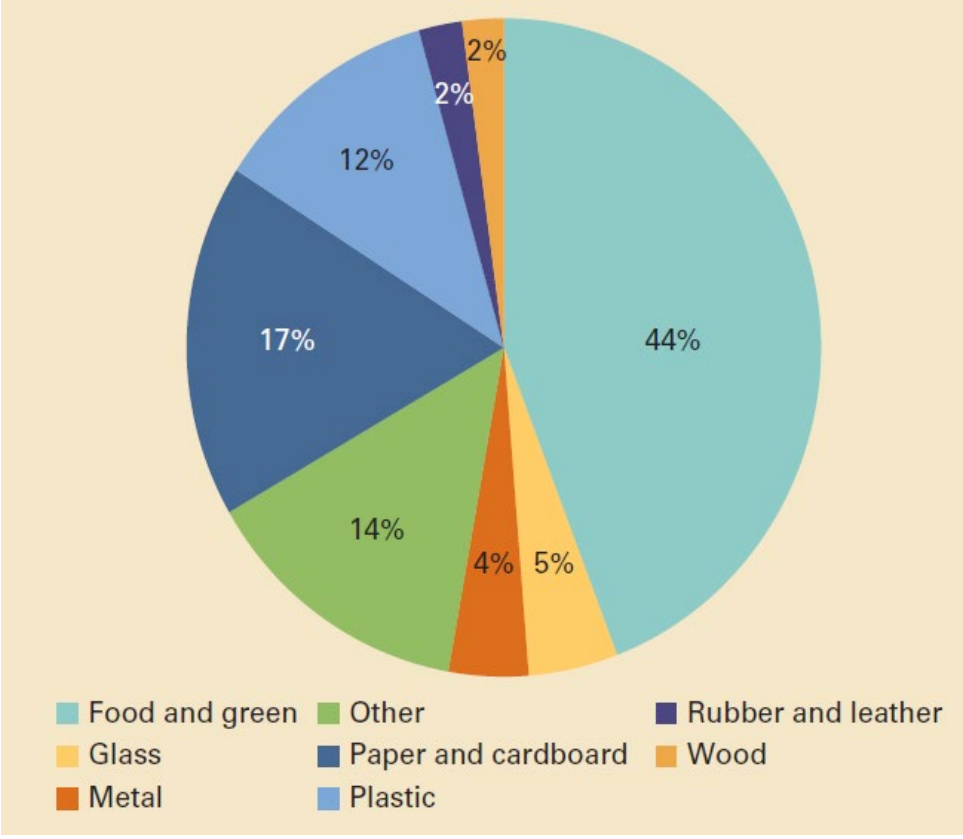


Figure 4.7: Global Waste Composition

Source: World Bank, 2019

feed-in tariffs can be an important push for these investments. However, high costs, usually significantly above current cost levels, and the high organic composition of the waste, meaning that it is low in calorific value, also could present challenges to implementation.

Sanitary landfills and incinerators are prominent in high-income countries. High-income countries experience greater recovery and reintegration of materials from recycling and organics and use of byproducts such as refuse-derived fuel or other energy from waste than lower-income countries. Greater attention is being placed on management of food and green waste, sometimes through windrow composting, in-vessel composting, anaerobic digestion, and waste-to-liquid technologies. These technologies allow organic waste to be used effectively through capture of biogas and creation of a soil amendment or liquid fertilizer. These advances are complemented by improvements to distributed waste management, which emphasizes household interventions such as source separation.

4.3.4 Turn food waste into biofuels

Organic and food waste makes up a major portion of municipal solid waste (MSW). According to the Food and Agricultural Organization of the United Nations, roughly 1.3 billion tonnes, or one third, of the food produced in the world for human consumption is lost or wasted every year (FAO 2013). Rising levels of affluence and living standards in many countries increase the amount of food waste. In most countries, food waste is disposed of at landfills along with other municipal solid waste.

The degradation of this waste fraction in landfills is creating problems such as air pollution, odor, and leaching. Organic components are major sources of GHG emissions from landfills, most notably carbon dioxide and methane. The IPCC expects that global annual emissions from solid waste disposal contribute 5-20% of global anthropogenic methane emissions, equalling 1-4% of the total anthropogenic GHG emissions.

Simultaneously, global demand for fossil fuels is rising which leads to increased GHG emissions, rising energy prices, energy poverty and energy security issues. Using biomass as fuel has environmental (GHG emissions from land use change) and social implications (the food vs. fuel debate): increasing land use for biofuel crops will reduce the land available for growing food crops (or wilderness) and contribute towards food shortage.

In this regard, biofuels from waste may serve as a 'new' source of energy. Biofuels such as bioethanol and biodiesel from organic waste fractions may substitute parts of demand for fossil fuels. Thus they might lower GHG emissions from landfills, contribute to energy security and access to energy.

The systematic use of food waste as an energy source requires separate collection (or segregation) of the organic waste fraction and capital-intensive technological equipment for the conversion of waste to energy but may also lead to considerable cost savings in the mid-turn.

Turning food waste into biofuel has the following positive effects:

• Using (zero-value) waste to produce high-value products

• Avoiding shifting problems from one sector to another (food vs. fuel debate, use of scarce agricultural areas, GHG emissions from land use change)

• Reducing GHG emissions from landfill

• Contributing to energy security

• Drastically reducing local noise, diesel soot, and other emissions from collection vehicles.

• Liquid and solid fermentation residues used as fertilizers and compost

(See the case of Berlin on waste treatment in the "Food waste to biofuel" factsheet)

4.3.5 Integrate the informal sector into Urban Mining

Population growth, urbanization, rising income and the emergence of a middle class in developing countries will increase the demand for new buildings, infrastructures and products and thus boost the use of raw materials, while at the same time these trends will increase waste generation.

Urban mining refers to (re-)using material already present in the urban environment, i.e. materials embedded in obsolete buildings, infrastructure, products, or even landfills, as input for socioeconomic activities. SDG 12 aims to establish sustainable consumption and production patterns. This includes the environmentally sound management of all waste and substantially reduced waste generation through prevention, reduction, recycling and reuse. This will be measured through the indicators recycling rates and amount of material recycled.

Increasing the use of recycled material and closing material loops can greatly lower GHG emissions from mining, land-use for biotic materials, and emissions from waste disposal. Open landfills and unsorted waste disposal are major sources of GHG emissions, notably methane. Urban mining requires efficient delivery of urban services such as the collection, segregation and safe disposal of waste.

Cities and city administrations can influence the organization of waste collection, recycling, and disposal – either via municipal utilities or as contracting authority for private service providers. In many cases, however, waste collection and recycling is organized informally, with a large number of people making their living by collecting, sorting and selling materials for recycling. Often, the informal sector is very efficient in segregating and collecting specific easy-to-recycle waste such as plastics, paper, or bulk metals. The recovery of other materials (e.g. metals from e-waste), however, requires more sophisticated technologies and thus a higher degree of equipment and organization.

Most importantly, waste treatment practices in the informal sector are often carried out under hazardous circumstances that are harmful to the health of workers and local communities. Against this backdrop, many cities will have to find ways to combine informal and formal arrangements in waste management in order to cope with increasing demand for raw materials and rising waste volumes.

Integrating the informal sector into urban mining can:

- Strengthen social protection for informal workers and contribute to more decent working conditions.

- Create formal and healthy job opportunities in the city.

- Bring positive health effects for urban dwellers and workers (unsanitary conditions).

- Significantly reduce landfill waste, avoiding land use for landfills.

- Avoid water and soil pollution.

- Secure raw materials for urban development.

- Close local and regional material loops.

(See the case of São Paulo in the "Integrating the informal sector into Urban Mining" factsheet)

Further reading

Factsheet: Urban Agriculture

Factsheet: Wood as Building Material

Additional resources

Webinars:

Waste Wise Education Webinar in South-Asia

Africa Waste Webinar Series – Towards clean, healthy and circular cities in Africa – Webinar #1 – Waste Collection: How to Improve Waste Collection Rate in African Cities?

Urban Pathways

Africa Waste Webinar Series – Towards clean, healthy and circular cities in Africa – Webinar #2 COVID Waste: What Additional Challenge was Imposed on African Cities

Africa Waste Webinar Series – Towards clean, healthy and circular cities in Africa – Webinar #3 How to Turn Open Dumpsites to Controlled Waste Disposal Facility in African Cities?

Africa Waste Webinar Series – Towards clean, healthy and circular cities in Africa – Webinar #4 Waste and Climate change: appropriate technologies and good practices in Africa

Africa Waste Webinar Series – Towards clean, healthy and circular cities in Africa – Webinar #5 Plastic Pollution from Waste - How to "stop the tap" of plastic leakage in African cities?

Waste Wise Education: Exploring Effective Approaches & Best Practices

Webinar series – Waste Technology Deep Dives

How to Continue Waste Management Services During the COVID-19 Pandemic

Organic Waste Treatment in Cities of the Global South: Solutions and Case Studies

Transforming Waste into Wealth: Global Challenge, Local Solutions

Localising Circular Economy Approaches into Policy Processes

4.4 Integrated Approaches

4.4.1 Design and Implement EcoZones

The EcoZones is a concept that was put together by the Urban Pathways team based on the initiatives in its partner city Belo Horizonte, Brazil. An EcoZone refers to a small, low-cost project focused at neighborhood scale, where an intersectoral approach is easily applicable, addressing simultaneously mobility and waste issues through a series of activities that include tactical urbanism, awareness-raising, community participation and impact assessment.

Understanding that the transition to a sustainable urban development is not only about infrastructure, but that a mindset change plays a huge role, the involvement of the community in these projects is key. Thus, EcoZones use participatory methodologies to increase support for sustainable mobility modes, transform public spaces, promote clean streets and waste reduction and separation. Their approach seeks to empower neighbors to have an impact in the change in their community, raise awareness and increase the collective knowledge on sustainable urban development and environmental issues.

EcoZones are a practical concept to implement integrated low-cost and low-carbon solutions to urban climate and sustainability challenges based on community needs and holistic-systemic urban planning for green recovery and climate change mitigation at the neighborhood level. The approach seeks to empower citizens to have an impact in their local community, raise awareness around and increase the collective knowledge of sustainable urban development and its socio-environmental impacts.

Multiple elements are addressed simultaneously: (i) Mobility & public space: tactical urbanism approach to provide safer spaces for commuting and recreation; (ii) COVID-19 mitigation measures: sustainable alternatives for public and private motorized transport have emerged in cities around the globe through a focus on walking and cycling. These allow for physical distancing, and strengthen population health; (iii) Nature-based Solutions (NbS) and Disaster Risk Reduction (DRR): The EcoZone framework was designed to harness and implement NbS at a local scale, reducing environmental impacts while helping surrounding areas to improve urban resilience in the face of climate and natural disaster risks. In selecting adaptation/DRR options, ecosystem solutions are usually more adaptive, cost-effective and easier to maintain, and provide more value to society compared to conventional solutions such as built infrastructure; (iv) Waste Management: local stakeholders engage with communities to increase awareness for source separation and support initiatives working with circular principles and highlighting the value of waste, like neighborhood composting programmes, upcycling and recycling initiatives. Figure 4.8 illustrates the Ecozone's concept in a

Figure 4.8: Ecozone's concept (Source: Urban Pathways)

diagram. It explores synergies, for instance by applying innovative sustainable mobility solutions to waste collection, or through placemaking activities integrating aspects of awareness-raising around recycling.

The EcoZones do not only carry out pilot sustainable mobility and/or waste projects (with a great potential of including further areas such as nature-based solutions); they also empower local communities, raise awareness and promote social cohesion. To implement the EcoZone concept in Belo Horizonte, the Urban Pathways team - together with the partner cities - combined the activities on active mobility projects, public space and composting & separation at source.

EcoZones have been developed as a framework to highlight the sectoral linkages and opportunities for synergies across key sectors. The Urban Pathways project have successfully implemented the EcoZone approach in developing countries, supporting small, low-cost projects that focus on neighborhoods as the geographical scale, where an intersectoral approach is easily applicable, addressing simultaneously mobility, energy and waste issues through a series of activities that include tactical urbanism, awareness-raising, community participation and impact assessment.

Further Reading

Ecozones - An Approach for co-designing, scaling and replication inclusive climate action at the neighborhood level.

4.4.2 Transform cities through inclusive river restoration

River restoration can be vital to urban regeneration by delivering diverse social and environmental benefits to create sustainable urban communities. Urban river regeneration initiatives can provide an opportunity to create sustainable jobs, transform informal settlements, and improve safety and security. River ecosystem restoration should target the basis of habitat and ecosystem change, localise restoration actions, align the restoration efforts to the scale of the problem and be clear about expected outcomes. Integrating nature-based solutions into municipal strategies is a prerequisite for effectively restoring rivers. Nature-based solutions are actions to address societal challenges by working with nature to protect, sustainably manage and restore the ecosystem and provide benefits for both human and biodiversity well-being (Ensuring effective Nature-based solutions. IUCN, 2020). Nature-based solutions help protect our environment, create habitat, and offer an alternative or complementary, low-carbon to traditional grey infrastructure. River restoration projects serve as nature-based solutions as they leverage nature to provide environmental, social, and economic benefits that include biodiversity increase and flood management, improved health and well-being, and increased property and land values, among others.

Figure 4.9: Challenges and opportunities on the Nairobi River Regeneration project (source: UN-Habitat)

The management of urban rivers previously entailed blue infrastructure interventions, but the focus is shifting towards working with natural processes. In urban areas, river restoration has to be unique to specific conditions to adhere to natural processes as much as possible through innovative approaches, including green infrastructure. Green infrastructure utilises nature systems to offer sensitive and intelligent solutions for stormwater management, community health and well-being, urban revitalisation, and biodiversity protection (Green Infrastructure: Riverside regeneration. BDP, 2022) The green infrastructure allows the regeneration of both river ecosystems and urban areas within them as multifunctional, connected, and integrated zones.

River corridors offer significant opportunities to expand active mobility options by integrating pedestrian and cycling lanes along linear and green open spaces adjacent to the river. River regeneration provides a good platform to leverage on the transformative potential for streets as instruments for urban regeneration.

The Urban Pathways supported river regeneration activities in Belo Horizonte, Brazil, with the Jardim Felicidades Initiative and Nairobi, Kenya, in the Nairobi River Regeneration Initiative.

Further reading:

Factsheet: The Transformative Potential of Urban River Restoration for Low Carbon Urban Development

Transformation of Nairobi Downtown.

4.4.3 Supporting innovation and co-development through Living Labs

The Planning and implementation of innovative solutions that help drive the transition to low-carbon development requires a participatory approach that takes into account the needs and aspirations of all stakeholders. Consequently, an integrated multi-modal, multi-level approach is needed to align and complement national and local policies, as well as the public and private sectors (Teko E. and Lah O., 2022).

One of the most important elements to (transport) innovation project success is building capacity of lead institutions and relevant stakeholders to attract the necessary public support and interest. In this regard, the Living Lab concept, which provides a platform for initiating ideas through co-production and innovation, offers the chance to adopt a participatory approach in capacity building activities. Moreover, it can act as a potential catalyst for a rapid transition to sustainable, low-carbon cities (Teko E. and Lah O., 2022).

To enable transformative change towards sustainable, low-carbon cities it is vital to go beyond a mere technical perspective on low-carbon technologies and take a systemic approach. The Living Lab concept aims to combine small to medium-sized implementation concepts with wider transformation pathways. Testing innovative urban development solutions at different Technology Readiness Levels (TRL) and in different environments can enable replication and can contribute to a supportive political, legal, economic and fiscal landscape (Lah, 2019). An integral part of an effective Living Lab approach is the facilitation of close cooperation between local, regional and national decision-makers, operators, industry and businesses to develop innovative solutions that not only fit into the local context but also are scalable and replicable (Voytenko et al., 2016). The Living Lab approach considers cities as a socio-technical system that consist of technologies, regulations, institutional settings, the economic system, interests, influence and power structures, behavioral patterns, and social norms. It considers that urban sub-sectors should be well integrated and solutions should be tailored to the specific local economic, technological, social, political and environmental context.

According to Teko E. and Lah O. (2022), the Living Lab approach, which takes into account real-life contextualization, level of participation, diversity of stakeholders and

duration of engagement, can help design and implement capacity building interventions tailored to the specific city needs and help sustain the innovation developed in such projects. Planners and implementers should, therefore, include physical environments that connect living lab participants with project innovations, as well as to involve city representatives and stakeholders from the beginning. The Urban Living Lab approach aims to co-develop solutions, integrating research and innovation along five pillars (see Figure 4.10):

- Inform: Boost capabilities, provide tools to plan, assess and implement
- Inspire: Foster the take-up by inspiring through peer-to-peer exchange
- Initiate: Strengthen collaboration by initiating partnerships
- Implement: Create reference models by implementing demonstration actions
- Impact: Scale-up, replicate and transfer

Regular feedback methods like workshops, surveys, interviews, email communication, or other physical platforms, can foster interactive engagement among project stakeholders, which is key to project success. For this, an adequate participation time must be considered, long enough to obtain refined and acceptable results for the participants, but short enough not to fatigue them. Last but not least, to ensure a range of perspectives and the achievement of a shared identity among stakeholders, project planners and implementers must maintain a broad diversity and expertise in shaping projects (Teko E. and Lah O., 2022).

Recommendations for living labs and respective interventions:

1. Begin with temporary interventions, e.g. in the spirit of tactical urbanism. These can be low-cost and should improve the local neighborhoods. The advantage is, that if successful, the intervention can be perpetuated (possibly at higher cost covered by the government).

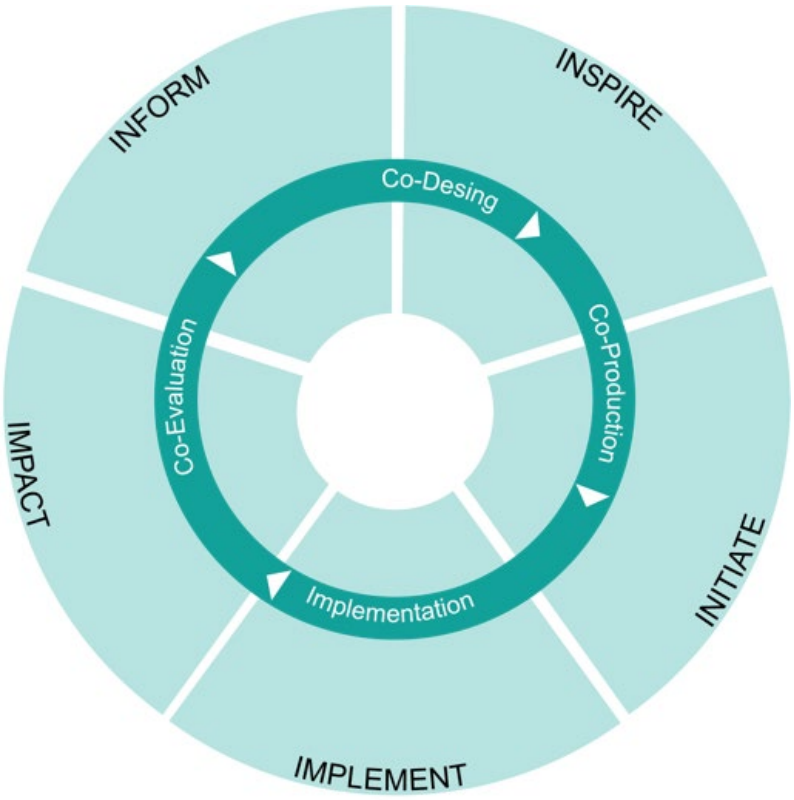


Figure 4.10: The Urban Living Lab approach (Source: Urban Pathways)

2. Identify an appropriate location. The location of an intervention needs to be well chosen and centrality plays an important role. Prioritize local centralities (schools, squares, etc). The reason is that people come to these places anyways and improving their quality of stay is likely to trigger positive attitude towards the intervention which in turn increases the likelihood of a permanent installment.

3. The intervention needs to be well planned and should include technical preparation. Therefore, first a local diagnosis is necessary, so that the intervention can be tailored to the local conditions. This preparation is important as badly prepared interventions can lead to failure and discredit the whole idea – inhibiting similar interventions for many years.

4. Participation. It is important to involve all kinds of people that are affected one way or the other by the intervention. The community (local actors & community participation) needs to be involved, as well as their strategies. At the same time, public authorities (see also 7. item) need to be included as well as various sectors (e.g. solid waste treatment and community of waste recycling workers). Moreover, it is essential to involve the community in the execution, implementation, construction (hands-on) so that they establish a relationship to the intervention. An overall participative manner is required in order to identify the wants and needs of inhabitants. Only such an integrative manner allows functional co-creation.

5. Advertise the intervention and the process of setting it up. Facilitate engagement and mobilize local actors. Therefore it is not only important to use contemporary communication and dissemination channels (social media etc.) but also multiple types in order not to exclude groups of local actors (e.g. elderly). The goal is to attract people to the intervention and its making (see participation, 4. item).

6. Don't forget communication and dialogue. Make sure implementation is high on the agenda of the budget cycle.

7. Inter-institutional cooperation. Implementation needs to be accompanied by public organs and maintenance should be treated by public authorities. Involve community in physical implementation and facilitate co-creation.

8. Organize an opening festivity to celebrate the inauguration of the intervention. The benefit is that people learn about it and get informed. This way they can get convinced, so that they accept, respect, and use the intervention.

9. Develop strategy for monitoring and documentation. Before and after assessments are important to prove a positive effect and thereby stimulate the permanent installment (see 1. item). Monitoring is critical for a learning process and the implementation of other interventions at the same place or elsewhere.

10. Replication. To have a large-scale effect, similar interventions need to be replicated in various neighborhoods. Unleash added value. E.g. the overall effect of 8 interventions is more than twice than of 4 interventions. Therefore, the replicability needs to be kept in mind when planning and implementing an intervention.

Further reading

Demonstration actions & Living Labs

Capacity Needs Assessment in Transport Innovation Living Labs: The Case of an Innovative E-Mobility Project

Additional resources

Urban Living Lab Center - Capacity building for the transformation of urban mobility, energy, and resource sectors

Chapter 5:

Good Practice: National Action Plans for low carbon urban development and local implementation concepts (Kenya, Brazil, Vietnam, India)

Initially, the Urban Pathways project focused on India, Brazil, Kenya and Vietnam as four pilot countries for the implementation of the programme's identified work agenda. At the close of the project, it stretched its activities far beyond those countries, being active in 10 pilot cities.

The Urban Pathways approach started with rather small-scale, bottom-up activities, believing in the potential of replicating and upscaling such pilot projects. The experiences highlighted the fact that - while material sites and infrastructure of course play an important role - a mindset change is a pivotal precondition for transitioning to sustainable urban development. Thus, small, low-cost projects, such as the EcoZone or Tactical Urbanism, focusing on neighborhoods as the geographical scale can play an important role in speeding up low-carbon urban action.

Cities are well positioned to move towards climate action, as they are the locations where implementation takes place, while also accounting for a large share of the GHG emissions. Urban Pathways contributed to identifying and testing impactful and inclusive actions across different sectors on the city level. It is important that the lessons learned from the four pilot cities are feeding back towards policy making on the national level, such as for reviewing the Nationally Determined Contributions (NDCs). Local level action can inspire policy adjustments on the national level and support the development of national strategies that can facilitate low-carbon action in cities.

5.1 Kenya

Pedestrianization

In the case of Kenya, through the sustainable mobility pilots carried out under the Urban Pathways project in Nairobi (see National Low-Carbon Urban Action Plan for Kenya), it was demonstrated how participatory planning and design can be translated into actual implementation on the ground.

As an example, Luthuli Avenue was transformed into a more equitable street, creating more space for pedestrians, introducing trees, a bike lane and bicycle parking facilities and seating among other street furniture. Overall, the design transformed the busy and chaotic street into a successful retail corridor that is welcoming and safe for all. Additional info on the project and impact can be found in "Transformation of Downtown Nairobi - Using Creative Methods to Rethink Stress As Public Spaces And Catalysts For Urban Regeneration".

Contributing to the implementation of local policy instruments such as the Nairobi Integrated Urban Development Masterplan (NIUPLAN) and as well as the Non-Motorised Transport Policy, the Luthuli Avenue transformation illustrates how multi-stakeholder participatory processes led by local decision-makers (Nairobi County Government) and supported by different sectors incl. civil society (Placemakers), academia (University of York and the Technical University of Kenya), international programs (i-CMiiST[1], UN-Habitat), international research institutes (Stockholm Environment Institute), think tanks (Naipolitans), professional associations (the Architectural Association of Kenya) and local businesses, among others, enable local actions towards more equitable and low-carbon services that could potentially be scaled up.

Following the transformation of Luthuli Avenue, the Kenyan Government was inspired to roll out further Non-Motorized Transport (NMT) infrastructure in Nairobi. Through the Nairobi Metropolitan Services (NMS) project, Nairobi kept implementing non-motorized transport infrastructure in the Central Business District (CBD), and is currently preparing for the Nairobi River Regeneration Initiative. Nairobi's successes were illustrated in city dialogues and other cities across the country have started expanding walking and cycling infrastructure too. A Street Design Manual for Urban Areas in Kenya was prepared by the Ministry of Transport, Infrastructure, Housing, Urban Development, and Public Works and is currently being discussed with decision-

1 The Implementing Creative Methodological Innovations for Inclusive Sustainable Transport Planning (i-CMiiST) project.

Luthuli Avenue (Before-After Image), Nairobi, Kenya (source: Urban Pathways)


TWEET AND LIKE
SLAM TO SHARE
SHORT STREET

makers for endorsement. This shows in particular how local actions can trigger replication to metropolitan and even national levels.

Air quality

In addition to the physical transformation, UN Environment, through the Urban Pathways project, also supported air quality monitoring in a before-and-after analysis at Luthuli Avenue. Following the air quality monitoring efforts, the National Environment Management Authority closed down an Oil Refinery Plant which caused heavy ambient air pollution that was causing harm to public health.

Similar efforts were undertaken in Addis Ababa, Ethiopia, where Urban Pathways installed air pollution monitoring sensors to collect and analyze data, resulting in the city banning medium-sized trucks to lower the peak of pollution levels in rush hours.

Building on the monitoring efforts and established partnerships, Urban Pathways supported the drafting of the following policies:

Nairobi Air Quality Action Plan, 2019-2023

2020 –2022 Nairobi City County Air Quality Policy

Nairobi City County Air Quality Bill, 2021

Addis Ababa City Air Quality Management Plan, 2021-2025

Urban Pathways' engagement on air quality in Kenya and Ethiopia is an example of informed decision-making based on reliable data at the local level - and will form the basis of inspiring action on the national level.

Air pollution monitoring device mounted on a bicycle in Nairobi, Kenya (source: Urban Pathways)

Accessible matatu in Nairobi, Kenya (UN-Habitat)

Inclusive mobility

Regarding inclusive mobility, Urban Pathways and its partners supported the production of a film on accessible and low-carbon public transport in Dar es Salaam and Nairobi. This film presents the contrast between the capitals of Tanzania and Kenya, in terms of the implementation of an inclusive and low-carbon transport system; demonstrating alternative communication channels that can help reach the target audience. In addition, a pilot wheelchair-accessible matatu and a pilot project in Kenya were designed to promote the development of a human rights-based transport system that is inclusive and accessible to all. These efforts resulted in the sensitization of government actors in Nairobi, who committed to adjusting some of the transport and road features and services to make it easier for people with limited mobility to enjoy movement in the city.

Public outreach and awareness raising activities

Examples of successful awareness and advocacy events include the high-level bicycle ride with public officials in Kenya, organized to reignite interest in cycling, which created an understanding of the opportunities and challenges of cycling in Nairobi to guide better policies. Moreover, Nairobi's first Bike Train brought together diplomats, government officials, the cycling community, people with little cycling experience and the media to promote the "Bike Train" concept among Nairobi's working class as a way to move around together safely. This concept,

Participants during Critical Mass Nairobi (Urban Pathways, 2022)

which has been repeated monthly with the support of the United Nations, is being extended to different neighborhoods in Nairobi, in collaboration with the Critical Mass cycling movement.

Finally, the COVID-19 pandemic, that struck during the life of the Urban Pathways project, revealed the low level of awareness of the risks and impacts of the pandemic, as well as the behavioral changes needed, especially in informal settlements, where access to information and research (via internet, TV, radio) is limited. Therefore, methods such as graffiti, painting and photography were used by the Urban Pathways project to raise awareness of low-carbon basic services, as well as the impacts of COVID-19, to use alternative communication channels to guarantee that all relevant stakeholders are reached.

Video links: prevention messages

In Kenya's informal settlements graffiti raises awareness on COVID-19

Murals showing COVID-19 behavioral messages in informal settlements in Nairobi, Kenya (source: Urban Pathways)

Waste

Resource and waste activities took place in Nairobi and Mombasa, through municipal solid waste data collection utilizing the Waste Wise Cities Tool (WaCT) (see National Low-Carbon Urban Action Plan Kenya). This triggered discussions between local government and waste stakeholders, formal and informal, on the most appropriate and feasible solid waste management improvement options. The Nairobi City County Sustainable Waste Management Plan 2020 –2022, developed as a result of the above activities, exemplifies how such local actions can be translated into policy instruments.

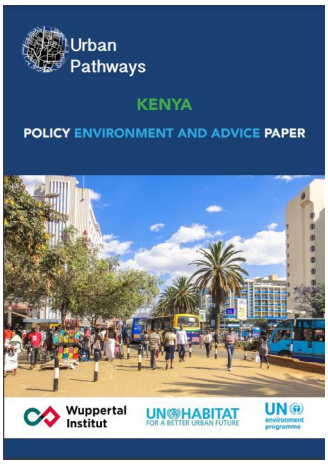
Urban Pathways' work in Nairobi has demonstrated how local data collection and pilot actions can initiate and contribute to informed decision-making, strategies and action plans at the city level. The use of tools (such as air quality monitoring or WaCT) can help national and local governments to track progress towards set targets, identify policy gaps that still need to be addressed, adjust action plans, put in place mechanisms to address barriers to policy implementation, and allocate funds or invest in replication action.

Energy

Urban Pathways supported the prototype of the Tiny House for the Tropics in Nairobi, Kenya, which approaches the challenges of sustainable and affordable construction by combining the traditional principles of passive environmental design with technological innovation in waste management, renewable energy and water conservation. The compact design takes up minimal space on the ground resulting in a smaller built up area and lower demand for land to build on while maintaining a spacious feel. It therefore scales down both the physical and ecological footprint of the house, greatly reducing the negative impact of the built form on the environment. The prototype was showcased to Member States from all around the world during the UN-Habitat Assembly in 2019, hoping to inspire local and national policy action promoting energy efficient building practices.

Youth group collects waste in slum in Yaoundé, Cameroon [Source: UN-Habitat]

Further reading



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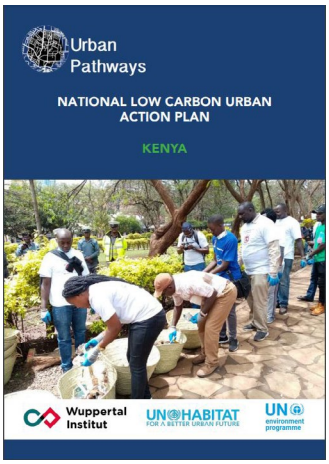


KENYA NATIONAL LOW CARBON URBAN ACTION PLAN

5.2 Brazil

Mobility

Urban Pathways supported Belo Horizonte, Brazil's third largest metropolitan region, in implementing Zone 30km/h and Ecozone projects.

In 2019, Belo Horizonte implemented four "Zones 30", one of which received Urban Pathways support from conceptualization to funding, the so-called Zone 30 Confisco. Reducing speed limits is a measure that can be adopted to reduce traffic fatalities, being a contemporary trend in cities that has the right to life as a priority (ITDP Brazil, 2016). In general, the measure seeks to review the priority of road circulation, clearly granting the preference of users who are moving through active means of transport (Trevisan, 2021), such as on foot, bicycle, skateboard, non-motorized scooter, etc. Such initiatives, particularly when implemented on a city wide scale, can encourage people to opt for active mobility and therefore have a reduction potential on emissions and air pollution.

The Zone 30 pilot project in the neighborhood of Confisco, Brazil, is an example of a small-scale, bottom-up intervention with a participatory approach. The implementation of the project ranged from street painting and tactical urbanism to community involvement with a mixed format of face-to-face meetings and articulations with the local community, as well as virtual meetings with the participation of dozens of stakeholders, including local associations and businesses. For this project, the school was chosen as the data survey of the area showed high-speed, two-way traffic in its vicinity. (see National Low-Carbon Urban Action Plan - Brazil)

The tactical urbanism approach used in Confisco's Zone 30 exemplifies one way to reclaim space from cars to pedestrians and cyclists and provide them with safer spaces for walking and cycling, raising awareness among children and adolescents of the environmental, health, social and economic benefits of non-motorized transport. The debate about the intervention was done in partnership with the school community, involving mainly elementary school children and students from the Youth and Adult Education. The gender perspective was also included, with a women's safety audit, carried out both on foot and by bicycle.The successful implementation of the Zone 30 Confisco pilot project resulted in high public acceptance and political support.

Video: Zone 30 Implementation in the Confisco Neighbourhood (Belo Horizonte, Brazil)

Further reading: Promoting Safe School Environments in Belo Horizonte, Brazil

Zone Confisco promoting 30km/h around schools in Belo Horizonte (source: Urban Pathways

Intersection Design at Ecozone Santa Tereza, Belo Horizonte, Brazil (source: Octopus Film)

Ecozone Santa Tereza, Belo Horizonte, Brazil (source: Octopus Film)

Following the successful Zone 30km/h, the Santa Tereza Ecozone was launched, replicating the intersectionality of the project in terms of active mobility, public space, green infrastructure and, on this occasion, including waste management. The intervention was preceded by meetings and articulations with the local community, with the participation of several relevant stakeholders, such as the Santa Tereza Residents' Association, business owners from the area, Rede Lixo Zero (Zero Waste network of waste management), as well as people directly or indirectly interested in the project. Online meetings were held, which presented the general proposal and discussed details of the proposed square renovation plan.

The example of the Ecozone highlights the importance of integrated approaches and showcases how small scale interventions can be replicated and scaled up. Moreover, the EcoZone shows the impact of a highly successful participatory process led by the local authority through a proactive and very motivated city official, and supported by civil society (the local NGO NossaBH) and international initiatives and programs (Transformative Urban Mobility Initiative, WRI Brazil, the Wuppertal Institute and UN-Habitat).

Video: Brazilian City pioneering green transport

Further reading:

Low Speed, Low Carbon Policies - An Assessment Report of Three 30km/h zones implemented in Belo Horizonte, Brazil

The third pilot project in Belo Horizonte focused on urban river regeneration, and expanded further the integrated approach to also include water management. This pilot project implemented the conversion of a car lane into a pedestrian living area in the banks of the Tamboril stream, which is part of the Ribeirão Onça watershed, and combines mobility, public space, and water resource management. Following the 3 successful pilot interventions in Belo Horizonte, the city has plans to roll out additional five Ecozones across the neighborhoods. There is need for city-to-city exchange for Belo Horizonte to share the good practice and inspire similar initiatives in other cities across the country.

Air quality

In addition to the tactical urbanism initiatives, an air quality meter was implemented in the Ecozone to assess whether the interventions had any impact on the air quality of the site compared with their previous state. While indicative data could be derived showing the potential to reduce local air pollution levels through such pilot initiatives, a much larger scale, longer-term monitoring would be needed to proof scientific evidence.

The Air Quality sensing powered by the Citizen Science project, a collaborative platform of measurement and data collection, whose data are available online, shows the importance of fostering local innovation, in this case partnering with the MIT-accredited laboratory FabLab Newton Paiva located at the Newton Paiva University in Belo Horizonte. Impact tracking and assessment has been considered essential in Belo Horizonte to measure the success of the pilot intervention - as the basis to justify further replication to other locations.

Preparing the air monitoring devices in Belo Horizonte, Brazil (source: Urban Pathways)

Lessons Learned

The implementation of the pilot projects carried out in Belo Horizonte shows the great potential for the implementation of living labs to: 1) test innovative measures with relatively low budget, 2) gain the community support and the public acceptance for its permanent implementation and replication, 3) collect the necessary data to adjust the projects and proof their viability, and 4) engage relevant partners, including academia and private sector.

For the pilots that were implemented in the field of sustainable mobility and public space, their success can be summarized in three key elements, i.e. community participation, inter-institutional cooperation and before-and-after assessments, which included vehicles and pedestrian counts, surveys, air quality and noise monitoring. The overall results of the projects are low-cost interventions, that improved road safety for pedestrians and cyclists, reduced emissions and air quality and strengthened the social cohesion in the selected neighborhoods. One big challenge is to maintain and ensure long term ownership of the interventions in the neighborhoods. Thus, the awareness-raising component is crucial for the effectiveness of the pilots.

Moreover, the positive perception from the public, with 78% of the residents that would like the interventions to become permanent, and the visibility that this and the previous zone 30 projects have achieved, have led to the institutionalization of this type of intervention and its city-wide replication in Belo Horizonte. BHTrans, the local transport department, is in the process of creating a dedicated team that will have the replication of Zones 30 and EcoZones in the city as its main task. EcoZones need to be implemented in as many neighborhoods as possible and linked through green networks. Their implementation and maintenance should become a normal duty for the public authority similar to the resurfacing of municipal roads.

Among the lessons learned from the implementation of pilot projects at the neighborhood level in Brazil, is the need to include such concepts in the national policy framework to ensure country-wide upscaling and the institutional support for such initiatives. This could for instance mean that the transformation of road spaces into public spaces or the concept of the Zone 30km/h could be promoted in the National Urban Mobility Plan (NUMP). It is evident that measures such as ecozones and Zone 30km/h must be replicated across cities to become more effective as a network and must be combined with other measures such as high investments in public transportation infrastructure and the modernization of public transport operations. In addition, it is necessary to adopt measures to restrict car use in order to support the fight against social and spatial inequalities, precisely by taxing the rich to enable the poorest to have

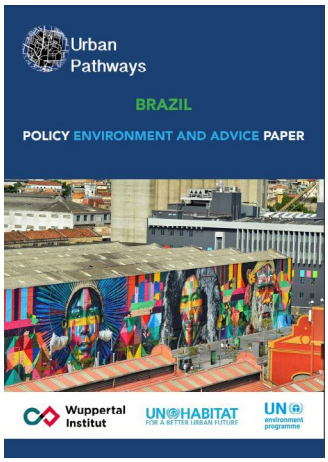
access to the city in a fair, equitable and sustainable way.

Having a national level policy that would promote such initiatives might help overcome the lack of funding. There is need for national funding programs for small-scale, low-cost pilot projects accessible to cities, NGOs and local communities. In addition, the development of guidelines for the implementation of such projects, based on lessons learned, can help their replication throughout the country. Such guidelines could provide not only tools for implementation, but also for the community participation process, stakeholder engagement, and monitoring and evaluation processes. One such Guide on "Livable Streets" was developed with support of Urban Pathways.

Waste Management

Brazilian cities need to develop action plans on solid waste management in order to access federal funding. However, lack of or insufficient internal capacity has led municipalities to hire consulting firms to develop such plans, which are often unfamiliar with specific local conditions, thus producing standard action plans that are too far removed from actual needs. Because of this and the certainty that local language material can be accessible to a wider audience in the country, Urban Pathways supported a Portuguese version of UN-Habitat's Waste Wise Cities free online course aimed at introducing the first steps to developing data-driven municipal solid waste management strategies and action plans in a participatory and inclusive manner. The fact that informal waste collectors represent 50% of the waste sector in Brazil has raised the need to recognize the enormous social and environmental dimension of the service they provide, as well as the need to structure and support the development of economically emancipated cooperatives. To this end, Urban Pathways suggests building capacity in the informal sector, providing technical support, equipment, as well as promoting and facilitating the regularization of cooperatives. Additionally, the promotion of strategic partnerships, such as São Paulo joining the Ellen MacArthur Foundation, can allow access to financing and, in this case, accelerate the circular economy at the city level.

The Urban Pathways project also supported waste management as an important concept of integrated Ecozones. Circular economy was promoted in the design of the Ecozone concept for instance by producing street furniture from sand, cement and clay.



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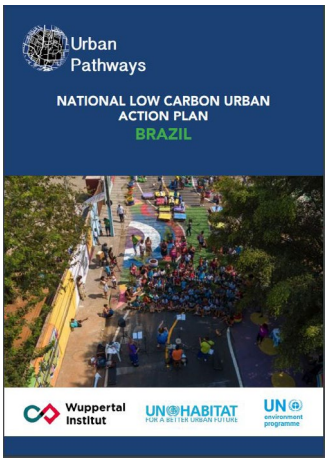


BRAZIL NATIONAL LOW CARBON URBAN ACTION PLAN

5.3 Vietnam

Electric Mobility

In Vietnam, Urban Pathways supported the project concept on electric mobility, aimed at promoting shared two-wheelers (see National Low-Carbon Urban Action Plan - Vietnam). This pilot project exemplifies an example of inter-institutional cooperation between the City of Hanoi, the University of Transportation Technology and local startups. This project in Hanoi focuses on boosting the ridership and effectiveness of the currently running Bus Rapid Transit and the forthcoming metro rail with shared electric 2-wheelers to serve for the last-mile connectivity. This shared E-scooter/ E-mopeds system, which is being implemented, will be equipped with state-of-the-art docking-cum-charging stations and contactless payment that provides a hassle-free experience of e-mobility and clubbing it with longer trips on public transport. The project concept developed by Urban Pathways was submitted to the European Commission H2020 call for proposal for funding, and is now being implemented under the SOLUTIONSplus project.

The project not only fostered local innovation and entrepreneurship through the collaboration between the local university and the private sector, but also sought synergies with international initiatives such as the ongoing IKI project on electric 2-wheelers, 'Integrating electric 2&3-Wheelers into Existing Urban Transport modes in Developing and Transitional Countries', led by UNEP.

The Vietnam project illustrates the importance of implementing locally appropriate, synergistic solutions. Enabling and mobilising local stakeholders in the process of co-ideation, testing, evaluation, and refinement of such solutions is a key strategy towards accelerating the attainment of the sustainability-related goals as set forth by the relevant national and sub-national authorities. The multi-stakeholder approach between the city, the university, startups and development partners have proved to be a successful ingredient for the Hanoi Living Lab and can be used as a best practice to scale up across the country.

Setting up an urban living lab financing mechanism that would support bottom-up initiatives exhibiting significant potential towards addressing multidimensional urban challenges (e.g. urban transport, energy, waste management, among others) could accelerate the engagement and cooperation of local stakeholders in the pursuit of Vietnam's sustainability goals.

The aforementioned proposed financing mechanism can be complemented by the creation of a national network that can help facilitate the scaling up of local innovations by providing assistance in terms of finding potential opportunities for private-private partnerships for scaling up, lowering potential barriers for scaling-up (e.g. regulatory, legal, among others), facilitating the integration of learnings into wider planning and

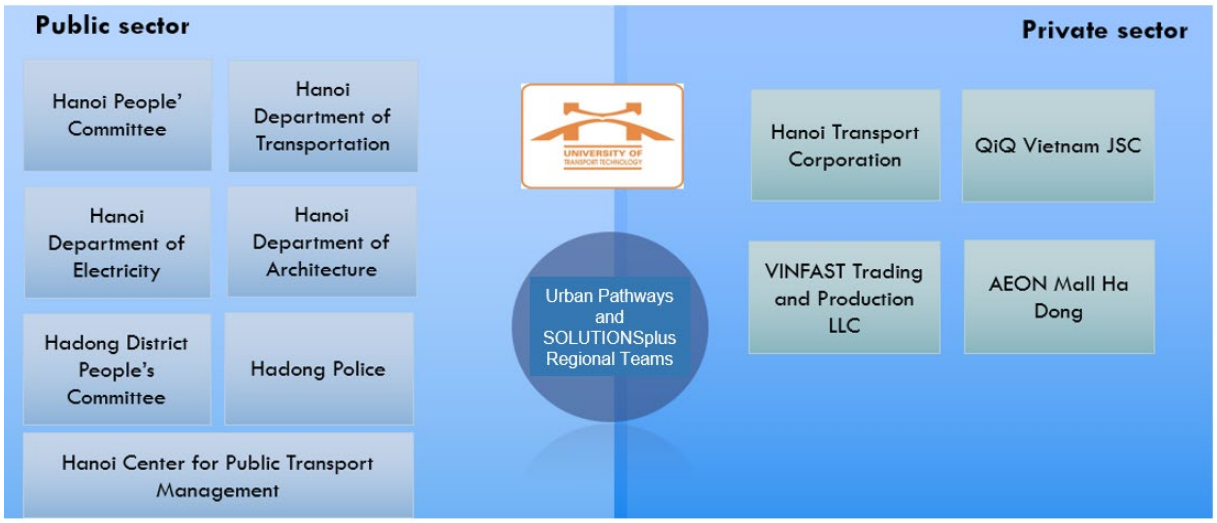
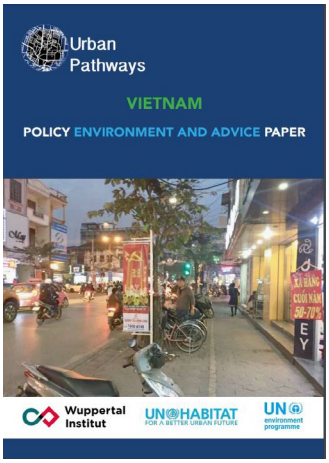


Figure 5.1 Hanoi Local Stakeholder Landscape (UTT, 2022)



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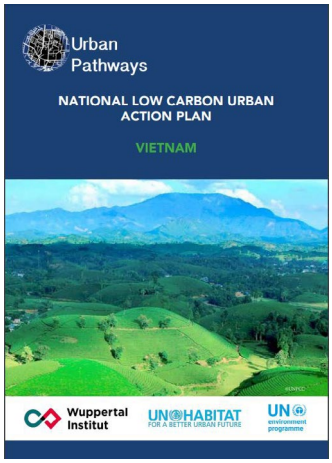


VIETNAM NATIONAL LOW CARBON URBAN ACTION PLAN

Electric Motorbikes in Vietnam (source: UTT)

policymaking processes.

5.4 India

Electric Mobility

In Kochi, India, the Urban Pathways project is engaged with Kochi Municipal Corporation (KMC) and Centre for Heritage and Environment Development (C-HED) in introducing 100 electric auto-rickshaws in the city to enhance last mile connectivity, together with the GIZ funded SMART-SUT project (see National Low-Carbon Urban Action Plan - India). On 15th November 2022, the pilot was launched with distribution of 30 auto rickshaws to the members of Ernakulam District Auto-Rickshaw Drivers' Co-Operative Society. This is a first of its kind of umbrella body in the district, unifying six trade unions affiliated to various political parties.

The key agency for the project implementation is KMC in close collaboration with Cochin Smart Mission Limited (CSML) and Kochi Metro Rail Limited (KMRL). The project aims to contribute to zero street-level emissions of air pollutants (cleaner air), CO2 emission savings of 30-50% compared to diesel 3-wheelers on a life-cycle basis and also to a green economy (generate jobs and augment income for drivers by switching from diesel to e-auto-rickshaw).

The society will take the benefit of the subsidy available from the Kochi Municipal Corporation and the Centre for Heritage, Environment and Development (c-hed) with the support of the Urban Pathways project and GIZ for Rs. 50,000 per auto for pilot project autos.

This would act as down payment for purchasing the auto on a loan by the Society. The charging infrastructure for 15 locations was set-up by the Kochi Municipal Corporation with the support of Kerala State Electricity Board (KSEB).

The pilot project in Kochi showcases the importance of identifying a feasible business model that provides benefits to the operators. With the support of Urban Pathways and GIZ, the society was enabled to purchase the E-autos with the subsidy offered and overcome the cost difference as compared to a conventional rickshaw. The subsidy helped to make electric mobility affordable

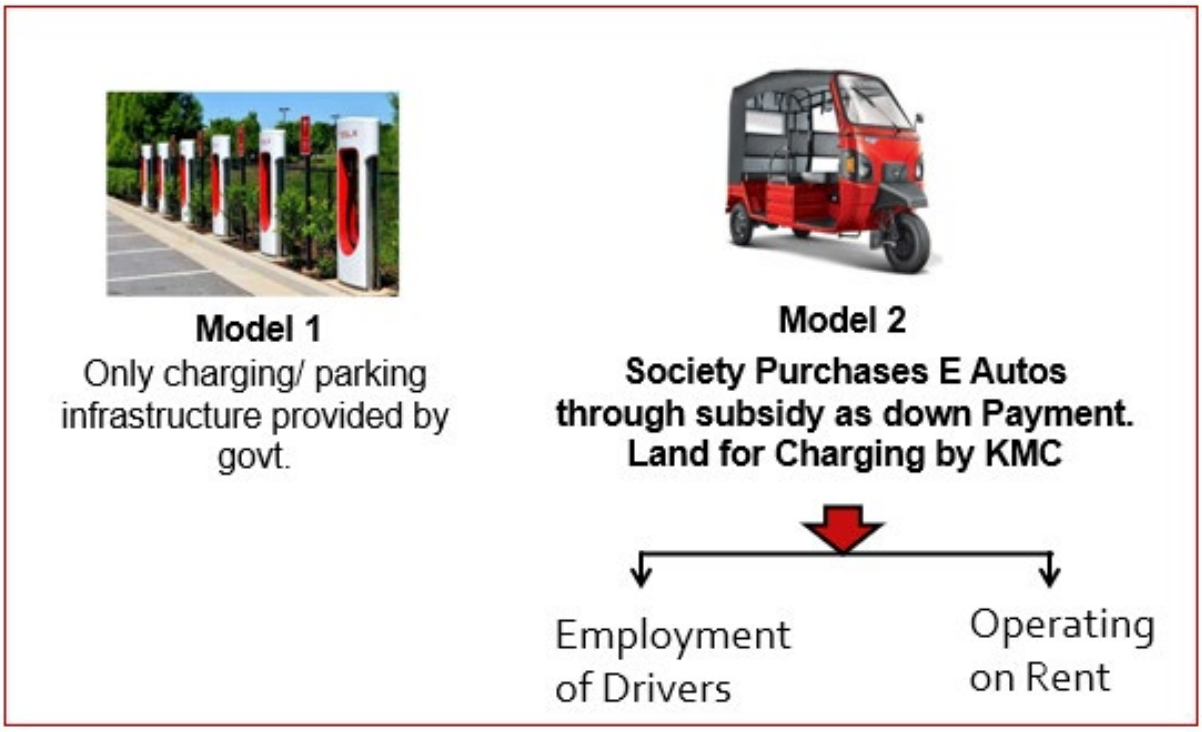
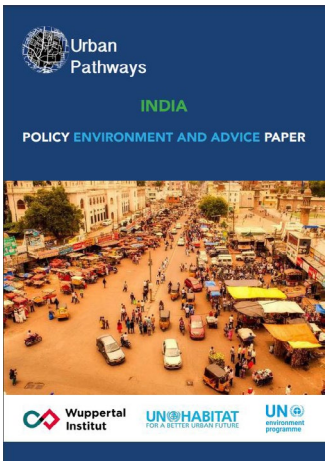


Figure 5.2 Selected business model taken up by Kochi (source: KMC, 2022)

Electric auto-rickshaws lined up during the launch of the project in November 2022 (source: Urban Pathways)



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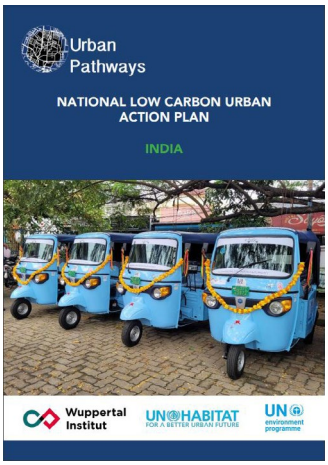


INDIA NATIONAL LOW CARBON URBAN ACTION PLAN

5.5 Closing

Cities have tremendous work to do, and a huge potential to initiate low carbon transformations at the urban scale, helping to reduce emissions and securing better living conditions. However, most cities in developing countries are facing constraints with regards to locally available finances, as often there is little national level allocations to the sectors of solid waste management, urban mobility and energy.

Pilot action can help to showcase the feasibility of urban transformations and low-carbon actions - and can inspire national level policy changes and budget allocations.

That is why the policy recommendations developed by the Urban Pathways project start from the city perspective:

- How can city level action inspire national policy changes towards low carbon basic services?
- But also, how can national governments in turn support low-carbon urban action?

For a real change, national level policy frameworks and funding sources become key elements to ensure replication and scale-up of the local action.

Very often national and local level policies incl. nationally determined contributions (NDCs), Transport Policies, Energy Policies, Waste Management Policies or their respective local Action Plans are very often drafted along sectoral targets, and the implementation of these is accordingly primarily sectoral. Through integrated approaches such as Ecozones or Electric Mobility projects, the Urban Pathways project has showcased the potential for increasing efficiency and for lowering emissions through sector coupling.

In order to scale up integrated, inter-sectoral approaches on local and national level, capacity has to be strengthened particularly in developing countries which often lack the policies, institutional frameworks or funding required for sector coupling.

Chapter 6:

Proposed Actions and Indicators for governments to monitor progress towards achieving low carbon basic services

Indicators that countries and cities can use to monitor the dimensions of sustainable urban development are needed to track progress, evaluate impact and assess whether the implementation of the New Urban Agenda is on track and being properly executed. Building on the experience of the Urban Pathways project, and complementing it through insights from the NUA Monitoring Framework and related indicators, this chapter provides a collection of proposed actions, and where available indicators, that will help cities to monitor progress and, where appropriate, to follow up on their international commitments (NUA, SDGs, Paris Agreement).

The full definition, calculation methods, data sources and data collection frequency for some indicators are marked in parentheses (#) and can be found in the NUA Monitoring Framework and related indicators.

6.1 Urban Design, Proximity and Mobility

Governments should:

- Promote compact, dense and inclusive urban design, mixed land use, as well as transportation integration and land use planning with the goal of reducing travel distances to enjoy and take advantage of urban opportunities. (See also: A new strategy of sustainable neighbourhood planning: five principles)
    - Measure: High density planning.
        - Indicator: At least 15,000 people per km^2, that is 150 people/ha or 61 people/acre.
    - Measure: Mixed land-use planning.
        - Indicator: At least 40 per cent of floor space should be allocated for economic use in any neighborhood.
    - Measure: Social mix.
        - Indicator: The availability of houses in different price ranges and tenures in any given neighborhood to accommodate different incomes; 20 to 50 per cent of the residential floor area should be for low cost housing; and each tenure type should be not more than 50 per cent of the total.
    - Measure: Limited land-use specialization. This is to limit single function blocks or neighborhoods
        - Indicator: Single function blocks should cover less than 10 per cent of any neighborhood.
- Provide equal access to basic services, sustainable mobility and public space.
    - Measure: Number of people who have access to dedicated and protected bicycle infrastructure.
        - Indicator: People Near Bicycle Lanes measurements include all people within 300 meters of qualifying cycle lanes. This indicator measures the number of people who have access to dedicated and protected bicycle infrastructure. This includes painted bike lanes and lanes that have otherwise been dedicated to bicycles.
        - Indicator: People Near Walkway Improvements measurements include all people within 300 meters of walkway improvements. This indicator measures the number of people who have access to walkway improvements. 'Walkway Improvements' include any major improvements to footpaths that significantly increase walkability at the street level.
- Ensure equal access to public spaces including streets, sidewalks, and cycling lanes.
    - Indicator: Percentage of road length that has dedicated bike lanes (excluding motorways).
    - Indicator: Percentage of road length that has dedicated sidewalks (excluding motorways).
- Retain and foster the levels of walking to minimize the negative effects and costs of congestion, poor air quality, non-communicable diseases and compromised public safety.
- Prioritize walkable streets through mixed use and more compact urban planning. Walking and cycling should be the first choices for mobility within a city, based on an integrated public transport system. Active modes are not only good for public health, but also release zero emissions.
- Implement complete streets that safely and efficiently serve everyone. This protects the lives of people on foot and on bicycles, ensuring their physical and personal safety.
- Enable people of any age or gender, both with and without disabilities, to walk and cycle with dignity.

- Invest in infrastructure that provides an acceptable level of service for people that walk and cycle.
- Incorporate funding for walking and cycling in transport infrastructure project budgets as well as strategic climate finance plans.
- Foster cooperation and provide the conditions to create a mutual understanding between transport and urban planning departments.
- Invest in relation to the amount saved - when people can walk, they spend nothing on public or private transport and therefore have higher levels of available income for health and education.
- Design for efficiency and identify ways to use the limited road space effectively. Public transport systems are by far the most space-efficient modes, and governments should ensure access to a safe and efficient public transport system.
    - Indicator: Percentage of commuters aged 15 years and over who used public transport as their main means to travel to work during a reference period (e.g. on Census day, survey date etc.).
- Strengthen the role of public transport. Integrated mass transit systems must remain the backbone of the mobility system, combined with active, shared and on-demand modes. This redefinition of public transport is necessary to provide door-to-door seamless journeys that eliminate the need for a private car.
- 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 (SDG target 11.2)
    - Indicator: Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities (See Training Manual SDG 11.2.1, Metadata Methodology SDG 11.2.1, Urban Indicators Database – SDG 11.2).
- Explore ways to cross-subsidize public transport operations (e.g. from collecting fees from car parking to congestion charging or taxing fuel). Investments into public transport are social investments!
- Ensure financial incentives and a policy and regulatory framework for an emission transition in the transport sector.
- Set up funds to assist with public transport operations & the procurement of cleaner vehicles.
- Establish and implement an institutional framework with fully fledged and funded institutions responsible for the coordination of an integrated public transport system. These could be Metropolitan Transport Authorities that are set up for the functional area (and not just for the city boundaries).
- Encourage an accelerated uptake and additional investments in clean technologies and innovations that promote sustainable mobility, while the focus should remain on human-centered innovation that are accessible to all.
- Ensure that clean energy sources are accessible to further reduce the carbon footprint of mobility systems. Incentives need to be identified for a shift towards renewables.
- Support the facilitation of greater collaboration among stakeholder groups, especially between public and private sector actors.
- Adopt a smart-city approach that leverages digitization, clean energy and technologies

- Indicator: Share of street junctions with traffic lights connected to traffic management systems .

- Adapt legislation to allow the creation of restricted traffic zones within cities to discourage the use of private cars and motorcycles.

- Remove minimum parking requirements for development of residential and commercial locations to reduce building costs and increase the amount of space that is available.

- End fuel price subsidies, and tax benefits for vehicle ownership (company cars).

6.2 Waste

Governments should:

- Assess the environmental performance of a municipal solid waste management (MSWM) system, food waste generation and resource recovery systems in cities.

  - Indicator: Collect data on municipal solid waste (MSW) generated, collected, and managed in controlled facilities. (See Waste Wise Cities Tool for computation method).

- Ensure access to safe solid waste disposal.

  - Indicator: Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities. (See Metadata on SDGs Indicator 11.6.1 for computation method).

- Promote resource conservation and waste reduction, reuse, and recycling.

  - Indicator: Recycling rate, tons of material recycled.

- Take a circular economy approach, emphasizing waste prevention, source separation and the use of waste and waste products.

- Facilitate urban mining and the reuse of wastes; establish material recovery facilities.

- Ensure the appropriate, transparent and prudent management of hazardous waste in line with international treatment and health standards.

- Establish extended producer responsibility schemes that include producers in the financing of urban waste management systems and reduce the hazardousness of waste streams and recycling rates by better product design.

- Develop local waste prevention concepts that take into account the specific urban metabolism and focus on the most urgent waste streams with the highest cost-saving potentials.

- Reduce the adverse per capita environmental impact of the city, by paying special attention to air quality and municipal and other waste management.

6.3 Energy

Governments should:

- Boost the accessibility of innovative, affordable and efficient renewable energy solutions.

- Facilitate exchange and partnerships between public and private sectors on sustainable energy innovation.

- Enable innovators in urban and rural communities to leapfrog to sustainable energy.

- Co-develop, validate and replicate innovative energy solutions tailored to urban and rural contexts.

- Foster long-term partnerships and exchange on innovative sustainable energy solutions.
- Ensure access to modern renewable energy.
    - Indicator: Renewable energy share in the total final energy consumption.
- Adopt a smart-city approach that leverages digitization, clean energy and technologies.
    - Indicator: Percentage reduction in annual final energy consumption in homes using smart monitoring systems.
- Promote an immediate and strong shift towards a low-carbon energy system in line with a 1.5°C stabilization pathway.
- Boost energy efficiency by optimizing building‐related energy consumption, improved industry processes, business and households, district cooling and efficiency through cogeneration (block or district heating networks).
- Create opportunities to leapfrog to renewable solutions for energy storage and warming water; e.g. Solar power and local small-scale smart grids in rural areas where conventional power lines do not exist.

6.4 Policymaking

Governments should:

- Build governance structure establishing a supportive Framework that enables subnational and local governments to undertake their assigned responsibilities.
    - Indicator: Is supervision of local authorities exercised in accordance with such procedures and in such cases as provided for by the constitution or by law?.
    - Indicator: Percentage of the total budget that the local / sub-national government has discretion over to decide on priorities (financial autonomy).
    - Indicator: Percentage of the local / sub-national government's financial resources generated from endogenous (internal) sources of revenue.
- Link urban policies to finance mechanisms and budgets.
    - Indicator: Percentage of the local / sub-national government's financial resources generated from endogenous (internal) sources of revenue.
- Strengthen the capacity of local and subnational governments to implement local and metropolitan multilevel governance.
    - Indicator: Published performance delivery standards at the sub-national level.
- Promote participatory, age- and gender-responsive approaches to urban policy and planning.
    - Indicator: Proportion of cities with a direct participation structure of civil society engagement in urban planning and management, which are regular and democratic.
- Promote women's full participation in all fields and all levels of decision-making.
    - Indicator: Proportions of positions (by sex, age, persons with disabilities and population groups) in public institutions (national and local legislatures, public service, and judiciary) compared to national distributions.

- Plan and manage the development of urban space through integrated and balanced territorial development policies.
    - Indicator: Does the country have a National Urban Policy or Regional Development Plan that (a) responds to population dynamics, (b) ensures balanced territorial development, and (c) increase in local fiscal space.
    - Indicator: Number of countries, regional governments, and cities in which plans and designs are publicly accessible to residents (on-line) and can be consulted at all times.
- Improved capacity for urban planning and design, and training for urban planners at all levels of government.
    - Indicator: Number of urban planners per 100,000 persons.

6.5 Financing

Governments should:

- Mobilize financial resources by developing financing frameworks to implement the NUA at all levels of government.
    - Indicator: Existence of national structure or office or committee for implementing the New Urban Agenda.
- Mobilize endogenous (internal) sources of finance and expand the revenue base of subnational and local governments.
    - Indicator: Percentage of the total budget that the local / sub-national government has discretion over to decide on priorities (financial autonomy).
    - Indicator: Percentage of the local / sub-national government's financial resources generated from endogenous (internal) sources of revenue.
- Promote s ound systems of financial transfers from national to subnational and local governments based on needs, priorities and functions.
    - Indicator: Stable existence of "transfer formula" in the last 5 years, without major changes, meaning reductions of more than 10%.
- Mobilize and establish financial intermediaries (multilateral institutions, regional development banks, subnational and local development funds; pooled financing mechanisms etc.) for urban financing.
    - Indicator: Existence of at least one finance or infrastructure fund available for local / sub-national governments.
    - Indicator: Percentage of the local / sub-national government's financial resources generated from financial intermediaries such as multilateral institutions, regional development banks, subnational and local development funds, or pooled financing mechanisms.

6.6 Capacity development

Governments should:

- Expand opportunities for city-to-city cooperation and fostering exchanges of urban solutions and mutual learning.
    - Indicator: Number of cities participating in city-to-city partnership programs.
    - Indicator: Number of public water and sanitation utilities participating in institutional capacity development programs.

- Promote capacity development as a multifaceted approach to formulate, implement, manage, monitor and evaluate urban development policies.
    - Indicator: Percentage of cities and subnational governments with staff trained in formulation, implementation, managing, monitoring and evaluation of urban development policies.
- Strengthen the capacity of all levels of government to work with vulnerable groups to participate effectively in decision-making about urban and territorial development.
    - Indicator: Proportion of cities with a direct participation structure of civil society engagement in urban planning and management, which are regular and democratic.
- Support local government associations as promoters and providers of capacity development.
    - Indicator: Size of budget of local government associations.
- Promote capacity development programs on the use of legal land-based revenue and financing tools.
    - Indicator: Number of people who have been trained in the use of land-based and financing tools by UN- Habitat or other institutions.
- Promote capacity development programs of subnational and local governments in financial planning and management.
    - Indicator: Percentage of cities/ subnational staff trained in financial planning and management.
- Develop user-friendly, participatory data and digital platforms through e-governance and citizen-centric digital governance tools.
    - Indicator: Percentage of cities utilizing e-governance and citizen-centric digital governance tools.
- Use of digital tools, including geospatial information systems to improve urban and territorial planning, land administration and access to urban services.
    - Indicator: Percentage of cities utilizing geospatial information systems.
- Strengthen capacities at all levels of government to effectively monitor the implementation of urban development policies.
- Support all levels of governments in the collection, disaggregation, and analysis of data.

Chapter 7:

Synergies with external international initiatives

7.1 Collaboration with sister projects financed by the International Climate Initiative (IKI)

EcoLogistics

ICLEI's 'EcoLogistics projct: Low carbon freight for sustainable cities' project (2017-2021) was supported by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) through the International Climate Initiative (IKI), involving 9 cities in Argentina, Colombia, and India. The project focused on capacitating governmental and non-governmental actors to build strategies and policies to promote low-carbon and more sustainable urban freight through local action and national support. "EcoLogistics" promoted transportation of goods by giving priority to health, safety, people-centered urban development and low-emission and encouraged circular and regional economies to limit the growth of freight transport. It followed the strategy to Avoid (and reduce) the freight volume and haul distance, Shift (and maintain) to more sustainable modes of freight transportation, Improve the logistics operations by use of technologies and better operation. Urban Pathways collaborated with the EcoLogistics in the context of several thematic and regional trainings and collaborated on implementation concepts for Argentina and India.

TRANSfer III

GIZ's 'TRANSfer III – Facilitating the development of ambitious transport mitigation measures' project (2018-2020) was supported by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with the aim of paving the way for measures to reduce greenhouse gases from transport. The project's work focused on three levels:

1. Support for the MobiliseYourCity Partnership: The aim of this multi-stakeholder partnership, which is currently being co-financed by France, Germany and the European Commission, is to get 100 cities and 20 national governments to commit to ambitious climate change mitigation goals for urban transport and to implement appropriate measures. 2. Preparation of mitigation measures: The project supported five countries (including Peru, the Philippines, Thailand and Indonesia) in developing measures to reduce greenhouse gases from transport. 3. Knowledge products, training, dialogue: The TRANSfer III project promoted the exchange of experiences and developed knowledge products.

Urban Pathways was actively engaged in the MobiliseYourCity Partnership, which included collaboration on various capacity building programmes and the development of a joint guideline on National Urban Mobility Planning. Urban Pathways also supported the city of Belo Horizonte to join the MobiliseYourCity Partnership.

100% Renewables Cities and Regions Roadmap

The 100% Renewables Cities and Regions Roadmap project is implemented by ICLEI – Local Governments for Sustainability and funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) through the International Climate Initiative (IKI).

The project facilitates the energy transition by raising local awareness on RE sources, showcasing how local and national governments can create coordinated enabling frameworks and policies, exploring access to public and private sector finance, and building local RE projects addressing electricity and heating and cooling.

Financing Energy for Low-Carbon Investment – Cities Advisory Facility (FELICITY)

FELICITY (2007-2021) was implemented by GIZ and funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). The overall project objective is that the cities and municipalities in the partner regions have the capacities to prepare and implement investment projects that are eligible for funding in the area of climate-friendly urban infrastructure. It focuses on measures in the energy, wastewater, transport and waste sectors, supporting mitigation measures in cities and municipalities in Mexico, Ecuador, Indonesia and Brazil. Urban Pathways worked with the project on several policy dialogues and knowledge exchanges, for example in the context of the COP 24 and 25 and the World Urban Forum 11.

Growing smarter – sustainable mobility in East Africa

The Growing smarter project (2018-2023) is implemented by the Institute for Transportation & Development Policy (ITDP) and UN-Habitat, and funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) through the International Climate Initiative (IKI). The rapid growth in African cities leads to traffic jams and uncontrolled urban sprawl – and the consequences are rising greenhouse gas emissions, air pollution, urban poverty and climate vulnerability. The project helps to avoid this and reduce greenhouse gas emissions in the transport sector at the same time by supporting public & non-motorised transport and urban planning in the target countries. It also supports the implementation of high-quality public transport systems in Addis Ababa, Nairobi, Kigali and Kampala and the expansion of the existing bus rapid transport system in Dar es Salaam. The project also promotes policy frameworks at urban and national levels, accelerating changes in the transport sector through quality standards, improved financing and other policy measures. Various initiatives on sustainable mobility, with a particular focus on Kenya, were implemented in collaboration with the Urban Pathways project, such as the High Level Bicycle Ride, or provision of technical support on street design.

Reducing Marine Litter in the Mediterranean through Waste Wise Cities Lebanon (ReMaL)

The ReMaL project (2022-2025) is implemented by the Wuppertal Institute, funded by the Grant Programme against Marine Litter of the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV). ReMaL aims to reduce marine litter by supporting coastal Lebanese Unions of Municipalities (UoM) and the national government in establishing the foundations of integrated sustainable waste management (ISWM).

The UoMs benefit from support for the assessment of their waste status through data collection on waste generation, management (Waste Wise Cities Tool) and potential plastic leakage (Waste Flow Diagram). Based on the data, policy and infrastructure gaps, as well as activities to close the gaps are identified in a participatory process. These results lead to the implementation of pilot projects and feasibility studies, which will be accompanied by awareness raising. A National Online Waste Observatory will be created to compile waste data and share results with the remaining UoMs, to induce change there too. For long-term sustainability, national policy recommendations will be formulated, which will benefit policy makers and more broadly citizens and refugees. ReMaL will for the first time promote evidence-based decision-making for ISWM to prevent marine litter.

The project concept development was supported by Urban Pathways, in collaboration with the Waste Wise Cities programme and capacity building tools that were co-developed with Urban Pathways will be used for project implementation in Lebanon.

7.2 Synergies with external initiatives

Transformative Urban Mobility Initiative (TUMI)

TUMI is a sustainable mobility implementation initiative formed by the union of 11 prestigious partners, including UN-Habitat, with the aim of changing mobility for the benefit of people and the environment, with a view to the future. The initiative supports transportation projects around the world and enables policy makers to transform urban mobility by believing in sustainable mobility for a better future.

TUMI is based on three pillars: innovation, knowledge, and investment. TUMI supports innovative pilot projects worldwide, shares knowledge with planners on modern mobility concepts in workshops and conferences, and invests in the construction and modernization of sustainable urban infrastructure.

With technical support of Urban Pathways, four cities were supported in successfully accessing TUMI funding for pilot initiatives: Promoting Non-Motorized Transport through Open Streets project for Cape Town (South Africa); the TUMI Mobility Startup Accelerator in Nairobi (Kenya); the Pop-Up Pedestrianization Project in Mombasa (Kenya); and the Ecozone in Belo Horizonte (Brazil).

C40 Cities Finance Facility (CFF)

The C40 CFF is an initiative implemented by GIZ and the C40 Cities Climate Leadership Group (C40) and funded by the German Federal Ministry for Economic Cooperation and Development (BMZ), the Government of the United Kingdom, and the Agence Française de Développement (AFD).The CFF facilitates access to finance for climate change mitigation and resilience projects in urban areas by providing technical assistance to develop cities' sustainability priorities into bankable investment proposals. It aims to deliver project preparation and capacity development, and to widely share knowledge and establish partnerships between cities and financiers. Urban Pathways closely collaborated with C40 CFF to learn about financing opportunities for scaling up the pilot initiatives tested under the Urban Pathways project.

Open Streets a catalyst for Non-Motorised Transport in Cape Town

Playing with Mobility in the neighborhood of Santa Tereza

Mobility Accelerator to support Start-Up incubation in Nairobi

Biasharra Street Redesign Mombasa

MobiliseYourCity

The MobiliseYourCity (MYC) Partnership aims to empower 100 cities and 20 countries to improve urban mobility for their citizens and decarbonise transport to fight the global climate crisis.

MobiliseYourCity's support and services to member cities and countries aim at: (1) Accelerate the transition to sustainable urban mobility in countries of the Global South by following the avoid-shift and improve paradigm. (2) Foster more comprehensive, integrated and participatory urban mobility planning at both local & national levels through the development of Sustainable Urban Mobility Plans (SUMPs) and National Urban Mobility Programs (NUMPs). (3) Close the investment gap for sustainable mobility by advocating for increased resources and action to support cities to decarbonize urban transport. The highlight of the collaboration with MYC was the co-development of the guideline on "National Urban Mobility Policies & Investment Programmes".

PREVENT Waste Alliance

Initiated by the German Federal Ministry for Economic Cooperation and Development (BMZ), the PREVENT Waste Alliance was launched in May 2019. It serves as a platform for exchange and international cooperation. Organizations from the private sector, academia, civil society and public institutions jointly engage for a circular economy.

The PREVENT Waste Alliance wants to contribute to minimizing waste, eliminating pollutants and maximizing the reuse of resources in the economy worldwide. PREVENT works together for waste prevention, collection, and recycling as well as the increased uptake of secondary resources in low- and middle-income countries. PREVENT focuses on waste from plastic packaging and single use products as well as waste electrical and electronic equipment.

The pilot project in Quito -"E-nnovating Quito", seeks to collect useful data and formulate policy recommendations to incorporate the normative of Extended Producer Responsibility (EPR) on city level – helping to replicate it elsewhere and/or to other waste streams. The project also supported a non-profit organisation to create a collective association for proper WEEE management called Producer Responsibility Organisation (PRO) and engage stakeholders.

The project contributed to the design and pilotage of the first domestic e-waste collection and Extended Producer Responsibility (EPR) scheme in Ecuador. It developed policy recommendations and builds stakeholder commitment. Additionally, a mobile unit was designed to serve as collection and learning centres for Quito's inhabitants.

Supporting Sustainable forms of transport in India (SMART-SUT)

The Integrated Sustainable Urban Transport Systems for Smart Cities (SMART-SUT) (2017-2022) project is implemented by the GIZ and funded by the German Federal Ministry for Economic Cooperation and Development (BMZ).

The SMART-SUT project follows a multilevel and multi-stakeholder approach, strengthening stakeholders at national, state and municipal levels with the objective of improving the planning and implementation of a sustainable urban transport system in selected Indian cities. Close collaboration with GIZ and the SMART-SUT project was achieved in the electric mobility pilot initiative in Kochi, India, that was co-funded by both projects.

Mobilise Your City

PREVENT Waste Alliance

Urban Air Action Platform

The Urban Pathways partnership, through the United Nations Environment Programme (UNEP), together with UN-Habitat and IQAir, a Swiss air quality technology company, launched the world's largest air quality data platform during the tenth World Urban Forum in Abu Dhabi in February 2020, bringing together real-time air pollution data from over 4,000 contributors, including citizens, communities, governments and the private sector to work towards healthier, more sustainable cities.

This partnership – currently reaching over 15 million users and covering more than 7,000 cities worldwide – aims to sustain and grow the world's foremost air quality database. The data, shared on a single, UN-coordinated platform, will empower governments to take action to improve policy, allow citizens to make more informed health choices and demand action from their governments, while giving businesses the ability to make investment decisions that promote a cleaner, greener environment.

The platform addresses the global air quality information gap by bringing together data collected by governments, NGOs, companies and local community groups and individuals.

Link to the platform

7.3 Creation of child projects

SOLUTIONSplus

SOLUTIONSplus is an international flagship project to support the global transition to sustainable mobility. In the context of the EU-funded SOLUTIONSplus project 45 partners and over 100 associated partners work together on transformative change towards sustainable urban mobility through innovative and integrated electric mobility solutions. The team of local authorities, knowledge and finance partners, industry, networks and international organizations help boosting the availability of public and shared electric vehicles, foster the efficiency of operations and support the integration of different types of e-mobility in urban areas that meet the needs of users and local conditions in Europe, Asia, Africa and Latin America. The project implements e-mobility solutions for the first and last mile (electric two and three-wheelers), electric buses and minibusses, innovative charging solutions and multimodal journey planners in the partner cities. The project encompasses city level demonstrations to test different types of innovative and integrated e-mobility solutions, complemented by a comprehensive toolbox, capacity development and replication activities. Demonstration actions will be launched in Hanoi (Vietnam), Pasig (Philippines), Lalitpur/ Kathmandu (Nepal), Nanjing (China), Kigali (Rwanda), Dar es Salaam (Tanzania), Quito (Ecuador), Montevideo (Uruguay), Madrid (Spain) and Hamburg (Germany) and replicated in twenty additional cities.

Urban Pathways supported the development of country profiles, policy assessments, and the co-development of pilot project concepts for the cities that were later taken up with funding from the EU SOLUTIONSplus project. Both projects are since then collaborating on capacity building activities and trainings, the development of a toolkit on gender-inclusive mobility, as well as monitoring and modeling air quality in the partner cities.

ACCESS - Accelerating Access to Low Carbon Urban Mobility Solutions through Digitalization

Accelerating Access to Low Carbon Urban Mobility Solutions through Digitalization (ACCESS) is a joint program of ten organizations engaged in six countries in Latin America. The programme is transformative, aimed at immediate impact through promoting a comprehensive approach on digitalization of transport in urban areas. A coordinated and coherent strategy shall be established at regional, national, and city levels with civil society, public and private partners. Policies and actions enabling deployment and market uptake of innovation and technology investments in the transport sector will be implemented, thus contributing to low carbon mobility and improved air quality.

This project builds on the innovation partnerships established under the Urban Pathways project, and takes forward the component of digitalization in the mobility sector (drawing lessons from the TUMI Mobility Accelerator in Kenya and the SOLUTIONSplus project in Latin America).

Smart Energy Solutions for Africa (SESA)

SESA facilitates a structured co-development process, which starts with the co-development of energy access innovations that have a high potential for take-up and are tested, validated and later replicated. The co-developed demonstration actions will be initially tested in the Kenya living lab and based on the initial learnings, various aspects of the tested innovations will be validated in living labs in different socio-economic operating environments (Ghana, South Africa, Malawi and Morocco). The learning from the validation living labs will strengthen the applicability and replicability of the technologies as well as the basic business concepts, which will be shared in the SESA toolbox and incubator program.

The Urban Pathways project paved the way for the SESA project, building on the engagement in Kenya. SESA builds its idea on the intersectoral approach of the Urban Pathways project and aims to develop solar hubs for sustainable energy access for electric mobility, purification of water and charging fishing lanterns.

SESA energy hub in Kenya (source: Urban Pathways)

Clever Cities – Quito

The CLEVER Cities project is funded by the European Union's Horizon 2020 innovation action program. CLEVER Cities uses nature-based solutions (NBS) to address urban challenges and promotes social inclusion in cities across Europe, South America and China. The project aims to increase and improve local knowledge of NBS, demonstrate that greener cities work better for people and communities, contribute data and information to EU policymaking, and ultimately promote and enable the uptake of NBS in urban planning world-wide.

Transforming Road Safety in Africa (TRANS-SAFE)

The TRANS-SAFE (2022-2026) project will involve national, regional, and city level demonstrations to test different types of innovative and integrated Safe System solutions, complemented by a comprehensive toolbox, capacity development, policy support and replication activities. To maximize impact, the project brings together in a consortium, highly committed cities, road safety agencies and experts from both Europe and Africa. Building on numerous synergistic projects, networks, and a strong technical experience among partners, the consortium will deliver an ambitious project through highly effective and innovative approaches to sustainable road safety development, thereby ensuring that road safety systems and interventions from this project deliver on the recommendations of the Road Safety Cluster of the African-EU Transport Task Force, adopted in 2020. Ultimately, the project will help deliver on the Joint EU-Africa Strategy (JAES) and advance countries' progress towards the 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs).

In preparation for the TRANS SAFE project, Urban Pathways has supported the review of existing road safety policies in selected African countries and proposed a set of well proven policies, strategies and suggestions as well as identified best practices with positive impacts on vulnerable road users in terms of road safety and climate change.

UN Road Safety Fund supported projects

Building on the active mobility pilot initiatives implemented under Urban Pathways in Kenya, three road safety initiatives were successfully submitted for funding to the UN Road Safety Fund.

- Scaling up Safe Streets in Ethiopia (2019-2021)
- Reclaiming Streets for Pedestrians and Cyclists - Building on the global momentum of COVID-19 (2021-2024)
- Global Alliance of Cities for Road Safety (2023-2026)

Chapter 8:

Outlook and Way Forward - Institutionalizing Urban Pathways through the Urban Living Lab Center

The transformation of cities towards sustainable and inclusive development is a key objective of the New Urban Agenda. There is substantial potential to improve urban access, air quality, safety and the quality of life in cities along with reducing Greenhouse Gas Emissions if an integrated policy approach is applied that combines all intervention areas for urban policy and involves all levels of government. Linking key sectors and actors is a vital step towards an integrated approach that helps decarbonize urban systems and delivers livable and accessible cities for all. Testing innovative solutions in urban living labs can be a key steppingstone, transferring these learnings into scaled-up public or private sector actions is then a vital next step towards transformative change. Therefore, as a way to institutionalize the work of Urban Pathways, the Urban Living Lab Center was created and launched in May 2022.

The Urban Living Lab Center brings together partners from around the world working in applied research and capacity building and actively participating in urban living labs. It focuses on key aspects related to urban transformations and aims to provide a common platform for projects and capacity building initiatives focused on: (1) Policy, planning, funding and financing (public sector) and (2) Green recovery, business modeling and start-up support (private sector).

The core partners are UN-Habitat, the Massachusetts Institute of Technology (MIT), the Technical University Berlin and the Wuppertal Institute for Climate, Environment and Energy, the latter leading the overall program and inviting laboratories and centers to participate in the partnership. The partnership builds on a range of projects that enable the activities. For the initial phase the projects are: Urban Pathways, SOLUTIONSplus, ACCESS, SESA, and Decarbonizing Transport. These projects support the development of the collaboration framework with the thematic and regional hubs and the development of the first knowledge products, learning materials, courses (face-to-face, blended and online), innovation and theses linked to these.

In the context of this joint collaborating center, knowledge, network and outreach partners are actively supported to co-develop training formats for local authorities, planners, practitioners and entrepreneurs for four thematic areas (urban development, energy, mobility and digitalization). This aims to foster local policy and planning capacities, improve the ability of local authorities to access funding and financing mechanisms and support the take-up of innovative business models by companies and start-ups in the partner regions.

The setting up of regional hubs and thematic labs will support the rolling out of activities and support the implementation of action-oriented urban development projects in Asia, Africa and Latin America, boost synergies and minimize duplications. The collaboration with these hubs will also strengthen the engagement with local level actors and experts.

Labs and hubs are being hosted at partner universities in living lab cities and other knowledge and network institutions, which are involved in relevant implementation. Regional hubs have been developed for Europe, Asia, Africa and Latin America and thematic hubs were established for urban planning, urban mobility, urban energy, digitization and urban resource management. The regional hubs facilitate blended- and in-person learning activities tailored for each region. The thematic hubs develop learning material for each of the core topics and contribute to the development of thesis and case study developments in collaboration with the lab and the regional hubs.

The Urban Living Lab Center and Hubs link the academic collaboration with local implementation action in urban living labs. In close collaboration with partner cities and universities the Urban Living Lab Center and Hubs will provide active support for the planning, development, implementation and scale-up of urban areas. A particular focus will be on urban electric mobility innovations that will be tested in different operating environments. This follows a structured approach that aims to link research, training and implementation along with local and international objectives:

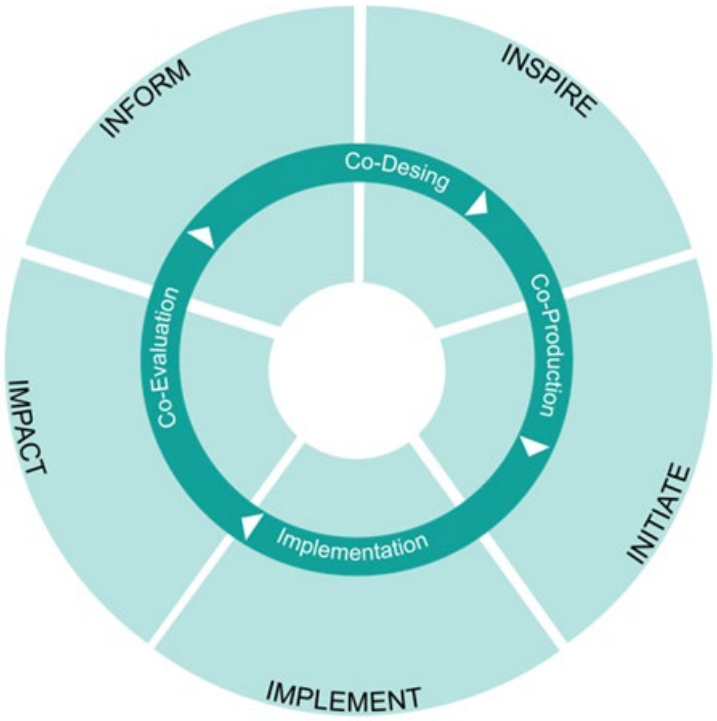
INFORM: Boost capabilities of local and national authorities, public transport operators and entrepreneurs about innovative urban e-mobility solutions across various transport modes by informing them about tools to plan, assess, implement and operate e-mobility solutions.

INSPIRE: Foster the take-up of e-mobility innovations by businesses, start-ups, local and national governments and transport operators by inspiring officials, operators, industry and businesses through peer-to-peer exchange on innovative e-mobility products and services.

INITIATE: Strengthen policy and business collaboration by initiating partnerships between local and national governments and local and European entrepreneurs and supporting the development of new e-mobility models business implementation plans.

IMPLEMENT: Create reference models for e-mobility innovation by implementing demonstration actions to test innovative e-mobility technologies and services, foster their replication and ensure their long-term sustainability.

IMPACT Contribute to global sustainability and climate goals by boosting the impact of this project through the integration of the innovative concepts into policy, funding, operation, research and business practice.



The Urban Living Lab Center will also reach out to key actors in relevant projects, in particular by the International Climate Initiative, and facilitate the co-development of the capacity building and innovation program and associated infrastructures, such as platforms and training centers. While this has been initiated by the Urban Pathways project, it is open to other relevant programs in order to sustain partnerships with local and national authorities, and local innovators to maximize synergies.

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