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Oliver Lah, Barbara Lah

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Opportunities for synergies and co-benefits

Oliver Lah, Barbara Lah

Abstract

It is often claimed that transport is one of the hardest sector to decarbonise (Vale 2016; Cai et al. 2015; van Vuuren et al. 2015). This view is challenged by a number of more recent papers, which show that an integrated policy approach can address create co-benefits with other key policy objectives, such as health, productivity, energy security and safety, which can lead to a maximum of socio-economic benefits (Bollen 2015; Dhar and Shukla 2015; Lah 2015; Schwanitz et al. 2015; Dhar, Pathak, and Shukla 2017). These synergies between policy objectives have the potential to incorporate the positions of relevant veto players, which can help forming coalitions to support policy implementation, which is often neglected in studies on the decarbonisation potential of the sector and is the main focus for this part of the chapter to answer the question. If applied in isolation policy measures are unlikely to achieve goals without generating trade-offs that create a risk of a veto player blocking the implementation process.

This chapter identifies the opportunities of an integrated policy approach to sustainable transport and identifies potential contributions to coalitions building. This is a vital element in the conceptual framework of this thesis as it creates the link between policy ambition, integration and the potential for coalition building. Practical examples of low-carbon transport policy measures are provided along with quantified co-benefits for key policy objectives and a mapping of institutional actors and potential veto players is proposed. The chapter provides a concise overview on potential co-benefits of a selection of specific measures to highlight the contribution of sustainable transport measures to economic, social and environmental policy objectives, which provides the basis for the identification of key policy actors and veto-players.

Introduction

Many low-carbon transport strategies can help achieve other economic, social and environmental objectives. These include improving access to mobility, reducing traffic and parking congestion, saving consumers money, supporting economic development, increasing public health and safety, and reducing air and noise pollution. Based on Avoid- Shift-Improve approaches and cases from Germany, Colombia, India and Singapore, the chapter shows that aiming for low-carbon transport does have significant and quantifiable co-benefits.

Estimates suggest that currently available and cost effective measures can reduce transport energy consumption by 40-50% lower compared to the 2010 demand. Yet, a number of barriers affect the optimal exploitation of this potential. Considering the possible economic, social and environmental benefits of sustainable transport, the shift towards a low-carbon pathway of this sector can be a win-win situation for climate protection and local development goals. This chapter aims to make a contribution to understand these win-win opportunities by presenting case studies and useful figures. Further, it will also explore assessment methodologies and tools that can help practitioners to assess sustainable development benefits and providing evidence for policy-makers to make more informed decisions on transport investments and polices.

With regard to the terminology, this paper evolves from using the well-established term co-benefit that describes positive side-effects of climate change mitigation actions, towards using the term sustainable development benefits to highlight the fact that diverse environmental, economic and social impacts are equally important from a societal perspective. The paper also explores the risks and uncertainties of some impacts of mitigation measures that may lead to trade-offs and negative side-effects. This aim will help to inform priority-setting for decision makers.

From a climate change mitigation perspective, the term co-benefits may make sense, as for example safety or air quality improvements are a (positive) by-product of the primary objective. However, from a wider political perspective it would be wiser to refer to these effects as sustainable development benefits. This will give a clear indication on the equal importance of all pillars of sustainable development and may facilitate coalition building between sector ministries and stakeholders from the environmental field, such as the environment ministries and NGOs. As the relevant sector institutions (e.g. the transport ministry or local transport departments) may have other primary policy objectives, such as improving air quality, access or safety it is important to emphasize and measure social, economic and environmental benefits of climate change mitigation measures beyond the greenhouse gas emission reductions in order to motivate actors from these groups by showing the synergies in goal achievement and the benefits a given mitigation action will have in terms of the ministry's priorities.

While of course, political and institutional structures are very different from country to country and equally on the local level, some of the key priorities and perspectives of institutions are likely to be somewhat similar depending on the mandate of the institution. As a result, it is important to tailor advice to reflect the needs and resources of the target audience, and to communicate these concepts in ways that effectively resonate with different stakeholders and interest groups.

1. Low-carbon transport as enabler for sustainable transport policy coalitions

This report analyses synergies between low-carbon transport strategies and other economic, social and environ- mental objectives, as these can substantially increase the measure´s cost-effectiveness and help build political support for their implementation. Low-carbon transport measures, by avoiding trips, reducing demand, shift to low-carbon modes and improving vehicle efficiency can help achieve various further planning objectives including reduced traffic and parking congestion, public infrastructure and service cost savings, consumer savings and affordability (savings targeting lower-income households), increased safety and security, improved mobility options for non-drivers (and therefore reduced chauffeuring burdens for motorists), and improved public fitness and health, in addition to their pollution emission reductions. Sector officials and many other stakeholders place a high value on these benefits, which creates opportunities for join forces to support their implementation. This report examines the possibilities for such win-win situations. It explores the linkages between climate change and typical sector objectives, and provides guidance on ways to use co-benefits to promote climate change mitigation measures and achieve an overall more sustainable development, optimizing economic, social and environmental objectives.

1.1 Identify potential synergies

Low-carbon transport strategies that – in addition to reducing Greenhouse Gas (GHG) emissions - help achieve further economic, social and environmental policy objectives, can have a far more extensive overall impact on sustainable development and count with more political support, than mitigation measures that solely focus on the reduction of GHG emissions (Eckermann et al. 2013). Only a few studies have actually examined the total cost of transport including congestion, air pollution, accidents, and noise, and therefore the total potential benefits of polices and programs that reduce these negative impacts. One example of the results of an estimation of positive impacts are the overall reductions of transport expenditures of a balanced sustainable transport policy in a 2 Degree Pathway that were assessed by the International Energy Agency of being up to USD 70 trillion by 2050 (IEA 2012). In another example from the local level, the combined benefits were assessed for Beijing to be between 7.5% to 15% of GDP annually (Creutzig and He, 2009).

When preparing arguments for a transport climate change mitigation measure it may help thinking about additional benefits that may be high on the agenda of important policy actors and stakeholders. Energy security, transport access and affordability, air quality, health and safety are all powerful policy objectives that need to be taken into account when designing integrated climate change mitigation strategies and Nationally Appropriate Mitigation Actions (NAMAs) that are geared towards a high level of synergies and co-benefits. The following section provides a short overview with some key messages related to each major sustainable development benefit (based on IPCC 2014):

Affordability are vital for individuals and businesses. Many transportation emission reduction strategies also reduce costs by improving affordable travel options including walking, cycling, ridesharing and public transit, and by creating more compact communities with shorter travel distances. Households living in automobile-dependent communities often spend 15-20% of their household budget on motor vehicles, but only 5-10% if they are located in more accessible and multi-modal communities (Isalou, Litman and Shahmoradi 2014; Mahadevia, Joshi and Datey 2013).

Air quality is another major issue to which low-carbon transport can make a positive contribution by reducing vehicle engine emissions such as sulphur oxides (SOx), nitrous oxides (NOx), carbon monoxide (CO), hydrocarbons (HC), volatile organic compounds (VOC), toxic metals, and particulate matter (PM), the finer particles of which can cause cardiovascular, pulmonary and respiratory diseases.

Noise pollution affects individual health and quality of life. Noise is second only to air pollution in the impact it has on human health, creating hearing loss, heart disease, learning problems in children and sleep disturbance. In Europe alone noise generated by traffic is linked to more than 50,000 premature deaths every year (T&E 2008).

Congestion is a major issue in many urban areas and creates substantial economic cost. For example, it accounts for around 1.2% of GDP as measured in the UK (Goodwin 2004); 3.4% in Dakar, Senegal and 4% in Metro Manila, Philippines (Carisma and Lowder 2007); 3.3% to 5.3% in Beijing, China (Creutzig and He 2009); 1% to 6% in Bangkok, Thailand (World Bank 2002) and up to 10% in Lima, Peru (Kunieda and Gauthier 2007). Re-allocating space from roads and parking to more people centred activities can further significantly improve the quality of live in cities.

Employment and economic impacts relate to a number of direct and indirect effects of sustainable transport, such as direct employment opportunities, e.g. in public transport or improved access to jobs and markets. Improved reliability of travel times for both people and freight can also contribute substantially to the attractiveness of cities and the ease of doing business.

Energy security is a key policy objective on the national level and transport plays a major role in this due to its almost complete dependence on petroleum products. Low-carbon transport can improve energy security for individuals, businesses and national economies (Leiby 2007; Shakya and Shrestha 2011). By improving affordable transport options, such as walking, cycling and public transit, low-carbon mobility also improves overall accessibility (people's ability to reach desired services and activities), particularly for physically and economically disadvantaged groups, as well as commuters, tourists and businesses (Banister 2011; Boschmann 2011; Sietchiping, Permezel, and Ngomsi 2012).

Public health benefits result from more active transport (cycling and walking). This is increasingly important due to increasingly sedentary lifestyles and resulting health problems such as diabetes. Although these modes incur risks, these tend to be offset by their health benefits, particularly if cities improve active transport conditions (Rabl and de Nazelle 2012; Rojas-Rueda et al. 2011). While some strategies towards modal shifts will have a direct mitigation effect, others such as the introduction of environmental zones may cause trade-offs, as they may ban efficiency, but polluting Diesel vehicles or re-direct traffic, which may increase trip length.

Road safety is also a major transport policy objective that many integrated climate change mitigation strategies can help achieve. Road accidents are estimated to kill around 1.27 million and injure between 20 to 50 million annually, mostly in developing countries (WHO 2011).

Access and social inclusion are vital for delivering sustainable development and climate change objectives. Improving access to urban services through sustainable urban planning is directly linked to better air quality, public health, equitable access to jobs and education, safety, social inclusion. Social inclusion aspects need to be considered alongside energy and climate change objectives, to apply the model of avoid, shift and improve in the urban development and transport planning context, putting people first. To address the access for all objective of the Sustainable Development Goals the following four aspects need to be considered:

a) Availability, providing transportation for people with less conventional timetables (e.g. non-paid work) in close range to their destination of choice;

b) Accessibility, serving all city districts and remote areas with stops in reasonable distance to peoples´ homes and destinations;

c) Affordability: prices need to be regulated by authorities, allowing all income groups to access their right of mobility, even though privately run transport modes makes the standardization and price stabilization difficult, resulting in the inability to calculate costs of not-public owned public transportation; and

d) Acceptability, means to provide a well maintained and secure transport options, e.g. avoid overcrowding, to allow safe transportation for all.

The IPCC (2014) pointed out that an integrated approach that addresses transport activity, structure, intensity and fuels is required for a transition towards a 2°C stabilization pathway as well as generating sustainable development benefits (Table 1). Different types of mitigation actions tend to bring along different impacts and benefits. Policy makers interested in the implementation of mitigation actions and looking for specific co-benefits should take this into consideration when selecting and prioritizing mitigation actions for implementation. Mitigation actions in the transport sector can be grouped roughly into three categories. Strategies that **avoid** total motor vehicle travel, e.g. by creating more compact, multimodal communities, and providing incentives for travelers to **shift** from automobile to more resource-efficient modes (walking, cycling, ridesharing, public transit, telecommunications that substitute for physical travel, and delivery services) tend to provide the greatest total benefits, reflecting the high costs (both, internal and external) of motor vehicle travel and the road and parking facilities it requires. **Improving** motor vehicle fuel efficiency and shifting to alternative fuels, on the other hand, provides fewer co-benefits. Table 1 gives an overview of the three categories and the respective development benefits they bring along.

Table 1 A high-level overview of mitigation strategies and their potential economic, social and environmental co-benefits (based on IPCC, 2014)

Insert Table 1 here

References: 1: (Greene 2010); 2: (Costantini et al. 2007); 3:(Kaufmann, R.K., Dees, S., Karadeloglou, P., Sánchez 2004); 4: (Boschmann 2011); 5: (Sietchiping,Permezel, and Ngomsi 2012); 6: (Cuenot, Fulton, and Staub 2012, Lah 2014); 7: (Creutzig, Mühlhoff, and Römer 2012); 8: (David Banister 2008); 9: (D. Banister 2008; Geurs and van Wee 2004); 10: (Creutzig and He 2009); 11: (Tiwari and Jain 2012); 12: (Rojas-Rueda et al. 2011); 13: (Sathaye et al. 2011); 14: (Olsson and Woxenius 2012); 15: (Garneau et al. 2009); 16: (Wassmann 2011); 17: Eliseeva and Bünzli 2011; 18: Massari and Ruberti 2013; 19: (Takeshita 2012); 20: (Kahn Ribeiro et al. 2012). 21: (IEA 2011a), 22: (Woodcock et al. 2009) , 23: (Schipper and Fulton 2012), 24: (Sims et al. 2014,)

Combine measures to maximise synergies

Decision making on transport policy and infrastructure investments is as complex as the sector itself. Rarely ever will a single measure achieve comprehensive climate change impacts and also generate economic, social and environmental benefits. Many policy and planning decisions have synergistic effects, meaning that their impacts are larger if implemented together. It is therefore generally best to implement and evaluate integrated programs rather than individual strategies. For example, by itself a public transit improvement may cause minimal reductions in individual motorized travel, and associated benefits such as congestion reductions, consumer savings and reduced pollution emissions. However, the same measure may prove very effective and beneficial if implemented with complementary incentives, such as efficient road and parking pricing, so travelers have both **push and pull incentives** to shift from automobile to transit. In fact, the most effective programs tend to include a combination of qualitative improvements to alternative modes (walking, cycling, ridesharing and public transit services), incentives to discourage carbon-intensive modes (e.g. by efficient road, parking and fuel pricing; marketing programs for mobility management and the reduction of commuting trips ; road space reallocation to favour resource-efficient modes), plus integrated transport planning and land use development, which creates more compact, mixed and better connected communities with less need to travel.

A vital benefit of the combination of measures is the ability of integrated packages to deliver synergies and minimise rebound effects. For example, the introduction of fuel efficiency standards for light duty vehicles may improve the efficiency of the overall fleet, but may also induce additional travel as fuel costs decrease for the individual users. This effect refers to the tendency for total demand for energy decrease less than expected after efficiency improvements are introduced, due to the resultant decrease in the cost of energy services (Sorrell 2010; Gillingham et al. 2013, Lah 2014). Ignoring or underestimating this effect whilst planning policies may lead to inaccurate forecasts and unrealistic expectations of the outcomes, which, in turn, lead to significant errors in the calculations of policies' payback periods (WEC 2008, IPCC 2014). The expected rebound effect is around 0-12% for household appliances such as fridges and washing machines and lighting, while it is up to 20% in industrial processes and 10-30% for road transport (IEA 1998, 2013). The higher the potential rebound effect and also the wider the range of possible take-back, the greater the uncertainty of a policy's cost effectiveness and its effect upon energy efficiency (Ruzzenenti and Basosi 2008).

A number of studies emphasize that an integrated approach is vital to reduce transport-sector greenhouse gas emissions cost-effectively (IPCC 2014, Figueroa Meza et al. 2014). While emissions reductions can be achieved through several means, such as modal shift, efficiency gains and reduced transport activity, it is apparent that the combination of measures is a key success factor to maximise synergies and reduce rebound effects. For example, overall travel demand reduction and modal shifts would need to be substantially stronger if not accompanied by efficiency improvements within the vehicle fleet and vice-versa (Figueroa Meza et al. 2014; Fulton, Lah, and Cuenot 2013). Vital element for this strategy is a policy package as summarised in the table below.

Table 2: Elements of a multi-modal, multi-level sustainable transport package

Examples measures	Complementarity of measures
National Measures	Vehicles standards and regulations ensure the supply of efficient vehicles and taxation helps steering the consumer behaviour Fuel tax encourages more efficient use of vehicles, which helps minimising rebound effects that might occur if individuals and businesses drive more or not as efficient as they would have driving a vehicles with lower efficiency standards
Local Measures Compact city design and integrated planning Provision of public transport, walking and cycling infrastructure and services Road User Charging, parking pricing, access restritions, registration restrictions and number plate auctions, eco-driving schemes, urban logistics	Compact and policy-centric planning enable short trips and the provision of model alternatives provides affordable access Complementary measures at the local level help managing travel demand and can generate funds that can be re-distributed to fund low-carbon transport modes

Considering that significant and diverse benefits can be gained from policies and projects that increase transport system efficiency, their uptake is far lower than economically justified. Shifting to a low-carbon development pathway requires substantial transport sector reforms. Many of these are options that provide significant economic, social and environmental co-benefits and so can conserve energy and reduce emissions at low or event negative costs. Because of their significant and diverse benefits, they offer opportunities to build coalitions involving many different stakeholders with various interests. This can help build support and strengthen the political case for the shift towards a low-carbon mobility pathway. Successful strategies need to be integrated across policy areas, regions and levels of government. One way of incorporating objectives of key players and include them in the process is to establish a cross-cutting working group (first in the department and then across departments and then across levels or government and including key business and civil society players).

Overview of sustainable development impacts

The examples above provide some insights on the possible costs and benefits of specific mitigation measures. Some more facts and figures of assessments of policy and infrastructure measures are provided below to give a broader picture of available assessments of CO2 emission reduction and the sustainable development potentials. Although economic assessments of transport programs can vary significantly in their scope and analysis methods some illustrative examples are provided below in Table 2

Table 2, Climate change mitigation measures, their CO2 emission reduction potential, and their contribution to other sustainable development objectives for the transport sector.

Strategy	Good practice cities/ projects	CO2 emission reduction	Sustainable development benefits (and risks for trade-offs)		
			Economic	Social	Environmental
Avoid					
Road user charging	Road charge in Peking:	London: 25% CO2 reduction	Travel time reduc- tions: €0.17 mio.	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Shift					
MRT	Metro in Delhi (3)		[illegible]	Value of air-pollution reduction (2011-2012): ~EUR 92 Mio.; Rate of return: 1.4%	Vehicles reduction [illegible]
BRT	Trans Milenio Bogotá (2)	Reduction of carbon dioxide [illegible]	[illegible]	Access for disabled and poor, 90% lower acci- dents in BRT corridors	Air quality improvements
BRT	Trans Milenio Bogotá (7)	CO2 reduction 2006-2012 =	Monetarization of present benefits (2012): € 3,410 Mio	Fewer accidents: €263 Mio., Reduced travel times: €1,533 Mio.	[illegible]
BRT	Metrobús Line 3 Mexico City		Monetarization of present benefits (2012): €177 Mio.	[illegible] €21 Mio., Reduced travel times: €129 Mio.	[illegible]
BRT	[illegible]	1.19 Mt CO2	[illegible]	Time saving: 357 mio. hours,	Reduced PM 232 t, NOx 1779 t, BC 109 t

BRT	BRT Line C-5 Manila (11)	Reduced CO2 /	Vehicle operating cost savings:	Time savings per year:	Reduced air pollution: NOx ~ EUR 1,100, PM ~ EUR 880
BRT	BRT Bangkok	Reduced CO2 / year: ~ €2.3 mio.	Vehicle operating cost savings:	Time savings per year:	Reduced air pollution: ... EUR, PM ... 000
MRT	[illegible]	Overall GHG emission reductions not quantified	Faster transport, Green jobs (650 full time in Copenhagen)	[illegible]	Zero air pollutants, Less noise

Improve

Emis- sions standards	Use EURO norm in Delhi (3)	Emission reduction not quantified	(KSHS 40,57	[illegible] traffic, especially	Less emissions, less congestion
Vehicle	Old buses	17874 t CO2 /	[illegible]	Reduce congestion and	Reduction of

Strategy	Good practice cities/ projects	CO2 emission reduction	Sustainable development benefits (and risks for trade-offs)		
			Economic	Social	Environmental
Heavy	Improved	37.9 t/year /	Lower costs		NOx: 0.239 tons,
Fuel	Shengyang Fu-	Medium to high		Emission reduction,	Increase in CO2
Improved	Bike	Reduction of	Income of ~ EUR	supporting long-	Lower ownership

Mixed approaches

Sustain-	Indian Trans-	CO2 Avoidance:	Improvement of quality	Avoidance of air

1: Copenhagen Bicycle Account (2010) 2: CDM Project Co-benefits in Bogotá, Colombia (2010) 3: Social Cost-Benefit Analysis of Delhi Metro (Murty, Dhalvala & Singh, 2006) 4: Creutzig & He (2009) Climate change mitigation and co-benefits of feasible transport demand policies in Beijing 5: Dhar & Shukla (2015) Low carbon scenarios for transport in India:Co-benefits analysis 6: Dirgahayani (2013) Environmental co-benefits of public transportation improvement initiative: the case of Trans-Jogja bus system in Yogyakarta, Indonesia 7: Embarq (2013) Social, Economic, Environmental impacts of BRT systems 8: Fabian (2008) Co-benefits: Linking low carbon transport to sustainable development 9: Geng et al (2013) Co-benefit evaluation for urban public transportation sector e a case of Shenyang, China 10: Gota & Mejia (2013) Assessing Co-benefits from BRT Projects 11: IGES (2011) Mainstreaming Transport Co-benefits Approach 12: Mrkajic et al (2015) Reduction of CO2 emission and non-environmental co-benefits of bicycle infrastructure provision: the case of the University of Novi Sad, Serbia. 12: Stompen et al. 2012, Reducing Carbon Emissions through Transport Demand Management Strategies.

Assess all relevant impacts to maximise synergies

There is significant potential for cost efficient emission reductions in the transport sector. Estimates suggest that, considering all benefits and costs, urban transport energy consumption and emissions could be reduced by 40- 50% compared to current trends using currently available and cost effective measures (Eads 2010; IEA 2014; ITF 2013). The implementation of these transport measures would generate substantial efficiency gains, greenhouse gas emissions reductions and improved air quality and energy security (Leiby 2007; Mazzi and Dowlatabadi 2007). Yet, these strategies are not fully utilised, despite the large potential co-benefits and high cost efficiency.

One factor that affects the uptake of low-carbon transport measures is the inadequacy of economic evaluation ad- vice that includes all relevant aspects of sustainable development. Compared to large-scale transport projects, such as highway construction, small but more sustainable concepts often lack the critical mass to allow for a thorough cost-benefit analysis. This section provides a short overview of economic evaluation methodologies, followed by an overview of tools that are available to assess the potential of urban mobility policies and projects.

Traditional impact assessment methodologies

To make informed decisions about transport infrastructure and policy options, local authorities with limited resources need clear guidance on costs, benefits and overall impacts. There is often insufficient knowledge of the costs and benefits of low-carbon transport measures which can affect the take-up of those measures. So- cio-economic benefits of low-carbon transport measures may be underestimated and this uncertainty may be perceived as a risk since it can lead to decisions in favour of more traditional and often unsustainable transport infrastructures. Classic cost-benefit analysis (CBA) is a well-established methodology for infrastructure apprai- sal. However, since it requires substantial efforts with regard to data and analysis CBAs are usually only car- ried out for large-scale infrastructure measures such as road or rail construction projects. CBA has often been criticised for failing to incorporate important sustainable development objectives (Jacoby and Minten 2009).

One of the main advantages of CBA is its ability to describe the costs and benefits of a measure in a single cost-be- nefit ratio (CBR). As such CBA becomes a very useful tool for decision-making based on economic efficiency. However, CBA usually fails to properly incorporate all relevant environmental, social and economic benefits as not all of them can easily be monetised. As it is highly challenging to properly measure social factors such as quality of life, these issues are usually neglected in CBAs. Another disadvantage of CBA is the extensive data requirements and relative complexity. The lack of transparency and acknowledgements of interactions of policy objectives and distributional effects is another element that affects the reliability of CBA as a decision making tool. As an additional guidance tool for decision making processes multi-criteria analysis (MCA) can be useful. It allows the incorporation of qualitative evidence as opposed to CBA which can only process quantitative data (Beria, Maltese, and Mariotti 2012). Hence factors in decision making processes that may be harder to measure but are equally important can be included.

Tools to asses sustainable development benefits

A number of tools can help guide decision making processes for sustainable transport policies and infrastructures. These apply some of the approaches from traditional appraisal methodologies, but with lower data requirements and with a specific focus to highlight the ability of measures to contribute to sustainable development. The following section provides a short description of a selection of such tools that can help assess some of the co-benefits of sustainable urban mobility measures.

To assess the direct and indirect CO2 emission reduction potential the Transportation Emissions Evaluation Mo- del for Projects (TEEMP) is a useful and relatively easy to use spreadsheet based tool, which also highlights some linkages to other sustainable development benefits, but does not provide proper assessments of those. The Rapid Assessment Tool, by UN-Habitat and ITDP builds on the TEEMP tool, aiming to add some further analysis on the wider costs, benefits and overall impacts of possible transport measures. The Co-benefits Calculator for Trans- port Projects developed by IGES provides a detailed step-by-step guidance also building on the TEEMP model.

Developed by the Wuppertal Institute for an EU- funded project, the TIDE impact assessment tool for urban transport innovations aims to combine the advantages of the quantitative and qualitative evidence to assess the impact of urban mobility measures. The methodology was designed to assess small-scale innovative projects. The TIDE handbook provides eight key steps from the project description, to the identification, analysis and testing of key performance indicators, to the visualisation and communication of the results. TIDE is Excel spreadsheet based and requires a number of standard input data, but also provides reference data based on other assessments.

Table 3: A comparison of tools available to help assess economic, social and environmental benefits of low-carbon transport policies, technologies and infrastructures, and their climate and sustainable development objectives.

Sustainable development benefits					
Tool and link	Data needs	CO2	Economic	Social	Enviromental
NAMA SD Tool (UNDP)	√√		√	√	√
Co-Benefits calculator for	√	√	√	√	√
Health Impact Assessment (HIA) in Transport Planning (CDC)	√√√		√√√		
The Co-benefits Evaluation Tool for the Urban Transport Sector (UNU-IAS)	√√	√√	√	√√	√
Health economic assessment tool (HEAT) for cycling and walking (WHO)	√√√			√√	
Harmonised European Approaches for Transport Costing and Project Assessment (HEATCO)	√√√	√√	√√	√√	√√
Transport Emissions Evaluation Model (TEEMP) Clean Air Asia / ITDP	√√	√√√			
Rapid-Assessment Tool (UN-Habitat)	√	√√	√√	√√	√√
CIVITAS cba tool (CIVITAS DYN@MO)	√		√	√√	√
TIDE Impact Assessment Tool (Wuppertal Institute / TIDE project)	√√	√√	√√	√√	√√
JOAQUIN (EU project)	√		√	√	√
Konsult (ITS Leeds)	√	√	√	√	√√

Level of coverage of CO2 or SD benefits and data needs: high √√√, medium √√, low √, not covered

Conclusions

There is great economic, social and environmental potential in low-carbon transport. Providing advice with evidence on all those aspects is important to make informed decisions about all potential synergies, but also trade-offs with other sustainable development policy objectives. Using examples of cities that have tried comparable measures can help to illustrate the basic concepts of a policy or infrastructure measure. For this some of the examples provided in this paper may help. However, transferability remains a key issue in this regard and policy makers may have diverging views on which cities or countries are comparable. Ex-ante impact assessments can provide another important input into the decision making process. Vital for this is transparency on the data and assumptions that formed the basis for an assessment. Most of the tools explored in this paper are intended to provide advice during the policy process, which is what this publication is focusing on, but they can also be used to assess the impacts of measures ex-post. This is vital to sustain support for a particular measure or to make the case for an extension in scope or time and of course it is also an important source of information to others to take-up measures.

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