Synergies and co-benefits of sustainable urban mobility

About this policy paper

This policy paper, prepared by the Wuppertal Institute and UN-Habitat, provides a context of sustainable urban mobility concepts with the aim to show the need to the integration of emobility solutions into a wider framework to maximise synergies and minimize trade-offs.

Synergies and co-benefits of sustainable transport

Low-carbon transport strategies that 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. 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 policies 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):

Access and mobility 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).

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 stabilisation 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 travellers 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)

Intervention level	Emission reduction approach	Sustainable development benefits (and risks for trade-offs)		
		Economic	**Social**	**Environmental**
Activity	***Avoid*** Reduce total vehicle travel by reduced trip distances e.g. by developing more compact, mixed communities and telework.	Reduced traffic and parking congestion (6,7). Road and parking cost savings Consumer savings Energy security (1,2). More efficient freight distribution (14). Reduced storm water management costs	Improved access and mobility, particularly for non-drivers, which improves their economic opportunities and productivity (9) Affordability (savings for lower-income households) Accident reductions	Ecosystem and health benefits due to reduced local air pollution (20). Reduced land consumption (7, 9). Potential risk of damage to vulnerable ecosystems from shifts to new and shorter routes (15,16).
Structure	***Shift*** to low-carbon transport modes, such as public transport, walking and cycling	Improved productivity due to reduced urban congestion and travel times across all modes (6,7). Improved energy security (1,2).	More equitable mobility access and safety, particularly in developing countries (8). Reduced accident rates from improved walking and cycling conditions, and shifts from automobile to public transit (7,11). Total accidents can increase if extra safety measures for cyclists are not introduced (22). Reduced exposure to air pollution (7). Health benefits from shifts to active transport modes	Ecosystem and health benefits due to reduced local air pollution (20).

			(7,12).	
Intensity	***Improve*** the efficiency of the vehicle fleet and use	Reduced transport costs for businesses (4,5). Improved energy security (1,2).	Reduced fuel cost for individuals and transport operators (1,2). Health benefits due to reduced urban air pollution (20).	Ecosystem and biodiversity benefits due to reduced urban air pollution (20).
Fuels	***Reduce*** the carbon content of fuels and energy carriers	Some measures may reduce the costs for businesses; others may increase (4). Improved energy security (reduction of oil dependency) (1,2). Reduce trade imbalance for oil-importing countries (3).	Lower exposure to oil price volatility risks (1,2). Electric and fuel cell powered vehicles give air quality improvements (13,20) and noise reduction (10) Potential increase in accidents due to electric vehicles (2-wheelers, cars, buses, trucks) being silent at low speeds (24). CNG and biofuels have mixed health benefits (19,20). A shift to diesel can improve efficiency, but tends to increase air pollution (23).	Electric and fuel cell vehicles Air quality improvements (13,20). Biofuels: Potential adverse effects on biodiversity, water and nitrification (24). Potential issues associated with sustainable supply of biofuels (21). Unsustainable mining of resources for technologies e.g. batteries and fuel cell (17,18).

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,)