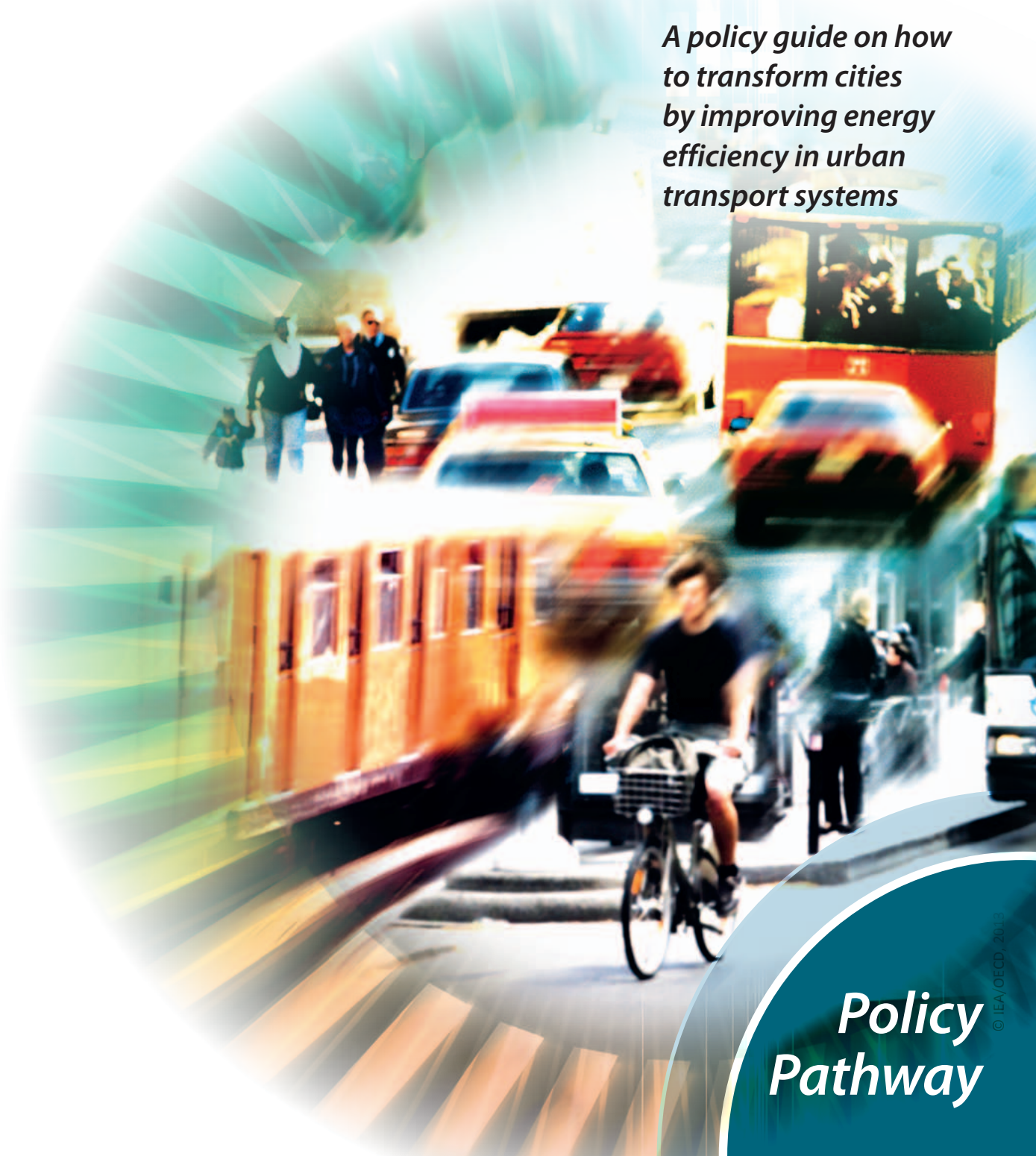
International Energy Agency

A Tale of Renewed Cities

A policy guide on how to transform cities by improving energy efficiency in urban transport systems



Policy Pathway

International Energy Agency

A Tale of Renewed Cities

Transport currently accounts for half of global oil consumption and nearly 20% of world energy use, of which approximately 40% is used in urban transport alone. The IEA expects urban transport energy consumption to double by 2050, despite ongoing vehicle technology and fuel-economy improvements. While increased mobility brings many benefits, the staggering rate of this increase creates new challenges. Urgent energy-efficiency policy attention will be needed to mitigate associated negative noise, air pollution, congestion, climate and economic impacts, all of which can cost countries billions of dollars per year.

This report highlights lessons learned and examples of good practice from countries with experience implementing a wide range of measures to improve energy efficiency in urban transport systems.

Part of the IEA Policy Pathway series, A Tale of Renewed Cities *sets out key steps in planning, implementation, monitoring and evaluation. The Policy Pathway series aims to help policy makers implement the IEA 25 Energy Efficiency Policy Recommendations endorsed by IEA Ministers (2011).*

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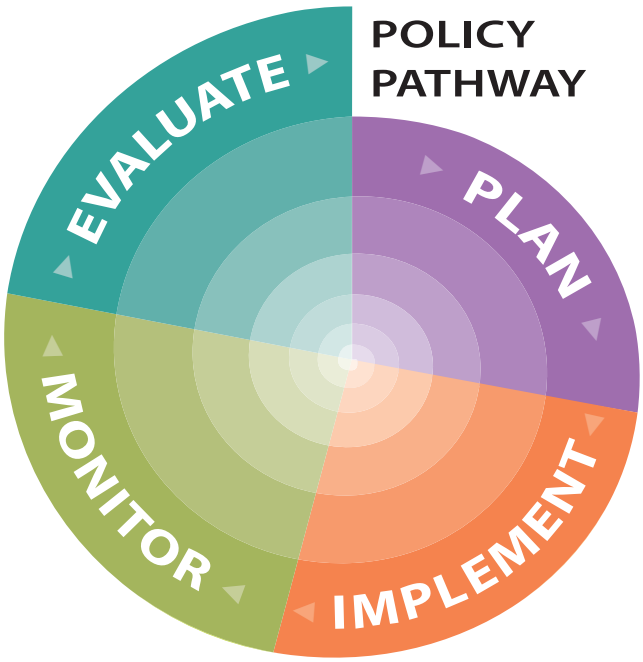
A Tale of Renewed Cities

A policy guide on how to transform cities by improving energy efficiency in urban transport systems

The IEA Policy Pathway series

Policy Pathway publications provide details on how to implement specific recommendations drawn from the IEA 25 Energy Efficiency Policy Recommendations. Based on direct experience, published research, expert workshops and best-practice country case studies, the series aims to provide guidance to all countries on the essential steps and milestones in implementing specific energy efficiency policies.



The Policy Pathway series is designed for policy makers at all levels of government and other relevant stakeholders who seek practical ways to develop, support, monitor or modify energy efficiency policies in their home country and abroad. The pathways can also provide insight into the types of policies best adapted to the specific policy context(s) of different countries, so that each country derives the maximum benefit from energy efficiency improvements.

INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA), an autonomous agency, was established in November 1974. Its primary mandate was – and is – two-fold: to promote energy security amongst its member countries through collective response to physical disruptions in oil supply, and provide authoritative research and analysis on ways to ensure reliable, affordable and clean energy for its 28 member countries and beyond. The IEA carries out a comprehensive programme of energy co-operation among its member countries, each of which is obliged to hold oil stocks equivalent to 90 days of its net imports. The Agency's aims include the following objectives:

- Secure member countries' access to reliable and ample supplies of all forms of energy; in particular, through maintaining effective emergency response capabilities in case of oil supply disruptions.
- Promote sustainable energy policies that spur economic growth and environmental protection in a global context – particularly in terms of reducing greenhouse-gas emissions that contribute to climate change.
- Improve transparency of international markets through collection and analysis of energy data.
- Support global collaboration on energy technology to secure future energy supplies and mitigate their environmental impact, including through improved energy efficiency and development and deployment of low-carbon technologies.
- Find solutions to global energy challenges through engagement and dialogue with non-member countries, industry, international organisations and other stakeholders.

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Table of contents

Foreword **6**

Acknowledgements **7**

Executive summary **8**

Introduction **12**

Defining urban transport system energy efficiency 15

Policy pathway 16

A tale of renewed cities **18**

Belgrade: co-ordinating actions and investments to support sustainable transport growth 20

New York City: maintaining and improving energy-efficient transport 27

Seoul: reforming bus operations to improve urban transport 34

Policy packages to improve energy efficiency in urban transport systems **39**

Why are policies needed? 39

Which policies are needed? 43

How to achieve transport system energy efficiency improvements: the policy pathway **57**

Plan 58

Implement 75

Monitor 80

Evaluate 82

Conclusions **86**

Policy tools and references **87**

List of acronyms **89**

References **90**

List of figures

Figure 1 Expected urban private motorised travel (in passenger kilometres) 13
Figure 2 Global transport sector emissions under the 6DS, 4DS and 2DS 14
Figure 3 Transport decision matrix 15
Figure 4 Belgrade Smart Plan planning process 23
Figure 5 Range of business models with private-sector participation 42
Figure 6 City contexts within the urban land-use and travel framework 46
Figure 7 Examples of co-benefits from transport system efficiency improvements 62

List of tables

Table 1 IEA policy pathway to improve energy efficiency in urban transport systems 17
Table 2 Summary of Belgrade, New York City and Seoul urban transport system case studies 18
Table 3 Transport objectives in the 2003 Master Plan for Belgrade to 2021 21
Table 4 Specific Belgrade transport policies identified in the 2008 Smart Plan 22
Table 5 Goals and examples of corresponding policy actions in Sustainable Streets 28
Table 6 Examples of financing tools to support transport system investments 41
Table 7 "Avoid" objectives and examples of policy responses 44
Table 8 "Shift" objectives and examples of policy responses 44
Table 9 "Improve" objectives and examples of policy responses 45
Table 10 Common policy targets and policy responses 53
Table 11 Examples of urban transport policies and their potential co-benefits 54
Table 12 Urban transport stakeholders 55
Table 13 Stages of stakeholder consultation 64
Table 14 Examples of urban transport system indicators 74

List of boxes

Box 1 Modelling urban transport – why technology is not enough 13
Box 2 Belgrade, Serbia: complementary policy measures to support transport objectives 23
Box 3 New York City, USA: congestion pricing, barriers and lessons on formulating policy response 30
Box 4 Fuel subsidies: real costs of keeping fuel below international retail prices 39
Box 5 Weakened policy framework: lessons from former Soviet states 40
Box 6 Rio+20 pledge: financing sustainable transport in developing countries 41
Box 7 Warsaw, Poland: innovative financing to improve transport efficiency 43
Box 8 Guangzhou, China: award-winning, integrated sustainable urban transport 46
Box 9 Nashville, USA: addressing sprawl through strategic planning and transport funding 47
Box 10 Shanghai, China: multiple approaches to address growing transport problems 48

Box 11	Vienna, Austria: improving energy efficiency in multi-modal city	48
Box 12	Manila, Philippines: increasing transit options through private concessions	49
Box 13	Mexico PROTRAM: urban transport initiatives to mainstream sustainable mobility	50
Box 14	Singapore: measures to counter congestion and increase modal shift	51
Box 15	Paris, France: multiple approaches to traffic reduction and efficiency improvements	52
Box 16	Lagos, Nigeria: committing significant investments to double public transport	54
Box 17	Grand Paris: national interest unites local jurisdictions to create dynamic global city	56
Box 18	Mobility surveys and modal shares: identifying energy efficiency in urban travel	59
Box 19	New South Wales, Australia: Transport Master Plan and public feedback	60
Box 20	Buenos Aires, Argentina: policy responses in support of sustainable mobility options	61
Box 21	Mexico City, Mexico: Metrobús, co-benefits of BRT development	62
Box 22	Eindhoven, Netherlands: engaging stakeholders and citizen involvement	64
Box 23	Moscow, Russia: art in the metro, increasing ridership through public partnership	65
Box 24	C40 cities: partnership for sustainable transport action in megacities	65
Box 25	San Francisco, USA: improving parking through smart technologies, public awareness	67
Box 26	Stockholm, Sweden: improving metro service capacity through mobile technology	68
Box 27	Kayseri, Turkey: PPPs to improve transport system technology	68
Box 28	Hong Kong, China: creating a learning environment to increase institutional capacity	69
Box 29	Istanbul, Turkey: private-sector financing to promote transport service improvements	69
Box 30	Montevideo, Uruguay: securing financing through development of shared trust fund	70
Box 31	Santa Monica, USA: five-year implementation plan to integrate bicycles into city life	71
Box 32	United Kingdom: The Green Book, best practices in policy appraisal	73
Box 33	European bike-share initiatives: engaging private sector to provide new services	76
Box 34	Terrassa, Spain: using film and street messages to increase safety	77
Box 35	Vienna, Austria: traveller information through mobile technology	78
Box 36	Lisbon, Portugal: sustainable mobility through public information campaigning	78
Box 37	Delhi, India: assessing the impact of urban bus corridors	83
Box 38	Paris, France: communicating the effects of transport initiatives	83
Box 39	Istanbul, Turkey: expanding rapid bus services through continual project evaluation	85

Foreword

Global urban populations are growing rapidly – and with them, city transport volumes. Urban transport energy consumption is expected to double by 2050, despite ongoing vehicle technology and fuel-economy improvements. Annual global urban transport emissions are expected to more than double to nearly 1 billion annual tonnes of CO_2 eq. by 2025. 90% of this growth in urban transport emissions is expected to come from private motorised travel.

The effects of growing travel demand and increasing shifts to private motorisation are leading to escalating roadway congestion that costs billions of dollars in wasted fuel and time. Moreover, motorised vehicle traffic has significant adverse effects on health, contributing substantially to respiratory and cardiovascular diseases from outdoor air pollution, and deteriorated safety in cities, leading to more than 1.3 million deaths per year from traffic accidents. Urgent policy attention to improve the energy efficiency of urban transport systems is thus needed not only for energy security reasons, but also to mitigate the negative climate, noise, air pollution, congestion and economic impacts of rising urban transport volumes and energy consumption.

This policy pathway highlights the holistic transport energy efficiency, city planning and traffic management approaches local and national leaders in Belgrade, New York City, Seoul and more than 30 other cities across Asia, Europe and the Americas are aggressively pursuing.

Drawing on these "real-life" case studies, this pathway offers national and local decision makers concrete steps on how to plan, implement, monitor and evaluate key urban transport system policies in order to improve not only energy security, but also quality of life.

Maria van der Hoeven
Executive Director
International Energy Agency

This publication is produced under my authority as Executive Director of the International Energy Agency.

Heavy levels of traffic and prioritisation of motorised transport result in less efficient transport systems. Cities across the globe – including New York City in the United States (pictured here in 2007 prior to policy changes) – are already tackling important issues and challenges to improve urban transport.

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Executive summary

Transport currently accounts for half of global oil consumption and nearly 20% of world energy use, of which around 40% is used in urban transport alone (IEA, 2011a)**.** The IEA expects urban transport energy consumption to double by 2050, despite ongoing vehicle technology and fuel-economy improvements. These numbers are staggering and demand urgent energy efficiency policy attention to mitigate associated negative noise, air pollution, congestion, climate and economic impacts, which cost countries billions of dollars each year.

Many cities are tackling the urban transport challenge head on. This policy pathway describes the broad policy measures designed to address urban transport issues in more than 30 cities. In-depth case studies are included for three cities – Belgrade, New York City and Seoul – to demonstrate how common responses can be applied in very different local contexts to achieve transport system improvements. Based on these case studies and the experiences from other cities highlighted in this report, the pathway proposes ten critical steps that local and national governments can take to develop, implement and evaluate key urban transport system policies.

Context

In order to improve urban transport energy efficiency, it is important to define it. **Urban transport energy efficiency can be understood as the maximisation of travel activity with minimal energy consumption through combinations of land-use planning, transport modal share, energy intensity and fuel type.**

There are various ways to improve urban transport energy efficiency. For example, cities with high private vehicle travel activity can promote shifts to non-motorised transport (*e.g.* bicycles and walking) and public transport modes. They can also require higher vehicle fuel-economy standards and establish stronger land-use regulations.

Policy solutions

Urban transport energy efficiency policies can be grouped into three broad categories: those that allow travel to be "avoided"; those that "shift" travel to more efficient modes; and those that "improve" the efficiency of vehicle and fuel technologies. This package of policies contributes to what is known collectively as an "avoid, shift and improve" approach (GTZ, 2004).

- **"Avoid" policies address transport energy use and emissions by slowing travel growth via city planning and travel demand management**. "Avoid" policies also include initiatives such as virtual mobility programmes (*e.g.* tele-working) and implementation of logistics technology.
- **"Shift" policies enable and encourage movements from motorised travel to more energy efficient modes, such as public transit, walking, cycling and freight rail**. For example, increases in affordable, frequent and seamless public transport can alleviate local congestion while improving access and travel time to destinations and reducing household expenses on travel.
- **When motorised travel is necessary, "improve" policies can reduce energy consumption and emissions of all travel modes through the introduction of efficient fuels and vehicles**. "Improve" policies include tightened fuel-economy standards and increased advanced-vehicle technology sales (*e.g.* clean diesel trucks and hybrid and plug-in electric cars).

The IEA estimates that between now and 2050, the "avoid, shift and improve" approach could lower total global expenditures on vehicles, fuels and transport infrastructure by as much as USD 70 trillion (IEA, 2012b).

These savings come both from reduced spending on oil in the transport sector, as well as from reduced capital and operational expenses on vehicles and the world's rapidly growing roadway infrastructure.

Pairing cities with policies

Which policies to put in place to improve the energy efficiency of an urban transport system first depends on the city context and its immediate transport needs. This policy pathway outlines four categories of urban transport system contexts: developing, sprawling, congested and multi-modal cities.

Developing cities are experiencing increasing demand for transport services and rapid growth in private motorisation. They frequently have relatively low densities, inadequate travel infrastructure and are often characterised by weak public transit services (*e.g.* unregulated, poor quality bus operators). Developing cities often have a rare opportunity to direct land-use and travel growth toward energy efficient transport systems before urban form and transport network development are strongly established. Target policies include regulations that discourage or penalise sprawling development (*e.g.* minimum density thresholds), land-use initiatives that prioritise dense urban cores (*e.g.* transit-oriented development), transport infrastructure development (*e.g.* dedicated spaces for pedestrians and public transit networks, increased service quality and frequency of public transport), removal of fuel subsidies and implementation of vehicle registration fees.

Sprawling cities tend to have low densities and high urban and suburban sprawl. They often have weakly-defined urban cores with commercial and business hubs spread intermittently throughout the urban and metropolitan areas. One way to promote more efficient transport in sprawling cities is to increase density. This generally requires years of planning and development. Land-use policies that address denser development, such as density credits and unified regional planning guidelines, can help to discourage continued sprawl and increase urban core development. Long-term zoning strategies, builder incentives and tax credits for business relocation are examples of policies that encourage urban densification. Policies that improve existing transport and prioritise shifts away from private motorised travel are also important. These policies can include travel demand management programmes, such as parking reform and road pricing, as well as tools that focus on improving transport and travel flow (*e.g.* advanced traffic signal control and buyer incentives for alternative vehicle technologies).

Congested cities often experience heavy roadway traffic, especially during peak travel hours. They generally have medium to high densities and strong urban cores, although urban sprawl may exist in surrounding metropolitan areas. Policies that discourage vehicle ownership (*e.g.* vehicle quotas and vehicle registration taxes) and private motorised travel (*e.g.* road pricing and parking fees) can help to reduce or stabilise increasing traffic levels. Improved travel management technologies, such as advance traffic signalisation and real-time travel information, can also help to improve mobility and system flow. Medium- to long-term policies include transport system development (*e.g.* increased funding streams to develop and improve public transport services) and an improved land-use transport interface (*i.e.* improved match between travel demand and destination). In the shorter term, policies and programmes that respond to existing gaps in travel networks (*e.g.* seamless connections between travel modes) can help to improve passenger travel and encourage shifts away from private motorised vehicles.

Multi-modal cities have high densities, strong urban cores, and high public transit and non-modal transport shares. Multi-modal cities generally have strongly interconnected, well-developed travel networks, which facilitate and encourage more efficient travel. Travel demand management policies are particularly useful in multi-modal cities to maintain or improve travel shares by more efficient transport modes. Examples of policies used to achieve additional improvements in transport system efficiency include transit-incentive programmes, car-free zones, parking levies, dedicated cycling lanes and road pricing schemes. Cities are also increasingly turning to technology to improve urban travel and transport efficiency. This technology includes "real-time" updates of road conditions and transit arrivals, smart-phone travel applications and online journey calculators.

Which policies to implement depend not only on urban context, but also on long-term city transport objectives (and related goals for economic growth, social equity and improved health). A long-term objective for a city facing increasing private motorisation could be to improve travel choices and to double the share of trips taken by public transport over the next ten years. This kind of broad policy objective can help to frame specific policy decisions in response to identified needs – for example, building a bus rapid transit (BRT) network to provide greater travel choice and support increased public transit use.

A policy pathway

This policy pathway is divided into four sections. **The first section introduces why improving the energy efficiency of urban transport systems is important.**

The second section provides illustrative "real-life" case studies of urban transport policies implemented in Belgrade, New York City and Seoul and distills learning that can be applied to other city contexts.

The third section analyses barriers to improving urban transport energy efficiency and the key polices (including interventions and measures) to overcome them. The barriers include:

- **Policy and market failures:** fuel subsidies, prioritisation of roadway funds and development incentives (*e.g.* subsidies for construction in green-field areas) can encourage markets that favour private motorisation. This policy pathway recommends countries eliminate these incentives and set taxation systems to reflect the full range of external costs of fuels and vehicles. Taxation and other price mechanisms should take into account CO_2 emissions, pollution and other environmental and social impacts caused by travel decisions.
- **Lack of access to financing:** budget constraints make it necessary to consider a variety of funding mechanisms, including revenues from road pricing (*e.g.* toll roads), congestion charges, parking levies, developer fees and tax increment financing (TIFs). Forms of agreements and public-private partnerships (PPPs), including Public Service Contracts (PSCs), Municipal Support Agreements (MSAs) and Build-Operate-Transfer (BOT) concessions can also be useful structures for financing projects.
- **Other barriers:** political resistance, administrative and legal barriers (*e.g.* authority to implement and enforce policies), public opposition, physical constraints (*e.g.* terrain and the built environment) and institutional, capacity and jurisdictional issues are all barriers to improving urban transport system efficiency.

Successful policies to overcome these barriers take into account the interface of land-use and travel network development (the physical transport context); access and travel choice (availability and proximity of travel options); and travel demand management (the extent to which travel behaviour, modal choice and energy efficiency are encouraged).

The fourth section sets out ten detailed steps for supporting the development, financing, implementation and evaluation of policies to improve the energy efficiency of urban transport systems. These steps follow the plan, implement, monitor and evaluate approach applied in all the IEA Energy Efficiency Policy Pathways series (Table ES1) and reflect a wide variety of urban transport policies and projects from around the world. The steps draw on proven practices and experiences from practitioners with diverse international experiences in the development and implementation of urban transport projects.

Table ES1 IEA policy pathway to improve energy efficiency in urban transport systems

		DONE
PLAN	1 Identify transport needs and define objectives	○
	2 Identify and engage stakeholders early on	○
	3 Address potential barriers and secure necessary resources	○
	4 Establish policy framework and action plan	○
IMPLEMENT	5 Engage actors and begin implementation	○
	6 Raise awareness and communicate targets	○
	7 Manage implementation process	○
MONITOR	8 Collect, review and disseminate data	○
EVALUATE	9 Analyse data and evaluate effects of transport policy	○
	10 Adapt transport policy and plan next steps	○

Introduction

People and freight are moving more, especially in emerging economies. Since 2000, total global passenger and freight movements have increased by an average of 4% per year. As a result, global transport energy use has increased 30% during the past decade – the equivalent of doubling 2000 transport energy consumption levels in the United States – while global transport emissions grew by nearly 2 billion annual tonnes of CO_2 equivalent (CO_2 eq.) since 2000 (IEA, 2012a). People and freight have also changed how they move. In 2000, there were roughly 625 million passenger light-duty vehicles (PLDVs) around the world. By 2010, that number had reached nearly 850 million PLDVs (IEA, 2012b).

Rising vehicle ownership levels worldwide have led to significant shifts away from non-motorised transport (NMT) and public transport modes, even in dense urban areas. PLDV mode share in rapidly growing cities, such as Beijing and Shanghai, increased by 20% or more over the past 20 years (Darido *et al.*, 2010). Surges in mobility have placed greater demand on transport infrastructure, with average national road occupancy levels (vehicle travel per km of infrastructure) increasing as much as two-fold in some countries since 2000 (IEA, 2013).

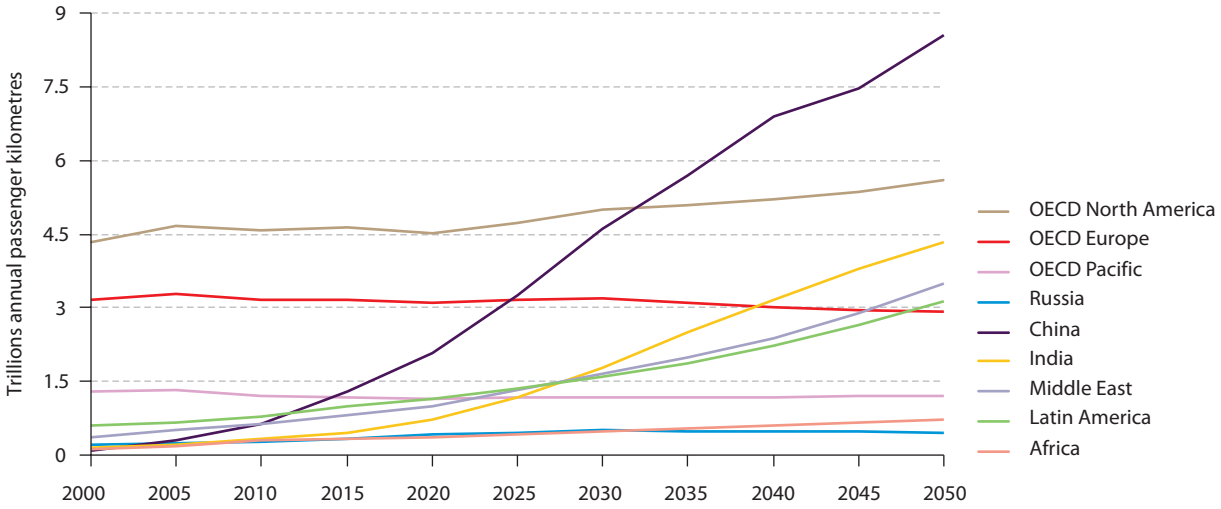
The effects of growing travel demand and increasing shifts to private motorisation are particularly evident in urban areas. Throughout the world, urban roadway congestion threatens the ability of cities to sustain long-term economic growth. Congestion alone costs countries billions of dollars in wasted time. Motorised vehicle traffic also has significant adverse effects on environmental quality and health and safety in cities. The World Health Organisation (WHO) reported in 2009 that the leading cause of death among 15- to 29-year-olds was road traffic injuries. Each year, global traffic accidents lead to 1.3 million deaths and are estimated to cost more than USD 500 billion. Increased road traffic from inefficient transport and land use also contribute substantially to respiratory and cardiovascular diseases from outdoor air pollution (WHO, 2009).

These issues are unlikely to diminish in a "business-as-usual" future. In fact, they are likely to worsen. The IEA expects global travel (in terms of passenger and freight-tonne km) to double and corresponding transport energy use and emissions to increase 70% between 2010 and 2050, despite expected vehicle technology improvements (Figure 1). Global motorised vehicle stock is expected to double, and subsequent roadway occupancy levels are projected to increase as much as six-fold in some countries (IEA, 2012b). This growth will increasingly affect urban areas as the world becomes more urbanised and likely lead to deteriorated road safety and increased local congestion and air pollution. Moreover, expected growth in the transport sector will be costly. The IEA estimates that cumulative vehicles, fuels and infrastructure expenditures to 2050 (in real, undiscounted terms) will account for more than 8% of global gross domestic product (GDP), or about USD 515 trillion over the next 40 years.

In effect, the world has reached a turning point. The 19th and 20th centuries changed how we move through rapid transit and private motorisation. The 21st century now must address how to move people and goods *most efficiently* in an energy-, budget-, time- and space-constrained world. This transition will require more than advances in vehicle technologies: fuel efficiency improvements alone cannot mitigate the consequences of a world in which nearly 70% of all movements will be made by motorised roadway travel in more than 3 billion vehicles in 2050. Instead, 21st century travel efficiency will require shifts in how we perceive, design, operate and manage the world's transport systems (Box 1).

Increasing motorisation, especially in rapidly developing urban areas, contributes to numerous health and safety issues.

Figure 1 Expected urban private motorised travel (in passenger kilometres)



Source: unless otherwise indicated, figures and tables in this document are from IEA data and analysis.

Box 1 *Modelling urban transport – why technology is not enough*

The global urban population is increasing rapidly, and with it, urban travel demand is growing. Between 2000 and 2010, the world's urban population increased by roughly 650 million people (UNDESA, 2011), and the IEA estimates that urban passenger travel increased by nearly 3 trillion annual passenger kilometres during the same period.

By 2050, an estimated 70% of the global population (or 6.3 billion people) will live in an urban area (UNDESA, 2011). The IEA expects that global urban passenger mobility under a business-as-usual scenario will more than double by 2050 and increase as much as ten-fold between 2010 and 2050 in rapidly urbanising, fast-growing regions, such as Southeast Asia, South Asia and the Middle East. This growth means that global annual urban transport energy consumption under a business-as-usual scenario is expected to increase more than 80% over 2010 levels by 2050, despite expected vehicle technology and fuel-economy improvements.

As cities grow, urban mobility and urban transport energy consumption and emissions will become a bigger challenge. The IEA expects annual global urban transport emissions to more than double to nearly 1 billion annual tonnes of CO_2 eq. by 2025, and 90% of growth in urban transport emissions will come from private motorised travel.

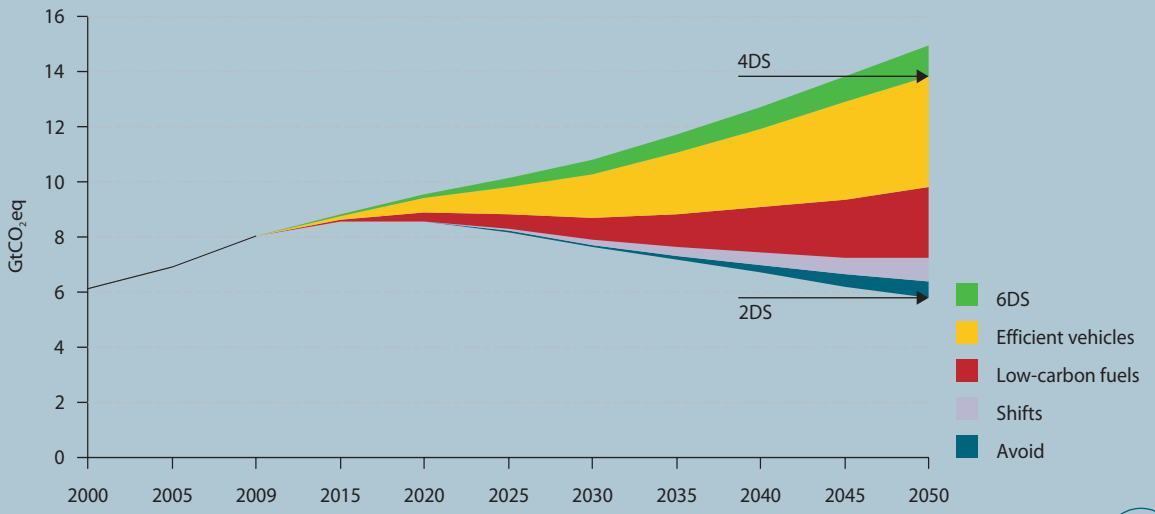
Vehicle and fuel technology improvements have a significant potential to reduce transport sector energy emissions to 2050. However, those improvements alone will not be enough to reach the 2°C Scenario (2DS) objectives by 2050,[1]

1. The 2°C Scenario (2DS), outlined in the IEA *Energy Technology Perspectives 2012*, describes an energy system consistent with an emissions trajectory that recent climate science research indicates would give an 80% chance of limiting average global temperature increase to 2 degrees Celsius.

without higher mitigation costs in transport and other economic sectors. An "avoid, shift and improve" approach is needed to reach a 2DS target (IEA, 2012b). Without reducing overall motorised travel (avoid) and shifting private motorised travel to more efficient modes (shift), a 2DS target is unlikely to be achieved (Figure 2).

Both developed and developing countries need to find solutions that respond to rising travel demand and its consequences for urban life and the urban economy. At a national level, energy security, economic development and climate change will continue to play a significant role in policy and planning discussions, especially because energy prices and extreme climate events can have considerable impacts on economic growth and stability. Urban transport system efficiency, therefore, will play a key role in ensuring the energy-effective, safe, timely and environmentally sound movement of people and goods.

Figure 2 Global transport sector emissions under 6DS, 4DS and 2DS



Source: IEA, 2012b.

Both developed and developing cities require solutions that respond to rising travel demand and the consequences of increasingly heavy vehicle traffic on urban transport efficiency.

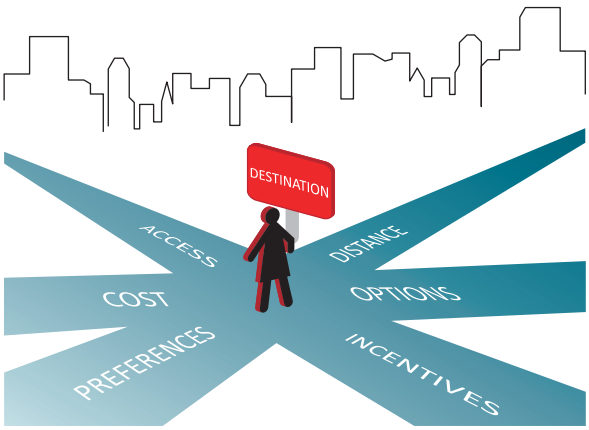
Defining urban transport system energy efficiency

This policy pathway seeks to help national and local policy makers improve urban transport system energy efficiency. Before delving into the details of this pathway, it is important to understand what is meant by the term "transport system energy efficiency". In theory, transport system energy efficiency can be achieved by maximising travel activity while minimising energy consumption by implementing measures that impact modal share, energy intensity and fuel type.[2]

In practice, achieving transport system energy efficiency improvements is much more complex. Transport activity is highly dependent on travel demand as a function of distance to destinations, which can be very difficult to change or improve, especially in the short term. The use of more efficient travel modes depends on available choices, the ease of reaching those modes (access) and travel preferences related to culture, values and socio-economics, etc. Energy intensity and fuel use likewise depend on technological capacities, local availability and market penetration.

Transport system energy efficiency policies thus should be considered within the urban transport context, which generally can be defined as an interface of (a) land-use and travel network development (the physical transport context); (b) access and travel choice (availability and proximity of travel options); and (c) travel demand management (the extent to which travel behaviour, modal choice and energy efficiency are encouraged or discouraged) (Figure 3).

Figure 3 Transport decision matrix



Source: author.

Energy efficient transport systems under this broader scope address transport activity and travel decisions from both an energy- and context-based approach because efficiency solutions in one city may not be the best solutions in another.

In other words, urban transport system energy efficiency can be expressed as the maximisation of the urban geography-transport network interface so as to (1) provide optimal access and choice and (2) maximise the efficiency of travel activity through combinations of modal share, energy intensity and fuel type. Highly energy efficient transport systems under this broader definition prioritise land-use planning and transport network development in a way that diminishes the need for energy-intensive travel modes, while also taking into account local travel needs, available resources (*e.g.* financial and administrative) and long-term transport objectives.

2. The IEA calculates transport energy consumption and emissions using the Activity Share Intensity Fuels (ASIF) scheme developed by the IEA on behalf of the World Bank in 2000 (Schipper *et al.*, 2000). The ASIF formula calculates energy consumption as the sum of all Activity (distance travelled) by modal Share (split of travel by mode), applying the respective energy Intensities (energy demand by mode per km travelled) and Fuels used (type of fuel and its energy intensity per km travelled). Emissions (G) are calculated by adding carbon intensities to each fuel type. Energy = ∑ ASIF (and G).

Policy pathway

Scope

Achieving energy efficiency improvements in urban transport systems is not always easy. This policy pathway is a practical guide for planners and policy makers in all kinds of cities. It explores essential elements, steps and milestones to improve urban transport system energy efficiency. It considers proven practice and urban transport policy examples from planning to implementation, monitoring and evaluation. It also identifies key questions to ask when devising, implementing and evaluating transport system energy efficiency policies.

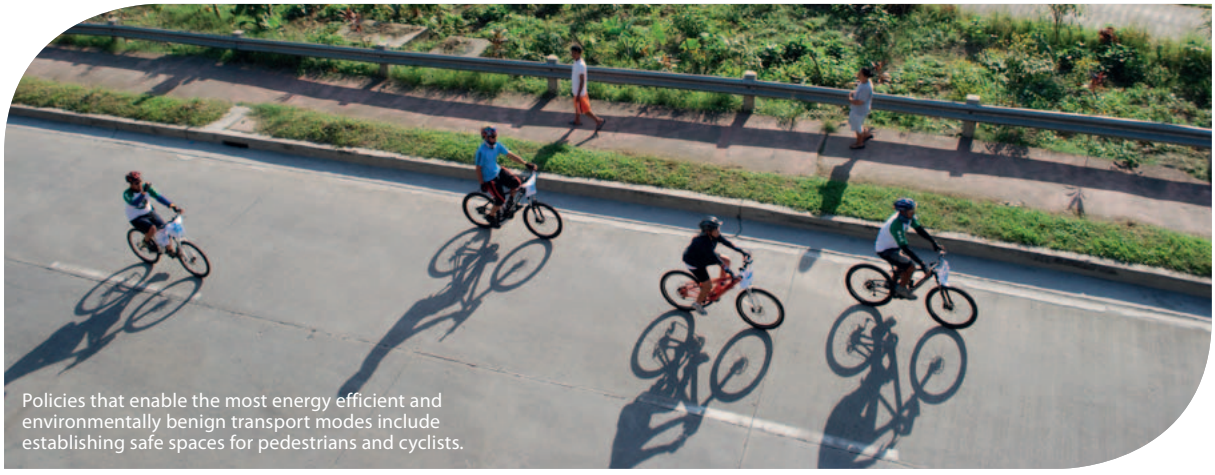
This report is part of the Policy Pathway series that seeks to help policy makers implement the IEA *25 Energy Efficiency Recommendations* within the context of national, regional and local frameworks. This particular policy pathway expands on transport recommendation number 20 that states (IEA, 2011b):

Governments should enable policies that increase the overall energy efficiency of national, regional and local transport systems and promote shifts of passengers and freight to more efficient modes. To achieve these objectives, government should adopt transport policies that ensure:

- *users pay the economic, environmental and energy security-related costs of the transport system;*
- *the transport infrastructure necessary to support the most energy, economically efficient and environmentally benign transport modes is built and maintained.*
- *urban and commercial development planning takes into account the likely implications for transport and energy demand.*

Structure

This policy pathway is divided into four sections. The first section introduces why improving urban transport energy efficiency is important. The second section highlights policies implemented in Belgrade, New York City and Seoul to demonstrate how common responses can be applied in very different local contexts to achieve transport system improvements. The third section analyses barriers to improving urban transport energy efficiency and the key polices (including interventions and measures) to overcome them. Finally, the fourth section sets out ten detailed steps for supporting the development, financing, implementation and evaluation of policies to improve the energy efficiency of urban transport systems (Table 1).



Policies that enable the most energy efficient and environmentally benign transport modes include establishing safe spaces for pedestrians and cyclists.

Table 1 IEA policy pathway to improve energy efficiency in urban transport systems

PLAN	1	Identify transport needs and define objectives • *Identify transport issues and user needs* • *Define objectives* • *Identify policy responses* • *Consider co-benefits and complementary measures*
	2	Identify and engage stakeholders early on • *Identify and engage stakeholders* • *Keep stakeholders involved* • *Explore co-operation and partnership opportunities*
	3	Address potential barriers and secure necessary resources • *Identify solutions to potential barriers* • *Formulate responses* • *Secure necessary resources: technical, institutional, financial*
	4	Establish policy framework and action plan • *Develop action plan: identify key step, responsibilities and milestones* • *Prepare robust analysis of economic consequences of options* • *Prepare contingency plan* • *Decide how progress will be measured*
IMPLEMENT	5	Engage actors and begin implementation • *Call for tenders* • *Establish roles, responsibilities and deliverables* • *Launch policy*
	6	Raise awareness and communicate targets • *Communicate targets and explain policy measures* • *Raise awareness of energy consumption and mobility choices*
	7	Manage implementation process • *Verify progress, ensure compliance and enforce deliverables* • *Manage capacity building and project support*
MONITOR	8	Collect, review and disseminate data • *Set clear data goals and define assessment methodology* • *Review and compare data* • *Share data*
EVALUATE	9	Analyse data and evaluate effects of transport policy • *Analyse data and assess policy results* • *Communicate results*
	10	Adapt transport policy and plan next steps • *Adapt policies with regards to results* • *Plan next steps and future actions*

A tale of renewed cities

More than 30 cities are highlighted in this report to describe how broad urban transport and planning policy measures can be implemented to improve transport system energy efficiency and urban quality of life (including decreased commute times, improved air quality, more dynamic neighbourhoods, reduced noise pollution and enhanced safety).

Among the cities highlighted in this report, three– Belgrade, New York City and Seoul – have been selected for in-depth case studies. These cities have all won recognition for their urban transport projects. The International Association of Public Transport (UITP) awarded Belgrade for its public transport modernisation projects in support of the UITP initiative to double the market share of public transport by 2025 (PTx2) and the Institute for Transportation & Development Policy (ITDP) presented New York City and Seoul with the International Sustainable Transport Award.

These illustrative, real-life case studies were selected to demonstrate how common responses can be applied to very different local contexts to achieve transport system improvements. From these case studies, critical steps that local and national governments can take to plan, implement, monitor and evaluate urban transport system initiatives have been distilled. The barriers, policies and steps presented in these case studies are further explored and developed later in this report.

Table 2 briefly highlights the experiences of these three cities following the plan, implement, monitor and evaluate process outlined later in this policy pathway.

Table 2 Summary of Belgrade, New York City and Seoul urban transport system case studies

	Belgrade	***New York City***	***Seoul***
CHALLENGE	• Travel demand growth • Urban land divide • Jobs far from households • Growing car ownership • Aging public transport infrastructure	• Infrastructure at or over capacity • Vehicle congestion • Long commute times	• Poor bus service quality • Noise and air pollution • Travel demand growth • No funding available for continued development of high-capacity metro
PLAN	• Belgrade and Urban Planning Institute developed Master Plan to 2021. • Plan seeks to optimise transport mode connectivity, increase public transport service and safety, decrease traffic volume, better regulate land-use and fund transport projects. • "Smart Plan" was developed under the Master Plan to detail investments in public transport and lay out parking strategies and NMT network development.	PlaNYC 2030 seeks to: improve city transport times; reach a full "state of good repair" for subways, bridges and rail systems; expand transport infrastructure; improve access and service on existing infrastructure; and manage roads more efficiently. • In 2008, New York City (NYC) developed a detailed roadmap called *Sustainable Streets*, committing to 164 objectives.	• Seoul Development Institute (SDI) produced guidance in 2002 on how to modernise the Seoul public transport system through integration of the bus and metro services, restructuring of fare schedules and overhaul of the bus systems. • Using this guidance, the Mayor and Seoul Metropolitan Government reformed, co-ordinated and modernised Seoul transport.

IMPLEMENT	Projects developed under the Smart Plan include: development of the Sava River bridge with a separate tram line; modernisation of tram and bus fleets with over 30 new efficient trams and 400 high-capacity compressed natural gas (CNG) buses; investments in traffic management systems; modernisation of the suburban rail service; implementation of park-and-ride stations; establishment of a pricing scheme for downtown parking.	*Sustainable Streets* initiatives included targeted safety programmes to cut fatalities, the *Green Light for Midtown* plan to reduce traffic congestion in the heart of Manhattan and create people-friendly boulevards, new BRT lines and bus-improvements measures such as Select Bus (BRT) Service and the development of 460 km of new cycling lanes.	Policy responses included reorganisation and regulation of bus services; installation of BRT corridors; co-ordination of bus and metro services; development of integrated public transport fare; parking reforms; increases on fuel taxes; street closures to vehicle traffic; improved pedestrian facilities; increased number of curbside bus lanes; conversion of some of bus fleet to CNG.
MONITOR	Projects are regularly monitored to inform stakeholders about progress.	NYC performs regular studies and analysis of transport activities for its annual *Sustainable Streets Index*.	Data is collected on passenger counts, transfer frequencies, traffic accidents, average bus speeds, etc.
EVALUATE	• Although projects are still being implemented, initial evaluations show: a tripling of ridership within the first six months of refurbishing and increasing frequency of suburban rail lines; 34 km of tramway construction; 52 km of city bicycle paths; 3 "park and bike" spots, where commuters can park their vehicles and rent bicycles; and, a new bridge over the Sava River. • Belgrade is working with the United Nations Development Programme (UNDP) to upgrade the Smart Plan for a next phase of initiatives.	In first year following the release of *Sustainable Streets*, NYC found bus ridership increased, vehicle traffic volumes remained flat, and bicycle travel increased considerably; by 2010, bicycle commuting had more than doubled over 2000 levels. The Select Bus Service carried 30% more weekday riders than the local bus service it replaced, and it cut 11 minutes off route time.	After bus reforms and BRT implementation, bus speeds increased between 33% and 65% from 2003 to 2004; in 2004, daily passenger trips on buses increased 11% over 2003; bus accidents and serious injuries fell by 23% and 43% by mid-2005; and, by 2010, more than 6 100 CNG buses were in use, and the BRT system had grown to 142 km along eight corridors.

Belgrade: co-ordinating actions and investments to support sustainable transport growth

Greater Belgrade[3], with a population of nearly two million inhabitants, is experiencing major changes to its urban transport system as travel demand grows and continues to shift away from public transport. Traditionally, the city was focused on the eastern side of the Sava River in Old Belgrade, although most growth is occurring now on the western "New Belgrade" side of the city. To the north, the city is divided by the Danube River, so that Belgrade effectively is split in three major parts – all of which affect the travel flow of people and goods throughout the city.

The effect of urban development outside the traditional city centre, paired with the natural split of city zones in Belgrade, has contributed to considerable changes in travel demand over the past two decades. Less than 30% of the metropolitan population in Belgrade today lives within the central zone of the city, while nearly 60% of employees work in this zone. As a result, more than two-thirds of trips taken within the city gravitate toward the central area, and one in five trips crosses one of the city's bridges to reach the central zone (Rubinjoni, 2011).

In addition, car ownership in greater Belgrade doubled over the last decade, and by 2011, nearly one-third of the three million trips made daily throughout the city were by private motorised travel. Public transport fell from a high of nearly two-thirds of trips in the late 1980s to less than 50% in 2000. By 2025, vehicle ownership is expected to double again, and the city expects that daily vehicle travel will increase to nearly 1.5 million trips per day by 2021 (BLDPA, 2008).

Another major issue facing the city is aging infrastructure. Decades of insufficient investment have left Belgrade with a transport system that is not able to accommodate existing and projected transport needs. In particular, the city's bridges, which are vital to movement between the city's different zones, are in need of significant investment. Additional bridge capacity also is needed to accommodate travel growth and changes in urban land-use development, and other transport infrastructure – including in particular the Soviet era public transport network – likewise requires increased investment to maintain service quality and a state of good repair. Without concerted action to improve street and bridge infrastructure and to increase public transport supply and quality, travel and congestion in Belgrade will continue to worsen, and basic urban mobility will be decreased significantly.

Plan

1 Identify transport needs and define objectives. In 2003, noting the urgency to address congestion throughout the city and the increasing preference for private motorised transport, the City of Belgrade and the Urban Planning Institute of Belgrade developed the Master Plan for Belgrade to 2021. The Master Plan, which also addressed other critical issues such as economic development, housing and the environment, set forth several goals for the transport sector, including mutually harmonised development of all transport modes and the promotion of public transport as an attractive choice over vehicle use. The Master Plan also addressed several additional issues that affect transport efficiency in the city, including land-use regulation and funding for transport activities and development (Rubinjoni, 2011). Several general goals were articulated for transport development under the Master Plan for Belgrade to 2021 (Table 3).

3. According to the typology presented in Figure 6, in the recent past, Belgrade's centre would have been classified as "congested", while its suburban areas would have fit under the "sprawled" category. Thanks to efforts to improve urban transport system energy efficiency, Belgrade is making strides towards becoming a "multi-modal" city.

Table 3 Transport objectives in the 2003 Master Plan for Belgrade to 2021

Issues	*Objectives*
Infrastructure	Optimise connectivity between transport modes Increase level of service and transport safety
Vehicle traffic	Decrease traffic volume throughout street network Increase attractiveness of public transport Decrease harmful impacts of traffic on environment and cultural-historic heritage
Financing	Establish rational use of material and financial resources Engage investors to build new infrastructure for Belgrade

Given the broad scope of the objectives outlined in the Master Plan and the time frame to 2021, the city established the Master Plan as a continuous process for adopting specific urban development plans that respond to the city's objectives and evolving transport needs. In this respect, the Master Plan set forth the framework for subsequent planning and policies with regards to transport development in Belgrade. These later activities included the subsequent establishment of a detailed regulation and operational plan for land-use development, urban renewal and urban transport corridors in the city. The forward-looking framework also led to the development of the Transport Master Plan, or Smart Plan, that was approved in 2008.

The Smart Plan responds to the broader transport strategies identified in the Master Plan to 2021 through a series of co-ordinated actions and investments to establish the basis for sustainable urban growth and mobility to 2020. In particular, the Smart Plan laid out an ambitious programme of hard investments to improve transport infrastructure throughout the city and to address increasing private motorisation. It also presented a plan for transport solutions, such as parking strategies and NMT network development, to address travel demand and transport efficiency.

Identify policy responses. In response to the urgent need for co-ordinated actions to support travel demand and transport growth, the Smart Plan established a five-point programme of investment that addresses both infrastructure improvements and travel demand management. The five points and policy responses helped the city to frame a strategic development plan that addresses the financing, resources and project timing that are necessary to achieve stated objectives (Table 4).

Consider co-benefits and complementary measures. Each of the five points identified in the Smart Plan was developed as part of a planning process that takes into account the time frames and resources required to meet those goals. This process takes into account any supporting policy actions (*e.g.* land-use regulation) that are necessary to achieve the five Smart Plan goals as well as the strategic steps that are necessary to ensure the successful implementation of the objectives (Figure 4). The planning process also accounts for eventual policy changes or adaptations as travel demand and transport needs evolve in response to programme.

The Smart Plan planning process accounts for all current transport problems, future expected travel demand and city resources throughout the strategic steps leading to policy implementation. Needs and objectives are continuously evaluated with respect to available financing, expected

impact of the policy and the time required to achieve policy implementation. For instance, as part of the Smart Plan goal to improve public transport supply and quality, the city set the objective to develop higher-capacity urban rail, including a light metro line through a priority north-east city corridor. In light of financial constraints and the time required to build higher-capacity urban rail, the city identified existing suburban rail tracks that could be used in the short term, while a light metro system is constructed in the medium term. The plans for the light metro construction also were designed in a way that enables the eventual implementation of a classic metro system if the need arises in the longer term.

❷ **Identify and engage stakeholders early on.** As part of the process to prepare the Smart Plan, the city of Belgrade began engaging different stakeholders in 2006, including investors, consultants, and public agencies. In particular, a project council was created to oversee the Smart Plan and to monitor the development of the Master Plan. The council consisted of eight members, including representatives of agencies and organisations of the city as well as urban development and traffic planning experts. The EBRD, the European Investment Bank (EIB), UNDP and the German government also contributed technical assistance and financing.

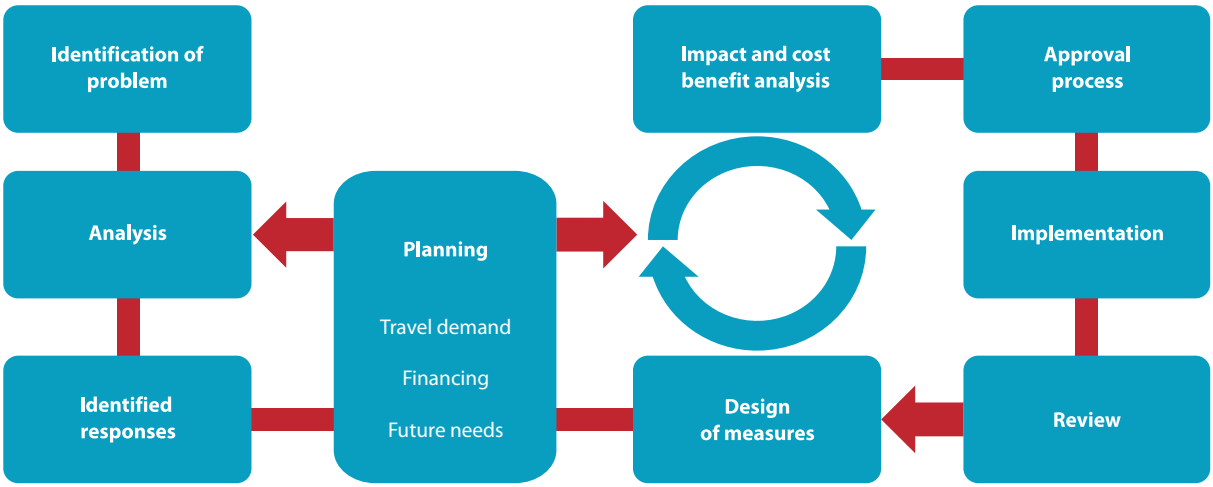
Stakeholders involved in project implementation were engaged from an early stage. This included organisational adjustments within the Belgrade Land Development Public Agency (BLDPA) that oversees project implementations and the forming of working groups to organise, co-ordinate, implement and monitor the development of Smart Plan objectives. Key stakeholders in diverse public agencies, such as the Secretariat for Finance and the Directorate for Public Transport, were invited to workshops during the development of Smart Plan goals. Once project implementation began, BLDPA working groups and a Project Implementation Unit (PIU) worked together to analyse project advancement and to propose updates to Smart Plan models and measures when necessary.

❸ **Address potential barriers and secure necessary resources.** As part of the policy strategies to 2020, the Smart Plan identified necessary financial resources and potential revenues

Table 4 Specific Belgrade transport policies identified in the 2008 Smart Plan

Objective	*Policy response*
Increase infrastructural capacity between the city zones	Construct new bridges over Sava and Danube Rivers
Improve public transport supply and quality	Integrate bus, tram and trolleybus services with higher-capacity urban rail, and establish automated fare collection system to allow for seamless transfers between modes
Improve travel flow and traffic management	Implement modern intelligent transport system (ITS) system to maximise traffic flows and prioritise public transport along busy corridors
Manage private motorised travel growth	Develop a parking strategy for the city centre with park-and-ride facilities in peripheral areas
Encourage NMT	Establish pedestrian and dedicated cycling networks throughout Old and New Belgrade

Figure 4 Belgrade Smart Plan planning process



Source: adapted from Rubinjoni, 2011.

for the ambitious plans for sustainable urban transport, including infrastructure development, public transit vehicle purchases and urban renewal projects. The city also worked with the EBRD and the EIB to help plan and co-finance the heavy investment costs to deliver major new infrastructure and public transport improvements.

Financial resources. Building on the basis of the Smart Plan, the city of Belgrade worked with EBRD and EIB to develop an integrated approach (the IA), co-financed by both EBRD and EIB, for the urban transport sector in 2010 to carry out significant capital investment to upgrade its transport infrastructure and improve regulatory approaches to the transport system. In particular, the IA set out

Box 2

Belgrade, Serbia: complementary policy measures to support transport objectives

*Belgrade's municipal transit operator, Gradsko Saobracajno Preduzece Beograd (GSP), held a monopoly on urban transit and bus services until the late 1990s. To improve public transport services and refocus GSP funding toward other public transport modes, the city began to implement a series of policy changes in the mid-1990s that it has continued to apply to improve overall public transport services. In particular, the city moved to open up the bus market to private competition for a portion of the bus route network, while at the same time committing to reinvest in GSP's other transit modes (*e.g. *tram and trolleybus). Today, a broad mix of operators and transit modes serve Belgrade's public transport system, including nine private bus operators that offer services on a multi-year basis through competitive tender, covering some 70 routes, or 30% of the bus market. The operators enter into PSCs that govern the level and quality of bus services in exchange for the right to operate on the public bus routes and receive public subsidies. These "gross-cost" PSCs, where operators are paid an index-based payment per km of service delivered, are now fairly common throughout Europe, and Belgrade has used the PSC approach to continue to increase and improve bus service quality over time.*

to "increase the capacity and standards of public transport services as an alternative to car usage and to provide an overall balanced approach to urban mobility" (EBRD, 2010, internal loan documentation). This initiative involved a strategic review of the needs of the urban transport sector in support of the Smart Plan objectives and has included over EUR 400 million to date of funding for several projects.

Institutional reform. In parallel to the various investments in new and modernised infrastructure throughout Belgrade, the city also has begun to work on the modernisation of the institutions that regulate the urban transport system. In particular, the Belgrade Traffic Secretariat and its dependencies, the Public Transport Directorate and the Traffic Management Directorate, have been consolidated to take a more active role in planning, regulating and managing the new transport ITS and automated fare collection (AFC) systems. One step taken by the agencies has been to engage newly trained traffic management engineers to run the new ITS system for the city in partnership with representatives from the suppliers. This partnership delivery approach is a key element to institutional capacity development, especially because technological solutions are increasingly complex and typically require cities to rely on suppliers and their service teams to assist with implementation and operations.

To achieve the partnership delivery approach, EBRD provided a comprehensive package of institutional and regulatory support to the city, its Traffic Secretariat and the GSP. This support came in the form of technical co-operation carried out by expert consultants, provided as grants by donor countries. The range of technical co-operation support connected to EBRD financing includes a combination of the following:[4]

- urban transport sector strategies;
- feasibility studies and conceptual designs;
- environmental and Social Impact Assessment (ESIA);
- strategic Environmental Assessment (SEA);
- tender preparation and procurement support;
- development of PSC;
- corporate development (business plans, management information systems, bench-marking on efficiency and costs, and twinning arrangements);
- regulatory development (tariff planning, e-ticketing development and PSC monitoring).

In total, over EUR 2 million in technical assistance has been provided to the urban transport sector in Belgrade in support of this multi-faceted programme.

4 Establish policy framework and action plan. The 2008 Smart Plan established a set of successive objectives for transport improvements in the city over five prognosis periods until 2021. Rather than creating a static list of long-term objectives in a single forecast period, the Smart Plan focused on optimising investments and measures in a framework that reflects expected available budgets for each of the five periods and the expected timing and resources necessary to support the different measures. This dynamic optimisation plan includes not only large investments in public transport and infrastructure but also measures to support NMT, ITS, parking reforms, and institutional and regulatory changes (PTV Group, 2011). It also allows the city to be prepared early in the planning and implementation processes for expected required resources and necessary steps to achieve policy objectives.

Implement

5 Engage actors and begin implementation. The IA developed with EBRD, and co-financed with both EBRD and EIB, comprises five strategic projects to deliver the infrastructure and policy responses to

4. The specific package of technical co-operation support varies from project to project, depending on specific needs.

the Smart Plan's five core objectives. The projects include development of the Sava River bridge with a separate tram line between Old and New Belgrade and the modernisation of the GSP's tram and bus fleets with over 30 new efficient trams and 400 articulated, high-capacity CNG buses. The five projects also include key investments in a traffic management system, the modernisation of the suburban rail service and the implementation of a parking strategy to provide park-and-ride stations in support of suburban rail use and to establish a pricing scheme for downtown parking.

Call for tenders and establish responsibilities. The Smart Plan IA calls for the implementation of a traffic management system that is focused, as a first step, in Old Belgrade along congested main arterial roads. The new ITS system is being implemented under a performance-based long-term arrangement between the traffic management system provider and the Belgrade Traffic Management Unit. This agreement will allow the city and the Traffic Management Unit to ensure a high level of functionality for traffic flow and bus prioritisation while also testing the ITS technologies through a reduced-risk contractual agreement.

A similar PPP structure has been applied by the city to achieve the Smart Plan objective of integrating public transport services through an AFC system called BusPlus. The new AFC system was contracted under a ten-year PPP structure to a newly formed consortium, "Apex," between the AFC system provider, KentKart of Turkey, and Lanus, a mobile phone operator. The new AFC system began operations in early 2012 and works on a clearinghouse model in which all funds are electronically deposited into a central account run by Apex (and supervised in real-time by the city), with the concessionaire retaining a percentage of all revenues processed through the AFC system at a rate sufficient to amortise its upfront costs and to cover all operations and maintenance. The early results of the new AFC system are very positive, with an increase in collected monthly revenues of 15 per cent in comparison to pre-AFC revenues as a result of drastically reduced cash leakages. The new system also includes a comprehensive automated vehicle locator (AVL) module to provide real-time information on all movements in the public transport system, which is critical to allow the city to improve and regulate the performance of GSP and private bus operators.

6 Raise awareness and communicate targets. A key component of any successful AFC is the ability of the ticketing company and the operators carrying the hardware on vehicles and at stops/stations to actively promote the new system. Far from a coercive approach, AFC systems should be able to sell themselves if they truly offer added value for users, both in terms of convenience and cost. Belgrade made the BusPlus system offer card users price advantages from the start of the programme, including offers to users for significant discounts at a major supermarket chain and reduced banking rates by financial sector sponsors. These efforts, combined with a successfully operating AFC system from the start, played a strong role in achieving a rapid penetration of the new system.

7 Manage implementation process. To implement the Smart Plan's ambitious investment objectives, while at the same time consolidating the institutional resources necessary to delivery several major projects, the city created a cohort of special PIUs. These PIUs are staffed primarily

Park-and-ride stations encourage shifts to more efficient travel in central Belgrade and help to reduce urban road congestion.

by municipal staff, although they also draw on external support from industry experts, which are typically provided by the EBRD through the use of technical co-operation funding. The city manager's office coordinates the myriad of projects under implementation and has adopted an integrated project management software platform to track the physical and financial progress that is being made.

Monitor

8 Collect, review and disseminate data. As part of the working groups and PIUs established to organise and monitor Smart Plan development, projects are analysed regularly to inform the decision-making process about progress, next steps and changes to Smart Plan objectives. The city does not have any systematic tracking of specific indicators or measures, although information about infrastructure projects and transport trends is collected on a regular basis by both city agencies and stakeholders involved in Smart Plan implementation. This includes monitoring of the diverse phases of construction of transport objectives, such as bridge construction and tramway construction. Project progress and completion are communicated with city officials and partners, and this information has been helpful to persuade politicians to adopt additional policy changes and transport plans.

Evaluate

Once the current wave of investments is completed, Belgrade will be well positioned to offer a robust urban transport system to residents, who should be able to make viable choices between private and public travel modes, and do so in an increasingly clean, low-carbon manner. As much as any other city in the region, Belgrade is showing how concerted investment and planning can deliver transport efficiency improvement results and increase urban liveability as well. In fact, Belgrade was awarded the 2010 UITP (International Public Transport Association) Annual Award for best urban transport initiatives in Europe for its efforts.

9 Analyse data and evaluate effects of transport policy. The modernisation and expansion of the Belgrade Suburban Rail service were considered critical investments to provide an alternative, clean (*i.e.* zero emission) travel choice to commuters from New Belgrade into Old Belgrade. As a first step to achieving this objective, the city made an initial refurbishment of the existing rolling-stock on existing suburban rail lines in 2011 and implemented a 15-minute service frequency during peak travel hours. The results of the investments and service improvement were a tripling of ridership within the first six months of the implementation.

The city also completed the new bridge over the Sava River, while the new bridge over the Danube River is making considerable progress. To date, additional infrastructure additions have included 34 km of tramway reconstruction, introduction of a public transport management system, 52 km of bicycle paths in Belgrade, and three "park and bike" spots, where commuters can park their vehicles and rent bicycles. These projects have helped to improve travel flow and traffic in the centre of the city, while they also have increased overall transport options for residents and commuters.

10 Adapt transport policy and plan next steps. As part of the broader Master Plan objectives, the city adapted and upgraded Smart Plan development and co-ordination as necessary to ensure successful project completion and the achievement of the plan's goals. In certain cases, this meant altering implementation timelines and priorities, including the decision to build the bridge over the Danube River before its original planned construction for 2025. The city also worked with UNDP to upgrade the Smart Plan under broader sustainable urban transport objectives. This upgrade is expected to be implemented in 2013 under the new Sustainable Urban Transport Master Plan for Belgrade, and diverse stakeholders are being engaged to prepare for this next phase.

New York City: maintaining and improving energy-efficient transport

With more than 8 million people living in NYC[5] and an additional 14 million people living in the greater New York metropolitan area, NYC requires a fast, safe and efficient transport system. The city's transport network includes more than 10 000 km of streets and highways, 1 350 km of subway track, seven major bridges into the heart of the city, and 21 tunnels that accommodate either vehicle or mass transit flow (DOT, 2012a). Yet, despite NYC's impressive travel network, much of the city's transport infrastructure is at or over capacity (PlaNYC, 2007). More than 11 million people ride the city's buses, subway and commuter rail trains every day (MTAa, 2012). An additional 800 000 vehicles use the city's four major bridges and two major tunnels daily (MTAb, 2012), and high roadway traffic makes New York one of the most congested urban areas in the United States (TTI, 2011). Of the 231 counties in the United States with populations of 250 000 people or more, the four longest average commute times in 2003 all were in NYC (ACS, 2003).

The majority of New Yorkers travel to work by public transport, but vehicle travel has risen at nearly the same rate as increased transit ridership for the past 30 years, remaining at roughly one-third of all work trips into the central business district. As a result, transport energy use and emissions in NYC have continued to increase, contributing to 20% of the city's global greenhouse gas emissions in 2007. Transport also affects the city's economy: roadway congestion alone was reported to cost the city USD 13 billion in 2007 (PlaNYC, 2007).

In response, NYC Mayor Michael Bloomberg announced in 2007 a strategic plan to address six major areas – including transport, energy efficiency and climate change – to support economic growth and an expected additional one million people in the city by 2030. The plan, known as *PlaNYC 2030*, set transport goals to improve city transport and travel times for all New Yorkers and to reach a full "state of good repair" on the city's roads, subways, bridges and rail systems. The broad goals incorporated 16 transport objectives, such as building and expanding public transport infrastructure, improving access and service on existing infrastructure, and managing roads more efficiently.

Plan

❶ Identify transport needs and define objectives. The 16 transport objectives outlined in *PlaNYC 2030* addressed already known and foreseeable shortcomings in the city's transport system. Several objectives were identified as first priorities, including the objective to build and expand the current transit infrastructure to alleviate crowding in public transport. Other immediate to short-term objectives focused on achieving a state of good repair in the city's transport infrastructure, while long-term objectives identified expansions and improvements meant to accommodate a growing population. The transport initiatives became the vision for policy changes and programme reform at the NYC Department of Transportation (NYC DOT), which developed its own policy goals to meet *PlaNYC 2030* objectives.

In early 2008, NYC DOT developed a strategic transport plan. The plan, *Sustainable Streets*, presented a detailed policy roadmap committing NYC DOT to 164 specific actions across seven target areas. Some of the plan's major policy goals included cutting city traffic fatalities by 50% from 2007 levels by 2030, launching a Main Street initiative in key corridors to develop people-friendly boulevards,

5. According to the typology presented in Figure 6, in the past, New York City would have qualified as a "congested" city. Recent policy measures have improved urban transport energy efficiency in New York City to an extent that it can now be considered a "multi-modal" city.

Table 5 Goals and examples of corresponding policy actions in *Sustainable Streets*

Improved safety
Complete traffic safety measures at 135 schools and 25 senior focus areas
Develop scope-of-work templates that focus on traffic safety deliverables
Expand and improve pedestrian countdown and safety-oriented signal strategies
Change public behaviour through marketing campaigns and safety education
Improved mobility*
Launch two BRT corridors by 2009, and implement three additional corridors by 2011
Implement bus stop improvements, including 2 300 new bus shelters
Complete installation of 350 bicycle lane-km by 2009
World class streets
Partner with city agencies to improve the street design review process
Implement a public plaza programme using a community-based development process
Initiate a temporary art program on city streets
State of good repair in infrastructure
Implement a street management plan to minimise frequency of street cuts
Increase annual road resurfacing to 1 600 lane-km, and expand preventative bridge maintenance
Establish use of recycled asphalt as roadway fill, and expand to construction fill
Implement preventative maintenance programme for the NYC ferry fleet
Greener transport
Expand the alternative fuels programme, and reduce vehicle trips by DOT employees
Improve efficiency of street lights and traffic signals (in line with 30% energy reduction goal)
Co-ordinate with the Department of Environmental Protection to create streets that retain a maximum volume of storm water and increase use of permeable surfaces
Global leadership: 21st century transportation department
Initiate study of project management and delivery issues
Overhaul data collection, and create new performance measures where necessary
Streamline design, procurement and grant administrative processes
Create a communications working group, and identify marketing campaigns to promote safety and sustainable transportation
Excellent customer service
Use websites to engage citizens, and post information on all current and ongoing projects
Develop training materials for, and educate and train, community board leaders
Augment services and outreach to stakeholders and customers

* NYC DOT manages the city's roadway network, and therefore bus lanes and bus routes. NYC DOT does not manage transit services or metro rail infrastructure.

implementing BRT lines and bus improvement measures, and doubling bicycle commuting by 2015. On a broader scale, *Sustainable Streets* laid out a vision for transport in NYC: the plan called for an "innovative, industry-leading urban transportation policy" intended to carry New York well into the 21st century with improved mobility, safer streets, reduced impact on the environment and a "world class quality of life" (DOT, 2008a).

Identify policy responses. Each of the policy goals in *Sustainable Streets* was developed with specific short-term and long-term action items (Table 5). For example, in response to its *World Class Streets* objective, NYC DOT decided to implement a public plazas initiative. A "plaza" is an area designated within the bed of a roadway, which may contain benches, tables or other facilities for pedestrian use. A short-term goal was set to develop a plaza maintenance strategy and to open four temporary public plazas each year between 2007 and 2009. The subsequent *NYC Plaza Program* was developed to choose temporary spaces through a community-based process, and plazas were developed using temporary materials for the first year of implementation. This community-based, short-term installation approach ensured that public plazas were developed in areas with a vested interest in the success of the programme. It also allowed the city to evaluate projects before installing plazas with permanent street design changes.

Consider co-benefits and complementary measures. The 164 action items detailed in *Sustainable Streets* are a package of implementation goals to pursue and complement *PlaNYC 2030* policy objectives. For example, to increase bicycle ridership in the city, NYC DOT developed a multi-pronged response to make bicycling safer and more convenient. This response included building a broader bicycle network with dedicated and separated cycling spaces, signalisation for bicyclists, annually updated cycling route maps, and new cycling parking shelters and racks throughout the city. NYC DOT also pursued actions to support further shifts to bicycling, including collaboration with the mayor's offices to pursue city legislation on bicycle parking at work places. The *Bicycle Access to Office Buildings Law*, passed in July 2009, aimed to increase commuting to work by bicycle by requiring secure bicycle parking in or close to workspaces. The law also provided building tenants a legal process through which to request cycling parking (DOT, 2009a).

❷ Identify and engage stakeholders early on. When proposing policy changes and potentially controversial transport programmes, NYC DOT has reached out to key stakeholders, such as transport and environmental advocacy groups, city agencies, civic leaders and local businesses. This outreach has included requests for input and feedback on proposals, calls for competitive participation (*e.g.* the *Design Competition for Temporary Plazas in Times Square* and *the City Racks Design Competition*), and direct contact with local vendors, tenants and storeowners. NYC DOT also has held public forums to invite comments and questions from vested public interests. The actions have helped to build support for programmes (*e.g.* the *Broadway Boulevard* project) and to address concerns and opposition to proposed changes.

❸ Address potential barriers and secure necessary resources. When *PlaNYC 2030* was published in 2007, the plan estimated that more than USD 15 billion was necessary to achieve a full state of good repair on the city's transit and road networks and that an additional USD 50 billion was necessary to meet the pressing demand for expansion of the transport system as the city's population continues to rise (PlaNYC, 2007). To secure the necessary financial resources, the city proposed a funding scheme in 2008. The scheme proposed three distinct revenue streams for the city: proceeds from a proposed pilot congestion pricing programme, unprecedented investments through general city budget allocations and contributions from the State of New York (PlaNYC, 2007).

Institutional resources. To implement and achieve *PlaNYC 2030* objectives, NYC DOT created a new Office of Planning and Sustainability to oversee

Box 3

New York City, USA: congestion pricing, barriers and lessons on formulating policy responses

In 2007, NYC was awarded a USD 354 million grant by the US Department of Transportation (US DOT) to implement a congestion pricing programme, as proposed in PlaNYC 2030, and to fund investments in transit infrastructure and services. The grant was contingent on the approval of the project by the New York State Legislature. Despite support for the project, the New York State Assembly did not approve the measure (in fact, the Assembly never held a vote on the bill), and NYC lost the funding awarded by the US DOT (Confessore, 2008).

The failure of the congestion pricing programme served as an important lesson for NYC DOT, city planners and road pricing advocates. A central conclusion of the failure was that "gaining approval of pricing will require changing how motorists view the effect of pricing on them personally. Given the power of even small groups of auto users to block pricing through the political process, pricing proposals need to be perceived as benefitting drivers individually and not simply society at large" (Schaller, 2010).

NYC DOT has taken this conclusion and applied it in subsequent policy actions and programme development. When proposing and implementing policy changes and potentially controversial transport programmes, NYC DOT has looked to build support of projects and proposals through outreach to key stakeholders (e.g. *local business owners, environmental and community advocacy groups, and civic leaders) and through public information campaigns that detail not only the benefit to society but also the implications for auto users* (e.g. *improved traffic flow and reduced congestion). NYC DOT has also been careful not to implement significant changes without first implementing pilot projects and temporary instalments. The "test" projects have helped the city authorities and NYC DOT to gauge public response to policy changes while also building broader support for long-term and permanent changes.*

the planning, design and implementation of policy goals and changes. This new addition included the recruitment of public and private transport experts with years of experience in industry, public policy development and transport planning. The experts and the new Office of Planning and Sustainability were critical in providing NYC DOT the institutional capacity to develop *Sustainable Streets* and subsequent NYC DOT initiatives.

Financial resources. When the congestion pricing programme was not approved by the New York State Legislature in 2008, the critical source of expected revenue for transport projects in NYC was eliminated (Box 3). NYC DOT, therefore, began to identify potential new means of financing proposed policy changes. These means included requests for federal funding through project grants and stimulus funds as well as increased revenues from local sources and new, innovative approaches to financing projects. For example, the city raised parking metre costs, which increased city revenue by more than USD 20 million per year (CBS, 2010). NYC DOT also began to explore co-operation and partnership opportunities, including increased shared-responsibility of project costs through PPPs and service agreement contracts. For example, public plaza partners are required to submit a funding plan that outlines how the organisation will fund and manage the plaza (DOT, 2012b).

❹ Establish policy framework and action plan. *Sustainable Streets* did more than set goals for transport in NYC; it also identified the key steps and milestones for each of the 164 action items across the seven targets areas described in the plan. Immediate actions to be taken between 2007 and 2009 were identified, as were continued, long-term actions to be taken beyond 2010. *Sustainable Streets* also identified the lead NYC DOT division to head

each of the 164 action items and summarized any actions that would be required outside NYC DOT (*e.g.* legislative approval).

Identifying responsible parties was especially vital in the development of the strategic implementation plan: with more than 25 government departments and numerous city agencies involved in the NYC transport system, the plan had to identify which city agencies were responsible for each element of each action item as well as identify which government department would have authority for specific issues. Determining roles and identifying potential conflicts early on enabled NYC DOT to form partnerships and working relationships with any critical players involved in the implementation of action items. It also helped NYC DOT to set realistic time frames for project implementations when working with other city authorities. All of these action items, responsibilities and time frames can be found in the Benchmarks section of *Sustainable Streets*.

Decide how progress will be measured. Some goals in *Sustainable Streets* were task items (*e.g.* developing scope-of-work templates with traffic safety deliverables). Other objectives identified specific targets that need to be measured over time (*e.g.* cutting traffic fatalities by 50% by 2030). To validate the achievement of targets, NYC DOT chose specific sites throughout the city to monitor and measure progress. For example, 11 major projects across the city were chosen to monitor progress on traffic, parking and safety goals. The sites were chosen to reflect the types of projects that NYC DOT regularly undertakes in neighbourhoods across the city, and NYC DOT collects data at the sites on a regular basis.

Implement

5 Engage actors and begin implementation. Following the publication of *Sustainable Streets* in 2008, NYC DOT launched numerous projects and initiatives across the city. These initiatives included targeted safety programs, the *Green Light for Midtown* plan to reduce traffic congestion in the heart of Manhattan, the new Select Bus (BRT) Service and the development of 460 km of new cycling lanes.

6 Raise awareness and communicate targets. One of NYC DOT's major goals in *Sustainable Streets* was to create a 21st century transportation department that openly communicates with the public and that is both accountable and transparent. In response, one of NYC DOT's first actions was to expand online communications with timely, up-to-date information on policy changes and transport projects. NYC DOT also uses its website to communicate its strategic plan and to provide key contacts for questions and requests.

NYC DOT also increased efforts to raise awareness of policy objectives, including public forums, press releases and media presentations of major policy implementations (*e.g.* a televised launch of *Sustainable Streets*). NYC DOT also used major events and project sites to show the public what it was trying to achieve. For example, in 2008, NYC DOT Commissioner Sadik-Khan invited New Yorkers to take to the streets on Saturdays between 7 a.m. and 1 p.m. The program, Summer Streets, closed seven miles of roadway to vehicle traffic for three consecutive Saturdays in August. By creating temporary car-free zones, NYC DOT was able to demonstrate to New Yorkers what it was trying to achieve in changing the street network to include public plazas, increased sidewalk space and more room for bicyclists.

7 Manage implementation process. To ensure the successful implementation of the 164 action items in *Sustainable* Streets, NYC DOT created task forces, planning groups and inter-agency teams to oversee and manage the numerous studies, policy reports and project developments taking place across the city. Groups convened regularly to monitor progress and discuss any changes that were necessary to ensure the successful implementation of action items.

NYC DOT also released a *Street Design Manual* in 2009 to support policy goals of building safer, greener and more balanced streets. The manual was developed

in co-ordination with numerous city agencies, and it provides city authorities, design professionals, private developers and community groups involved with street projects with design guidelines for the development and improvement of streets and sidewalks throughout the city. The manual, which was updated in February 2013, serves as a single source for street design policies, and it reflects numerous policy changes to support goals identified in *PlaNYC 2030* and *Sustainable Streets*.

Project support. NYC DOT has provided public information and support during the implementation of policy changes and transport projects. For example, during the implementation of the Select Bus Service, NYC DOT worked with the Metropolitan Transportation Authority (the public transport authority) to provide on-site staff support to passengers. Support included information for customers about the new bus service, help with the ticketing and boarding process, and assistance with changes in local bus services. By providing information and support, NYC DOT was able to implement the Select Bus Service with few complications and little public resistance. Project support helped to accelerate public acceptance of the service and led to a 9% increase in ridership during the first year of implementation.

Monitor

8 Collect, review and disseminate data. *Sustainable* Streets was developed with the intention of using performance-driven policies to achieve *PlaNYC 2030* objectives. To ensure projects were aligned with objectives, NYC DOT implemented a comprehensive process to review project proposals, their designs and implementation. At the same time, NYC DOT performed internal studies to review, refine and streamline the project approval process. This oversight helped to ensure that projects across the city comply with policy changes without creating unnecessary bureaucratic review or significant additional administrative work.

Share data. As part of its open communications objective, NYC DOT regularly conveys project information and policy results through its webpage. Webpage entries include up-to-date information on current projects as well as the results of studies, project development and policy implementation. Data can be found in NYC DOT's *Sustainable Streets Index*, which provides annual statistics on trends in traffic, parking, travel and safety throughout the city. It also includes detailed indicators and reviews of specific projects completed each year. The index focuses on empirical data gathering to monitor policy implementations and formulate next steps and policy revisions. This performance-driven process ensures that NYC DOT does not continue to pursue projects that do not meet policy objectives, and it is used to inform the public of what has been achieved since the release of *Sustainable Streets*.

Evaluate

9 Analyse data and evaluate effects of transport policy. Continuous programme evaluation plays a critical role in ensuring that progress is being made on the 164 action items outlined in *Sustainable Streets*. In the first year following the release of the strategic plan, NYC DOT found that transit ridership (*e.g.* bus use) in the city increased, while vehicle traffic volumes remained flat. Bicycle travel increased considerably, and it continued to be the fastest-growing mode of travel into the city's central business district (DOT, 2008b). In response, NYC DOT continued to expand successful transport initiatives, and by the end of 2009, bicycle commuting had more than doubled over 2000 levels. The Select Bus Service carried 30% more weekday riders than the local bus service that it had replaced and it saved 11 minutes on average bus route time (DOT, 2009b).

⑩ Adapt transport policy and plan next steps. The results of policy implementation since the publication of *Sustainable Streets* in 2008 have helped NYC DOT to develop a new range of initiatives and goals. As part of the *Sustainable Streets Index* publication, NYC DOT sets forth new goals for the coming year. The goals reflect project results and transport sector trends from the previous year while seeking new and better ways to continue to achieve *Sustainable Streets* and *PlaNYC 2030* objectives.

NYC DOT has adapted policies to reflect unforeseen challenges and weak responses to policy changes and project implementation. For example, NYC DOT worked with local businesses to refine its policies on vehicle lane closures to include certain exemptions during specific hours for livery vehicles and business deliveries. The revisions improved the effectiveness of the policy by providing businesses with necessary street access without changing the underlying intent of the policy change.

Installation of bus-only lanes, sheltered bicycle lanes, median traffic islands for pedestrian crossing and reduced curbside parking have all helped to improve travel flow, safety and efficiency in NYC.

Seoul: reforming bus operations to improve urban transport ……..

Between 1970 and 2000, the number of inhabitants in the city of Seoul[6] doubled to 10 million people. The larger Seoul metropolitan area nearly tripled during the same period to 22 million inhabitants, making it one of the world's largest megacities (Jeong, 2011). As population grew and per capita wealth increased with economic growth – a 40-fold increase in real per capita income between 1970 and 2002 – vehicle ownership and the number of registered vehicles in Seoul also grew (Pucher *et al*., 2005a). By 2000, more than 5 million vehicles were operating in the Seoul metropolitan area (a 30-fold increase over 1970), and the transport sector constituted more than two-thirds of total oil consumption, with more than half of oil consumption going to private motor vehicles (Kim, 2009).

By 2003, traffic volumes in the Seoul metropolitan area had reached unsustainable levels: between 1996 and 2003, vehicle travel into the city increased 20%, with roughly 3 million vehicles travelling into the city centre each day in 2003. Conversely, average vehicle speed fell by 20% during the same (Ko, 2011). By 2004, the annual economic cost of congestion in Seoul was estimated at USD 5.2 billion (Kim, 2008). Growing vehicle traffic contributed to slowed bus speeds throughout the city, leading to a 50% drop in bus ridership between 1983 and 2003 (Ko, 2011).

The consequences of increased private motorisation went beyond roadway congestion. By 2003, air and noise pollution from vehicle traffic were at dangerously high levels (Pucher *et al*., 2005a). Particulate matter (PM_{10}) levels in Seoul were more than twice the recommended international standard, and air pollution from emissions was estimated to have an economic cost of more than USD 2.5 billion (Kim, 2008).

When Seoul Mayor Myung-Bak Lee took office in 2002, transport in Seoul was a major issue: solutions were needed to sustain rising travel demand and to support continued economic growth in the metropolitan area. However, the mayor and the Seoul Metropolitan Government (SMG) faced another challenge in addition to growing travel demand and rising vehicle travel. The city had no funding to finance continued development of its high-capacity metro system.

Between 1974 and 2004, the SMG rapidly constructed 487 km of metro rail to accommodate the boom in travel growth. The Seoul metro system is one of the largest in the world and it carried 8.4 million passengers per day in 2004 – more than twice the daily volume of the NYC and London metros (Pucher *et al*., 2005a; SMRTC, 2005). However, the rapid construction of the Seoul metro came at a high cost. By 2004, the cumulative construction debt of the metro represented nearly USD 6 billion, or roughly 80% of the city's total debt. In addition, the city government had to subsidise metro operations, which in 2003 amounted to more than USD 630 million (Pucher *et al*., 2005a). Because of the mounting construction and operations debts, the Korean state government restricted funding for any new metro lines or extensions after 2003. The SMG had to find other solutions to solve Seoul's growing traffic problem.

Plan

Faced with restrictions on funding for metro development, the mayor commissioned a series of in-depth studies with the SDI in 2002 to address potential solutions to improve the city's public transport system. The studies resulted in recommendations to co-ordinate and modernise the Seoul public transport system through integration of the bus and metro services, along with a restructuring of fare schedules (SDI, 2003a and b). The studies also recommended a complete overhaul of bus organisations and operations in the city (SDI, 2004).

6. According to the typology presented in Figure 6, Seoul evolved from a "developing" city to one with a "congested" core and "sprawling" suburbs. Recent policy measures are transforming Seoul into a "multi-modal" city.

1 Identify transport needs and define objectives. Bus services were the primary mode of travel in Seoul until the 1980s, when ridership began to decline. To combat decreasing bus usage in the city, SMG began developing curbside bus lanes in 1984, and by 2003, had developed more than 200 km of curbside lanes, which helped to increase bus speeds marginally (Pucher *et al*., 2005a). However, bus use continued to decline despite the changes, and by 2004, bus ridership had dropped to 25% of urban trip share from more than 65% of trips in 1980 (Jeong, 2011; SMG, 2004; KMCT, 2003).

One of the principal causes of bus decline was diminishing service quality. Poor bus management, low operator wages, slow speeds due to congestion, unsafe buses and overcrowding on buses all contributed to a low quality in bus services in Seoul (Ko, 2011). Bus service quality was also compromised by private firms that only sought to maximise profits. Buses were old and poorly maintained, and bus companies engaged in both dangerous and outrageous treatment of customers, including intentionally slamming on and off brakes to squeeze in more passengers (Pucher *et al*., 2005a). Bus operators also drove recklessly – causing high accident and injury rates – in order to reach passengers waiting at bus stations before competing services could reach them. Bus companies were reported to deliberately avoid elderly and disabled passengers to save time. The cost-cutting techniques contributed to decreased ridership, which in turn reduced profits for operators, thereby creating a vicious cycle of lower revenues and increased competition to cut costs. By 2002, not only had service quality declined, but the number of bus companies in Seoul had fallen by 30% over 1995 levels (SDI, 2003b). Another major issue that SDI identified with bus services in Seoul was a lack of regulation regarding private operations. Virtually no government guidelines had been developed for bus routing, scheduling and service provision, which contributed to inefficient, poorly organised bus services. Only bus fares were regulated by the city, which paradoxically continued to provide increased subsidies to bus companies to cover rising operations costs due to decreased ridership.

Define objectives. In response to SDI findings and recommendations, the mayor and SMG established a vision to reform, co-ordinate and modernise transport in Seoul. In particular, the vision called for the city to develop a low-cost, highly effective transport system that reduced energy consumption and air pollution while improving speed, convenience, safety, economic competitiveness and social equitability (Kim, 2009; Ko, 2011). This vision reflected broader Korean objectives to achieve a four "S" strategy – sustainable, smart, safe and silver (high-quality) transport services – in urban areas across the country (KMCT, 2006).

Identify policy responses. To achieve the vision for a modern, efficient and co-ordinated transport system in Seoul, the city decided that far-reaching reforms for bus services were necessary to improve service quality, reliability and efficiency. These reforms targeted bus service provision, including the organisation and regulation of existing bus services. The city identified key corridors for BRT development throughout the city and the need for co-ordination of bus and metro services, including the need for a fully-integrated public transport fare structure for ticketing.

Consider co-benefits and complementary measures. As part of broader objectives to improve transport and travel mobility throughout the Seoul metropolitan area, the mayor and SMG developed a three-prong strategy to support the city's transport vision while addressing long-term economic and environmental sustainability. The strategy sought to address the urban transport, socio-economic, environmental interface through policies that encouraged eco-friendly land-use and green space development, improved transport system efficiency, and applied travel demand management that prioritised pedestrians and more efficient travel modes (Kim, 2009). Policy responses included parking reforms (*e.g.* a 50% reduction in parking requirements for new buildings), increases on fuel taxes and the replacement of more than 130 000 traffic lights with energy efficient LED lighting.

Additional measures included street closures to vehicle traffic (*e.g.* Insa-dong in central Seoul), improved pedestrian facilities with more than 111 new pedestrian crossings by 2011, sidewalk expansions, bicycle parking and the construction of more than 200 km of cycling lanes throughout the city (Pucher *et al*., 2005b; Kim, 2009). The city also reclaimed 8.4 km of the Cheonggyecheon stream that had been covered by elevated highways between 1938 and 1976. The project was completed in 2005 as part of a major urban renewal and beautification programme, and it helped to decrease vehicle traffic by eliminating the highway that accommodated hundreds of thousands of vehicles into the city centre daily. The restoration was considered a major environmental success because it cleaned the Cheonggyecheon stream and reduced vehicle emissions in the downtown area (SMG, 2012).

❷ **Identify and engage stakeholders early on.** The bus reforms and supporting actions implemented by the mayor and SMG were developed in co-ordination with numerous partners, including SDI, the Korea Transport Institute (KOTI), academic partners and transport policy groups, such as the Victoria Transport Policy Institute. Seoul also collaborated with international "sister" cities through the Connected Urban Development initiative. As part of the programme, Seoul partnered with San Francisco and Amsterdam to collaborate on urban transport policy development and implementation (Kim, 2009).

❸ **Address potential barriers and secure necessary resources.** To implement bus reforms and improve travel flow in the city, SMG had to address both institutional and technical issues affecting bus operations and efficiency. Changes included the creation of the city bus management system (BMS) to co-ordinate and monitor bus operations as well as the implementation of ITS technologies, such as GPS on buses, to monitor bus travel and speeds (Pucher *et al*., 2005a; SDI, 2003a). ITS technologies also allowed BMS and the city to provide real-time information on buses and system operations to passengers and bus operators.

Technical. SMG also implemented a city-wide transport operations and information service (TOPIS) to co-ordinate, analyse, and manage transport data pivotal to transit operations. TOPIS compiles data from various agencies and transport systems, including traffic and accident reports, BMS bus operation information and passenger statistics from the new integrated smart card system. This information is used in co-ordination with system operations management to facilitate travel flow and system efficiency. TOPIS provides critical information for transit signal priority technologies that facilitate bus turns and reduce wait times at traffic intersections (Kim, 2009).

Financial. Bus reforms in 2004 implemented a new, semi-public bus operation structure to improve the accessibility and reliability of bus services. Before the bus reforms, bus operators were compensated based on the number of passengers carried, which contributed to dangerous practices to fit as many passengers in a bus as possible. Under the new private-public structure, private bus operators were contracted in a bidding process to provide services along bus routes and schedules pre-determined by the city. Bus operators also were awarded contracts with compensation based on bus vehicle travel (in vehicle km), and the agreements guaranteed government subsidies for operations below collected revenues to maintain passenger fees at government set fares. As a result of the new service contract structure, public subsidies of bus operations increased nearly three-fold within the first year of the policy change. By 2010, annual subsidies to buses were still 50% higher than in 2005. Reductions in subsidies to metro operations, however, occurred during the same period. Because bus operations costs are significantly lower than metro operations, the net result was to lower annual public transport subsidies for the city (Pucher *et al*., 2005a).

❹ **Establish policy framework and action plan.** The mayor and SMG announced far-reaching reforms for bus services to improve service quality, reliability and efficiency in January of 2004. The

reforms included reorganisation and regulation of bus services, installation of BRT corridors throughout the city, co-ordination of bus and metro services and development of a fully-integrated public transport fare structure for ticketing between all public transport modes. The reforms included development of a BMS that addressed some of the major problems in bus transport throughout the city by improving accessibility, establishing convenient connections and transfers, ensuring predictable schedules and creating a safe environment for passengers.

Implement

In addition to regulating bus fares, routes and schedules, the city also implemented a new colour scheme and bus numbering system. Four different colour categories were applied to buses: blue to indicate long-distance express buses connecting suburbs and the city centre; red to indicate long-distance express buses between satellite cities and Seoul; green to indicate local service with connections to metro and express services within the metropolitan region; and yellow to indicate local bus service within the city centre. Buses were co-ordinated by numbers using a new city and suburb neighbourhood code system to indicate origin (first number), destination (second number), and the bus number (third number) (Pucher *et al*., 2005a; Ko, 2011).

The city increased the number of curbside bus lanes throughout the metropolitan area, from 220 km in 2003 to nearly 300 km in 2004. The city also began the conversion of the city bus fleet to CNG buses and started development of a new BRT system. By 2010, more than 6 100 CNG buses were in use in the city, and the BRT system had grown to 142 km along eight corridors, including 55 km along motorway arterials into the city (SMG, 2004; Kim, 2009; Ko, 2011).

5 Engage actors and begin implementation. One critical objective of bus reforms was to integrate all public transport services. Bus route design consequently was organised to complement high-capacity metro and suburban rail through short, easy transfers and connections from buses and rail. This integration included the development of 22 major transfer centres with sheltered bus stations throughout the city. The city also applied a unified, integrated fare scheme across all public transport modes. The new scheme charged passengers using a distance-based fare with free transfers between modes. The programme implemented a new smart card system ("T-Money") that can store credit and be used anywhere in the metropolitan public transport system. "T-Money" allows the city to monitor daily trips and travel activity on public transport modes (SDI, 2003b; Pucher *et al*., 2005a).

6 Raise awareness and communicate targets. In support of the major bus reforms and to encourage shifts to bus use, the mayor and SMG started an intensive public relations campaign in 2004 to explain the need for reform and the benefits that the proposed initiatives would have on the city. The campaign focused especially on explaining and defending measures that would affect motorists in the city (Pucher *et al*., 2005a). These efforts included a "No driving day" campaign that encouraged drivers to leave their cars at home in exchange for an automobile tax reduction (Kim, 2009). The public transport authority of Seoul also developed a web-based service platform to assist passengers with trip-planning information, a carbon calculator, and real-time trip and route information.

7 Manage implementation process. When bus reforms were implemented in July 2004, the transport system experienced considerable disruption to services, and public reaction included confusion about changes and dissatisfaction with the new system. Within the first month of implementation, customer complaints spiked from fewer than 2 000 daily complaints in June to more than 8 000 daily complaints in July (Kim and Kim, 2012). Customer satisfaction rates likewise fell below 50% (SDI, 2004).

SMG investigated the unexpected response to bus reforms and found that technical issues were occurring with the "T-Money" system and that

customers lacked sufficient information about new bus routes and scheduling. The city fixed the technical issues and worked with customers to increase understanding of bus changes. By October of 2004, customer satisfaction had returned to nearly 90%, and complaints fell to fewer than 500 per day (Pucher *et al*., 2005a; SDI, 2004; Kim and Kim, 2012). In reviewing the initial implementation, the city recognised that it could have addressed changes through a better information campaign paired with a trial period for certain changes, especially for some of the ITS technologies (Pucher *et al*., 2005a).

Monitor

8 Collect, review and disseminate data. The city performs periodic analyses of bus operations and customer satisfaction to ensure the reforms are improving bus service quality and efficiency. These analyses include customer satisfaction surveys, review of customer feedback and suggestions, and analysis of data collected from TOPIS and BMS operations (Ko, 2011). Indicators collected for data analysis include bus operation hours, passenger counts, transfer frequencies, financial statements of bus operating companies, and the frequency of smart card malfunctions, civil complaints, traffic accidents and average bus speeds (Kim and Kim, 2012). Data is shared with partners, such as KOTI and SDI, and the city releases reviews and self-assessments of policy changes.

Evaluate

9 Analyse data and evaluate effects of transport policy. Within the first six months of the bus reforms and BRT implementation, bus speeds throughout the city and along the four initial BRT corridors increased significantly. Along the Dobong-Mia corridor, bus speeds doubled from 11 km/h in 2003 to 22 km/h at the end of 2004. Bus travel along the other corridors improved between 33% and 65% during the same period. Vehicle speeds in the city also improved, largely because of bus regulations that discouraged reckless driving to compete for customers. Eliminating the zigzag pattern of bus traffic throughout the city improved overall traffic flow and travel efficiency (Pucher *et al.,* 2005a).

In addition, daily passenger trips on buses increased by 750 000 passengers per day between July 2004 and July 2005, an 11% increase over 2004 ridership. Bus accidents and serious injuries fell by 23% and 43%, respectively, by mid-2005, and by 2009, the use of public transport (notably because of increased bus ridership), had grown from 60% in 2003 to 63% in 2009 (Pucher *et al*., 2005a and 2005b; Yonchang, 2011).

10 Adapt transport policy and plan next steps. In response to the success of bus reform in Seoul, SMG has continued to pursue sustainable growth and transport efficiency policies since the implementation of bus changes in 2004. Continued activities include expansion of the BRT system, with plans to increase system length in the Seoul metropolitan region to 221 km (Ko, 2011). SMG is planning a light-rail transit (LRT) network in the city as an expansion of public transport services, but at a much lower cost than metro rail (Pucher *et al*., 2005a). The city government is also improving access to public transport services through increased mobility services (*e.g.* elevators, escalators, wheelchair lifts and moving walkways), and it is studying the technical feasibility and socio-economic impact of a potential congestion pricing scheme in the city centre (Kim, 2009).

In addition, SMG announced a new set of Green Development Policies in 2009. The new policies include renewed objectives for the transport sector, such as reducing energy consumption by 15% by 2020 and 20% by 2030. The city also has set a goal to increase public transport's share to 75% by 2020 (Pucher *et al.*, 2005a; Kim and Kim, 2012). The renewed objectives have helped the city to identify new strategies to reduce energy consumption, increase public transport use and expand existing programmes to manage travel demand.

Policy packages to improve energy efficiency in urban transport systems

Why are policies needed?

Overcoming barriers

The case studies of Belgrade, NYC and Seoul presented in the previous section, policy makers charged with developing efficient urban transport systems face many challenges, including budget constraints, political resistance, administrative and legal barriers (*e.g.* authority to implement and enforce policies), and public opposition. Other barriers include physical constraints (*e.g.* terrain and the built environment), institutional capacity and jurisdictional issues. All of these challenges can affect the successful implementation of urban transport efficiency policies.

Market and policy failures

Policies play a key role in shaping and directing the transport market. They can skew travel decisions in favour of transport modes that are not energy efficient. Fuel subsidies, prioritisation of roadway funds and development incentives (*e.g.* subsidies for construction in green-field areas) can encourage markets that favour private motorisation (*i.e.* personal vehicles, not public transportation). Lack of information about transport options, poorly regulated transport supply chains and public transport services, and high participatory and investment costs (*e.g.* expensive licensing fees for public transit providers) similarly can encourage growth in private motorisation while discouraging the development of more efficient travel modes.

Failure to address the true costs of travel choices is another example of how policies can skew travel decisions. Urban transport issues, such as local congestion and air pollution caused by motorised vehicle travel, can have significant social and economic consequences (*e.g.* increased travel time). Those consequences and the related costs to society, whether direct or external, reflect a market failure to integrate the true cost of travel decisions in the cost that individuals pay (Box 4).

The IEA recommends several policies to address transport market failures (25 Energy Efficiency Recommendations). These policies include demand-side policies (*e.g.* congestion and road pricing), regulatory policies (*e.g.* parking restrictions) and supply-side policies (*e.g.* public transport infrastructure expansion). The IEA also recommends that countries eliminate incentives for private motorised travel, such as fuel subsidies, and set taxation systems to reflect the full range of external costs of fuels and vehicles (IEA, 2012b). These taxation systems include taxes and price mechanisms that address pollutant and CO_2 emissions, as well as charges for congestion and other social and environmental impacts caused by travel decisions.

Box 4

Fuel subsidies: real costs of keeping fuel below international retail prices

Energy prices impact consumer demand for fuels and the cost-effectiveness of energy efficiency measures. Fossil-fuel subsidies result in economically inefficient allocation of resources and market distortions. They represent a burden on state budgets – particularly for net-exporting countries where subsidies restrict exports by inflating domestic demand. Worldwide fossil-fuel consumption subsidies totalled USD 523 billion in 2011, with the Middle East accounting for 34% of the global total subsidies. Oil products received USD 285 billion in subsidies, equivalent to over 54% of all global subsidies (IEA, 2012a).

Market failures can also be the result of weak or nonexistent regulatory frameworks (Box 5). For example, oversupply of inefficient public transport services can be the result of increased market

Box 5 *Weakened policy framework: lessons from former Soviet states*

Following the collapse of the Soviet planning model in 1991, formal public transport in Russia and the former Soviet Union (FSU) suffered major changes, with funding sources drastically reduced. Into this vacuum, low-quality, low-capacity minibuses began to replace formal, higher-capacity public transport across the region, with little to no planning or regulatory controls. This phenomenon grew throughout the 1990s, partly out of necessity due to the collapse of public funding mechanisms and partly out of a desire from a new generation of policy makers to allow the private sector to grow. By the early 2000s, however, the ill-effects of unregulated minibus and private transit operators became apparent: many areas had an oversupply of transit operators, leading to local bottlenecks and at times unsafe operations; other areas where demand was low were left without access to services. High levels of market competition between private operators also contributed to a "race to the bottom" effect, with older, inexpensive, polluting and energy-intensive vehicles becoming the competitive norm. With mounting congestion, most major cities in the region now have begun reasserting their planning and regulatory controls over public transport, through reinvestment in municipal companies (including electric trams, trolleybuses and heavy rail) and issuing tenders for formal bus services to private bus operators.

Source: Jordan-Tank, 2012.

competition that lowers profitability for service providers and encourages cost-cutting approaches that lower system efficiency and service quality. Increases in highly-emitting vehicles with poor fuel economies likewise can be the result of policy failure to impose or regulate vehicle standards. By improving regulatory policies that discourage or prevent these types of market and policy failures, policy makers can increase transport system efficiency while also improving transport quality and encouraging shifts to more efficient travel modes.

Financing challenges

Financial constraints manifest themselves because high upfront development and implementation costs are often required for transport infrastructure, travel demand management tools (*e.g.* congestion pricing) and energy efficiency programmes (*e.g.* subsidies for alternative vehicle technologies). These activities can also require long-term funding streams for operations and maintenance. Finding the right financing mechanism, therefore, is critical to the success of implementing transport system improvements.

Transport projects have traditionally been financed through public monies raised either through general taxes or specific revenues (*e.g.* fuel taxes), and the public sector has carried financing and investment risks for those projects. Multilateral banks and financial institutions have also played a significant role in financing transport sector development, especially in developing countries, and have pledged future support (Box 6). Historically, financing has been predominantly for road construction and maintenance (IEA, 2013; ITF, 2012). As countries and banks have realised the increasing need for more efficient, long-term solutions to travel demand, however, funding has increased for non-roadway transport development, including public transit and non-motorised (NMT) networks for walking and bicycling.

Increasingly, governments have developed new sources of financing for transport sector development. These sources include revenues from road pricing (*e.g.* toll roads), congestion charges, parking levies and developer fees. Governments have also turned to financing tools such as TIFs to subsidise urban development and transport projects. TIFs are a public financing tool used to subsidise development, infrastructure and other local improvement projects by leveraging public financing through expected future tax revenues (Table 6). Generally, TIFs rely on public projects resulting in an increase in the value of surrounding real estate, which thereby generates future additional tax revenue that can be used to repay the investment.

Box 6

Rio+20 pledge: financing sustainable transport in developing countries

*Eight multilateral development banks announced at the United Nations Conference on Sustainable Development (Rio+20) in June 2012 that they would invest USD 175 billion over the next decade for transport in developing countries. The pledge to fund loans and grants is intended to help alleviate transport problems (*e.g. *congestion and air pollution) through more efficient, environmentally friendly, accessible, affordable and safe transport solutions. The pledge supports pre-existing initiatives, including the Sustainable Transport Initiative at the Asian Development Bank, the Urban Transport Planning Program at the World Bank and the Infrafund at the Inter-American Development Bank.*

Source: United Nations News Centre, 2012.

In response to pressures on public budgets and limitations in revenue-raising capacity in the public sector, governments are turning more to the private sector for investments in transport projects. Private-sector participation can be achieved through various forms of agreements and PPPs, including PSCs and BOT concessions (Figure 5). PPPs generally engage private firms to provide a service or to develop transport infrastructure; in turn, the firms often receive fixed-term rights to charge for services or infrastructure provided in exchange for certain responsibilities (*e.g.* construction, operations and maintenance). PPPs can be structured to improve transport services (*e.g.* create operation cost discipline) in exchange for public subsidies.

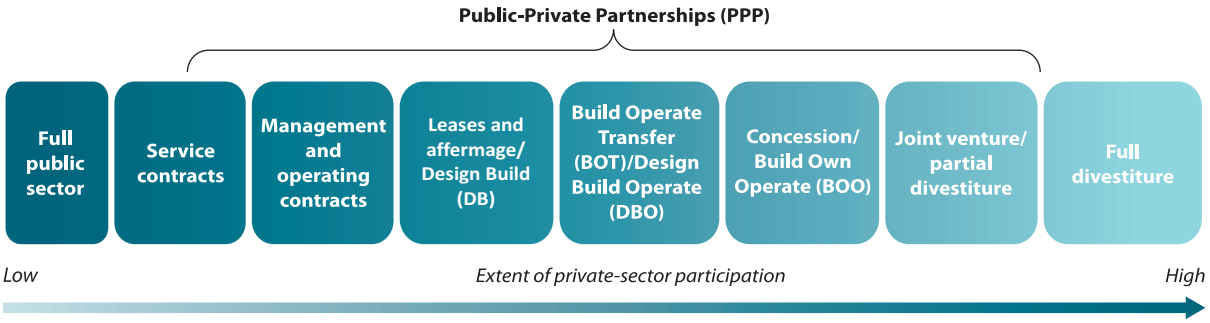
When structured correctly, PPPs for urban transport projects have many characteristics that can be attractive to private firms and financial institutions, including defined and stable revenue sources. The effectiveness of PPPs depends largely on how well agreements are structured and how effectively governments attract private-sector involvement.

Table 6 Examples of financing tools to support transport system investments

Instrument	*Examples*
Regulatory tools	• Carbon pricing (*e.g.* carbon tax and cap-and-trade systems) • Fuel subsidy removal/increased fuel taxes • Vehicle taxes and registration fees • Charge scheme (*e.g.* congestion pricing, road charges and parking fees)
Land value capture tools	• TIF • Development charges and impact fees • Transferable development rights
PPPs	• Concessions • BOT and Build-Own-Operate-Transfer (BOOT)
Others	• Multilateral development banks/green transport funds/loan guarantees

Source: Ang and Marchal, forthcoming.

Figure 5 Range of business models with private-sector participation*



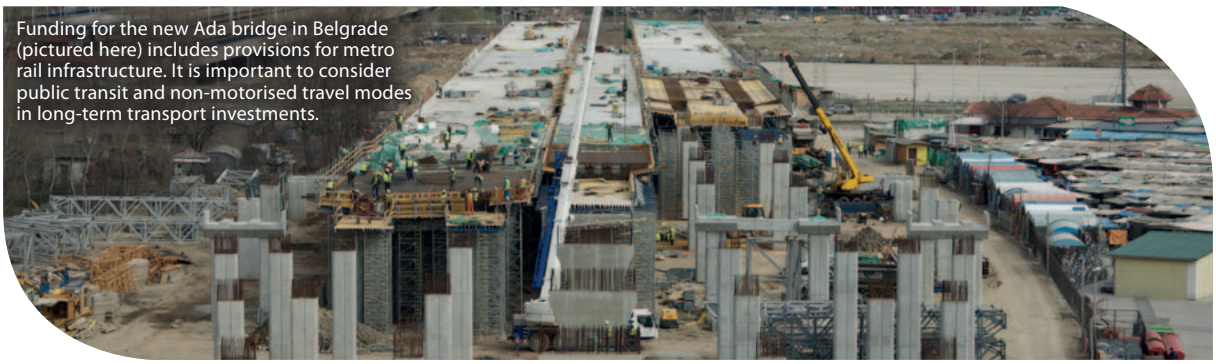
Source: Ang and Marchal, forthcoming.

* Affermage in Figure 5 refers to public-private sector arrangements under which the private operator is responsible for operating and maintaining the utility but not for financing the investment.

Governments can encourage private investments by implementing regulatory reforms to establish transparency in the rules and regulations governing transport investments and the structure of PPPs. This transparency includes establishing competitive procurements with clear rules about the bidding and selection process, full disclosure of conditions before the bidding process to facilitate negotiations, detailed agreements on responsibilities and risks, clear rules on project cancellation and compensation, and pricing regulations to secure revenue while incentivising new participants (Ang and Marchal, forthcoming).

The choice among diverse PPP business models and the extent of private participation should be driven by market efficiency, a proper allocation of risks and a full assessment of costs and benefits for both the public sector and private investors (Box 7). PPPs are most effective when they increase the efficiency of transport projects in a regulated, profit-driven structure, and the procurement of private services should optimise outputs compared to costs (*i.e.* the project should yield the most value while environmental, social and economic public benefits exceed the costs) (Ang and Marchal, forthcoming).[7]

7. More information on key regulatory challenges to implementing transport-sector PPPs and on actions to mobilise private-sector investments in the transport sector can be found in Corfee-Morlot *et al.*, 2012 and Ang and Marchal forthcoming.



Funding for the new Ada bridge in Belgrade (pictured here) includes provisions for metro rail infrastructure. It is important to consider public transit and non-motorised travel modes in long-term transport investments.

Box 7

Warsaw, Poland: innovative financing to improve transport efficiency

*The EBRD has assisted more than 20 cities in the last five years to develop robust regulatory approaches to transport projects and investments. This assistance has included engaging private-sector investments in transport through PSCs between the competent authorities and a transport undertaking, using an off-balance sheet structure vis-à-vis the municipalities (*i.e. *financing of large capital expenditures that are kept off the municipality's balance sheet) backed by MSAs. MSAs provide a quasi-guarantee of municipal support for projects if expected fare revenues and PSC payments do not materialise as expected. The PSC and MSA approach was used to approve USD 160 million (EUR 130 million) for the Warsaw metro and tram companies in 2011 to procure new metro wagons and trams with significant gains in fuel efficiency over older stock. The financing, prepared and co-financed jointly with the EIB, was syndicated to commercial banks as B-lenders through the "off-balance sheet" structure, and PSCs were implemented with the metro and tram companies for an 18-year duration based on a detailed calculation of total compensation that will be available to the two companies during that period. The PSC structure also calculated foreseeable capital expenditure plans for each company as Warsaw continues to build out its mass transport networks through 2030. By financing the improvements through a PSC and MSA structure, Warsaw was able to mobilise USD 920 million (EUR 740 million) in European Union Cohesion Funds grants for transport improvements, which the city otherwise would not have able to fund by itself. This EBRD-supported operation is an important step by Warsaw towards implementation of a sustainable urban transport strategy. The improvement of the quality of clean public transport services to achieve a modal switch from private cars to public transport, thus reducing the city's carbon footprint, is at the heart of this strategy.*

Source: Jordan-Tank, 2012.

Which policies are needed?

The "avoid, shift and improve" paradigm

The IEA has identified measures to increase energy efficiency in the transport sector that include improvements in vehicle and fuel technologies, policies to shift travel to more efficient modes and measures to avoid motorised travel when possible (IEA, 2012b). This package of measures contributes to what is known collectively as an "avoid, shift and improve" approach[8] (GTZ, 2004), which is necessary to achieve fuel security and climate change targets.

"Avoid"

"Avoid" policies address transport energy use and emissions by slowing travel growth via city planning and travel demand management (Table 7). "Avoid" policies also include initiatives such as virtual mobility programmes (*e.g.* tele-working) and freight delivery co-ordination and logistics technology that decrease travel volume by finding shorter, more efficient routes.

8. Additional approaches, such as the "Visioning and Backcasting" technique applied for transport policy in the United Kingdom (Hickman and Banister, 2007) and the "Sustainable Mobility" paradigm (Banister, 2007) address transport development and policies through a different lens than the "avoid, shift and improve" approach identified in this pathway.

Table 7 "Avoid" objectives and examples of policy responses

Objectives	*Policies*
Reduce trip length	• High-density, mixed land-use development (*i.e.* work/housing/leisure) • National/regional urban planning guidelines • Subsidies/tax incentives for low-carbon transport city design/planning
Reduce the need or desire to travel	• Information tools to raise awareness of real travel costs • Mobility management and marketing (*e.g.* IT-based communications) • Promotion of car-pooling • Freight logistics • Parking standards and fees/levies

Sources: Ang and Marchal, forthcoming, adapted from Dalkmann, 2009; Sterk, 2011; UNEP, 2011; and Zusman *et al.*, 2012.

"Shift"

"Shift" policies enable and encourage movements from private motorised travel to more energy efficient modes, such as public transit, walking and cycling, and freight rail (Table 8). For example, increases in affordable, frequent and seamless public transport can encourage greater use of public transport over private vehicles, which in turn alleviates local congestion, while improving access and travel time to destinations and reducing household expenses on travel.

Both "avoid" and "shift" policies can help to achieve significant efficiency improvements and emissions abatement, while also addressing urban transport issues, such as congestion, access to services and employment, poor air quality and deteriorated quality of life.

Table 8 "Shift" objectives and examples of policy responses

Objectives	*Policies*
Shift passenger travel to public transport and NMT Prevent passenger shifts to motorised transport	• Integrated public transit and land-use planning • Improved bus routes and services • Parking restrictions • Pricing strategies (*e.g.* congestion charges, vehicle quotas/bidding system for plates, and fuel/vehicle taxes) • Traffic restrictions and travel bans in city centres • Road space allocation: dedicated lanes for buses, BRT and bicycles. More sidewalks, crossings and overpasses for pedestrians • Congestion and road charges (*e.g.* roadway tolls)
Shift freight transport from trucks to rail and water transport	• Standards for size and weight of vehicles authorised on roads • Logistics management technology

Sources: Ang and Marchal, forthcoming, adapted from Dalkmann, 2009; Sterk, 2011; UNEP, 2011; and Zusman *et al.*, 2012.

"Improve"

When motorised travel is necessary, "improve" policies can reduce energy consumption and emissions through the introduction of efficient fuels and vehicles (Table 9). "Improve" policies include tightened fuel-economy standards and increased advance vehicle technology sales (*e.g.* clean diesel trucks and hybrid and plug-in electric cars).

Table 9 "Improve" objectives and examples of policy responses

Objectives	*Policies*
Reduce energy use and emissions	• Vehicle standards (*e.g.* fuel-economy or emission regulations) • Speed limits • Planning of low-carbon electricity generation and smart grids for electric vehicle charging stations • Eco-driving
Improve fuel and vehicle technologies	• Vehicle feedback instruments • Fiscal incentives for fuel-efficient/lower-carbon vehicles • Subsidies for alternative fuels • Vehicle fuel-economy/environmental performance labelling

Sources: Ang and Marchal, forthcoming, adapted from Dalkmann, 2009; Sterk, 2011; UNEP, 2011; and Zusman *et al.*, 2012.

Potential benefits of "avoid, shift and improve" policies

The IEA estimates that "avoid" and "shift" policies have the potential to reduce projected net global transport sector expenditures to 2050 on vehicles, fuels and infrastructure by nearly USD 30 trillion over a business-as-usual scenario (in 2010 real value) (IEA, 2012b). These savings will be made even taking into account the additional expenditures for the projected construction of more than 200 000 million km of new rail track (including nearly 90 000 km of potential high-speed rail) and a ten-fold increase (or roughly 25 000 km of trunk road) in BRT networks in urban areas across the globe. When paried with "improve" policies, an "avoid, shift and improve" approach could lower global transport expenditures by nearly USD 70 trillion by 2050.

Although "improve" policies can reduce energy consumption and emissions, experience shows that "improve" policies are not necessarily effective when applied alone (Dalkmann, 2009). For example, energy efficiency gains from improved fuel economy can be offset by increased travel and rising vehicle ownership (Gallachoir *et al.*, 2009). Consequently it is preferable to pair "improve" policies with "avoid" and "shift" measures to ensure that gains from vehicle and fuel improvements are not lost to increased motorised travel.

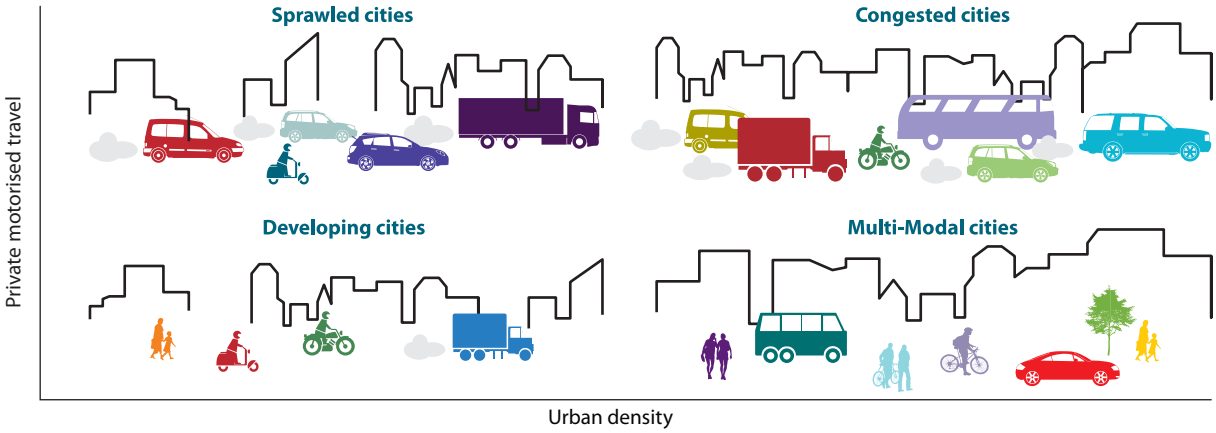
Matching policies with city needs

Which policies to put in place to improve the energy efficiency of an urban transport system depend on the type of city, including the immediate transport needs and challenges and the underlying drivers of travel demand.

City context: four typologies

To assist policy makers, this policy pathway has devised a typology of four common city transport contexts within the land-use and travel framework. The four contexts (Figure 6) describe some of the general travel trends and transport system issues facing cities across the globe. Variations to each of the four contexts exist, but the framework outlined

Figure 6 City contexts within the urban land-use and travel framework



in this pathway is a useful typology of common transport issues and corresponding policy measures for cities across the globe.

Developing cities. Rapidly developing cities are experiencing increasing demand for transport services and rapid growth in private motorisation. Developing cities can have relatively low densities and often have inadequate travel infrastructure, especially for NMT modes (*e.g.* walking and bicycling), and weak public transit services (*e.g.* unregulated, poor quality bus operators). Combinations of convenience, inexpensive and subsidised fuels, poor public transit services, and increasing distances due to urban sprawl encourage growth in private motorisation. As a result, developing cities generally experience increasing roadway congestion, rising travel injuries and fatalities, more local air pollution and large disparities in access to transport, employment and social services. The city of Guangzhou in China is an example of a developing city that has managed to overcome these trends (Box 8).

Box 8

Guangzhou, China: award-winning, integrated sustainable urban transport

The city of Guangzhou in the Guangdong province of China has done considerable work in transport planning and development in recent years to develop a more sustainable, more efficient transport system that addresses the city's environment, economy and overall urban mobility. As part of this effort, Guangzhou opened a high-capacity BRT system in 2010 as well as a public bicycle system, urban greenways and improved bicycle and pedestrian facilities. Today, the Guangzhou BRT system accommodates more than 800 000 passengers per day, with as many as 27 000 passengers per hour per direction. The BRT project and sustainable transport initiatives have been so successful that Guangzhou won the 2011 Sustainable Transport Award from the ITDP in recognition of its integrated urban transport system. In addition, the Guangzhou integrated transport system is being used as a model in other Chinese cities, including for a BRT project in Lanzhou. Technical assistance for these projects was provided by ITDP.

Source: Wright, 2012.

Sprawling cities. Sprawling cities tend to have low densities and high urban and suburban sprawl. they often have poorly-defined urban cores with commercial and business hubs spread intermittently throughout the urban and metropolitan areas. Public transit use and NMT shares tend to be low, while private motorised transport tends to be the primary means of travel. These cities may have difficulty providing efficient and cost-effective public transit services because of long distances between destinations (Box 9). Local congestion, especially during commuting hours, is high in sprawling cities, and road infrastructure often requires heavy investments and maintenance as a result of extensive, highly travelled networks. Local air pollution and road safety are also common issues of concern.

Congested cities. Heavy roadway traffic, especially during peak travel hours, is common in congested cities. Congested cities generally have medium to high densities and strong urban cores, although urban sprawl may exist in surrounding metropolitan areas. Congested cities can have extensive transit systems and high public transport modal shares (Box 10). However, heavy traffic levels, often paired with increasing motorisation, can lead to daily gridlock throughout these cities. Numerous causes, including poor or diminishing public transport, fuel subsidies, free or subsidised parking, and high levels of funding for roadway networks, all can contribute to the preference to use private motor vehicles. Zoning policies (*e.g.* housing and employment mismatches) can also encourage private vehicle use. Local air pollution, road injuries and travel fatalities can be major issues in these cities.

Multi-modal cities. These cities typically have high densities, strong urban cores, and high public transit and NMT shares. Multi-modal cities generally have strongly interconnected, well-developed travel networks, which facilitate and encourage more efficient travel (Box 11). Mixed land-use development paired with a high level of public transport services means that travellers generally have good access to energy efficient modes and a choice of different modes depending on their preferences and needs.

Box 9

Nashville, USA: addressing sprawl through strategic planning and transport funding

Nashville, Tennessee is one of the most sprawled metropolitan areas in the United States. In 2012, average commuting distance was nearly 60 km, and the city estimated that development would consume another 1 500 km^2 of rural land by 2035 if urban sprawl continued to go unchecked. In response, the regional planning authority for the Nashville metropolitan region developed a 25-year vision for transport in the greater Nashville area, the 2035 Regional Transportation Plan, with objectives to adopt a "fix-it-first" approach on existing infrastructure (rather than expanding roadway networks), shift investments to more efficient transport modes and support the development of more sustainable communities. The plan also adopted a scoring system to evaluate new transport proposals along nine weighted categories, including system preservation and enhancement, multi-modal transport options and economic development. While the plan is still in the early phases of implementation, it has set forth the framework for future policy action regarding transport development and urban planning. It also established an Active Transportation Funding Policy with nearly USD 6 billion over the next 25 years, including approximately USD 115 million of dedicated funds for NMT infrastructure.

Sources: Benfield, 2012; Nashville MPO, 2010.

Many multi-modal cities have dedicated spaces for more energy efficient travel modes, such as bus and cycling lanes. A key feature of these cities is also public transport terminals (*e.g.* train stations, or bus terminals) where several modes of public transport can be seamlessly accessed by users. In addition, these cities often have implemented policies that discourage driving, such as caps on parking (*i.e.* limitations on parking development), road pricing schemes and car-free zones.

Box 10

Shanghai, China: multiple approaches to address growing transport problems

*Transport in Shanghai, the largest city in China, has grown at an exceptional pace since the 1990s, making it one of the busiest hubs in Asia. Increasing urban population and strong economic growth triggered significant congestion through the city's vast transport network, and by 2005, transport in the city centre had replaced industry as the key factor in poor urban air quality. In response, Shanghai began a multi-faceted strategy to improve traffic and travel within the metropolitan region, including traffic management, strong investments in public transport, separation of travel modes (*e.g. *bus-exclusive lanes) and commitment to research and development in support of efficiency in vehicle technologies (*e.g. *plug-in hybrid, electric and hydrogen fuel cell vehicles). Since 2005, Shanghai has increased development of public transport, including announcements to build by 2015 nearly 600 km of new rail network, 300 km of bus-only lanes with signal priority to ensure timeliness and reliability, and a BRT and feeder bus network. Shanghai has also optimised interactions between public transport and road networks and invested in energy efficient buses, while it committed in the 12th Five-Year development plan for 2011-15 to increase the share of public transport from 34% of trips in 2010 to 50% by 2015. In addition, Shanghai has been selected as one of 25 pilot cities in China for energy efficient and new energy vehicle demonstration, and as such, the city will spend three years building a demonstration base for exploring sustainable development of urban transport while setting up international platforms for electric vehicle (EV) development and EV innovation, demonstration, operation and test drive centres.*

Sources: UITP, 2012; IEA/EVI, 2012.

Box 11

Vienna, Austria: improving energy efficiency in multi-modal city

*The city of Vienna built an urban motorway in 1978 to relieve increasing traffic on crowded urban streets. By the 1990s, traffic accidents and congestion along the motorway and city streets had peaked, and development started moving to the outskirts of the city. To combat the effects of increased traffic and urban sprawl, Vienna developed a Transport Master Plan in 1993 with specific measures to address the city's growing transport needs. The plan also sought to reduce private motor use through expanded public transit and regulatory policies, including parking pricing and reduction of on-street parking spaces. By 2000, the share of Vienna travellers using motorised personal transport had diminished, with nearly 65% of travel made by public transport and NMT modes. In 2003, the city issued a renewed Transport Master Plan. The updated plan set new targets for the city, including reducing motorised vehicle use to less than 25% of city travel. The plan also set forth new strategies to accommodate the changing population in the city, while continuing major investments in transit expansion and high-performance travel infrastructure. These investments included roadway safety enhancements, increased NMT travel networks (*e.g. *cycling lanes and wider sidewalks) and more than USD 500 million for new tramlines throughout the city.*

Sources: Wien, 2006; Winkler, 2009.

Which policies should be implemented in which city contexts?

To assist decision makers, this policy pathway identifies some common targets and policy measures applicable to the four city typologies described in the previous section (Figure 6). Many of the policies are applicable in numerous contexts, although cities should take into account their own specific local transport needs and issues when considering policy targets. More information on policy tools can be found in the appendix of this report.

Developing cities. Developing cities often still have a rare opportunity to direct land use and travel growth toward energy efficient transport systems before urban form and transport network development are strongly established. Target policies include regulations that discourage or penalise sprawling development (*e.g.* minimum density thresholds and urban zoning laws) and land-use initiatives that prioritise dense urban cores, such as transit-oriented development. Transport infrastructure development (*e.g.* dedicated spaces for pedestrians and public transit networks) can help to steer growth in travel demand toward more energy efficient modes while improving access to destinations and travel choice.

At the same time, infrastructure development and land-use policies should be paired with well co-ordinated, complementary travel demand management policies to ensure that improvements are accessible, affordable and attractive (*i.e.* competitive with private motorisation). Policies include formalising and regulating public transport operations, increasing service quality and frequency on public transport networks, and discouraging private motorised travel (*e.g.* removal of fuel subsidies and implementing vehicle registration fees) (Box 12). Additional tools to combat growing motorisation include policies such as road pricing and eco-driving programmes. Improve policies (*e.g.* fuel-economy and emissions standards enforced through mandatory inspections) should help to increase energy efficiency of motorised transport while improving local air quality.

Sprawling cities. Low densities, urban sprawl and heavy traffic in sprawling cities require strategic, comprehensive planning and policy actions. Transitioning to a denser urban environment that supports more efficient transport generally requires years of planning and development, especially in cities where urban form is well established. For this reason, medium- and long-term development goals are critical in addressing travel demand. Land-use policies that address denser development, such as density credits and unified regional planning guidelines, can help to discourage continued sprawl and increase urban core development. Long-term zoning strategies, builder incentives and tax credits for business relocation are examples of policies that encourage urban densification.

In the shorter term, policies that improve existing transport and prioritise shifts away from private motorised travel are important. These policies can

Box 12

Manila, Philippines: increasing transit options through private concessions

*The majority of Filipinos use public transport, but car ownership and congestion are high in the Manila metropolitan region. Independent, poorly regulated buses and jeepneys contribute to slow, inefficient public transport on city roads, despite high passenger volumes. In response, the city built an elevated light-rail system that was opened in 1984. The system was an immediate success, and in 1989, the government set out to build a second elevated rail line as part of a bundled BOT concession with the first line. However, the bidding process failed to lead to a concession agreement, and the construction on the second line – as a stand-alone project – did not begin until 1998. Although the original BOT concession for the second line failed, the Philippine government continued to push for increased development of the public rail network. In 1996, taking lessons from the power sector, the government approved a 25-year "build-lease-transfer" (BLT) concession for a third rail line (MRT3) with a 50-year commercial development implementation agreement along the right-of-way for the line. In return for construction and maintenance risks (*e.g.* cost overruns and project delays), the concessionaire received a guaranteed return with annual rental payments. The results of the project are high system ridership (the highest of the three lines) at modest costs to the city, while the corridor and catchment area of the metro line have continued to densify. More information regarding lessons from urban rail concessions can be found in the World Bank Halcrow Group Limited report, A Tale of Three Cities.*

Source: World Bank, 2004.

Box 13

Mexico Federal Mass Transit Program (PROTRAM): urban transport initiatives to mainstream sustainable mobility

Inadequate land-use regulation in the 1990s and early 2000s contributed to low-density, sprawling growth in cities all across Mexico. In many cities, urban roads accounted for as much as 30 to 50% of land-use, while urban automobile use was growing at more than 8% per year. By the 2000s, chronic congestion, high levels of air pollution, and high rates of accidents plagued Mexico's major cities. In response, the government of Mexico developed a vision for sustainable mobility, which included urban land-use and public transport development plans as well as goals to rationalise transport infrastructure use and improve transport system energy efficiency. In 2009, the Mexican government created the National Infrastructure Fund (FONADIN) and PROTRAM. FONADIN and PROTRAM set forth the objective to support Mexican cities in mass transit investment projects that are integrated into sustainable mobility plans. The programmes also sought to strengthen local institutions in urban transport planning, regulation and management. Since 2009, PROTRAM has reviewed the technical and financial feasibility of more than 30 public transport projects across the country while improving the quality of designs for 8 urban public transit programmes. These efforts include support for the development of three new suburban trains in Mexico City, mass transit rail in 7 cities and 25 BRT corridors in 16 cities. The commitment of the Mexican government also helped to secure USD 350 million in financing from the World Bank and the Clean Technology Fund in 2010. This funding will support the Urban Transportation Transformation Project, which complements PROTRAM objectives through funding for integrated transport systems, institutional capacity strengthening, and project administration and monitoring.

Sources: Mier-y-Teran, 2009; EMBARQ, 2012b; World Bank, 2010.

include travel demand management programmes, such as parking reform and road pricing, as well as tools that focus on improving transport and travel flow (*e.g.* advanced traffic signal control and buyer incentives for alternative vehicle technologies). At the same time, policies that improve roadway travel can have rebound effects (*i.*e. increased motorisation due to improved travel flow). Short-term system improvements, therefore, should seek to serve or at least complement long-term objectives rather than temporarily relieve existing transport problems. These improvements include supporting travel choice (*e.g.* park-and-ride stations), addressing shortcomings in existing public transport networks (*e.g.* redesigning bus routes and frequencies) and building more efficient travel infrastructure, such as BRT and light rail (Box 13). Additional policies include incentives that encourage shifts away from private vehicles (*e.g.* employer tax credits for providing public transit passes).

Congested cities. Heavy traffic makes getting around in congested cities very difficult. Travel demand management policies are useful tools to improve and facilitate shifts to more energy efficient travel while improving existing travel movements. Policies that discourage vehicle ownership (*e.g.* vehicle quotas and vehicle registration taxes) and private motorised travel (*e.g.* road pricing and parking fees) can help to reduce or stabilise increasing traffic levels. Improved travel-management technologies, such as advance traffic signalisation and real-time travel information, can help to improve mobility and system flow, while incentives (*e.g.* rideshare incentives) can encourage additional shifts to more efficient travel.

In the short term, policies and programmes that respond to existing gaps in travel networks (*e.g.* seamless connections between travel modes) can help to improve passenger travel and encourage shifts away from private motorised vehicles. The policy tools are even more effective when paired with travel demand management measures (Box 14). Medium- to long-term policies that address transport system development (*e.g.* increased

Box 14

Singapore: measures to counter congestion and increase modal shift

Between 1996 and 2007, daily travel demand in the city-state of Singapore grew by more than 1 million trips per day, and the number of vehicles in Singapore increased by 27%, while public transport trip share declined by nearly 5%. By 2008, the physical constraints of the island state could not continue to accommodate additional vehicle growth. In response, the Land Transport Authority (LTA) of Singapore released a Land Transport Master Plan in 2008. The plan called for three key strategic shifts in land transport policies, including making public transport a choice mode and improving management of road usage. To accomplish these goals, LTA adopted a commuter-centric approach to create a more integrated and service-oriented public transport network. This approach included improving bus and rail frequency and implementing a contactless smart card system for public transport through a distance travelled, fully-integrated (no transfer fees) transport fare structure. The city increased road priority for buses and began work to double the rapid transit network by 2020. It also revised the city's Electronic Road Pricing (ERP) rate structure to ensure that rates were effective at influencing motorist behaviour, and it revised the vehicle quota system (VQS) to limit the number of vehicle registrations to 1.5% per annum, including an upfront (upon purchase) vehicle tax that is equal to 100% of the open market value of the vehicle.

Sources: LTA, 2008; Yap, 2012.

funding streams to develop and improve public transport services) and an improved land-use transport interface (*i.e.* improved match between travel demand and destination) will encourage longer-term shifts to more efficient travel.

Multi-modal cities. They often have strong public transit systems and dense urban cores, but they can still achieve additional efficiency improvements. Policies that improve traffic flows and travel options can encourage greater shifts to more efficient modes and increase efficiency of the entire transport system. These efforts include development of dedicated facilities for energy efficient modes (*e.g.* bus and cycling lanes) and investments in vehicle technology improvements for both public and private vehicle fleets (*e.g.* CNG buses and "green" taxi programmes) (Box 15).

Urban roadways can often be urban dividers, splitting communities in two and making it difficult to reach local destinations.

Box 15

Paris, France: multiple approaches to traffic reduction and efficiency improvements

*The French government passed a law in 1996 requiring all French municipalities of more than 100 000 people to develop a master plan to reduce transport related energy consumption and improve air quality. In response the city of Paris created the Urban Mobility Plan (PDUIF) in 1998 in conjunction with separate land-use plans and regional energy and climate schemes. PDUIF focused on all aspects of transport, including mass transit, NMT, parking, traffic management and energy use. To meet PDUIF objectives, Paris implemented numerous initiatives to improve transport in the capital region, including expansions of public transport infrastructure, development of dedicated bus lanes and the introduction of the Vélib' cycling-share programme (more than 20 000 bikes in 1 800 stations around the city). The city also reduced on-street parking and trimmed several boulevards from six vehicle-lanes to two traffic lanes, two bus lanes, with the remaining space going to pedestrians, bicyclists and green space. The results of the diverse measures led to a 24% reduction in driving in Paris between 2001 and 2010. During the same period, travel on regional rail into the city increased by nearly 30%, while metro rail trips increased by more than 18% and bus travel increased by 10%. In response to the success of the programmes, Paris has continued to expand initiatives, including additional street closures and improved public transit (*e.g. *automated trains on metro line 1). The city also introduced in 2011 an electric car-sharing scheme, Autolib', to encourage eco-friendly travel and to discourage vehicle ownership. More than 3 000 cars in 1 000 stations are being made available in the Paris region.*

Sources: Freemark, 2010; Fried, 2008; Mairie de Paris, 2011; STIF, 2012.

Travel demand management policies are particularly useful in multi-modal cities to maintain or improve travel shares by more efficient transport modes. Examples of policies used to achieve additional improvements in transport system efficiency include transit-incentive programmes, car-free zones, parking levies and road pricing schemes. Cities are increasingly turning to technology to improve urban travel and transport efficiency. This technology includes "real-time" updates of road conditions and transit arrivals, smart-phone travel applications and online journey calculators. Other practical tools, such as geospatial analysis software, can help cities to identify gaps in transport services and infrastructure (*e.g.* proximity to transit and sidewalk access to bus stops).

Effective policy measures seek to achieve both immediate transport objectives (Table 10) and long-term city goals. These objectives can entail broader goals for the city, including economic growth, social equity and improved health. For example, the Mayor of London announced a transport vision in 2008, called "Way to Go!", as part of a broader set of social, economic and environmental goals for the city. The transport strategy contained six broad targets for transportation, including improving the travel safety of all Londoners, supporting economic development and population growth, improving transport opportunities for all travellers and reducing transport's contribution to climate change (GLA, 2008). Specific transport policies were created to achieve the stated goals.

Bike-share programmes, such as Vélodi in Dijon, France, have been implemented in numerous cities throughout Europe and they have encouraged considerable shifts in urban modal shares.

Table 10 Common policy targets and policy responses

	Developing cities	*Sprawling cities*	*Congested cities*	*Multi-modal cities*
Increase density	Minimum density requirements, transit-oriented development, mixed-use zoning, clustering		Affordable housing programmes, zoning reform, builder incentives, smart growth reforms	
Improve transport network	Park-and-ride facilities		Bus-/taxi-only lanes	
	BRT network development (with feeder routes)			
	Formal transit development	Light/Commuter rail	Trolley/Metro/Light rail	
	Prioritised bus lanes and signalisation		Complete streets design	
	Dedicated pedestrian infrastructure and cycling lanes	High-occupancy vehicle (HOV) lanes	Cycling lanes	
	Seamless transport (interconnectivity): easy, accessible, demarcated connections between travel modes (*e.g.* bus to metro)			
	Road freight to rail facilities			
Reduce driving	Tele-working programmes		Transit incentives	
	Parking maximums/restrictions, fees and levies			
	Road pricing/tolls		Congestion pricing and vehicle quotas	
	Vehicle registration tax/pay-go fees/fuel prices and taxes			
	Improved public transport services and increased frequency/reliability			
	Carpool/rideshare programmes		Integrated ticketing for transit	
	Freight delivery restrictions			
Improve safety	NMT facilities: separated cycling lanes, sidewalk improvements, zebra crossings, median barriers/islands (mid-road protection for crossing pedestrians)			
	Safe routes to transit/school programmes			
	Traffic-calming measures: lane narrowing, road "diets" (reduction in lanes), speed reductions, one-way to two-way streets, street closures, reduced speed zones, improved signalisation		Traffic-calming measures: speed bumps, curb extensions, "shared space" roads, cyclist/pedestrian priority roads, chokers (narrowing at crossroads), pedestrian zones (reduced speed), car-free zones	

When considering responses to transport and travel needs, policy makers should identify targets and policy goals that respond to the local context and transport issues. For example, a city with increasing private motorisation may set a broad target to improve travel choices and to double the share of trips taken by public transport over the next 10 years (*e.g.* the International Association of Public Transit's [UITP's] "Public Transit x 2" [PTx2] challenge). This kind of broad policy objective can help to frame specific policy decisions in response to identified needs – for example, building a BRT network to provide greater travel choice and support increased public transit use.

Box 16

Lagos, Nigeria: committing significant investments to double public transport

The 2005 Lagos State Transport Master Plan set a vision for the city to develop integrated and sustainable transport by 2020. This Plan included specific targets to (1) alleviate poverty through reduction in transport costs, (2) support economic development through capital transport projects, and (3) reduce transport emissions through increased public transport use. In particular, the state committed to the UITP PTx2 challenge, setting the goal to double formal public transport share by 2025. As part of that objective, Lagos and the government of Nigeria committed significant investments to implement and operate higher quality, efficient public transport in Lagos. This investment included state funding for BRT network development in Lagos, which has led to a reduction in average transport costs by 50% for commuters, while also reducing congestion and improving travel time along the BRT network by as much as 40%. In 2010, the governor of the state also adopted additional new policies to transform public transport in the city from a system of informal operators to a regulated, benchmarked system. Those reforms and increased commitment by the state have attracted additional private-sector participation, including a consortium of local and international companies that will operate and maintain the city's new metro rail line. The governor has continued to adopt innovative financing methods, including private-public partnerships, to fund capital investments in the transport sector. More information on commitments to the UITP PTx2 challenge can be found on the PTx2 Showcase webpage.

Source: UITP, 2012.

How can measures be combined to increase impact?

Analysis of existing transport efficiency policies and projects demonstrates the need to approach transport efficiency improvements from a holistic perspective. Single improvements in one area may be lost to changes in another. For example, vehicle efficiency improvements have been offset by growth in motorisation, increased travel distances and switches to private vehicle travel from public transport and NMT modes (Greene *et al.*, 1999; IEA, 2012b).

The complexity of transport systems requires a strategic approach to achieve transport efficiency improvements with supporting measures that

Table 11 Examples of urban transport policies and their potential co-benefits

Benefits / Policy options	GHG emissions reduction	Improved air quality and health	Reduced congestion	Increased transport accessibility	Improved road safety
BRT	Medium	Medium	High	High	Medium
Light-rail or metro rapid transit	Medium	Medium	High	Medium/ High	Medium
Rail	Medium	Low	Medium/ High	Medium	Low
Low-carbon vehicles	Medium/ High	High	Low or Negative	Low or Negative	Low or Negative
NMT	Low	Medium	Medium/ High	Medium/ High	Medium
Land-use planning	Medium	Medium/ High	High	High	Medium

Sources: Ang and Marchal, forthcoming; adapted from UNEP, 2011.

ensure policy implementations achieve their intended impact. Complementary policy measures can be as simple as outreach and public awareness campaigns, and can include broader land-use regulations and reforms, travel demand management tools, and energy efficient transport infrastructure development.

Transport efficiency improvements can also have increased impact when they are planned using a co-benefits approach that addresses the relationship between transport and other urban issues, such as health improvements, social development, economic growth, and climate change adaptation (Table 11). By developing "synergies" between transport and other urban policies, policy makers can effect changes in the transport sector that are integrated into overall urban policy objectives, which can help to secure broader support for transport initiatives and ensure that policy goals are considered in wider urban policy discussions.

Conversely, a co-benefits approach can help to incorporate other urban policies into transport initiatives. For example, transport development can increase the long-term resilience of infrastructure by including climate risk screening tools and vulnerability assessments into transport planning (Ang and Marchal, forthcoming).

Which stakeholders should be involved in policy making and implementation?

Actors involved in urban transport projects are not limited to city and regional elected officials and civil servants (Table 12). Often national governments are involved in the planning, financing and implementation of projects that extend beyond municipal lines and are deemed of national interest (Box 17). Non-governmental bodies such as civil-society associations, consumer groups and private companies can also play key roles.

Table 12 Urban transport stakeholders

Diverse urban transport stakeholders
Local, regional and national policy makers and legislators responsible for approving policies and overseeing their implementation
Regulators responsible for maintaining environmental quality, setting transport prices and regulating competition issues
Residents
Land-use planners and transport planners providing the conceptual ideas and directions on the shape and structures of cities and the urban transport systems
Land developers implementing land-use plans and thereby influencing the transport demands
Financing groups including local, regional, national and international bodies/institutions, as well as public and private groups, who provide financing for transport systems
Technology providers, for example, providers of vehicles, fuels and ITS
Public and private providers of commercial goods and passenger transport
Private companies and public organisations requiring the transport of goods and persons
Community-based organisations

Source: WRI, 2007.

Box 17

Grand Paris: national interest unites local jurisdictions to create dynamic global city

The greater Parisian metropolitan region is home to nearly 10 million people, covering more than 2 500 km² and numerous urban zones ("territoires") and jurisdictions. Transport throughout the metropolitan region is in the form of an "étoile," or star, meaning that major transport lines, including principal roadways, trains and public transport, all converge on the capital city of Paris. The result is a heavy influx of traffic into and out of Paris and a mismatch of transport provisions between economic centres throughout the metropolitan region and energy efficient transport options: within Paris central, public transport accounts for two-thirds of passenger trips; in the surrounding region, less than one-fourth of trips are by public transport.

The Grand Paris project seeks to strengthen the French Capital Region and enhance its role as a global city and an internationally competitive economic growth driver. The project, launched in 2007 by former French President Nicolas Sarkozy and former Minister Christian Blanc, includes the construction of more than 100 miles of automated subway lines and 57 new stations, linking the suburbs around Paris in a massive "figure eight".

This new transport network seeks to improve the mobility of residents and workers in areas outside of the Paris capital by eliminating the need to come into the city to make connections, while also increasing the use of public transport in the metropolitan region.

The project is unique in that it goes beyond administrative and social borders in the interest of the common good, drawing in key areas outside of the city of Paris, including the Plateau of Saclay (a research and innovation centre) and Saint Denis (a growing business district with a focus on creative industries.

To date, the French national government has played an essential role, particularly regarding transportation issues and the overall coherence of development, policies and financing. However, mobilisation of all sectors has played a key role in the development of the project, from local officials (especially in suburb cities), to international investors, small innovative businesses, researchers, urban planners and neighbourhood associations. This co-ordination has been pivotal in the allocation of resources across the numerous metropolitan jurisdictions especially as the Grand Paris project is expected to last more than 15 years, with the metro alone costing more than EUR 35 billion.

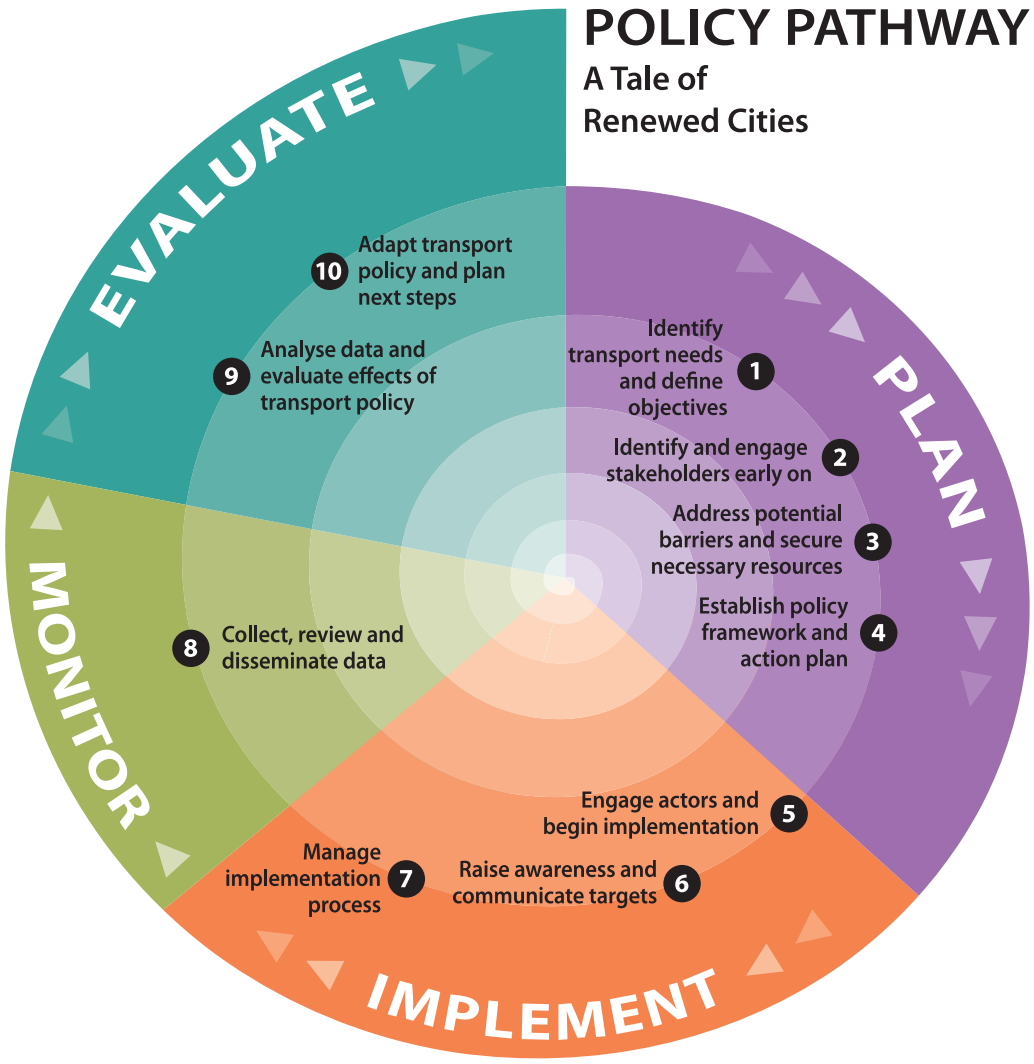
Source: Missoffe, 2012.

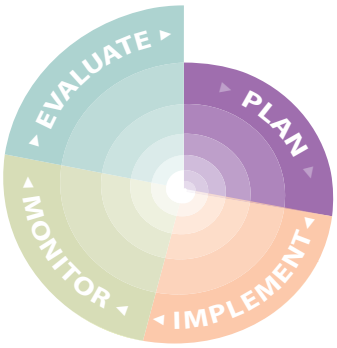
Local government officials, particularly mayors, are very important in urban transport system improvements. Cities often have direct ownership of city roads, pavements, sidewalks and on-street car parking. Thus many mayors have the capacity to set and enforce policies related to urban transport systems. This control enables mayors to introduce cycling lanes, congestion charging (road pricing), BRT and EV charging infrastructure, etc. Often mayors also exert control over the major public transport services and taxis through regulation and policy setting (ARUP, 2011).

Numerous stakeholders can play a role in the success of urban transport policy measures, including informal stakeholders, such as this bicycle repair service in Accra, Ghana, where bicycling still remains a common form of travel.

How to achieve transport system energy efficiency improvements: the policy pathway

The pathway to improving energy efficiency in the urban transport system includes four stages – plan, implement, monitor and evaluate – with ten critical steps. The steps were developed from experiences drawn from successful policy implementations and expert input from practitioners. The examples represent a wide variety of transport systems, as well as a broad range of urban environments, local travel needs and economic contexts.





PLAN

Effective implementation of transport efficiency policies can require regulatory actions, stakeholder outreach, secure funding streams and institutional preparedness. The planning phase includes administrative, technical and financial preparation to set the stage for implementation of proposed policies. The involvement of stakeholders from an early stage is also important because it increases the likelihood of acceptance once policies are implemented, and it helps to ensure that policy proposals reflect not only energy efficiency objectives but also transport, economic, social and environmental needs. The following steps – with important questions to ask – will help to plan policy goals, objectives and actions to achieve successful project implementation later on.

❶ Identify transport needs and define objectives

The first steps toward improving implementation of energy efficiency in the urban transport system require asking several specific questions:

Where are we now?	Identify issues and needs.
Where do we want to go?	Define the objectives.
How do we get there?	Identify policy responses.

Identify transport issues and user needs

Identifying present transport issues and expected future needs helps to organise responses to improve transport system efficiency (Box 18). Issues to consider include:

Mobility	Are mobility needs of households, businesses and public services understood? Do relationships exist between socio-economic status, access to services and employment, and travel distance, time or mode? Where is mobility service compromised? How are people and goods moving, and what are future mobility needs? What are city modal shares (Box 18)? Are low-energy modes utilised? If not, why not? Are travel times becoming longer? Have the costs of congestion and excessive travel times been assessed? What is the role of transport (including private vehicles) in the city?
Infrastructure	Is the transport network in a state of good repair? Can it accommodate expected growth? Are existing modes effectively connected? Can visitors unfamiliar with the city easily use public transport modes to get to their destination? Are ticketing systems convenient, and do they enable journeys that are transferable across different modes and operators? Is the transport network secure and reliable? Are alternative routes available if one leg of the network fails? Is there an existing transport system development plan and an effective system maintenance and development strategy?

Land-use	Where do people work? Where do they live? Where do children go to school? What are the size and density of the city? How is it zoned? Are destinations far apart or randomly dispersed, or are there high-density and activity nodes? Is development occurring outside the city centre? What governmental mechanisms exist to change the built environment?
Economy	What is the urban economic structure now? Is there consensus among stakeholders on its future direction? How should it affect and be affected by transport and travel? Is a lack of mobility negatively affecting the ability of a significant number or a class of citizens to access better employment?
Governance	Who are the decision-making entities at the national, regional and city level? Are their objectives and roles aligned to support public transport systems? Are planning laws effective? Are transport services regulated? How is transport funding distributed? Is institutional capacity strong?
Population	Is city population growing? Is it aging? Are travel needs changing?
Preferences	Is demand shifting? Do time and costs influence or affect travel choice? Do cultural values and behaviours need to be understood in developing transport options?
Climate	How do weather and geographic setting affect travel needs and decisions? Does the regional climate affect the transport system? Will climate change threaten the system?

Box 18

Mobility surveys and modal shares: identifying energy efficiency in urban travel

Mobility surveys are critical to understanding the movement of people and goods throughout cities, but these surveys can be both expensive and time consuming. The design and scope of the surveys, therefore, should be carefully defined to obtain the desired information. Often surveys define a trip as the principal mode taken from the starting point to a final destination, without considering feeder modes (i.e. other modes used to get to and from the principal travel mode). This definition can artificially increase the distance of the principal mode, while skewing the distance travelled or the number of trips taken by non-principal travel modes. Mobility surveys also often express modal split as the share of trips performed by travellers using a given transport mode. However, 25% of trips by bicycle or walking does not equate to 25% of total distance travelled or 25% of energy consumed. Surveys need to choose appropriate measurement units when addressing modal shares and urban transport energy and emissions. The IEA refers to modal share as the split of distances travelled per mode (in contrast to trip modal shares).

Define objectives

Once transport issues and system needs are identified, policy makers need to define objectives that address them (Box 19). Goals can be straightforward descriptors of necessary outcomes (*e.g.* faster journey times, more journeys and reducing energy consumption by 20% by 2020), or they can be broader visions that set the tone for subsequent policy responses. For example, the city of Vienna, Austria developed a Transport Master Plan in 2003 with broad targets to reduce private motorised transport and emissions, enhance traffic safety and improve mobility for people and goods (Wien, 2006). Policy makers should consider both short- and long-term objectives, ensuring that the objectives are effectively integrated. The targets and improved services that the public can expect to see as a result of the policies should be clearly expressed to the community.

Identify policy responses

Broad transport objectives do not necessarily translate automatically into specific policy actions. The next step is to identify policies that will help to achieve the selected transport objectives. For example, NYC set a goal to expand sustainable transport choices in 2007 (PlaNYC, 2007; DOT, 2008a). In response, the city identified more specific policy actions to improve and expand bus services, such as granting authority to the NYC DOT to implement bus-only lanes. Similarly, Buenos Aires outlined transport objectives for prioritising public transport and creating healthy mobility and then implemented specific policy responses such as redesigning the routes of public transport and expanding bus-only lanes (Box 20). Examples of other potential policy responses can be found in Table 10 (set out in previous section).

Box 19

New South Wales, Australia: Transport Master Plan and public feedback

Over the next 20 years, the state of New South Wales (NSW) in Australia is expected to grow by nearly 2 million people. With more people, increased crowding on public transport and congestion on roads, NSW, the largest economy in Australia, needs to meet increasing demand for mobility and economic growth with a strong, modern transport system. In response, NSW released a brief, four-page discussion paper in February of 2012 that highlights the major challenges facing the NSW transport system and sets broad objectives for a long-term Transport Master Plan. The paper listed questions asking for feedback on the strength and appropriateness of the objectives, the importance of identified issues and needs, and the potential methods to fund improvements. NSW also held community forums throughout the state to seek views on how to improve transport. Those forums and feedback on the discussion paper were applied to issue a draft Master Plan in September 2012. The draft plan included three major objectives: putting the customer first; integrating, modernising, growing and managing the transport system; and developing an integrated approach to transport planning. The draft also identified six major areas of transport challenges in NSW, as well as actions on how NSW transport plans to address these challenges. To provide a transparent process informed by public opinion and expert input, NSW transport opened the draft plan to public feedback, including a dedicated webpage with information regarding NSW transport issues and needs, the consultation process, and the future NSW Long Term Transport Master Plan.

Sources: NSW, 2012a; NSW 2012b.

Box 20

Buenos Aires, Argentina: policy responses in support of sustainable mobility options

More than 13 million people live in the metropolitan area of Buenos Aires, and more than 2 million people commute into the city centre daily. In 2009, 54% of those commuters travelled by private vehicle, amounting to more than 900 000 cars entering the city daily, and traffic was increasing – at roughly 16% per year in 2009. To combat growing motorised traffic and its impacts on the city and its transport system, the city of Buenos Aires developed a Sustainable Mobility Plan in 2009. The plan outlined four transport objectives for the city, including; prioritising public transport, creating healthy mobility, planning for traffic and road safety, and instituting intelligent mobility. To achieve those objectives, the city implemented specific policy responses, such as prioritisation of public transport by redesigning system routes, expanding bus-exclusive lanes, and implementing a BRT system (Metrobús) and cycling-share programme (Mejor en Bici, or Better by Cycling). By 2012, Buenos Aires had constructed 25 km of bus-priority lanes, 12 km of trunk lane for Metrobús and more than 70 km of protected on-street cycling lanes. The city also installed 21 Mejor en Bici stations with 600 bicycles across the city. The results of the initiatives to date are more than 90 000 daily Metrobús users, resulting in an average travel time savings of 40% for Metrobús passengers. Metrobús has also contributed to improved traffic flow along the BRT corridor, while bus-priority lanes have led to an average travel time savings of 20% for the affected bus lines. Cycling in the city grew 128% in 2011, and Mejor en Bici has an average of 3 500 users per day. Because of the programmes' success, Buenos Aires now is studying the potential to add more than 200 km of new BRT corridors in the city, and it is expanding Mejor en Bici to 100 stations by 2013.

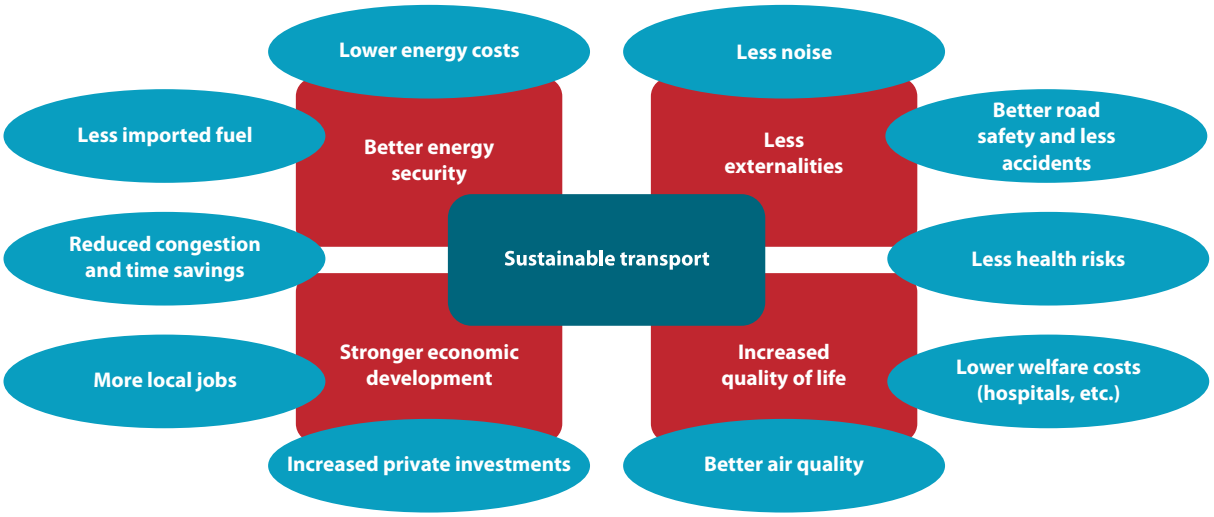
Sources: Buenos Aires Ciudad, 2009; Chain, 2011; Dietrich, 2012; ITDP, 2012.

Consider co-benefits and complementary measures

The need for efficient transport systems in urban areas is critical, but efficiency is not the only important issue in urban transport. An effective and energy efficient transport system is a means to many ends. Transport systems need to support economic growth, improve urban environmental quality, increase safety, improve quality of life and contribute to poverty reduction. In developing countries in particular, the negative externalities (*e.g.* increased air pollution, road injuries, fatalities and congestion) of transport growth highlight the need to approach transport from a perspective that considers the multiple motivators, outcomes and co-benefits (Figure 7). In other words, simply building more roads to add capacity for growing travel demand will not facilitate long-term social and economic health in developing cities (IGES, 2011). A strategy that draws on an integrated set of policies to serve multiple outcomes, on the other hand, will stimulate the needed changes.

When addressing urban transport issues, policy makers can implement a multiple-benefits approach that capitalises on common threads between multiple urban issues. For example, road safety programmes can be paired with road-travel demand policies to redouble efforts to improve travel movements while addressing energy efficiency and roadway congestion. This multi-pronged approach can accomplish significant urban benefits beyond a traditional supply-demand approach that focuses only on meeting demand for travel capacity (Figure 7 and Box 21). Likewise, the multi-pronged approach can be used to engage additional stakeholders and funding by incorporating the co-benefits of energy efficiency policies in the planning and development phase of projects, rather than only considering the co-benefits as post-project added value. In utilising this approach, policy makers must understand how policy measures can complement one another and be implemented to support multiple goals.

Figure 7 Examples of co-benefits from transport system efficiency improvements



Source: GIZ, 2012.

Box 21

Mexico City, Mexico: Metrobús, co-benefits of BRT development

In 2002, private vehicle use in Mexico City, Mexico – increasing at the rate of roughly two new vehicles for every child born in the city – was contributing to alarming traffic volumes and air quality issues. More than 80% of days in 2002 exceeded city ozone standards. In response, the city began the development a 67 km BRT system, Metrobús, in 2005 as part of the Programme to Improve Air Quality in the Mexico City Metropolitan Area. The city also purchased high-capacity, higher-efficiency, articulated buses for Metrobús, which replaced over 260 inefficient peseros (microbuses). By 2007, Metrobús accommodated more than 600 000 passengers per day. This new system contributed to a 15% mode shift away from passenger cars – the equivalent of 72 000 people leaving their car each day – and numerous additional benefits to the city, including reduced travel times (between 40% and 50% improvement along Metrobús corridors), decreased fatalities (84% reduction in annual fatalities along the Insurgentes Avenue corridor), and emissions reductions (nearly 80 000 annual tons of CO_2, 690 annual tons of NO_x, and 2.8 annual tons of particulate matter). Together, the co-benefits from the BRT system are estimated to reduce annual economic losses (e.g. from lost time, fatalities and health issues) by more than USD 12 million (Martinez, 2007). Emissions reductions from Metrobús also generate revenue for the city: between 2005 and 2008, the city received an average of USD 192 000 a year from carbon credits for CO_2 reductions.

Sources: Ortega-Alcazar, 2006; Martinez, 2007; Voukas, 2011.

❷ Identify and engage stakeholders early on

Stakeholders play an important role in the successful implementation of urban transport policies. They provide critical support and feedback and can have valuable experience with specific transport projects. Engaging stakeholders can increase awareness of policy objectives, help to ensure support and approval of policy goals, and bring in additional resources, including funding. Identifying and engaging stakeholders early in the planning process, therefore, can be extremely beneficial.

Identify	Who contributes to decision making (*e.g.* political leaders and city agencies)? Who has resources (*e.g.* financial institutions and business leaders)? Who has power to support (or hinder) implementation (*e.g.* lobbyists)? Who is affected by the proposed policies? (Ensure that the values and accountabilities that motivate decisions are understood.)
Prepare	How will stakeholders be involved? What outreach is necessary? What will be the roles and responsibilities of stakeholders? What information and resources are needed? What are potential conflicts? How will they be resolved?
Engage	What do stakeholders think of policy objectives and responses? What do they see as critical needs for improvement? What do they want transport and the city to look like? What barriers do they think exist? Do they have related project experience?
Co-operate	How can stakeholders be engaged in the planning and implementation process? What feedback requires response? Are any concessions necessary?

Identify and engage stakeholders

The number of stakeholders involved in transport policy implementations can be considerable. They can include city departments and authorities, transport operators, contractors, lenders and activist groups. Some stakeholders are critical to policy implementation (*e.g.* financial institutions and city authorities*)*. Others may oppose policy changes. It is, therefore, important to identify stakeholders, understand stakeholder needs and work with them to achieve policy implementation goals.

Stakeholders – a structure for ensuring effective consultation. Effective consultation is achieved by clarity, consistency and communication. Consultation with stakeholders is important for public transport system policy and system design because of the complexity and implications of transport investments at national and local levels. The consultation process should be transparent to ensure that all relevant stakeholders understand what is under consideration and the roles expected of them (Table 13). Engaging an independent consultation expert can help provide sound feedback and give all involved confidence that the consultation is genuine and will be effective.

Table 13 Stages of stakeholder consultation

Consultation stages	*Objective*
Planning	Design a transparent learning process that clarifies issues, enables views to be heard and "publicises" the opportunities with relevant stakeholders
Draft option proposals and key feedback questions	Make clear to all stakeholders the features and costs/benefits of various options. Ensure counterfactuals are clear and the costs of ongoing congestion or inadequate mobility services are outlined
Consult	Ensure clear communication and reliable feedback collection. Fulfilling this objective may include separate meetings with critical stakeholders.
Feedback report	Ensure stakeholders can see they have been heard and feedback on issues is clearly conveyed to decision makers
Consider future roles for stakeholders	Ask if those involved can also assist with implementation and longer-term operational feedback

Keep stakeholders involved

Stakeholders can be valuable long-term allies. Involving them in the planning and implementation process and keeping them informed of decisions and progress helps to ensure the success of policy objectives from planning to achievement (Box 22).

Stakeholders can also provide valuable ongoing support and resources (Box 23). Identifying roles and activities to keep them involved will encourage continued interest and involvement and will help to ensure long-term policy success.

Box 22

Eindhoven, Netherlands: engaging stakeholders and citizen involvement

As part of a broader initiative to engage citizen involvement in city planning and policies, the city of Eindhoven in the Netherlands established a programme on citizen participation in 2008 called "Maak't mee!" (or, roughly, "'Join in" or "Experience it!"). The programme was developed as part of a strategic objective to improve governance through an interactive experience that empowered citizens and stakeholders to be actively involved in shaping city policy. This programme involved various initiatives, including thematic- and location-based projects as well as information campaigns. Specific rules of engagement were defined to make it clear when, how and to what extent stakeholders and citizens were involved in the policy planning process. The city engaged stakeholders, such as borough organisations, to support initiatives to target citizens in their respective networks. Initiatives included meetings, information-sharing, and awareness-raising campaigns. In addition, the city did extensive research in partnership with universities and local institutions. Research results were used to evolve the programme and continually increase participation. Over the course of the two-year programme, citizens became actively involved in programme initiatives.

Source: Christiaens, 2012.

Box 23

Moscow, Russia: art in the metro, increasing ridership through public partnership

As part of its objectives to raise awareness and attract increased ridership in public transport, Metro Moscow in Russia has paired with numerous public partners to bring art into the metro (since 2007). Partners have included art galleries and museums, Russian porcelain factories, foreign embassies in Moscow and popular Russian chamber orchestras. Art and music exhibitions have been placed in metro stations and on trains, including the specially designed train on the Arbatsko-Pokrovskaya line, and exhibits are changed regularly. The metro art programme has drawn a great deal of attention and support from both the public and mass media in Russia, while it has improved service quality and the public transport experience in Moscow. This is evident in the lack of vandalism in the stations and trains with exhibits: during the five years of expositions, not a single case has occurred of damage or vandalism to the interior of the metro cars or to the reproductions of paintings on display.

Source: UITP, 2012.

Explore co-operation and partnership opportunities

Co-operation and partnership opportunities are increasingly valuable tools to achieve transport policy objectives, especially in light of budget constraints and limited city resources. Collaboration with stakeholders can be as simple as co-ordinated activities (*e.g.* joint launches of programmes and initiatives), or it can be in the form of official partnerships that combine financial resources or delegate roles and responsibilities (*e.g.* ensuring national and local policy makers are aligned with local transport operators). This collaboration can be particularly useful with regards to financing policy objectives. Other potential partners include government agencies and public organisations with common motivations (*e.g.* environmental advocacy groups). Partnerships can also include private-sector stakeholders, such as urban developers and transit operators, and sister cities that have implemented or are pursuing similar policy objectives (Box 24).

Box 24

C40 cities: partnership for sustainable transport action in megacities

Forty mayors from megacities across the globe – in both developing and developed countries – came together in 2006 to commit to work collaboratively to address global climate change through sustainable urban practices. The group, known as C40, agreed to work together to share best practices to support climate actions in multiple sectors, including transport. By 2011, C40 cities had implemented more than 900 actions that address urban transport and mobility. Key actions include the development of dedicated cycling lanes and priority bus lanes, congestion charging schemes and restrictions on cars entering city centres. More than 15 cities have introduced high-efficiency, ultra-low emission buses, and 13 cities have implemented policies to improve taxi fleet efficiency and emissions. Today, C40 represents more than 60 cities that continue to share practices and implement multiple measures to improve transport system efficiency and quality, while also supporting economic growth and other urban sustainability measures. More information can be found at www.c40cities.org.

Source: ARUP, 2011.

❸ Address potential barriers and secure necessary resources

Many barriers to implementing transport efficiency policies can arise, including financial constraints, legal restrictions, regulatory frameworks and public opposition. Identifying potential barriers early in the planning process can help to formulate responses before barriers delay or inhibit policy initiatives.

Identify	What are potential barriers to policy implementation? Do regulations or policies impede or inhibit sound policy action? Do potential actors or groups oppose the policy? Is there political support for the proposed initiatives? Is there funding? Is critical data missing?
Prepare	What actions can be taken to respond to barriers? Can a legal framework, new policy or political process be implemented to address barriers or accelerate progress to achieving policy goals? Can stakeholders be involved in overcoming barriers? Will concessions or compromises be necessary?
Respond	How should responses be organised and orchestrated? When should they be applied? Do responses require multiple engagements or specific timing? Who should be involved? Is there a target audience?

Identify barriers and formulate responses

As discussed earlier in this pathway, there are many barriers to effective policy implementation. Anticipating and planning for barriers is essential to policy success.

Actions, such as seeking early legislative approval to establish political authority to implement policy initiatives, outreach to potential opposition organisations, partnerships with public agencies and transport advocacy groups and launching public outreach and awareness campaigns, can be pre-emptively taken before barriers hinder progress (Box 25). For example, the City of London had to request legislative authority to establish a statutory body, the Greater London Authority, to have the legal right to develop and implement a congestion pricing scheme through a central transport decision-making authority for the London metropolitan region (Greater London Authority Act, 1999). The General Assembly of the Municipality of Budapest similarly had to approve a new transport authority, the Budapest Transport Centre (BKK), in 2010 to replace a fragmented management structure of diverse transport and urban planning agencies and authorities (Heves, 2012; BKK, 2012). The approval gave BKK the authority to implement policy initiatives that otherwise would have required significant agency co-ordination and political will.

Box 25

San Francisco, USA: improving parking through smart technologies, public awareness

The San Francisco Municipal Transportation Agency (SFMTA) in California, United States launched a new parking initiative in 2011 called SFpark. SFpark is a pilot parking management system that employs real-time information about where parking is available. The management system also applies demand-responsive pricing, with enforced minimums, to reduce parking demand in over-used areas. SFMTA is testing the technology on 7 000 metered spaces throughout the city, and the initiative is expected to support the broader objectives of SFTMA to improve transport in the city. Because changes to the city's 28 000 metered-space system were expected to draw criticism and opposition from motorists and affected businesses, SFMTA worked with numerous partners – including government agencies, academia, and communications strategy and marketing groups – to increase public awareness of the initiative and how it will improve transport and parking in the city. This outreach included development of a webpage that describes the program and its benefits as well as an animated video that describes present parking issues in the city and how the management technology will help. SFMTA also released a report in 2012 on Draft Policies for On-Street Parking Management. Since launching the test pilot, the city has continued to work with partners to address complaints and adjust parking rates to ensure the long-term feasibility and success of the initiative.

Sources: Bialick, 2012; SFpark, 2011.

Secure necessary resources: technical, institutional and financial

Successful implementation of transport efficiency policies can require significant resources, including technical, institutional and financial support. Long-life assets are needed to achieve service improvements and energy efficiency objectives, and these assets generally require long-term investments.

A wide range of options are available, and all options should be explored. Securing resources early on can help to prevent any significant delays or complications in the implementation process, especially because transport projects often can run over schedule and over budget. Resources to consider include:

Technical	Are specific tools or technologies required to implement the policy initiative? Will training or guidance be necessary prior-to, during or after implementation? Does the implementing agency or authority have the technical capacity to achieve the implementation on its own? Will technical support be required for public users?
Institutional	Does governance structure provide sufficient administrative mechanisms to address transport challenges? Does the implementing body have the experience and knowledge to manage the implementation process? Does it have the authority to implement changes? Will additional staffing be required? Should external consultants or project managers be hired?
Financial	Can policy objectives be achieved under general transport budgets? Are new funding streams necessary, and if yes, how can these be acquired? Is national or international funding available? Should alternative financing (*e.g.* public service contracting) be pursued?

Box 26

Stockholm, Sweden: improving metro service capacity through mobile technology

The Stockholm Local Transport Authority granted a franchise agreement to Mass Transit Railway (MTR) Stockholm in 2009 to plan, operate and maintain the Stockholm underground metro. Under the agreement, MTR Stockholm pledged to increase customer satisfaction and attract new metro travel through increased staffing, improved punctuality, reduced departure cancellations, and a cleaner metro. A key factor in achieving the pledge was improved relay of system information. MTR Stockholm engaged Appear and Logica, two business and technology solutions providers, to implement the "Appear IQ" mobile transport technology, which allows MTR Stockholm to have instant access to system information (e.g. disruptions) and dispatch staff immediately to precise locations (e.g. in the case of an emergency). Appear IQ allows MTR to improve service provisions (e.g. direct request for handicap access) through instant communication between staff, stations and managers.

Source: UITP, 2012.

Box 27

Kayseri, Turkey: PPPs to improve transport system technology

Kayseri is a rapidly growing city with quickly increasing travel demand. To encourage the use of public transport and to facilitate trips on all public transport modes, the Kayseri Municipality System (the public transport authority) launched an integrated, paperless ticketing system, Intracard, in 2010 in collaboration with Smartsoft, a smartcard technologies firm, and AktifBank, a transport provider. The PPP was designed to acquire and implement the Smartsoft technology through a concessionary agreement with AktifBank, which is responsible for operating the transport system and managing the Intracard system. This responsibility includes adding the Smartsoft validator in buses as well as sales kiosks (for recharging cards) and point-of-sale (POS) terminals (to purchase cards) in strategic locations throughout the city. POS terminals are rented to merchant stores, such as cafés and shopping centres, and merchants in turn pay a marginal rental fee over POS turnover. By using Smartsoft Intracards, merchants can also load loyalty points on cards (i.e. customer rewards). Intracards likewise will help to prevent corruption by transport operators by eliminating cash transactions in buses.

Source: UITP, 2012.

Technical. Technical capacity to implement proposed policies can range from knowledge-based needs (*e.g.* engineering expertise) to technological capability, including operations and maintenance software tools and specific transport technologies (*e.g.* on-board ticketing systems and vehicle GPS trackers) (Box 26 and Box 27). Because technical resources can be expensive and may require time (*e.g.* to customise technology to local application), technical needs should be identified early on, and those resources should be secured before policy implementation. Delayed capabilities and late technical reports can delay project implementation and raise project costs significantly.

Institutional. Institutional capacity to handle policy implementation can include both human resources and administrative capacity (Box 28).

Ensuring that there is institutional capacity at the different national, regional and local levels and securing any necessary additional support will improve the smoothness and effectiveness of the implementation, monitoring and evaluation processes. It will further help ensure that the implementing body is prepared if difficulties arise, especially because administrative and institutional problems can foster opposition to change and undermine institutional credibility.

Box 28

Hong Kong, China: creating a learning environment to increase institutional capacity

The Hong Kong railway system will expand by 25% over the next 10 years, which will require additional staff and organisational capacity. In addition, expected retirements mean that many experienced staff will be leaving. In response, Hong Kong MTR Corporation launched a Learning Organisation Programme in 2009 to increase organisational capacity and innovation. The programme includes over 20 different initiatives to support professional growth and increased institutional capacity. Examples of major initiatives include a single information platform, OK Mall, to serve as a central repository for day-to-day operations knowledge sharing and an integrated staff development programme. The MTR Learning Organisation Programme was awarded "The Most Admired Knowledge Enterprise (MAKE) Award" in 2010.

Source: UITP, 2012.

Financial.[9] Adequate financing is generally one of the most important keys to successful transport policy implementation, and the kind of financing available often drives the decision about what transport policies to invest in (Box 29 and Box 30). Insufficient funding in the implementation, monitoring and evaluation phases can have damaging effects on the impact and long-term credibility of policies. Financial resources, therefore, must be secured before undertaking policy implementation. Potential sources of financing include (Hilke and Ryan, 2012):

- fiscal instruments: taxes (fuel and roadway charges) and tax reliefs;
- financial measures: loans and grants;
- direct investment: public procurement, public investment in R&D, investment in public infrastructure and PPPs;
- trading schemes: emissions trading schemes and white certificates.

9. Additional information on potential financing options for transport system development and efficiency policies can be found in (Corfee-Morlot *et al.* ,2012; Ang and Marchal forthcoming).

4 Establish policy framework and action plan

Once transport system needs and policy responses have been identified, the next task is to establish the policy framework and action plan for policy implementation, monitoring and evaluation. Implementing and achieving policy objectives in the transport sector can take a long time, and policies can fail to meet objectives if strong frameworks

Box 29

Istanbul, Turkey: private-sector financing to promote transport service improvements

In addition to financing transport network development, PSCs and MSAs can be used to engage the private sector to improve public transport services. In 2011, EBRD was a key financier in the privatisation of the Istanbul Ferry Company (IDO), which provides ferry services for more than 50 million passengers annually in Istanbul. Through privatisation, the city was able to enhance ferry services for customers, including integrating ferry and bus services that connect Istanbul to Bursa and then Izmir. This integration has allowed travellers to buy inner-city ferry services across the Mamara Sea to Bursa from Istanbul, with adjoining bus service to cities along the route to Izmir. The privatisation agreement also attracted additional investments into the financing structure by allowing the service providers to offer catering and shopping for customers, similar to concessionary agreements in airports.

Source: Jordan-Tank, 2012.

Box 30

Montevideo, Uruguay: securing financing through development of shared trust fund

*Numerous public transport operators provide service in Montevideo, and investments, such as vehicle acquisitions, traditionally have been financed through private banks in foreign currency (*e.g. *USD). This type of financing meant that transport operators were vulnerable to fluctuations in currency exchanges, and consequently the operators often avoided further investments because of the risks for repayment. In response, the Municipality of Montevideo developed a Trust Financial Fund for the Montevideo Urban Public Transport. The fund, initially issued through certificates of participation in indexed (adjusted according to inflation) Uruguayan pesos, was set at an initial equivalent of USD 46 million. The trust involves securitisation of mandatory contributions by the transport companies in the amount of 3% of total monthly revenue from ticket sales using an asset management company. In turn, the fund issues debt certificates with a 5.8% interest rate in USD. The repayment period is linked to performance of ticket sales, and the municipality warranties the payments with subsidies generated each month. The funding scheme ensures that transport providers have access to funding with lowered risks, which subsequently ensures that public transport services investments continue to be made.*

Source: UITP, 2012.

outlining the necessary steps and actions to project achievement are not established in the early implementation stages.

Develop action plan: identify key steps and milestones, set time frame and determine responsibilities

A clear strategy for policy implementation is vital. Formulating this strategy includes determining tasks to accomplish, roles and responsibilities, time frames, and expected outputs. Establishing a clear plan for "who, what, when, and how" will help to delineate a step-by-step framework to implementing and achieving policy goals. When developing detailed action plans, policy makers should involve implementing bodies (*e.g.* contractors and implicated city agencies) and stakeholders to ensure that the proposed steps and time frames are feasible and acceptable. Negotiations may be necessary, however, and the parties need to iron out details before implementing projects.

Identify key steps and milestones. Some policy objectives (*e.g.* reducing vehicle speed in residential neighbourhoods) can be accomplished quickly; others, such as infrastructure development and land-use policy changes, require longer-term investments. Identifying key steps to achieve implementation and co-ordinating actions in a strategic framework help to ensure that the implementation process runs as smoothly as possible (Box 31). Determining these steps is particularly important if actions that impede further implementation (*e.g.* legislative approval) are possible.

Identifying project milestones is important. Beyond a step-by-step series of actions, identifying milestones, either in the form of achieved actions or specific project dates, serves as a tracking tool to evaluate progress, timing and next steps as implementation moves along. Milestones can be used to evaluate needs throughout the implementation process and they can be a powerful public relations tool to ensure the public and stakeholders that the city is meeting its objectives in a timely, efficient manner.

Set time frame. Transport policies and projects can require significant amounts of time to implement, and project overruns are common. Establishing an initial time frame with respect to policy objectives and action steps is an important tool to monitor progress from start to finish. Implementation schedules, in the form of a Gantt chart (bar charts that illustrate a project schedule), for example, can help to organise actions with regards to expected time frames. They can also provide a framework

Identify	What actions are necessary to implement objectives? Which actions need to come first? Can any actions be grouped together? Can any actions be avoided or achieved through existing institutional frameworks? Who needs to be involved in the implementation process? What are their roles and responsibilities?
Prepare	Do any areas of potential conflict exist between actors or actions? Can any potential institutional issues or gaps affect the implementation process? Have they been addressed? What will happen if an action is not achieved? Do contingency plans exist? Are there legal or financial repercussions for failure to achieve a task?
Assess	How will progress be measured? How will actions be evaluated? How frequently should progress be monitored? Who will monitor progress? Do specific indicators need to be measured?

Box 31

Santa Monica, USA: five-year implementation plan to integrate bicycles into city life

*In 2010, the city of Santa Monica in California adopted a Land Use and Circulation Element (LUCE) to express the city's vision for urban development and streets design. LUCE called for the integration of bicycles into the city's long-term goals, and in response, the city released the Santa Monica Cycling Action Plan in November 2011. The cycling plan identified key goals for transport policies to support bicycling as an alternative to driving, connect people with destinations, balance roadway use, support seamless connections and improve neighbourhood streets. Specific actions, such as implementing pavement design standards for cycling lanes, were developed to support those goals, and the cycling plan established a five-year action plan that identifies projects and programmes that can be implemented immediately with minimal additional process as well as policies that will require additional community planning and detailed reviews (*e.g. *engineering and environmental review). The action plan includes specific implementation steps, including streets identified for cycling development and the achievements that are necessary on those streets (*e.g. *lane markings and buffered cycling lanes). The action plan also identifies specific policy programmes that will be implemented, such as the Safe Routes/Smart Ways to School and Cycling-Pooling initiatives. All of the policy goals and program actions are indicated in a table, which includes base (short)-, medium-, and high (long)- term priorities for the different programme categories over the next five years. The table also indicates funding needs for the programmes using the same low – medium – high categorisation. The last sections of the cycling plan outline a long-term, 20-year vision for bicycle policies in the city.*

Source: city of Santa Monica, 2012.

for re-evaluating project schedules as projects move along. Given the nature of transport projects, schedules should include margins for delays and unexpected implementation obstacles.

Assign responsibilities. Many players and stakeholders may participate in the implementation process, including transport and civil works agencies, government legal offices, financial institutions, transport operators and local businesses. Designating who is responsible for what and identifying how diverse actors will contribute to policy actions is a critical step to ensure a smooth implementation process without unnecessary delays or challenges.

Responsible parties should also be convened before and during the implementation process to gather input, consider potential challenges and discuss potential collaborations. This co-ordination helps to establish clear responsibility of tasks and authority, while providing all the main actors sufficient time to prepare and complete necessary tasks.

Policy makers should also identify leaders and influential stakeholders who can help convey the objectives and support public understanding of the benefits of more efficient transport systems.

Prepare robust analysis of policy economics

Transport infrastructure projects involve significant infrastructure planning and long-life asset investments. These projects also alter the dynamics of city spatial and demographic systems. Analysing the social and economic implications of these projects is not easy, but all decision makers and stakeholders should be well informed of the costs and outcome benefits from the proposed policy options.

The analysis should define a clear counterfactual, *i.e.* a baseline case that outlines what would occur in the absence of any interventions. Developing this case requires clear understanding of the:

- population trends and economic structure shifts that will drive the demand for mobility;
- expectations about the future technology options, their costs and capabilities (*e.g.* IEA *Energy Technology Perspectives* and *Roadmaps*);
- future energy price trends from global fuel futures markets and national energy markets (*e.g.* IEA market reports and New York Mercantile Exchange [NYMEX]) and national fuel scenarios;
- effective modelling tools, market intelligence and expert review to identify suitable counterfactuals and their sensitivity to key variables;
- life-cycle costs and benefits associated with counterfactuals and efficient policy options;
- public and private costs and long-term finance options;
- costs of ongoing inadequate, or worsening, mobility;
- transfers (costs and payments for services shifting to alternative modes or service providers);
- material implications of the policy options so that all can understand the costs and benefits.

The above analysis is complex and may require external expertise. Although the above analysis may be the realm of economic modellers, the findings must be portrayed in a manner that all stakeholders can understand the various pros and cons and implications over the life of the policy options. The United Kingdom HM Treasury guidance on policy assessment provides an example of a comprehensive assessment framework (Treasury Guidance, 2012) (Box 32).

Prepare contingency plan

Project delays, cost overruns and legal opposition can slow or halt transport policy implementations. Considering foreseeable interferences and obstacles (*e.g.* applying "what if" scenarios) and preparing potential responses to major hurdles help to ensure that policy objectives continue to be implemented.

Box 32

United Kingdom: the Green Book, best practices in policy appraisal

The Green Book, created by the UK Government Treasury, sets out a framework for the appraisal and evaluation of policies, programmes and projects. It outlines key steps in the development of a proposal, from writing the rationale for an intervention and setting objectives, to options appraisal and implementation and evaluation. The Green Book set out how the economic, financial, social and environmental assessments of a proposal should be combined and seeks consistency and transparency in the appraisal process throughout government. Where existing frameworks for evaluation exist, the Green Book provides a reference for testing the capability of the analysis. In addition to this overall framework, the Green Book also offers supplementary guidance with more detailed information on particular issues. It provides guidance on specific contexts, including valuing environmental impacts, assessing competition impacts, and adjusting for risk and optimism bias.

Source: Treasury Guidance, 2012.

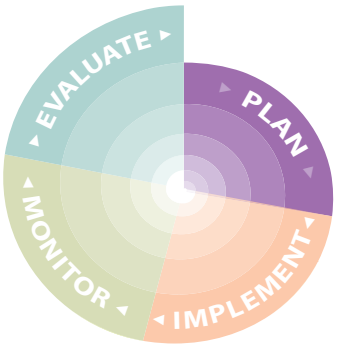
Improving the efficiency of urban design can require long-term planning and policy action. Establishing an action plan and measuring progress over time can help to ensure long-term policy success.

Decide how progress will be measured

Data is critical to measuring policy and project progress. Data collection helps to gauge the effects of policy implementation, and it can help to identify project weaknesses, additional benefits, possible spill-overs and next steps or alternative measures to achieve policy goals. Because project monitoring and data collection can be time consuming and expensive, policy makers should establish a clear plan of the scope and timing of measuring progress. This plan would include deciding which indicators to monitor and collect, where data collection will occur, how often it should be collected, and if multiple measurements (*e.g.* peak travel versus week-end travel) are necessary (Table 14).

Table 14 Examples of urban transport system indicators

Dimension	*Example indicators*
Energy	• Fuel purchases by mode and fuel type • Vehicle type and average fuel efficiency • Energy per passenger km
Travel	• Vehicle ownership and registrations (especially trends and prospects) • Passenger trips, purpose of travel and distance travelled by mode • Public transport ridership and revenues • Passenger satisfaction • Traffic volumes and frequency of travel delays
Infrastructure	• System kilometres (*e.g.* road lane-km, BRT km, and cycling lane-km) • Frequency of public transport service and required number of connections • State of repair (*e.g.* bridges in need of repair) • Parking spaces (free and metered)
Land	• Urban (and metropolitan) land area • Population density
Environment	• Emissions (*e.g.* carbon dioxide, particulate matter, sulphur oxides and nitrogen oxides) • Impermeable surface area and surface runoff
Health and safety	• Accidents, injuries and fatalities • Exposure to noise and emissions
Economic	• Household expenses on transport • Investments and property values around transit • Percentage of city GDP spent on mobility • Business revenues (in affected areas)



IMPLEMENT

Well-defined responsibilities, strong project management and clear communication are essential to moving transport efficiency policies from concept to reality. Poorly-defined contracting and weak project management can lead to numerous problems, including delays, corruption, increased costs and ineffective or unintended results. Policy changes and project costs likewise can invoke criticism and confusion about what policies are trying to achieve. Managing the implementation process and communicating objectives in a clear, understandable fashion help to ensure an implementation process that is as smooth and successful as possible.

❺ Engage actors and begin implementation

Launching transport policy initiatives often requires the engagement of numerous actors, from diverse public agencies to transport operators and construction firms (Box 33). Some policy implementations may only necessitate engaging actors to ensure the policy change is applied and enforced correctly. Other policies may require contracting services, managing the implementation process and monitoring progress. Engaging actors early on and delineating the implementation process from the start help to ensure a successful programme launch and policy execution.

Identify	What needs to be accomplished, and who will accomplish it? Is training necessary? Is contracting required? Will contracting be done through a bidding process? What will be the process for inviting tenders? How will services be selected?
Engage	What are the roles and responsibilities of each actor? What are the required actions and deliverables? What is the budget and time frame for actions and deliverables? What consequences are incurred if actions are not delivered on time or go over budget? Will delivery that is early or under budget be rewarded?
Launch	Will there be an official policy launch (*e.g.* ground breaking) or announcement? Who should be involved or informed? How will objectives be communicated? How can awareness of mobility choices and energy efficiency be increased?

Call for tenders

Many policy initiatives (*e.g.* construction projects and PPPs) require contracting services. A call for tenders, for example in the form of invitational offers or open bidding, facilitates a competitive process that encourages cost-effectiveness and efficiency in services. The call for tenders should define the project and requested services, the scope of the project and services, the criteria for selection and the selection process for tenders. Additional information, such as previous reports and studies regarding the project, may be included to support the bidding process and inform interested parties.

Box 33

European bike-share initiatives: engaging private sector to provide new services

*Since the launch of Vélib in Paris, France and Bicing in Barcelona, Spain in 2007, numerous cycling-sharing schemes (BBS) have been implemented in European cities, including London, Brussels, Berlin, Rome and Stockholm. BSSs have also started to appear in other non-European cities, such as Montreal, Canada, Hangzhou, China and Washington D.C., United States. BSSs generally are implemented and operated through PPPs, which include partnerships with advertising agencies (*e.g. *JCDecaux in Paris and Clear Channel in Stockholm), banks (*e.g. *Barclays in London), transport operators (*e.g. *Vinci Park) and specific cycling-share operators (*e.g. *Bicincittà in Italy). BSS contracts generally define ownership, responsibilities, service costs and the length of the service agreement. Responsibilities can include both construction and operations or can be a combination of mixed roles by both the contractor and municipality. Cost structures usually cover fixed and variable costs over the length of the agreement, and they can require subsidies, especially if registration costs are the principal source of revenue. Some cities have avoided subsidies by applying different financing terms, including advertising rights (*e.g. *Paris JCDeceaux), cycling sponsorships (*e.g. *London Barlays) and external charging rights (*e.g. *Vinci parking). More information about BSSs in Europe and guidelines on optimising cycling-share planning and implementation can be found in the ELTIS Handbook on Optimising Cycling Sharing in European Cities.*

Source: ELTIS, 2011.

Establish roles, responsibilities and deliverables

Before a project can begin, the organisers should inform the implementing parties of their roles and responsibilities. This information should set out a clear division of tasks to be performed and actions to be accomplished as well as clear deadlines and a detailed time frame for policy implementation.

For projects implemented through a procurement process, contracts should establish a detailed scope of the project and the required deliverables. The project scope includes defining the activities that will be undertaken, the responsibilities of the respective parties and any boundaries associated with the deliverables (*i.e.* the limits and liabilities of the renderer). Deliverables should be tangible, measurable and verifiable, and contracts should include agreements on budgeting, the timing of deliverables and any consequences for failure to deliver on time or on budget. A well-defined service contract that outlines key actions and deliverable dates helps to prevent disagreements after services are proffered and can be used to manage and track the implementation process.

Launch policy

Once the planning process is complete and actors are engaged, the policy can be launched. Often cities introduce policy initiatives and programmes through official announcements, press conferences and ground-breaking ceremonies. Policy launches are a valuable tool to inform the public of changes and can be used to raise awareness of policy objectives, mobility choices and the importance of energy efficiency in transport. Involving stakeholders in policy launches can increase target audiences and help to ensure continued support of policy initiatives during the implementation process.

❻ Raise awareness and communicate targets

Public acceptance of policy changes and initiatives increases when the public has a widespread understanding of policy objectives and the benefits

of the changes. By communicating the goals of policy measures and raising awareness of the consequences of energy consumption and mobility choices, policy makers can encourage shifts to more efficient travel and increase support of actions to improve urban transport system efficiency.

Communicate targets and explain policy measures

Campaigns can help to dispel public misconceptions about policy initiatives by providing information that addresses why policy changes are necessary and how policy measures are addressing transport issues (Box 34). This communication helps to raise awareness of energy efficiency goals and the benefits of improving transport system efficiency. Effective communications not only tell the public what is happening and why, but they also convey how policy changes will save energy, improve travel times, increase safety and reduce long-term public transport expenditures. Examples of constructive communication measures include visual information campaigns (*e.g.* billboards and advertisements on buses), online informational videos, programme websites and outreach to target audiences.

Raise awareness of energy consumption and mobility choices

Policy makers need to raise awareness of transport energy consumption and mobility choices. Public awareness tools encourage better travel choices and help to increase participation in energy efficiency initiatives (Box 35). For example, the Bangkok Metro Public Company Limited (the concessionary operator of the metro system in Bangkok, Thailand) launched an "Extra Time, Extra Value" initiative in 2008 as part of objectives to promote the use of the Bangkok Mass Rapid Transit system and to create awareness of the benefits of using public transport (UITP, 2012). The initiative used advertising to communicate that fast, high-quality public transport service would save travellers time and money, allowing them extra time to shop at destinations and to spend with family and friends – a value-added experience by using public transport.

Box 34

Terrassa, Spain: using film and street messages to increase safety

The city of Terrassa developed an Urban Mobility Plan in 2001 in response to issues identified by a group of 40 public and private stakeholders who met to discuss transport issues and the future of mobility in the city. The plan included specific objectives to prioritise pedestrian mobility and bicycle use, while also increasing safety throughout the city transport network. In response, the city began implementing measures to improve road safety, including speed-limited areas throughout the city, infrastructural changes, speed radars, and pedestrian countdown markers at traffic lights. To raise awareness about safety initiatives and increase driver caution when moving about the city, the Terrassa City Council designed a safety campaign, "We are all pedestrians", with the Royal Automobile Club of Catalonia in 2011. The campaign installed roadway markings at pedestrian crossings around the city with the message "one out of two serious injuries in traffic accidents are pedestrians". The city also installed tyre screech markings on streets "crashing" into media displays with the message, "Your trip can end up like this. Slow down." In addition, the city released a nine-minute movie, "Terrassa stands for safety", describing the motivations behind implemented actions, including the speed radars that had been considered negatively by parts of the public.

Sources: IAE, 2011; Ajuntament de Terrassa, 2012; Verger, 2012.

Cities are increasingly turning to technology to increase awareness of travel choices and policy initiatives as well as to communicate the benefits of more efficient transport. Real-time travel information, smart-phone technologies, online eco-calculators, Facebook pages and Twitter accounts all can provide the public with information about transport services and options, including information on the next train, the nearest cycling station, and the most energy efficient travel mode

between destinations (Box 36). These tools can be exceptionally valuable in reaching broad audiences to raise awareness of energy efficiency targets and available travel choices.

7 Manage implementation process

A key part of the implementation process is ensuring that responsible parties are doing their jobs and that progress is being made. Regardless of whether the public or private sector has been given the responsibility of project execution and delivery, the public sector is almost always held responsible if policies are not carried out effectively, within budget and in a timely manner. Poorly managed projects can undermine confidence in government capacity to implement change, and such projects likewise can lead to the ultimate failure of policy goals.

Box 35

Vienna, Austria: traveller information through mobile technology

In 2009, the city of Vienna implemented qando, a traveller information system for mobiles and smartphones. qando allows travellers instant access via their phones to timetables, route planning and real-time service information for public transport services in the Vienna metropolitan area. Travellers can buy paperless tickets using their mobile devices, and they are informed of any changes or disruptions to their trips. To facilitate and encourage use of the qando mobile application, or app, the developers, Fluidtime Data Services GmbH, built a user-friendly design that works on all mobile devices. The application's interactive map assists users in trying to find and access nearby public transport and provides information on local amenities, such as restaurants, shops and upcoming events in the area. The application has a main website, where travellers can get instructions on using the mobile app, get help on troubleshooting and post questions in a public forum. To date, the mobile app has been installed on more than 80 000 devices.

Source: UITP, 2012.

Box 36

Lisbon, Portugal: sustainable mobility through public information campaigning

In 2009, the city of Lisbon, in partnership with Carris, a passenger transport company serving the greater Lisbon area, launched Menos um Carro ("One Less Car"). The One Less Car campaign promotes more sustainable mobility through information on the need to shift to more efficient transport and the benefits of choosing more sustainable travel modes. The campaign has an online meeting place where users can post questions and share information (e.g. where to buy an electric bicycle) as well as Facebook and Twitter pages. Anyone can join the movement, and visitors can calculate their Sustainable Mobility Index (IMS), which allows them to understand the economic, social and environmental impact of their travel behaviour. Since 2009, the Menos um Carro campaign has gained significant interest, with more than 9 500 followers on Facebook and 1 600 bloggers on its discussion board. The number of partners in the project likewise has grown, and the movement has spread to other cities in Portugal.

Sources: e-nova, 2012; Stoycheva, 2012.

Verify progress, ensure compliance and enforce deliverables

Managing the policy implementation process can entail project supervision, liaising with implementing parties and stockholders, inspecting progress, ensuring observance of rules and regulations, enforcing project deliverables, promptly responding to unexpected events and adjusting

contracts and programme implementations when project goals are not being met. Verifying progress, ensuring compliance and enforcing timely delivery of actions help to ensure that policy implementations run on schedule and on budget, to the greatest extent possible.

In many cases, contracts may require implementing parties to provide periodic progress reports (*e.g.* weekly, monthly or at certain milestones) or project status and budget updates upon completion of deliverables. Penalties can be established for project overruns, or incentives may be offered for achieving implementation under schedule or under cost. These penalties or incentives, however, should be developed and managed in a way so as not to compromise project implementation *(i.e.* encouraging cost-cutting techniques and false reporting).

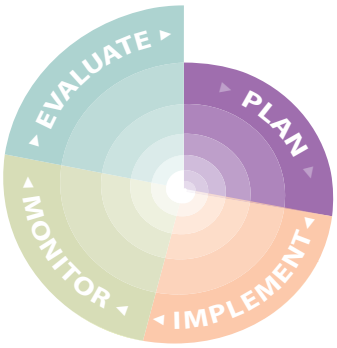
Provide capacity building and project support

Technical training and capacity building should be provided to all relevant stakeholders and support agencies to facilitate execution of policy changes (*e.g.* employee understanding of new ticketing technologies and guidelines for policy enforcement).

Modules and workshops tend to be more effective for training than a copy of rules and training procedures. Providing the best possible training to stakeholders and supporting agencies is critical, because these actors will be the day-to-day providers of public support once the initiative is up and running. Training can include on-site demonstrations, scenario building and discussions with field experts who can instruct groups on the implementation and operations process.

Once policy initiatives are in place, information should be provided to the public to explain new programmes and regulations, and to describe how they work and to whom they apply. These measures help to encourage policy acceptance and compliance. Examples of project support include on-site staff to assist with new ticketing procedures, service change announcements, online access to programme information and news flashes to remind citizens of policy changes and their effects.

Connections between public transit services, such as this bus, tram and rail (not seen in photo) station in Amsterdam, facilitate "seamless" journeys and encourage energy efficient travel choices.



MONITOR

The type of monitoring of transport policies and initiatives depends to some extent on the project or programme. Some policies require monitoring of compliance (*e.g.* parking levies and vehicle standards). Other policies require monitoring of system performance, such as traffic volumes and public transport service frequency.

To determine the effects of policies on citizens, businesses and transport system efficiency, all policies require measurements of outcome indicators (*e.g.* public transport journey times, urban density and peak-hour congestion levels) as well as policy outputs (number of buses or bus routes or number of tickets sold). Without monitoring specific effects, policy makers cannot determine if a programme is effective and if policy objectives are being met.

8 Collect, review and disseminate data

Effective, meaningful data is necessary to assess the effects of policy initiatives on energy efficiency and other social, environmental and economic issues. The data collection process should be adapted to the characteristics of the data needed, describe how the data will be collected and assessed, and specify the extent that the data will be shared.

Identify	What indicators should be monitored? Who should be involved in the monitoring process? Can monitoring of different indicators be combined? Is anyone else already collecting relevant data?
Collect	How will data be collected? How often should data be collected? Who will collect data? Do consultants need to be hired? Is any specific equipment needed?
Review	What is the source of data? Is it reliable? Is it consistent? Is it comparable? Can exceptions or inconsistencies be explained? How will data be accessed?
Share	Who gets access to data? Should data be made public? Is any data privileged information?

Set clear data goals and define assessment methodology

When considering how progress will be measured, policy makers should ensure that data goals and the assessment process reflect institutional needs and resource limitations, including financing. Because data collection and project assessment can be expensive and time consuming, the monitoring process should seek minimally to collect enough data to analyse the programme's progress and its effects on efficiency improvements.

Policy makers also need to decide how data will be analysed, which includes defining indicators to measure policy effects and setting benchmarks or reference points to be able to compare data against objectives. Establishing a clear method for collecting and analysing data will help to ensure that the impacts of policies are measurable, reportable and verifiable.

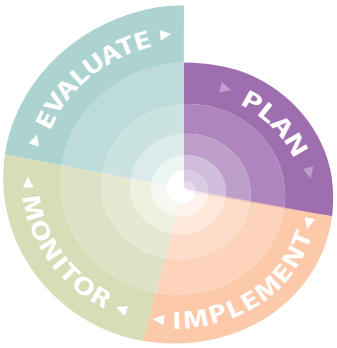
Review and compare data

Once data has been collected, it should be reviewed and compared to validate the effects of the policy on improving transport system efficiency. Data should be reliable, comparable and consistent. Progress cannot be measured if data is not representative of what is happening and if data cannot be compared to selected benchmarks. If data appears inconsistent or has apparent exceptions, the data results may need to be confirmed through additional, independent measurements.

Share data

Data sharing can provide important opportunities to understand the effects of energy efficiency policies. Stakeholders and interested parties often consider data in a framework that may not apply directly to project monitoring and evaluation but that nonetheless may add considerable value to understanding the impact of policies on transport and related urban issues. Stakeholders and researchers may also have separate data that can be used for additional policy evaluation. Disseminating data, therefore, can increase opportunities, not only to measure the achievements of policies, but also to understand how policies are shaping the urban plexus.

Understanding the effects of urban transport policies, such as this reduced speed zone in Berlin, Germany, is critical to evaluating the success of policy measures. Reduced speed zones (or "Zone 30") have been implemented in numerous cities across Europe in recent years.



EVALUATE

Policy makers need to establish how effective programmes are in meeting policy objectives. Evaluating programme effectiveness helps to determine how policies can be improved and to identify next steps to achieve policy goals.

9 Analyse data and evaluate effects of transport policy

Comprehensive policy evaluations can demonstrate the effectiveness of policy programmes in meeting efficiency objectives and the extent to which policies have an impact on urban life and urban transport systems (Box 37). Evaluating the effects of transport policies identifies any weaknesses or failures in programmes and distinguishes areas of potential improvement and possible directions for continued policy work.

Analyse data and assess policy results

Once data has been collected and reviewed, the next steps are to analyse project results and assess how the results respond to policy objectives. When assessing project results, the OECD Development Co-Operation Directorate has suggested five areas to consider in project evaluation (OECD, 2012a), including:

Relevance	Did the project meet policy objectives? Were all objectives met? Were certain project elements not successful? If so, were there any evident causes?
Effectiveness	How well were policy objectives met? Did certain project elements achieve better results? Were resources sufficient? Were partnerships successful? Were they helpful? Did they strain the implementation process or hinder achievement?
Impact	What has happened since the project was implemented? Did it improve transport system efficiency? Do results vary for different areas or for different target groups? Did spill over effects or unintended consequences occur? Did the policy implementation lead to efficiency gains or benefits in other areas?
Efficiency	Are policy benefits greater than required input (*e.g.* time and resources)? Was the project cost effective? Could the policy have been implemented differently? Could resources have been used otherwise? Could the same results be achieved more effectively or efficiently with a different policy?
Sustainability	Is the policy likely to maintain benefits in the long-term? Will additional resources be necessary to sustain results? Are changes to the policy necessary? Is additional action necessary to support or improve existing benefits and efficiency gains?

Source: adapted from OECD, 2012a.

The evaluation should identify reasons for which actions or outcomes were not achieved or for which targets were not met entirely. Identifying project weaknesses and unexpected influences on policy achievement can help structure future responses to ensure the success of policy objectives. Analysing any reasons for which projects were not effective likewise helps to identify next steps to continue progress toward policy goals.

Box 37 Delhi, India: assessing the impact of urban bus corridors

The city of Delhi launched a new bus corridor in 2008 in response to policy objectives to develop a sustainable transport network in the city. The six-km bus corridor provided priority, segregated median lanes for public buses and created additional dedicated spaces for bicycles, cycle-rickshaws and pedestrians. The corridor development led to a 19% reduction in average bus travel time, and by 2009, it supported the movement of more than 6 500 passengers per hour in each direction. Despite initial results and positive feedback from passengers, the project received harsh criticisms because of traffic congestion and safety concerns alongside the bus corridor. To help improve the system, transport experts from EMBARQ and the Centre for Science and the Environment evaluated the performance of the corridor in 2009. The evaluation included interviews with relevant stakeholders, analysis of corridor characteristics and bus performance, first-hand observations of travel operations along the corridor, and comparison with other bus corridors in developing cities around the world. The evaluation also asked whether curbside bus lanes would achieve better results than the median bus corridor. The conclusions of the study found that the project did improve the mobility of people along the initial bus corridor and that although private vehicle travel times had increased slightly, the average travel time (weighted) for all users was reduced because more people travel by bus than by car. The evaluation identified several weaknesses in the project implementation, such as signalisation issues and poor access to bus stations, and it recommended actions to improve the programme.

Sources: Hidalgo, 2009; EMBARQ, 2012a.

Communicate results

Communicating project results is vital to raising awareness of the benefits of energy efficiency programmes and to maintaining (or increasing) public support of policy objectives and initiatives (Box 38). Providing information on energy savings, cost-effectiveness, improved travel times and project co-benefits encourages further support of policies and builds institutional credibility.

The effects of policies should be communicated in a tangible way that highlights achievements and describes how the city or other entity will continue to seek transport efficiency improvements. This approach can be particularly useful when discussing projects that did not achieve intended results or that had unintended consequences. Presenting facts in a positive context emphasises why efficiency policies are important and how additional efforts will continue to improve overall transport system efficiency.

Box 38 Paris, France: communicating the effects of transport initiatives

The city of Paris has released an annual report on mobility in the city each year since 2001. The annual Mobility in Review, or Bilan des déplacements, provides data on indicators of transport in the Parisian metropolitan region, including the movements of people and goods by mode, congestion levels, parking availability, safety, emissions and the economic impact of transport. The review is a key source of evaluating and communicating the effects of transport policy initiatives in Paris, especially with regards to travel demand management policies and public transport improvements that are intended to reduce traffic inside the city centre while increasing the use of public transport modes throughout the metropolitan region. The review is also used as an index to improve and expand policy initiatives. For example, the initial successes of pilot bus corridor lanes and the Vélib cycling-share programme led to significant expansions of the two initiatives across the city.

Source: Mairie de Paris, 2011.

Adjust	Are policy programmes responding to efficiency objectives? If not, why? Have circumstances changed? Should the policy programme be altered? Can it be improved? How should it change? Is a new approach necessary?
Plan	What are the next steps? Who should be involved? What resources will be necessary? When should changes be made?

⑩ Adapt transport policy and plan next steps

Transport systems are complex and continue to change. Policies need to adapt and adjust with changing transit systems and with overall energy efficiency objectives. Policy reviews and programme changes should reflect how well policies are responding to energy efficiency objectives as well as how the transport system is changing with respect to implemented policies.

Adapt policies with regard to results

Evaluation of projects and programme results over time generally provides improved insight into the interactions between urban travel demand and the transport system. Policy evaluation also helps to understand public willingness to change with respect to policy initiatives. The results of evaluation should be used to adapt transport policies effectively. Where support and participation are strong, policies should seek to maximise efficiency improvements through continued programme development and supporting policy work. Where public support and participation are weak, policy makers should adapt policies and adopt improved communication techniques to increase programme effectiveness.

Plan next steps and future actions

Planning next steps to continue development of existing programmes and implementation of new initiatives contributes to maximum potential efficiency gains and transport benefits (Box 39). This policy pathway has focused on energy efficiency improvements in transport systems. More broadly, many economic, social and environmental issues related to the transport sector can be addressed through the urban land-use and transport policy framework. Broader initiatives, when tied to energy efficiency objectives, increase the effectiveness of transport efficiency policies, while also drawing on wider support audiences and improving overall urban transport and quality of urban life.

Urban renewal projects, such as the removal of elevated highway to reclaim the Cheonggyecheon stream in Seoul, Korea, have drastically improved urban environment and urban quality of life.

Box 39

Istanbul, Turkey: expanding rapid bus services through continual project evaluation

In 2007, the Istanbul Metropolitan Municipality (IMM) implemented a pilot BRT corridor along one of the city's most highly congested corridors. The pilot project, Metrobüs, established a high-capacity, dedicated, median BRT corridor in the two middle lanes of the six- to eight-lane D-100 motorway. Despite significant criticisms and some project weaknesses, such as the required use of steep, narrow stairways to access the corridor, the project had strong initial results. In response, the city collaborated with EMBARQ to open an 11-km BRT expansion to Metrobüs in 2009 on the Bosphorous bridge across the Asian-European continental divide. Within the first year of the expansion, 10% of travellers on the BRT system reported that they had left their cars at home to use BRT, and the BRT system reduced travel time across the bridge to roughly 30 minutes. IMM consequently decided to expand the corridor to 50 km along the D-100 motorway. By 2011, the BRT network was 43 km in length with 33 stations, carrying more than 600 000 passengers per day. It reduced travel time along the corridor from roughly 4 hours by car to 80 minutes by BRT, and the city is working on continual improvements, such as integrating the BRT line into existing tram and metro systems. The success of the BRT system has encouraged a change in thinking about how to address urban transport issues in city policies. The city has started to shift investments from road infrastructure and is focusing on expanding and improving public transport services. These efforts include improving access and transit connections along the BRT system and plans to expand BRT with five new corridors. The city also is building bus-dedicated lanes where BRT is not possible, and IMM is investing in fuel-efficient, hybrid buses as well as a contactless electronic ticketing system that will be used in all public transport modes.

Sources: EMBARQ, 2009; UITP, 2012.

Conclusions

As the world continues to urbanise and travel growth continues to affect life and energy use in cities around the globe, urban transport systems will play an increasingly important role in supporting economic growth and achieving global emissions targets. Already, cities have taken measures to reduce motor vehicle traffic and to promote more efficient and environmentally friendly travel. The effects of those policy measures – from travel demand management tools to transport master plans – have been increases in urban transport efficiency, improved passenger mobility, safer roads, reduced congestion, improved health and better air quality.

Achieving energy efficiency improvements in urban transport systems is not easy. Progress can be slow, and many barriers can arise, including financial constraints, public opposition, complex political frameworks and legal challenges. Many cities, nonetheless, have achieved urban transport efficiency gains through well-planned policy implementations. Examples include vehicle and system technology improvements, land-use and transport network development initiatives, travel demand management tools, improvements in service frequency and quality, and outreach and awareness campaigns.

Although each city is different and transport efficiency responses vary, the overall pathway to transport system energy efficiency has a common thread: cities that have implemented effective transport policies have worked with a broad range of interested stakeholders to develop and implement clear objectives and policy responses while also monitoring, evaluating and communicating progress over time to ensure policy objectives continue to be achieved.

This policy pathway not only highlights the many policy measures and benefits of transport efficiency programmes in cities across the globe, but also serves as a practical tool to help cities pursue the plan, implement, monitor and evaluate process to achieve transport objectives.

Permanent street design changes (pictured here) will replace temporary plazas built in Times Square as part of the NYC DOT *World Class Streets* initiative.

Policy tools and references

To assist planners and policy makers, the authors have compiled the following list of transport policy references, practitioners' guides and project examples. Although the list is by no means exhaustive, it can serve as a useful reference tool for decision makers seeking more information on specific sustainable transport policy measures and project examples.

Transport policy publications

Changing course: a new paradigm for sustainable urban transport (ADB)

Climate action in megacities: a comprehensive analysis of what mayors in the C40 megacities are doing to tackle climate change (ARUP)

Eco-efficient and sustainable urban infrastructure development toolkit (UNESCAP)

Guidelines and toolkits for urban transport development (ADB)

Moving cooler: transportation strategies to reduce greenhouse gas emissions (US DOT)

Online transportation demand management encyclopaedia (VTPI)

Principles for transport in urban life (ITDP)

Sustainable transport: a sourcebook for policy makers in developing cities (GIZ)

Sustainable urban transport project: guides for policy makers (GIZ)

Urban passenger transport: framework for an optimal modal mix (ADB)

Urban transport and energy efficiency: a sourcebook for policy makers in developing cities (GIZ)

Urban Transport Policy and Planning Documents (GIZ)

WebTAG: transport analysis guidance (UK DfT)

Land-use and travel network development

Bus rapid transit

Bus rapid transit planning guide (ITDP)

Bus rapid transit (BRT): toolkit for feasibility studies (ADB)

The bus rapid transit performance assessment guidebook (PAG) tool (PATH)

The BRT standard (ITDP)

Land-use development

Low car(bon) communities (ITDP)

Affordable-accessible housing in a dynamic city: why and how to increase affordable housing development in accessible locations (VTPI)

Smart growth reforms: changing planning, regulatory and fiscal practices to support more efficient land use (VTPI)

Transit-oriented development: traveller response to transportation system changes handbook (TRB)

Non-motorised transport facilities

Complete streets: best policy and implementation practices (APA)

Context sensitive solutions in designing major urban thoroughfares for walkable communities: recommended practices (ITE)

Urban cycling design guide (NACTO)

Access and travel choice

Better streets, better cities (ITDP)

Cycling-inclusive policy development: a handbook (GIZ)

Getting cycling share right: politics, policies and planning (ITDP)

Guidelines for bus service improvements: policy and options (ADB)

Integration for seamless transport (ITF)

Modernizing public transportation (EMARQ)

Seamless transport policy: institutional and regulatory aspects of inter-modal co-ordination (ITF)

Bringing public transport into the information age: improving customer service through innovation (TTF)

Non-motorised transport

Guidelines for non-motorised transport measures: policy and options (ADB)

Strategic planning for non-motorized mobility (World Bank)

Travel demand management

Mobility management (GIZ)

Transportation demand management: a small and mid-size communities toolkit (FBC)

Transport demand management: a training document (GIZ)

Win-win transportation solutions: mobility management strategies (VTPI)

Carpool incentive programs: implementing commuter benefits (US EPA)

Tele-work Programs: implementing commuter benefits (US EPA)

Parking

Guidelines for parking measures: policy and options (ADB)

Reforming parking policies to support smart growth (MTC)

Parking management: comprehensive implementation guide (VTPI)

Parking management in rapidly emerging cities (GTZ)

Financing tools

Developing best practices for promoting private sector investment in infrastructure: roads (ADB)

Hiving off noncore activities in railways: Indian rail (ADB)

Towards a green investment policy framework: mobilising private investment in sustainable transport: the case of land-based passenger transport infrastructure (OECD, final document forthcoming 2013)

List of acronyms

ADB	Asian Development Bank
AFC	Automatic fare card
ASI	Avoid, Shift and Improve
ASIF	Activity, modal Share, energy Intensity, and Fuel
AVL	Automated vehicle locator
BKK	Budapest Transport Centre
BOT	Build-Operate-Transfer
BRT	Bus Rapid Transit
CO_2	Carbon dioxide
EBRD	European Bank for Reconstruction and Development
ETP	Energy Technology Perspectives
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GSP	Gradsko Saobracajno Preduzece Beograd
HOV	High-Occupancy Vehicle lane
IEA	International Energy Agency
ITDP	Institute for Transportation and Development Policy
MoMo	IEA Mobility Model
MSA	Municipal Service Agreement
MTR	Mass Transit Railway
NMT	Non-Motorised Transport
NYMEX	New York Mercantile Exchange
OECD	Organisation for Economic Co-Operation and Development
PATH	California Partners for Advanced Transportation Technology
PIU	Project implementation unit
PLDV	Passenger Light-Duty Vehicle
PPP	Public-Private Partnership
PSC	Public Service Contract
PTx2	Public Transport x 2 (UITP initiative)
TIF	Tax Increment Financing
UITP	International Association of Public Transport
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
VTPI	Victoria Transport Policy Institute
WEO	*World Energy Outlook*

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