OECDpublishing

Please cite this paper as:

Ang, G. and V. Marchal (2013), "Mobilising Private Investment in Sustainable Transport: The Case of Land-Based Passenger Transport Infrastructure", *OECD Environment Working Papers*, No. 56, OECD Publishing. http://dx.doi.org/10.1787/5k46hjm8jpmv-en

OECD Environment Working Papers
No. 56

Mobilising Private Investment in Sustainable Transport

THE CASE OF LAND-BASED PASSENGER TRANSPORT INFRASTRUCTURE

Géraldine Ang and Virginie Marchal



OECD

Unclassified **ENV/WKP(2013)3**

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development

21-May-2013

English - Or. English

ENVIRONMENT DIRECTORATE

ENV/WKP(2013)3
Unclassified

Cancels & replaces the same document of 16 May 2013

ENVIRONMENT WORKING PAPER No. 56 - MOBILISING PRIVATE INVESTMENT IN SUSTAINABLE TRANSPORT: THE CASE OF LAND-BASED PASSAGER TRANSPORT INFRASTRUCTURE

By Géraldine Ang and Virginie Marchal (1)

(1) OECD

JEL Classification: G18, L92, O18, Q01, Q50, R40

Keywords: Transport, Infrastructure, climate change, development, private investment, climate finance, transport policy, urban planning.

All Environment Working Papers can be found available at www.oecd.org/env/workingpapers

JT03339869

Complete document available on OLIS in its original format
This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

English - Or. English

OECD ENVIRONMENT WORKING PAPERS

This series is designed to make available to a wider readership selected studies on environmental issues prepared for use within the OECD. Authorship is usually collective, but principal authors are named.

The papers are generally available only in their original language English or French with a summary in the other if available.

The opinions expressed in these papers are the sole responsibility of the author(s) and do not necessarily reflect those of the OECD or the governments of its member countries.

Comment on the series is welcome, and should be sent to either env.contact@oecd.org or the Environment Directorate, 2, rue André Pascal, 75775 PARIS CEDEX 16, France.

OECD Environment Working Papers are published on
www.oecd.org/env/workingpapers

Applications for permission to reproduce or translate all or part of this material should be made to:

OECD Publishing, rights@oecd.org or by fax 33 1 45 24 99 30.

Photo credit: © eloleo - Fotolia.com

COPYRIGHT OECD 2013

ABSTRACT

Transport infrastructure is a pillar of economic development and a key contributor to climate change. Globally, transport-related greenhouse gas emissions are expected to double by 2050 in the absence of new policies. There is an urgent need to scale-up and shift transport infrastructure investments towards low-carbon, climate-resilient transport options and help achieving the environmental, social and economic benefits associated with sustainable transport infrastructure. Given the extent of investment required to meet escalating global transportation infrastructure needs, and the growing strains on public finances, mobilising private investment at pace and at scale will be necessary to facilitate the transition to a greener growth. Investment barriers, however, often limit private investment in sustainable transport infrastructure projects, due to the relatively less attractive risk-return profile of such projects compared to fossil fuel-based alternatives. In part, this can be attributed to market failures and government policies that fall short of accounting for the full costs of carbon-intensive road transport and the benefits of sustainable transport modes.

Governments have a key role to play in influencing private sector investment, by improving the enabling conditions for investment in sustainable transport infrastructure and delivering investment grade policies. This report aims to advise governments from developed and developing countries on a broad mix of policy tools and instruments that they can use at the national or sub-national levels, to scale-up private investment in sustainable transport infrastructure and shift investment away from carbon-intensive road transport. These include regulations, pricing instruments, innovative financial tools and risk-sharing mechanisms.

The focus of this report is on land-based transport infrastructure for passenger use, including passenger rail, bus rapid transit systems, metros, non-motorised transportation and electric vehicle charging infrastructure.

Keywords: Transport, Infrastructure, climate change, development, private investment, climate finance, transport policy, urban planning.

JEL Classification: G Financial Economics, L Industrial Organization, O Economic Development, Technological Change, and Growth, Q Agricultural and Natural Resource Economics, R Urban, Rural, Regional, Real Estate, and Transportation Economics.

RESUMÉ

Les infrastructures de transport sont un pilier du développement économique, et un contributeur important des émissions de gaz à effet de serre (GES). Au niveau mondial, les émissions de GES liées aux transports devraient doubler d'ici 2050, en l'absence de nouvelles politiques publiques. Il y a un besoin urgent d'augmenter les investissements vers les infrastructures de transport à faible intensité carbone et résilientes au changement climatique, afin d'atteindre les bénéfices économiques, sociaux et environnementaux associés aux transports durables. Compte-tenu de l'ampleur des investissements requis pour répondre à la croissance des besoins en infrastructure de transport, et des contraintes actuelle sur les finances publiques, il est nécessaire et urgent de mobiliser l'investissement privé, à grande échelle, pour faciliter la transition vers une croissance plus verte.

Cependant, de nombreux obstacles limitent encore l'investissement privé dans les projets d'infrastructure de transport durables, souvent moins rentables et/ ou plus risqués que leurs alternatives à base de combustibles fossiles. Ceci est lié à des défaillances de marché, et à l'échec des politiques publiques qui n'internalisent ni le coût de la pollution du transport routier, ni les bénéfices de santé publique des modes de transport durables dans leurs arbitrages économiques. Les gouvernements ont un rôle clé à jouer pour influencer les investissements du secteur privé en mettant en place un cadre règlementaire favorable à ces investissements durables. Ce rapport vise à proposer aux gouvernements des pays développés et en développement un éventail d'outils, d'instruments et de politiques publiques qu'ils peuvent utiliser au niveau national ou local pour orienter les investissements privés vers des infrastructures de transport durable. Ce rapport étudie les outils dont disposent les gouvernements, dont le cadre règlementaire, les instruments de tarification ainsi que les mécanismes financiers innovants de partage des risques. Le cadre de l'étude se limite aux infrastructures de transport de passagers par voie terrestre : trains, métros, systèmes de bus à haut niveau de service (BHNS) et bornes de recharge des véhicules électriques.

Mots clés : Transport, infrastructure, politiques publiques et cadre réglementaire, développement économique, finance climatique, planification urbaine.

Classification JEL : G Économie financière, L Organisation industrielle, O Développement économique, avancées technologiques et croissance, Q Économie des ressources naturelles et de l'agriculture, R Économie urbaine, rurale et régionale.

ACKNOWLEDGEMENTS

This paper benefited from discussion and review by the Environment Policy Committee as well as the Environment Working Party on Climate, Development and Investment.

The authors would like to acknowledge the contribution of David Banister (Oxford University) and Ian Cochran (CDC Climat), as well as the helpful comments and inputs received from external experts Mondher Chargui (RFF), Harald Diaz-Bone (GIZ), Cornie Huizenga (SLoCaT), Joop F.M. Koppenjan (Erasmus University Rotterdam) and Ko Sakamoto (ADB), as well as from OECD colleagues: Andrea Beltramello, Carole Biau, Nils-Axel Braathen, Zack Brown, Jan Corfee-Morlot, Anthony Cox, Jane Ellis, David Gierten, Jongwan Joo, Christopher Kaminker, Osamu Kawanishi, Christopher Kennedy, Nicolina Lamhauge, Olaf Merk, Katlego Moilwa, Dambudzo Muzenda, Andrew Prag and Marie-Christine Tremblay. The authors would also like to acknowledge the helpful inputs and support received from colleagues from the International Transport Forum (ITF) and the International Energy Agency (IEA): Stephen Perkins (ITF), Philippe Crist (ITF) and John Dulac (IEA).

The document also benefitted from discussion during a series of workshops and consultation events held in 2012, where government representatives joined private sector participants and other experts to discuss the themes addressed herein. More information on these events and participation in these can be found on the following website: www.oecd.org/env/cc/financing.

This paper builds on relevant OECD work and publications developed by EPOC, as well as the ITF, the IEA, the Investment, Public Governance and Territorial Development Policy Committees and the International Futures Programme. In particular, this paper draws from the recent paper *Towards a Green Investment Policy Framework: the Case of Low-Carbon, Climate-Resilient Infrastructure*, developed jointly by EPOC and the Investment Committee.

Contact persons: Géraldine Ang (geraldine.ang@oecd.org) and Virginie Marchal (virginie.marchal@oecd.org).

TABLE OF CONTENTS

ABSTRACT 3
RESUMÉ 4
ACKNOWLEDGEMENTS 5
EXECUTIVE SUMMARY 7
INTRODUCTION: THE INVESTMENT GAP FOR SUSTAINABLE TRANSPORT 12
Transport and climate change: challenges and opportunities 12
The broader sustainability challenge 14
The infrastructure investment gap 15
The need to mobilise private investment towards sustainable transport 16
MOBILISING PRIVATE INVESTMENT IN SUSTAINABLE TRANSPORT INFRASTRUCTURE: A POLICY CHECKLIST 18
1. Strategic goal setting and policy alignment 19
1.1 Strategic goal setting 19
1.2 Aligning policy goals and maximising synergies and co-benefits 20
1.3 Integrating land-use and transport infrastructure planning at the metropolitan level 22
1.4 Policy coherence across levels of governments and stakeholders engagement 25
2. Enabling policies and incentives for sustainable transport infrastructure investment 27
2.1 Policies to enable and mobilise investment 28
2.2 Open and competitive markets for green trade and investment 29
2.3 Shifting investment incentives towards sustainable transport 31
2.4 Regulatory and other policies to create markets and remove investment barriers 34
3. Transitional financial measures and instruments 37
3.1 Ensure a financial regulatory framework conducive to sustainable transport investment 37
3.2 Set innovative financial tools and instruments 38
3.3 Transitional direct support for sustainable transport infrastructure investment 51
3.4 Structuring and integrating financing instruments upfront in the planning process 53
4. Harness resources and build capacity for sustainable transport infrastructure 54
4.1 Foster innovation with R&D policies 54
4.2 Training and human capacity 54
4.3 Administrative capacity for assessment, monitoring and enforcement 55
5. Promote green business and consumer engagement 56
CONCLUDING REMARKS 58
REFERENCES 59
ANNEXES 78
Annex 1 - The challenge of using marginal abatement cost curves in transport 78
Annex 2 - Experiences with public-private partnerships in different transport modes 79

EXECUTIVE SUMMARY

1. Transport is the second largest contributor to greenhouse gas (GHG) emissions globally, largely driven by the road sector. Achieving the transition to a low-carbon economy will require significant reductions of transport-related emissions. Transport infrastructure systems are also vulnerable to climate change impacts due to their long operational lifetime and localisation in vulnerable areas. As a result, delivering both climate mitigation and adaptation at scale requires unprecedented changes in transport infrastructure systems and demand patterns across developed and developing countries.

2. Strategies towards sustainable transport – often described as the Avoid-Shift-Improve (A-S-I) approach – requires that governments adopt policies that encourage people and businesses to avoid or reduce the need to travel, shift to more carbon-efficient transport modes, and improve vehicle and fuel technologies, as well as to integrate climate-resilient goals into transport infrastructure strategies, all of which are highly dependent on specific country contexts.

3. Irrespective of the climate change agenda, current investment flows are insufficient to meet transport infrastructure needs to support economic growth and social goals. There is a need to *scale-up* investments to renovate existing infrastructure ("brownfield" projects) and to build new infrastructure ("greenfield" projects), notably in rapidly growing economies. To avoid lock-in into carbon-intensive and climate-vulnerable transport infrastructure development pathways, there is also a need to *shift* investment towards sustainable transport. Developing countries have the opportunity to transition directly to sustainable transport infrastructure, as most surface transport infrastructure is yet to be built, notably public transport infrastructure. The financial gap applies as well to the renewal of infrastructure in developed countries, where there is a window of opportunity to improve performance or shift towards more energy-efficient transport modes.

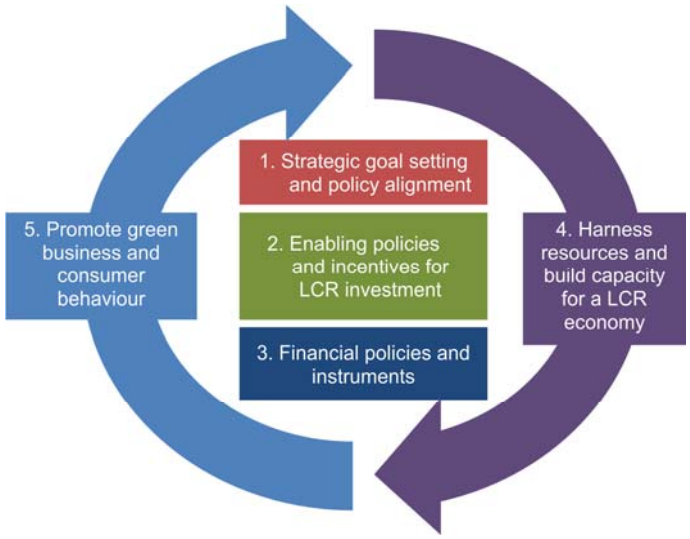
4. Given the scale of investment required, and the growing constraints on public finances, mobilising private investment at pace and at scale will be necessary to meet the investment needs. The public sector has traditionally played a key role in financing land transport infrastructure, as passenger transport displays a quasi-public good nature and provides high social and economic returns. Since the 1990s however, increasing pressure on public finances has encouraged governments to increase private sector participation (PSP) in land transport infrastructure, whether through public-private partnerships (PPPs) or full privatisation. However, private involvement remains limited, largely due to the lower perceived risk-return profile of sustainable transport infrastructure investments such as rail and metros (or "mass rapid transit", MRT), compared with more traditional carbon-intensive options.

5. In the absence of credible mechanisms to internalise the cost of transport externalities (*e.g.* GHG emissions, local air pollution and congestion) and capture the full benefits of sustainable transport, market and government failures will continue to encourage investment in carbon-intensive road transport (*e.g.* through fossil-fuel subsidies). A key challenge for policy makers is to distribute costs and benefits across actor groups.

6. This report aims to advise governments on how to improve the domestic enabling conditions to scale-up and shift private investment in sustainable transport infrastructure. It focuses on the specific case

of sustainable land transport infrastructure for passenger use, such as rail, metros, bus rapid transit systems, electric vehicles charging stations and non-motorised transport. It builds on the paper "Towards a Green Investment Policy Framework: The Case of Low-Carbon, Climate-Resilient Infrastructure", which identifies elements of good practices to establish reform agendas that deliver "investment-grade policies" in green infrastructure and develops a non-prescriptive five-point policy checklist for policy makers (Figure ES.1).

Figure ES.1 Toward a Green Investment Policy Framework



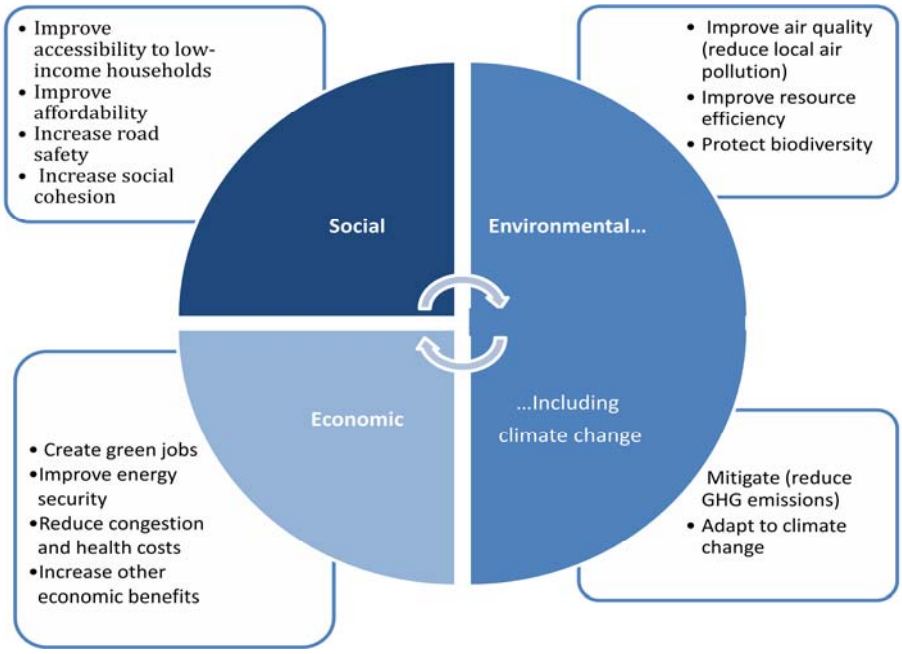
Source: Corfee-Morlot *et al.,* 2012.

1. Strategic goal setting and policy alignment

7. Mainstreaming climate change considerations in transport infrastructure planning helps create a stable, long-term stream of investment opportunities in sustainable transport infrastructure. This requires taking into account the full social, economic and environmental co-benefits of sustainable transport infrastructure when setting strategic goals and objectives (see Figure ES.2). Though this report focuses on climate change mitigation and adaptation as the central objectives of sustainability, it emphasises the importance of other environmental benefits (such as local air quality, biodiversity protection and resource efficiency), in addition to economic and social goals.

8. Integrating land-use and transport planning is a key enabling condition to help reverse the trend of auto-based sprawl, and support public transport infrastructure at the metropolitan level. Coordinating transport and land-use planning is conditional on appropriate governance frameworks, stakeholder engagement — particularly due to the multiplicity of stakeholders involved in metropolitan transport systems — and institutional integration to align policy objectives across levels of governments, horizontally and vertically.

Figure ES.2. Co-Benefits of sustainable transport infrastructure



Source: Authors, adapted from GIZ, 2012.

2. Enabling policies and incentives for sustainable transport infrastructure investment

9. Promoting investment policy principles such as non-discrimination, transparency and property protection forms the core of an enabling investment environment to attract private investment in transport infrastructure (OECD, 2006). Ensuring open and competitive access to sustainable transport infrastructure markets is also critical*, e.g.* in tenders and procurement procedures.

10. Adequate pricing mechanisms and policy measures are also needed to help correct market and government failures, and account for the full costs of traditional road transportation (in terms of externalities such as GHG emissions, local air pollution and congestion). Existing market-based instruments to account for externalities include carbon prices, fuel and vehicle taxes, congestion charges and parking levies. Reforming fossil-fuel subsidies would play a significant role in changing consumers' behaviour and shifting investment incentives away from carbon-intensive road transport towards sustainable transport options.

11. The effectiveness of carbon pricing schemes in reducing road transport demand is, however, hampered by the relative short-run price inelasticity of transport demand, as switching transport modes depends on the existence of alternatives to carbon-intensive road transport, such as high-quality public transit systems. Furthermore, carbon prices, fuel taxes, fuel subsidy reforms and road user charges are politically challenging to implement. As a result, pricing instruments often need to be complemented with regulations such as land use planning and zoning, standards and public procurement programmes. Packaging congestion charges with land use planning and zoning can be particularly effective to provide users with an opportunity to shift away from individual car use towards public transport alternatives.

3. Transitional financial measures and instruments

12. Availability of financing hinders private investment in sustainable transport infrastructure. The provision of long-term financing for transport infrastructure projects has become tighter in key parts of the banking sector, due to economic circumstances, financial turbulence, impending financial regulations and deleveraging, and it may be further constrained in the coming years. There is hence a competition for accessing long-term capital. Rail and metros projects are often constrained by higher upfront capital costs, relatively lower returns and longer development and payback periods, compared to carbon-intensive investment alternatives such as toll highways. In addition to high capital costs, direct user fares are often set too low to cover operational costs, due to social affordability concerns, thus limiting returns. Public transport infrastructure projects are hence less attractive to private long-term investors than carbon-intensive alternatives.

13. A number of financial instruments and risk-sharing mechanisms however are available to redistribute risks and returns across stakeholders and channel private investment towards sustainable transport infrastructure. Such instruments need to be carefully designed and tailored to specific country contexts and transport options:

- *Public-private partnerships (PPPs)* can be effective sustainable transport procurement methods allowing private sector participation and risk sharing, provided that they offer sufficient "value for money" compared to traditional public procurement, and that the right institutional capacities and processes are in place. Experiences to date suggest that PPPs have been successfully implemented in bus rapid transit systems, specific rail and metro links, and shared-used bicycle and car systems.
- *Land value capture tools* capture revenues from the indirect and proximity benefits generated by transport infrastructure (*e.g.* increased real estate value) to finance transport projects. They can be used as part of the capital financing mix to improve projects' profitability. Examples of land value capture tools include tax increment financing (TIF) districts, development charges, development rights and joint development. Experiences to date have mostly been for roads, metros and rail.
- *Loans, grants* and *loan guarantees* are traditional financial tools frequently used to support private sector participation in large-scale sustainable transport infrastructure projects that would otherwise be fully owned and operated by public stakeholders, such as rail and metros. Infrastructure banks or infrastructure funds can play a transitional role to disburse financial tools such as loans and guarantees, and mainstream sustainable transport goals across levels of government.
- *Green bonds* have the potential to attract institutional investors by tapping into the debt capital market, which are currently underexploited for infrastructure investment. Currently, most of the bond markets are used to finance rail infrastructure projects in Europe.
- *Transitional domestic incentive measures and short-run subsidies,* such as tax exemptions, can also be used to provide transitional support to sustainable transport options and technologies, to foster innovation, ramp-up production, offset upfront capital costs, and compensate for network infrastructure bias towards high-carbon transport options. Temporary subsidies can notably be used to support charging infrastructure for electric vehicles (EVs) and plug-in hybrid vehicles (PHEVs).

14. When implementing those instruments, governments will have to carefully balance private and public goals; achieving financial sustainability while ensuring the provision of the social, economic and environmental goals of sustainable transport.

4. Harness resources and build capacity for sustainable transport infrastructure

15. Administrative hurdles and capacity gaps can hamper private investment in transport infrastructure projects. Effective transport planning requires addressing those obstacles to ensure a proper project implementation, foster innovation, and harness human and technical resources in support of sustainable transport goals. In particular, inadequate administrative capacity creates hurdles for private investors and operators. Monitoring and evaluation and climate risk assessment tools for transport infrastructure are also needed to mainstream climate-resilient goals in transport planning.

5. Promote green business and consumer engagement

16. Information, education, public awareness campaigns and business outreach programmes can help reduce information barriers and promote changes in corporate and consumer behaviour encouraging the use of alternative transport modes and helping to shift investments towards sustainable transport infrastructure. Individuals and private actors need reliable information, on which to base respectively their travel and investment decisions.

Concluding remarks

17. Several policies and instruments can help to capture the non-monetised costs of carbon-intensive transport and the benefits associated with sustainable transport, and improve the risk-return profile of sustainable transport infrastructure projects. Governments need to package and integrate those instruments into a coherent mix of enabling policies and policy tools, in order to effectively shift and scale-up investment in sustainable transport infrastructure. For example, pricing instruments such as congestion charges are generally more effective when packaged with land-use planning and public awareness campaigns. Similarly, structured financing plans need to be integrated upfront in transport planning process, with the appropriate mix of traditional and innovative sources of financing. Transport infrastructure planning can usefully be integrated within wider land development programmes and projects, notably to capture the indirect or proximity benefits of transport services on housing development, property values, and commercial activities, using land value capture tools. Such financing arrangements can be particularly useful to decrease reliance on public funds, and encourage private sector participation and respect of the user-pays principle.

18. Finally, there is no one-size-fit-all approach to mobilise private investment in sustainable transport infrastructure. Although the elements of good practice highlighted in this report are likely to be similar for all countries, country contexts do matter and policy mixes and designs need to be tailored to specific domestic country contexts and adapted to the policy and regulatory framework, both at the national and sub-national levels.

INTRODUCTION: THE INVESTMENT GAP FOR SUSTAINABLE TRANSPORT

19. *Note: The focus of this report is on land-based transport infrastructure for passenger use, including passenger rail, bus rapid transit (BRT) systems, metros (i.e. mass rapid transit systems - MRT), non-motorised transportation and electric vehicle charging infrastructure. This report does not address inland waterways transport, rail freight, traditional bus transit systems and taxis, though they also play a significant role in mitigation and adaptation strategies.*

Transport and climate change: challenges and opportunities

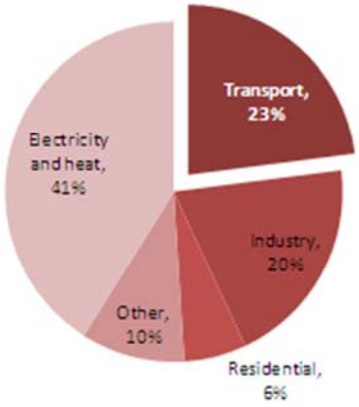
20. In Cancún in 2010, global leaders agreed to work together to tackle climate change, with a view to limiting the global average temperature increase to 2 degrees Celsius by the end of the century compared to pre-industrial levels, to avoid large-scale, irreversible and potentially catastrophic climate change impacts. Achieving this goal requires reversing greenhouse gas (GHG) emission trends, to stabilise atmospheric concentrations at 450 ppm CO_2e[1] or below (IPCC, 2007; UNFCCC, 2010).

21. Transport infrastructure systems display inertia, due to their long life span and to the time lags between planning and construction. As a result, delivering both climate change mitigation and adaptation at scale, across country context, requires unprecedented efforts today to transform our mobility patterns, whether to renovate existing transport infrastructure ("brownfield") or build new infrastructure projects ("greenfield"). Transport also shapes land use, particularly at the urban level, which requires coordinating transport with land use planning (see subsequent section 1.3).

22. GHG emissions from the transport sector will have to be significantly reduced to achieve this goal (OECD, 2009c). Transport is the second largest contributor to global GHG emissions, causing 23% of global carbon dioxide (CO_2) emissions from fossil-fuel combustion and about 15% of global GHG emissions (see Figure 1). In the absence of new policies, transport-related global CO_2 emissions are expected to double between 2010 and 2050, largely driven by emerging and developing countries (OECD, 2012a; IEA, 2013a). Indeed, global passenger transport volumes in 2050 could be up to 2.5 times as large as in 2010 (ITF, 2012). Road transport for passenger and freight accounts for 73% of transport-related CO_2 emissions as of 2009 (see Figure 2). Current investment trends towards fossil-fuel road transport in emerging economies and developing countries will further lock-in CO_2 emissions for decades to come (Corfee-Morlot *et al.,* 2012; OECD, 2012b).

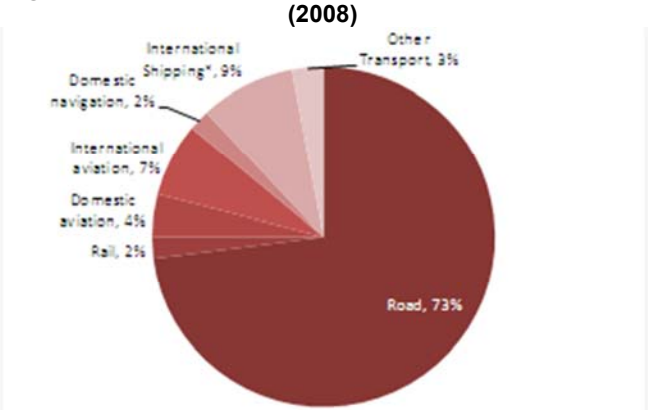
[1] Parts per million of carbon dioxide equivalent

Figure 1. Word CO_2 emissions by sector*, 2009



Source: IEA, 2011a. *Other includes commercial/public services. Agriculture/forestry, fishing, energy industries other than electricity and heat generation not specified.

Figure 2. Modal split of transport related CO_2 emissions (2008)



Source: OECD, 2010b.

23. With more than half of transport occurring in urban areas as of 2010, cities have a key role to play. There is a growing understanding that achieving a green growth development path will require designing efficient and sustainable urban transport systems in support of urban mobility. Rapid urbanisation trends[2] give rise to key environmental and economic challenges due to uncontrolled, auto-based urban sprawl, including traffic congestion, local air pollution and GHG emissions (UN DESA, 2010; Suzuki *et al.,* 2013). Urban private motorised travel increased by nearly 35% between 2000 and 2010 (in passenger km), with two-wheelers and light-duty passenger vehicles increasing by as much as 90% in some regions. Coupled with income growth, vehicle ownership rates are increasing by 15-20% per annum in some developing countries. The IEA expects that urban passenger travel under a business-as-usual pathway will more than double by 2050, and annual urban transport energy consumption will increase by 80% over 2010 levels by 2050 (IEA, 2013a; 2012a). As a result, annual urban transport emissions are expected to more than double to nearly 1 billion annual tons of CO_2e by 2025, when 90% of urban transport emissions growth will come from private motorised travel.

24. Due to their long operational lifetime and localisation in vulnerable areas, transport infrastructure systems are also vulnerable to climate change. Extreme temperatures, precipitation, increased wind strength as well as increased storm intensity and frequency can disturb railway operations and damage road and bridge foundations. More intense and frequent heat waves for instance affect road pavements and rail services (as do shifting permafrost conditions in certain northern regions). In addition, sea-level rise, heightened storm surge and increased delta river-flows will raise flood and salinity risks for coastal transport infrastructure (*e.g.* risk of road pavement deterioration due to salinity) (ADB, 2011; Agrawala *et al.,* 2011; DEFRA, 2011).

[2] Between 2010 and 2050, the world urban population is expected to increase by 2.8 billion, including 2.7 billion in emerging economies and developing economies; the average size of the top 100 cities in the world has grown tenfold since 1990; UN DESA, 2010; Suzuki *et al.,* 2013.

The broader sustainability challenge

25. Though this report focuses primarily on climate change mitigation and adaptation as key factors for implementing sustainable transport systems, it emphasises the need to consider transport infrastructure through the broader lens of sustainability, and recognises the importance of other environmental, social and economic goals of sustainable transport (Sakamoto, 2010b; IEA, 2012b). This is particularly relevant as climate change goals will rarely be the main objectives of policy makers when supporting investment in urban transit systems, rail or nonmotorised transport (Corfee-Morlot *et al.,* 2012; see section 1.2). Rather, policy makers are often concerned with other goals such as traffic congestion and economic growth, local air quality, affordability and urban mobility.

26. In addition to climate change concerns, other *environmental goals* of sustainable transport include: health and local air quality, biodiversity, noise pollution, resource efficiency and land use impact (Sakamoto, 2010b). *Economic goals* include: supporting economic growth and competitiveness through achieving mobility of persons and goods; avoiding congestion; and using resources efficiently without over-burdening public and private budgets (Sakamoto, 2010b; Fjellstrom, 2002). *Social goals* consists notably in allowing individuals to meet their basic mobility needs (access to jobs, healthcare, education, other social activities) in a way that does not impact their health and is equitable.

Box 1. A strategy towards sustainable transport: the A-S-I approach

How to transition away from carbon-intensive and unsustainable transport demand patterns? The strategy towards sustainable transport is often described in the literature as the Avoid-Shift-Improve (A-S-I) approach. Sustainable transport policies can be grouped into three types of policies:

- **"Avoid**" or "reduce" the need to travel and the trip length, by improving the efficiency of the overall transport system through integrated land-use planning and transport demand management, *e.g.* through compact, mixed-use development planning, traffic restrictions, mobility management and marketing, and national subsidies for low-carbon transport metropolitan design and planning;
- "**Shift**" or "maintain" tools, to improve trip efficiency by encouraging modal shift to low-carbon transport modes such as public transport, e.g. through parking restrictions, road space allocation, public awareness campaigns on private vehicles' alternatives; procurement of public transport; and
- "**Improve**" fuel and vehicle efficiency and technologies, e.g. through vehicle standards, speed limits, labelling of vehicles' environmental performance; and fiscal incentives for electric or hybrid vehicles.

Experiences to date show that A-S-I strategies need to be tailored to specific country context, depending on infrastructure needs, income levels, transport trends, energy mix and urban development patterns. For instance, while in developed countries, "Improve" strategies can help promote electric vehicles and rail electrifications, developing countries often make better use of encouraging small, efficient cars and innovations for traditional non-motorised transport modes such as cycle rickshaws. Effective sustainable transport strategies often require enhancing synergies between "Avoid", "Shift" and "Improve" policies. For example, when investing in a bus rapid transit (BRT) corridor ("Shift"), urban policy makers can alter land-use regulations to promote densification around the corridor ("Avoid"), and use clean-fuel buses ("Improve"). A-S-I strategies require infrastructure investments, such as: BRT corridors ("Shift"); rail infrastructure for metros and high speed rail ("Shift"); parkings ("Avoid"); and electric vehicle charging stations ("Improve").

Climate-resilient strategies have to be mainstreamed in A-S-I approaches to adapt to an already changing climate. Cost-benefit analyses show – when they account for the costs of climate change – that building-in climate resilience upfront in greenfield transport infrastructure is sometimes less expensive than retrofitting brownfield infrastructure to adapt to climate impacts. Examples include improved drainage systems to increase road's resilience against heavier rainfall (*e.g.* in Kosrae, Micronesia). In addition, there are synergies between climate-resilient and low-carbon transport strategies. For instance, multimodal and intermodal strategies for passenger transport, which integrate public transport modes and planning (*e.g.* with connected transfer stations, common fares and synchronised timetables) can encourages the use of public transport modes while increasing the resilience of the overall system, provided they allow for redundancy and limit vulnerability and systemic risk.

Sources: IEA, 2013b ; UNEP, 2011; GIZ, 2011; Agrawala *et al.*, 2010; Eichhorst, 2009; Dalkmann et al., 2009, 2007; Klein *et al.,* 2007.

The infrastructure investment gap

27. The growth of global transport demand and global mobility will require significant increases in transport infrastructure investment (IEA, 2013a). The challenge of financing sustainable land transport infrastructure can be analysed along two lines: 1. the need to *scale-up* land transport infrastructure investment and 2. the need to *shift* investment towards sustainable transport options. The two are intertwined and cannot be studied in isolation.

28. The increase in global passenger and freight travel will require *scaling-up* current levels of investments in transport infrastructure, particularly in rapidly emerging economies, to meet development goals and increased travel needs. Current infrastructure investment flows will not suffice to handle the resulting growth in transport infrastructure needs, neither for extension of transport network nor for building missing links, removing bottlenecks and upgrading existing infrastructures. Cumulative capital construction expenditures on land transport infrastructure investment are estimated to USD 45 trillion by 2050 in the IEA Energy Technology Perspectives 2012's 4ºC or "4DS" scenario (which assess what announced policies can deliver), representing about 0.7% of global GDP (IEA, 2013, 2012a). Cumulative needs reach USD 120 trillion by 2050 (or USD 3 trillion per year on average) when including reconstruction, upgrade, operational and maintenance costs on roads, rail, bus rapid transit, high speed rail and parking (IEA, 2013, 2012a).

29. Incremental investments for adaptation and mitigation in the transport sector might just represent a small share of the total investments required. In particular, high investment needs in low-carbon vehicles could be offset by net savings on rail, high speed rail (HSR) and bus rapid transit (BRT) infrastructure. Under the IEA's 2DS scenario, despite increases in expenditures on rail, HSR and BRT, investment in sustainable transport options could represent net savings of nearly USD 20 trillion in global land transport infrastructure spending over 4DS estimates (though the IEA 2DS scenario does not include investment needs to purchase additional train and BRT buses; IEA, 2013). This comes mostly from reduced investment and maintenance costs in roads and parkings, and savings in travel times, through "avoid" and "shift" policies. In addition, "Improve" policies could represent an estimated 30 trillion of savings in vehicle and fuel expenditures[3] (IEA, 2013a, b, 2012a, 2011c). The "Avoid-Shift-Improve" approach (see Box 1) has the potential to lower total global expenditures on vehicles, fuels and transport infrastructure, while at the same time increasing investments in public transport and non-motorised transportation. For adaptation, the incremental cost to climate-proof investments in infrastructure sensitive to climate change is estimated at 5-20% of new investment costs (UNFCCC, 2007).

30. The additional costs of investing in sustainable transport infrastructure should also be assessed with regard to the benefits across the whole network of infrastructure systems. Indeed, those estimates do not take into account potential positive feedback loops and interdependences between land transport and other infrastructure systems. Kennedy and Corfee-Morlot (2012) argue that "although cost estimates are incomplete, the technical interdependency and financial tradeoffs across infrastructure systems suggests the potential to generate virtuous cycles of low-carbon growth". Three interactions are central in generating those virtuous cycles: increased electricity production through clean energy for electric cars; decreased

[3] The IEA estimates that total undiscounted incremental investment costs required to cut global energy-related CO_2 emissions by half by 2050 compared to 2007 levels amount to USD 22 trillion for vehicles, and USD 48 trillion for fuels (USD 144 trillion in the BLUE Map scenario, compared to USD 96 trillion in the baseline scenario). Half of these incremental costs will occur in emerging and developing economies; IEA, 2012a.

demand for oil and natural gas, which reduces capital requirements for new infrastructure in these sectors; and alternatively, reinvestment of this capital in the greening of the electricity sector, which decreases demand for coal, hence demand for additional infrastructure in ports or trains to transport coal (Kennedy and Corfee-Morlot, 2012; ITF, 2012).

31. The urgent need to *scale-up* transport infrastructure investments creates a unique leapfrogging opportunity to *shift* investment towards sustainable transport modes and options (Corfee-Morlot *et al.,* 2012). In developing countries facing rapid urbanisation in particular, most of the transport infrastructure required to meet development goals remains to be built.

The need to mobilise private investment towards sustainable transport

32. Who could finance the transition? Public actors have traditionally played a key role in financing transport infrastructure as transport display a quasi-public good nature, providing high social and economic public benefits. In particular, public transport systems represent a classic example of market failure where there is a public good associated with the infrastructure (economic development, health benefits) that is greater than the private good for the individual user of the infrastructure and therefore justifies public policy intervention.

33. As a result, public stakeholders have historically carried ownership, financing and investment risk of transport infrastructure (Zegras, 2002; Freshfields, 2010). Most urban transport infrastructure worldwide has been financed through local governments' operating savings, national and regional grants and public borrowing, rather than through user charges (Peterson, 2012). Most road and rail infrastructure in OECD countries has been funded through taxation and public borrowing since at least the middle of the 20th century (OECD/ITF, 2008b).

34. Given the scale of investment required in sustainable transport infrastructure, and the growing pressure on public finance, mobilising private investment has become indispensible. Since the early 1990s, pressure on public budgets and limited revenue-raising capacity in the public sector, coupled with competing public priorities and rising social expenditures[4], have encouraged governments to increase private sector participation (PSP) in land transport infrastructure. This has been done using various business models, from service contracts to public-private partnerships (PPPs) to full privatisations (Della Croce *et al.,* 2011a; OECD/ITF, 2008b, OECD, 2007a). Since 2008, the global economic crisis and fiscal crisis of the Eurozone have exacerbated public finance strains (through reduced tax revenues and increased deficits and debt servicing costs due to lower credit ratings), and encouraged national and local governments to promote PSP in transport infrastructure.

35. Investment barriers however often limit the scale and pace of private sector investment in sustainable transport infrastructure projects. Investment barriers relate to the relatively lower risk-return profile of sustainable transport infrastructure projects and lack of opportunities, relative to fossil fuel-based alternatives, due to market and government failures that fall short of accounting the full costs of carbon-intensive transport modes (*e.g*. from externalities such as GHG emission, local air pollution or traffic congestion). Public investment is still skewed towards carbon-intensive road transport modes in most country context, which further discourage private investment's *shift* towards sustainable transport. In most emerging economies, the growing demand for transport in rapidly growing cities is often met by

[4] Between 1980 and 2003, social expenditures have increased on average from about 16% to 21% of GDP. The key drivers of increases in social spending were health and retirement expenditures.

infrastructure geared towards fossil fuel-based motorised modes. In developing countries for instance, road investments still account for 75% of infrastructure investment (Sakamoto *et al*., 2010a). In addition, policy failures fall short of accounting the benefits of sustainable transport, which provides many non-monetised benefits to the society as a whole, difficult to capture by the private investor in the absence of policies such as market-based and pricing instruments to capture the net benefits associated with sustainable transport investments. A key challenge for policy makers is to distribute costs and benefits across actor groups.

36. In the absence of robust domestic policy and regulatory frameworks in support of sustainable transport infrastructure investment, to account for the full costs for carbon-intensive road transport and the benefits of sustainable transport, projects such as high-speed rail, metros or electric vehicle charging infrastructure remain characterised by lower investment opportunities, lower returns relative to carbon-intensive alternatives and high investment risk, which justifies public policy intervention:

(i). *Lower investment opportunities*: Climate change and other environmental concerns are too often overlooked in the planning processes of municipalities and national governments, which often promote investment in private fuel-based vehicle transport through various incentive schemes and land-use planning geared towards suburban sprawl;

(ii). *Lower returns on investment*. Rail or metro investments are characterised by high upfront capital costs and long development timelines and payback periods relative to road projects. They require large-scale carriers operating on extensive networks, and often need to be managed on a network basis, unlike toll highways (OECD/ITF, 2008b). This is particularly true for rail networks, which bear natural monopoly characteristics, whereby provision is facilitated by the presence of only one operator. Sustainable transport infrastructure is also constrained by network externalities – resulting for instance from existing technologies and rolling stock, which raise implementation costs, require systemic transitions and parallel investments and limit new technologies' near-term cost competitiveness, *e.g.* for electric vehicle charging infrastructure. In addition, welfare and affordability concerns often discourage governments from charging users with the full cost of transportation, particularly with urban transit systems, which limits revenues from user fares; and

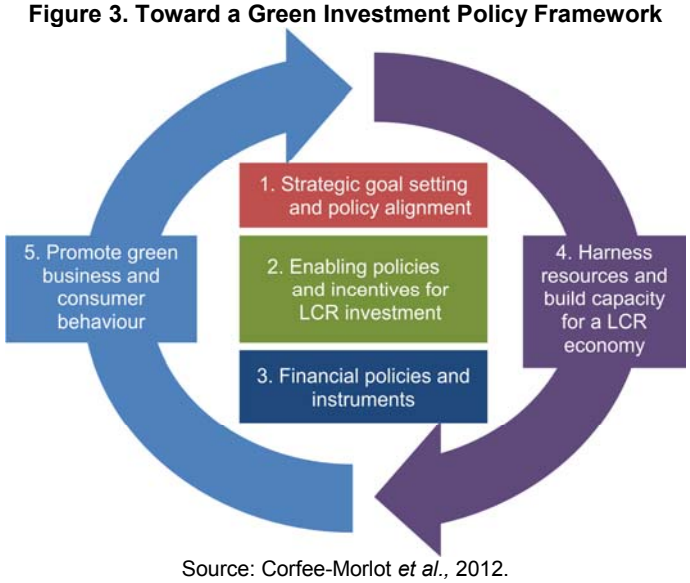
(iii). *High risks or perception of higher risks faced by private investors throughout the life of projects.* The profile of sustainable transport projects bears many of the risks associated with infrastructure projects, including construction, financial, operational, demand and revenue risks (see Corfee-Morlot *et al.,* 2012). In addition, longer development timelines associated with complex public-private partnership contractual arrangements increase exposure to a change in policies and politics governing the contracts. As a result, investors require some certainties on the policy environment, public willingness to finance or commission projects, and on revenue streams.

MOBILISING PRIVATE INVESTMENT IN SUSTAINABLE TRANSPORT INFRASTRUCTURE: A POLICY CHECKLIST

37. Governments have a key role to play in influencing private investment for sustainable transport infrastructure through domestic policies, even under tight fiscal constraints. The OECD paper "Towards a Green Investment Policy Framework: The Case of Low-Carbon, Climate-Resilient Infrastructure" provides a policy checklist to help governments mobilise private investment in low-carbon, climate-resilient infrastructure (Corfee-Morlot *et al.*, 2012*)*. From the perspective of private sector engagement, a green investment policy framework can influence three key investment conditions: i) the existence of investment opportunities; ii) the return on investment, including boosting returns and limiting costs; and iii) the risks faced by investors. It recognises that country contexts matter and that instrument mixes and policy design will need to be tailored to unique national characteristics and institutions. Yet regardless of the country context, the main elements for good practice are likely to be similar, even if there is variance in terms of the priority and urgency placed on various elements as well as a tailoring of the policy details.

38. Five elements for policy intervention have been identified (see Figure 3): 1. Setting strategic goals and align policies across and within levels of government; 2. Improving enable investment environment and strengthening market incentives for low-carbon, climate-resilient infrastructure; 3. Establishing financial policies and instruments to provide transitional support for low-carbon, climate-resilient infrastructure investments; 4. Harnessing resources that can increase the social returns for private investment, *e.g.* through training, research and development (R&D) and risk assessment tools); and 5. Promoting green business and consumer behaviour*, e.g.* through information and education policies.

Figure 3. Toward a Green Investment Policy Framework



Source: Corfee-Morlot *et al.,* 2012.

39. Building on those five elements, this paper identifies key enabling policies and tools to scale-up and shift private investment in sustainable transport infrastructure. In particular, several instruments are available to better capture the non-monetised costs and benefits associated with sustainable transport infrastructure.

1. Strategic goal setting and policy alignment

40. Mainstreaming climate change considerations in the transport planning process helps create a stable, long-term stream of investment opportunities in sustainable transport infrastructure. This requires taking into account the full social benefits of sustainable transport infrastructure when setting strategic goals and objectives. As transport and land-use planning cuts across different jurisdictions, it also requires developing appropriate governance frameworks to align objectives across different policy areas and levels of government.

1.1 Strategic goal setting

41. Some countries have already integrated sustainable priorities within their strategic national planning plans national and sub-national transport infrastructure plans and national disaster risk-management strategies, to support the transition towards sustainable growth and overcome the carbon-intensive motorisation trend under business-as-usual scenarios (see the UK example in Box 2). Conversely, other countries have set long-term national climate goals for GHG emissions reduction in the transport sector (*e.g.* with the EU binding commitment to achieve a 10% reduction in the transport sector by 2020 compared to 2012). From an economic perspective, setting separate goals for specific sectors of the economy increase the total costs associated with the policy. However, it is a first step in sending clear signals to investors and policy makers to factor climate change into their decision-making process.

Box 2. Sustainable transport infrastructure planning in the UK

The UK has established several plans and strategies for sustainable transport infrastructure investment across various agencies and ministries.

Set by Infrastructure UK, a unit within HM Treasury department, the UK 2010 and 2011 *National Infrastructure Plans* both stress the importance of sustainable transport infrastructure. The 2010 Plan outlines infrastructure investment challenges and strategic planning to underpin sustainable growth in the UK. The 2011 Plan stresses the importance of supporting the transition to a low-carbon economy by reducing the impacts of transport systems. In order to achieve those goals, the UK is planning to invest GBP 30 billion in key transport projects, including *High Speed Two*, a high-speed rail network; the construction of Crossrail, a high-frequency railway for London and the South-East; and maintenance, investment and energy efficiency efforts for Network Rail, UK's railway network.

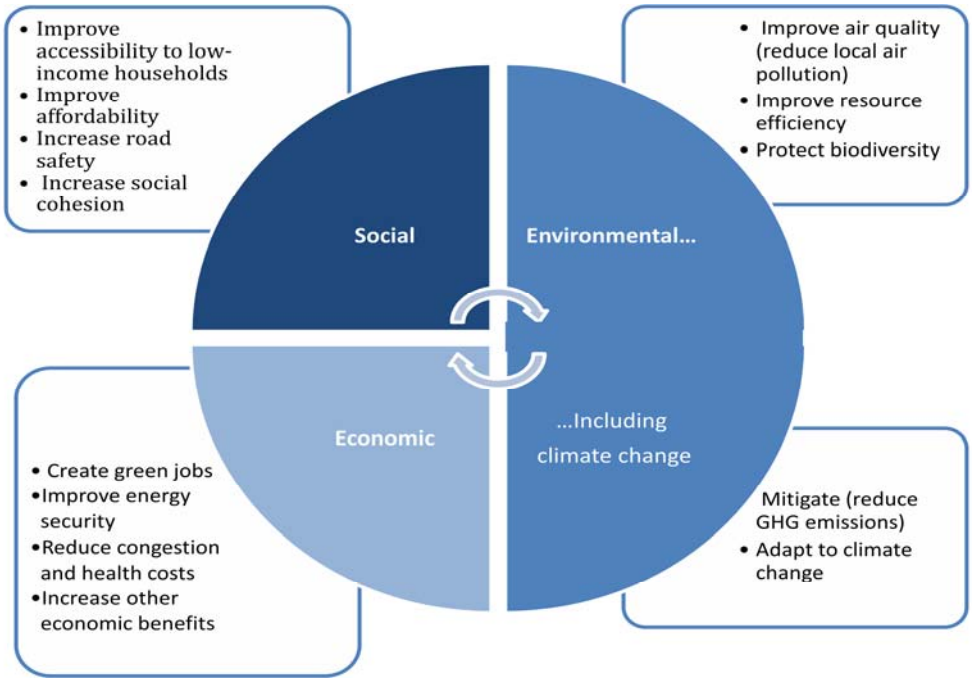
The UK Department for Transport (DfT) has also laid out a low-carbon transport strategy, *Low Carbon Transport: A Greener Future* (as part of *UK Low Carbon Transition Plan* set by the UK Department of Energy and Climate Change - DECC), and published *Making the Connection: The Plug-in Vehicle Infrastructure Strategy*. Finally, the UK Department for Environment, Food and Rural Affairs (DEFRA) has developed a *Climate Resilient Infrastructure Plan*, which considers adaptation challenges for infrastructure, particularly transport.

Sources: Infrastructure UK, 2010, 2011; DEFRA, 2011; DfT, 2011, 2009; HM Treasury, 2012; DECC, 2009.

1.2 Aligning policy goals and maximising synergies and co-benefits

42. Climate change concerns, however, will rarely be the main catalysts for sustainable transport policies and planning, in most domestic contexts. Rather, other policy goals will motivate public support for sustainable transport infrastructure, such as reduced congestion, improved accessibility, reduced local air pollution or energy security. Mitigation and adaptation will be side-benefits of selected transport options. Bus rapid transit (BRT) systems have for instance been implemented by several city governments to reduce local air pollution (see example in Box 3). National railway systems have often been used to reduce congestion and pollution, provide access to remote and small communities, or to support economic development and trade (OECD/ITF, 2008b). Similarly, in several developing cities, public decision-makers have supported sustainable transport infrastructure projects mainly to relieve traffic congestion and increase mobility[5] and accessibility to low-income populations (Suzuki *et al.,* 2013). The rationale of transport strategies will thus inevitably exceed climate change goals and other environmental goals, to address social and economic goals, while at the same time achieving climate change goals.

Figure 4. Co-Benefits of sustainable transport infrastructure



Source: Authors, adapted from GIZ, 2012.

43. Aligning policy goals and taking into consideration synergies and co-benefits is essential in ensuring policy coherence (Corfee-Morlot *et al.,* 2012). Many authors urge consideration of low-carbon, climate-resilient transport strategies and infrastructure planning from a "co-benefits" perspective, taking into account other environmental, economic and social goals. This enables the climate agenda to advance through synergies with more prominent policy goals since sustainable transport can generate social, economic and environmental co-benefits (see Figure 4 and Bollen *et al.,* 2009a, b; Cochran, 2012; Corfee-Morlot *et al.,* 2009; Leather *et al.,* 2009; Viguié, 2011; GIZ, 2012; UNEP, 2011; Zusman *et al.,* 2012).

[5] I.e. "the ease and speed of moving about cities"; World Bank (2012 forthcoming).

Sustainable transport infrastructure investment driven by policy concerns such as congestion or health are likely to have low-carbon and climate-resilient co-benefits. In an urban context for instance, promoting public transportation primarily to reduce congestion and improve accessibility provides mitigation co-benefits (see Table 1). Similarly, in least developed countries (LDCs), upgrading and maintaining roads to support development goals is already *per se* an adaptation strategy, as it increases the system's resilience to climate change impacts.

Table 1. Benefits of sustainable transport modes and options

Benefits (→) Policy options (↓)	GHG emissions	Air quality & health	Congestion	Transport accessibility	Road safety
Bus Rapid Transit (BRT)	Medium	Medium	High	High	Medium
Light Rail/Metro or Mass Rapid Transit (MRT)	Medium	Medium	High	Medium/High	Medium
Rail	Medium	Low	Medium/High	Medium	Low
Low-carbon vehicles	Medium/ High	High	Low/Negative	Low/Negative	None
Non Motorised Transport	Low	Medium	Medium/High	Medium/High	Medium
Land-use planning	Medium	Medium/High	High	High	Medium

Source: Authors, adapted from UNEP, 2011.

44. Assessing the full environmental, social and economic costs and benefits of sustainable transport infrastructure projects requires mainstreaming the use of multi-criteria cost-benefit analyses, and including co-benefits as part of standard appraisal methods. Improving measurement metrics and promoting the use of multi-criteria analysis can help account for social and environmental factors, in addition to traditional economic costs and benefits. This practice is already widespread in several countries. This is for instance the case in France, to assess major transport infrastructure projects and long-term transport infrastructure plans in terms of environmental, social and economic impacts (Quinet, 2010). However, since the results of cost-benefit analyses are often presented as consolidated, it is difficult to trace the synergies across policy objectives, and assess how each element is calculated and how selected hypothesis (*e.g.* for carbon prices) will impact calculations. In addition, multi-criteria analyses are often misused, as the weight assigned to specific social outcomes largely determines total outcomes.

Box 3. Policy goals and co-benefits of bus rapid transit systems in Mexico City

The bus rapid transit (BRT) system Metrobus was launched to improve air quality (and reduce congestion) in Mexico City, by introducing cleaner buses, as part of the 2002-2010 "Programme to Improve Air Quality in the Mexico City Metropolitan Area (MCMA)", led by the Ministry of Environment of Mexico's Federal District. The programme aimed to reduce emissions of particulate matter ($PM_{2.5}$), ozone precursors and GHGs from mobile and fixed sources. Efforts were then conducted to better integrate climate change concerns into Metrobus strategic planning.

Metrobus received support from the Global Environment Facility (GEF) through the USD 4.8 million project "Mexico: Introduction of Climate Friendly Measures in Transport", implemented by the World Bank. The project's objective was to support a long-term modal shift towards climate-friendly, more efficient and less polluting, less carbon-intensive transport in Mexico City, through better strategic planning (GEF, 2002; World Bank, 2002). The project emphasised the need for Mexico metropolitan authorities to: (1) better harmonise their programmes and policies on the issues of transport, air quality and land-use; and (2) better integrate climate change concerns into the transport sector planning and decision-making, since local authorities had insufficiently recognised the harmonisation potential between climate change and sector policies on air quality and transport. The World Bank established an interdisciplinary team to support the project planning and was insistent on the low-carbon agenda. Thanks to a better integration of climate issues, Metrobus' Line 1 "Insurgentes" was registered under the Clean Development Mechanism (CDM). Metrobus' first phase generated USD 1.1 million from the sale of carbon credits.

Since Metrobus was established to achieve multiple policy goals, the notion of co-benefits was a key concept to gain support of discrepant government authorities. Though the results presented below are *ex post,* they were relevant to project acceptance. Metrobus' benefits included:

- ***GHG emissions reductions***: 110,000 tonnes of GHG emissions savings each year;
- ***Air quality improvements***: 2-3 times reduced exposure to particulate matter ($PM_{2.5}$) - as well as reductions of carbon monoxide (CO) and mono-nitrogen oxides (NO_x) emissions, leading to reduced health damages;
- ***Average speed***: Increased from 12km/hr to 19km/hr for Metrobus lanes and 17km/hr for other lanes;
- ***Travel time savings***: 40% trip time reduction for users, amounting to 180 million man-hours per year;
- ***Reduction in the number of daily car trips***: 122,000 fewer; 17% of Metrobus users formerly travelled by car;
- ***Road safety improvements***: solely considering Line 1 Insurgents, accidents were reduced by 84% from 2005 to 2010, with a 54% reduction in the first year alone;
- ***Technological change***: Replacement of 1108 one-man, one-bus units (older, more polluting) with 380 clean units (All Euro III, IV or V compliant, higher capacity, 95% lower emissions).

Sources: EMBARQ Mexico based on Francke *et al.*, 2012; GEF, 2002; World Bank, 2002; NYC Global Partners, 2012

1.3 Integrating land-use and transport infrastructure planning at the metropolitan level

45. A key obstacle in setting and aligning policy goals for sustainable transport infrastructure planning is that policy actions are often selected on an *ad hoc* basis, and not developed within an integrated planning framework, particularly at the metropolitan level (OECD, 2010a). Many metropolitan areas have not yet integrated climate and sustainability goals into urban planning, in part due to the lack of an integrated urban planning framework, ranging from transport infrastructure to financing and zoning. A key prerequisite to move towards sustainable transport infrastructure at the metropolitan level is thus to integrate land-use and transport policies (OECD, 2010a). The metropolitan level may be more appropriate than the city level, to include suburban municipalities.

46. The interaction between land-use and transport planning represents a unique opportunity to support the transition towards a low-carbon, climate-resilient economy at the metropolitan level. This stems from the fact that urban forms are defined by land-use and transport systems (Kennedy *et al.,* 2005).

Integrated land-use and transport planning is a key enabling condition to reverse the trend of auto-based sprawl (OECD, 2010a; UNEP, 2011; Suzuki *et al.,* 2013). Key principles include: reducing travel needs and distances; supporting public transport; and limiting car use.

47. An example of integrated urban planning towards sustainable development is the "compact city" concept. Compact cities are characterised by: (1) dense and proximate development patterns; (2) urban areas linked to public transportation systems; and (3) accessibility to local services and jobs through mixed-use development, which reduces the need to travel by putting housing, amenities and businesses within short distances of each other (OECD, 2012f; OECD, 2010a). Another example of integration is the "transit-oriented development" (TOD) model, putting emphasis on the role of public transport systems (Suzuki *et al.,* 2013). Compact city or transit-oriented development can increase cities' economic competitiveness by improving accessibility and energy efficiency. Both models however require the presence of high-quality public transport systems that are time-competitive with private transportation, not over-crowded and with integrated connections. This is because users' decision to use public transportation depends on the availability, affordability and speed of public transit options (Weis, 2012; Peterson, 2002).

48. Despite a growing recognition of the importance to integrate transport and land-use planning and programmes, experiences across domestic contexts highlight the difficulty in coordinating and implementing those efforts, due to the multiplicity of stakeholders involved in the decision making process - for instance, with suburban development often exceeding the jurisdiction of urban authorities (*e.g.* in New York tri-state area) (Suzuki *et al.,* 2013; Bowen and Rydge, 2011). Examples of cities that have successfully integrated land-use and transport planning include: cities in the Netherlands (with a regulated hierarchical structure and land-use controls from central government) and Curitiba in Brazil (with an integrated low-carbon urban planning strategy) (ICLEI, 2002; Kennedy *et al.,* 2005).

49. The timing of transport infrastructure investments is another challenge to avoid lock-in into auto-based sprawling patterns. Experiences show that land-use impacts are optimised when transport infrastructure investments precede rapid urbanisation periods. This ensures new housing developments are being built within walking distance of subway, light rail and commuter rail stations (Suzuki *et al.,* 2013). Though sometimes hard to predict, the synchronisation of investments and planning is particularly important to take into account in fast-growing cities.

50. Consolidating transport agencies' responsibilities across different modes can facilitate the application of integrated transport and land-use planning, which promoting integration between transport modes. Examples include Transport for London in the UK, which helps coordinate metro lines, buses, trams and light railway, amongst other modes.

51. There is no one-size-fits-all, and land-use strategies need to be tailored to specific urban contexts (see Box 4).While large developed cities have been concerned with brownfield and inner-city redevelopment (*e.g.* in New York City and London), one of fast-growing developing cities' main challenges is to ensure that greenfield developments are located along public transport routes, and with shopping and service facilities and nearby jobs (Peterson, 2002). In addition, integrating land-use and transport strategies requires a package of measures tailored to specific context. In this regard, transit-oriented development at the city, metropolitan or regional level have been identified as promising tools, combining land-use planning with various transport policies and instruments.

Box 4. Tailoring land-use planning to different urban context

Since sustainable urban transport policies depend on specific city context, the IEA has defined a decision matrix based on four scenarios or typology of cities within the urban land-use and travel framework, based on urban density and private motorised travel characteristics. The four city scenarios include:

• ***Developing cities***: Cities that are urbanising rapidly often experience rapid growth in private motorisation as individual wealth and travel demand increases. Examples: Ahmedabad, Luanda, Phnom Penh.

• ***Sprawled Cities***: Cities in this category generally have low densities and high urban and suburban sprawl. Examples: Atlanta, Mexico City, Toronto, Johannesburg.

• ***Congested Cities***: Cities in this category generally have medium to high densities and often have strong urban cores. Examples: Bangkok, Boston, Brussels, Seoul.

• ***Multi-Modal Cities***: these cities most often have high densities, strong urban cores, and high public transit use shares. Examples: London, Paris, Hong Kong, New York City, Tokyo.

Table 2 below identifies common targets and policy responses applicable to the four city scenarios.

Table 2. 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 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)			
Reduce driving	Road freight to rail facilities			
	Teleworking 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			
	Eco-driving programmes			
	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	

Source: IEA, 2013b.

52. Coordinating land-use and transport planning is also crucial to increase the climate resilience of new or existing transport infrastructure: land-use and zoning can worsen or reduce the exposure and vulnerability of transport infrastructure to climate change impacts (OECD, 2010a; IPCC, 2011). Decisions regarding the location and design of new transport infrastructure are crucial to ensure sufficient resilience to climate impacts such as increased flood risk (CCC, 2012). Urban underground rail is particularly vulnerable to flooding and extreme heat risk, which can cause speed restrictions, delays and health risks. Total value of urban assets (including transport) exposed to coastal flooding due to storms was estimated to be USD 3 trillion in 2005 (*i.e.* about 5% of global GDP), primarily located in developed countries (IFC, 2010). In addition, as transport has the potential to shape spatial patterns, a key issue is ensuring that new transport projects are screened in terms of their long-term impacts on residential and commercial development. For instance, if a new road is built in an area vulnerable to climate change, it is likely to increase climate vulnerability of future residential, commercial and business developments around it.

53. To address the growing threat of climate change, climate risk assessments and adaptation strategies need be integrated into transport and land-use planning, from the city master plan level down to the project's investment and maintenance level (Hallegatte *et al.,* 2008; Eichhorst, 2009). Experiences in the UK emphasise that urban design and land-use planning often provide the best options for increasing the resilience of new transport infrastructure. This is, for instance, the case when implementing sustainable drainage systems (SuDS) in new road developments (CCC, 2012). Successful examples of adaptation strategies in transport planning include: Kuala Lumpur's Stormwater Management and Road Tunnel (SMART) project that integrates flash flood risk into traffic and storm management process; Manila's metro infrastructure (2009) with elevated rails to adapt to flash floods; the London Underground metro, with flood mapping and other adaptation measures such as construction of barriers in high flood risk areas, and improved ventilation; Kosrae, with a drainage system adapted to increased rainfall for the construction of a new road section. In each case, comprehensive cost-benefit assessments have shown that those systems generated a higher internal rate of return than retroactive renovations or business-as-usual, thanks to avoided damages, and despite high upfront capital costs (Eichhorst, 2009).

1.4 Policy coherence across levels of governments and stakeholders engagement

54. Transport infrastructure projects involve a multiplicity of stakeholders, including national and regional governments, local administrations, international finance institutions (IFIs), formal and informal private sector, and transit users. Stakeholders' engagement and political support is paramount to successfully integrate and coordinate transport and land-use planning at the local and metropolitan level, as well as to ensure a projects' success. This is particularly important in the case of public-private partnerships (PPPs), due to the long-term nature of PPP contracts, and the capital-intensive nature of most rail and metro projects (see Table 2 and section on PPPs). Coordination is for instance needed to ensure coherence between infrastructure planning and operations, when the transport operator is different from the infrastructure planner and contractor (*e.g.* to ensure planning and construction account for the climate impacts that may affect the infrastructure during its operational lifetime) (OECD, 2008a, 2012e).

Table 2. Actors involved in financing urban public transport systems

Key actors	Role in financing urban transport
Donors/ international organisations	- Providing financing in developing countries, e.g. through Official Development Assistance (ODA) - Promoting good governance - Providing technological support
Local city administrations	- Raising local financial resources - Coordinating funding and implementing policies - In some cases, operating public transport systems
National and regional governments	- Raising national resources - Setting rules for allocation and distribution at national and local level
Public transport authorities	- Securing the provision and development of public transport services, including through planning, infrastructure provision and traffic management
Citizens	- Users of public transport systems - Payers through taxes, charges, fees and fares - Voters
Private sector	- Operating public transport - Manufacturing vehicles - Providing infrastructure
Private financiers	- Participating in the financing as equity investors or providers of loans and grants

Source: Adapted from Sakamoto *et al.,* 2010b.

55. Given the multiplicity of stakeholders and authorities involved in transport, aligning policy goals and integrating transport planning require systems of governance and institutional integration across levels of governments, *horizontally* and *vertically:*

- *Horizontal* institutional fragmentation is particularly challenging to integrate transport and land-use planning. The lack of coordination across transport authorities and land-use planners is highlighted as one of the most common governance barriers to promote sustainable transport infrastructure at the urban level (Kennedy *et al.,* 2005; Sakamoto *et al.,* 2010b). Horizontal integration also helps eliminate policy incoherence (*e.g.* public support to both fossil-fuel subsidies and public transportation) and ensure a holistic and network view of infrastructure planning (Corfee-Morlot *et al.,* 2012, 2009; 2007a; ADB and World Bank, 2006; UNEP, 2011; Schipper *et al*., 2009). A major source of institutional fragmentation takes place across jurisdictional boundaries, notably for metropolitan transport networks in the case of multiple suburban municipalities across the metropolitan areas (OECD, 2010h).
- There is no "one-size-fits-all" approach to improve *vertical* coordination across the national, regional and local levels of governments. Coordination can be effective using either a top-down, bottom-up or hybrid approach (in which national authorities provide voluntary guidelines for private sector involvement, and help engage local stakeholders) (OECD 2010a).

56. Engaging key public, private and civil society stakeholders early in the decision-making process of transport infrastructure investment is essential to ensure widespread acceptance and commitment to sustainable transport objectives. Effective provision of sustainable transport infrastructure also requires federating financial decision makers, the environmental community, transport operators and land-use and transport planners, to ensure the establishment of common objectives, acceptable approaches, federate them around a planning document to facilitate projects' implementation (see Table 2). Bringing together different actor groups in iterative processes to explore planning issues together and find acceptable solutions is an efficient way to facilitate project implementation. In India, the Andhra Pradesh government established in 2008 a Unified Metropolitan Transport Authority (UMTA) for the Hyderabad metropolitan area, to integrate urban transport system management and coordinate planning and implementation of urban transit projects (PwC, 2008; Sakamoto *et al.,* 2010b).

57. Enforcement and implementation of transport infrastructure planning and regulations is another key issue, as well as training and capacity building (see section 4).

Box 5. Integrating transport authorities: The case of Unified Metropolitan Transport Authorities in India

Before 2006, the governance structure of the Indian transport sector provided insufficient coordination mechanisms to address urban transport challenges, especially given the presence of multiple stakeholders. Consequently, in its 2006 National Urban Transport Policy (NUTP), the national Ministry of Urban Development (MoUD) supported the creation of Unified Metropolitan Transport Authorities (UMTAs) in Indian cities above one million inhabitants, in order to better integrate, coordinate and align the planning, implementation and management of urban transport programmes, projects and systems.

UMTAs in particular can facilitate the integration of urban transport financing, by enabling local transport and urban development stakeholders to better access central government funding under the national Jawaharlal Nehru National Urban Renewal Mission. Integrated financing can be achieved by establishing a special purpose vehicle (SPV), an independent entity responsible for project financing and involving all relevant stakeholders, to better access governmental financial support through equity participation or capital grants (see Box 15 on India's capital grant scheme to support PPPs, called Viability Gap Funding).

In 2008, the government of Andhra Pradesh enacted a law to create a Unified Metropolitan Transport Authority (UMTA) for Hyderabad metropolitan region, with decision powers on urban infrastructure projects, including new railway lines and bus terminals.

Sources: PwC, 2008; MoUD, 2012.

2. Enabling policies and incentives for sustainable transport infrastructure investment

58. Setting a strong investment framework with principles of transparency, property protection, non-discrimination and policy coherence is a prerequisite for mobilising efficiently private investment in transport infrastructure sector. Removing regulatory and administrative hurdles, ensuring open access to transport infrastructure markets, and setting clear rules about market structure, is also critical.

59. Furthermore, without policy intervention to correct market and climate failures, the private sector will continue to exacerbate the social costs of conventional road transportation, by generating externalities such as GHG emissions, local air pollution and congestion. Policy makers can notably design fuel taxes and congestion charges and reform environmentally harmful fossil fuel subsidies to eliminate perverse incentives encouraging carbon-intensive road transport.

60. However, the relative price inelasticity of transport demand in the short-term, limits the effectiveness of carbon pricing instruments in reducing demand, as switching modes depends on the existence of alternatives to carbon-intensive road transport. Furthermore, carbon prices, fuel taxes, fuel subsidy reforms and road user charges are politically challenging to implement. As a result, pricing instruments need to be embedded in a framework integrating regulatory tools such as land use planning and zoning policies, standards and public procurement procedures.

2.1 Policies to enable and mobilise investment

61. Setting a strong investment policy framework is a prerequisite for efficiently mobilising private investment in any infrastructure sector. Principles include: transparency, property protection, non-discrimination and policy coherence (OECD 2007; Corfee-Morlot *et al.,* 2012).

62. *Transparent* regulations governing transport infrastructure investment are essential to provide a stable framework for investment and encourage private sector participation, particularly through public-private partnerships (PPPs) (see Box 7). Ensuring policy transparency also helps fighting corruption in the provision of transport infrastructure, *e.g.* through public procurement or PPPs (See Mexico example in Box 6). Globally, the cost of corruption in road transport projects is estimated to reach 3 to 15% in terms of resource losses, at the point of awarding contracts, and an additional 10-20% of the contract value during contract allocations (World Bank, 2009; Sakamoto *et al.,* 2010b).

63. Implementing legal reforms and enforcing transparent regulations can help the private sector invest and operate efficiently in transport PPP projects. Conversely, the lack of an enabling regulatory framework limits PPP opportunities (PwC, 2008). Key regulatory challenges for transport infrastructure PPPs include: multiple agency and regulatory barriers; legal barriers, including inadequate legislation and judiciary system; absence of competitive procurement; potentially high transaction costs; and lack of regulatory experience and know-how in identifying bankable projects (Merk, *et al.,* 2012*;* Zegras, 2002). This is particularly true in the case of PPP concessions (see Section II.3. for definitions). Several provisions can enhance transparency and enable project financing in transport PPP projects (see Box 7).

Box 6. Improving the policy and regulatory framework for public-private partnerships in Mexico

In Mexico, the concept of public-private partnerships did not exist in the law prior to the introduction of the new Public Private Societies Law on 16 January 2012. As a result, the design of PPPs had to be negotiated on an *ad hoc* basis, creating delays in the implementation of the bus rapid transit system Metrobus. Indeed, the public sector had to negotiate and design specific contracts with the numerous private bus companies that were operating on the line chosen for Metrobus. The new law aims at increasing investments and new possible Public Private Society's laws, provide legislative certainty for private actors, improve public fund efficiency, speed-up project development and increase transparency in infrastructure investments. The law aims at increasing transparency, including anti- corruption mechanisms, and available resources due to legal certainty. It focuses investments according to the National Development Plan and defines contractual obligations for both parties.

Source: Francke *et al.,* 2012.

64. Governments also need to consider the legal framework governing *intellectual property (IP) protection* of sustainable transport infrastructure investments. For hybrid or electric vehicles' charging stations for instance, IP protection creates first-mover incentives for the automobile industry and equipment companies to develop new technologies and apply for new patents (OECD, 2011f). Technology

patent counts can even provide a proxy measure of innovation (Hasčič and Johnstone, 2011; Beltramello, 2012a). IP protection however should be balanced by ensuring market competition amongst different technologies, product designs and business models, in order to support the diffusion of potentially better technological alternatives, avoid the risk of technological lock-in and avoid monopolies (Beltramello, 2012a; see section II.2.2.).

65. Ensuring *non-discrimination* can help drive foreign investments, notably regarding low-carbon vehicle technologies and charging infrastructure. The Chinese government, for instance, has created legal incentives for foreign investment in electric vehicle technology, by allowing foreign investors to establish fully-owned foreign enterprises without a joint-venture with a Chinese partner, and without any equity participation restraints. Another option is to maintain a controlling interest within joint ventures in technologies related to electric vehicles (Vinson and Elkins, 2009).

Box 7. Principles for transparent and competitive PPPs

- ***Estimation of projects' affordability.*** PPPs, considered as an alternative to traditional public sector procurement, should be used whenever they provide a higher benefit-cost ratio than conventional public procurement. This is defined as the "value for money" (VfM), or as the "efficiency" of infrastructure provision (OECD, 2008a). Examples of tools to measure the VfM include the *public sector comparator*, a tool widely used to calculate *ex ante* the VfM of viable projects;
- ***Competitive bidding process*** in tendering procedures and project allocation;
- ***Full disclosure*** of conditions in the bidding stage to facilitate negotiations and limit future conflicts;
- ***Clear responsibility sharing,*** through detailed agreements between public authorities and private investors on the allocation of responsibilities and risk;
- ***Flexibility*** in sub-contracting to encourage innovation and future adjustments;
- ***Clear rules*** on project cancelation and compensation;
- ***Pricing regulations*** to secure revenue flows and incentivise new entrants;
- ***Independence*** of PPP operators, through a clear separation of operating and regulatory functions;
- ***Competitive markets*** with a level playing field whenever feasible (*e.g.* the appropriate competition level for bus services supply varies, from liberalised entry in small cities to franchises in large ones); and
- ***Creation of PPP units*** (*e.g.* in the Netherlands, Australia and the UK) to create effective institutional capacity to plan, implement, manage and evaluate PPP projects.

Sources: Merk, *et al.,* 2012; OECD, 2007a, 2008a; OECD/ITF, 2008b; Amaral *et al.,* 2008; ADB and World Bank, 2006.

2.2 Open and competitive markets for green trade and investment

66. A key role for government intervention is to address barriers to entry for sustainable transport infrastructure investments. This can be achieved, *inter alia,* by removing unnecessary regulatory and administrative hurdles, and ensuring open access to transport infrastructure markets and clear rules about market structure and competition.

67. At the project level, ensuring that markets are open and competitive is a priority in the case of transport infrastructure provision through public-private partnerships (PPPs) (see Box 7). Establishing competitive bidding processes during PPP tenders is particularly important to improve the efficiency of PPP provision, especially for public transport. This practice, however, is rarely used in rail on a network level. The Swedish Arlanda Express fast-track rail link was for one of the rare rail concessions set as a result of a competitive bidding, in the 1990s (see Box 13). Experience suggests that transferring transport operations to the private sector in a competitive environment can improve operational efficiency and reduce costs, provided that the appropriate incentives are included in PPP contracts (*e.g.* by establishing independent regulatory regimes to encourage private providers to invest sufficiently in service provision and guarantee the fairness of user fees) (Meakin, 2004; Zegras, 2002). Experiences with introducing competition in tenders include the London model of urban public transport, which uses the transparency of auction procedures and the discretionary authority of the regulator to foster competition and avoid anti-competitive practices (Amaral *et al.,* 2008).

68. At the national and transnational levels, efforts to create open and competitive markets in connected transport infrastructure markets can create investment opportunities for the private sector by improving the regulatory framework, especially for railways. Examples include efforts to open, connect and harmonise European transport networks (see Box 8).

Box 8. The EU transport regulations: the steps towards competitive markets

The EU Trans-European Transport Network (TEN-T) belongs to the EU system of Trans-European Networks (TEN), established by the 1993 Maastricht Treaty. Comprised of 30 corridors, TEN-T aims to secure free movement of goods and passengers by developing intermodal transport infrastructure network. TEN-T prioritises railways (as well as inland waterways) projects with stable and strong cash flows. Amongst 30 strategic TEN-T projects, 18 are rail projects, three are mixed rail-road projects, two inland waterway projects and one is for Motorways of the Sea.

Since the EU has no legal competence to plan transport networks, it uses its funding instruments to ensure national governments follow the EU TEN objectives. Available funds for 2007-2013 include: EUR 8 billion through the TEN Fund; EUR 264 billion through the European Regional Development Fund, the European Social Fund and the Cohesion Fund; loans from the European Investment Bank (EIB); national co-finance; and funding support for PPPs.

The EU, however, has been legally empowered with EU competition policy since the 1985 European Court of Justice decision (O.J. No. C 144, 13.6.1985), which set competition legislation at the European level. The "essential facilities doctrine" argues that network monopolies, whether public or private, have to be open to non-discriminatory competition. Other key regulations include: the liberalisation of the road freight sector in 1998, in accordance with 1985 court decision; steps towards a common railway market, with the Directives 2001/12-14, followed by successive railway packages (2001, 2002 and 2004); and regulation of user charges on heavy duty vehicles on EU motorways, with the Directive 1999/6.

Sources: Rothengatter, 2007; European Commission, 2005.

69. International trade in sustainable transport technologies (*e.g.* electric cars and batteries) is still small – the value of world exports (excluding intra-EU trade) of batteries used in electric cars was estimated at USD 8 billion in 2008, mostly lead by Japan, China and other Asian countries (Vossenaar, 2010). Though it is important to liberalise trade and remove existing barriers, the relatively small volumes of trade is more linked to the lack of sufficient policy incentives and regulations.

2.3 Shifting investment incentives towards sustainable transport

70. Market-based instruments to internalise GHG externalities include carbon taxes and cap-and-trade systems. In addition, fuel taxes often serve as implicit carbon price in the road sector. Given the nature of passenger transport decisions, and the relatively low price elasticity of transport demand, carbon pricing strategies may not be sufficient to create the necessary demand-shift to low-carbon options. As a result, carbon pricing strategies need to be complemented with other instruments and policy reforms, notably: (i) policy reforms of environmentally harmful fossil fuel subsidies to remove existing market disincentives; (ii) pricing tools integrating other environmental and economic externalities (*e.g.* local air pollution and congestion), such as congestion charges, to shift demand towards public transport and rail; and (iii) regulatory instruments such as fuel economy standards.

Carbon price mechanisms

71. *Setting carbon taxes or cap-and-trade systems* is even more challenging in the transport sector than in other infrastructure sectors. Existing carbon price mechanisms rarely have sufficient economy-wide coverage and level to be cost-effective and significantly impact transport demand (UNEP, 2011). From a political economy perspective, carbon prices often require sustainable transport modes such as public transport and rail to be readily available before major changes in pricing occur, so that users can shift modes as a response to the new price signal. In addition, the difficulty to estimate the appropriate carbon price level in the transport sector, and tendency to overestimate costs and underestimate abatement potential in the transport sector can, can deter policy action in this sector. In particular, marginal abatement cost curves, based on the estimated costs of emission-reducing technologies, are of limited relevance in the transport sector, as they focus on capital-intensive technological options such as vehicle and fuel efficiency, and often fail to consider cheaper abatement options such as modal shift and demand-side management. They also fall short in taking into account the co-benefits of sustainable transport policies, as well as transaction costs (de Rus, G, 2008; see Annex I for a review of the limitations of marginal abatement cost curves in the transport sector).

72. Existing carbon tax and cap-and-trade initiatives remain fragmented and price signals are still at an insufficient level to deter carbon-intensive transport investments. The UK Climate Change Levy (2001) mostly targeted electricity generation, indirectly impacts the transport sector through decarbonisation of the power sector. The Swedish carbon tax (1991) mostly targets non-industrial fossil fuel consumers (*e.g.* for district heating), with a 50% discounted rate for industries and exemptions for fuel use from electricity generation and most of the transport sector. Transport is now the main source of GHG emissions in Sweden (Jamet, 2011). The Australian carbon tax (2011) principally targets the electricity sector, with no carbon pricing on petrol or diesel for cars (Banister, 2012b). It is expected to impact only indirectly transport, on the commercial use of transport fuels via the offset of the excise rebates.[6] A Vivid Economics study estimates Australia's carbon price impact on transport to be limited. It would need to exceed USD 60/Mt to influence freight mode selection, and USD 90/Mt to match pump price variations, as of 2011. Nonetheless, the Australian carbon price may impact behaviours by integrating carbon measurement into transport services' accounting and reporting. The low-carbon social value change may create a demand effect on transport greater than the price effect (Lennox, 2011). Cap-and-trade experiences include New

[6] Recently set at USD 23.8/MtCO_2 on the top 500 polluters from July 2012, evolving into an emission trading scheme from 2015; Sectors directly targeted include power generation, fugitive emissions, industrial process emissions and emissions from waste.

Zealand's Emission Trading Scheme (ETS) (2008), covering domestic aviation, and the EU-ETS, which included aviation emissions in 2012 (but not other transport-related emissions).

73. However, one of the reasons why existing carbon taxes and cap-and-trade systems do not directly target the transport sector is that carbon is already implicitly taxed in most countries through fuel taxes, at levels that often exceed most of the relevant externalities. This was for instance the case in the UK and Sweden. In the UK for instance, car users currently pay the equivalent of around £273/tCO_2 in fuel duties (as of March 2012, including value-added tax), a level about 15 times as high as the Australian carbon tax and more than 30 times as high as the EU ETS price (Banister, 2012b).

Fuel and vehicle taxes

74. *Fuel and vehicle taxes* are indeed frequently used in most countries. Fuel taxes can sometimes act as shadow/implicit carbon price, as they can – if set high enough - approximate carbon taxes and capture the externality cost of motorised transportation (OECD/ITF, 2010d). Fuel and vehicle taxes are usually controlled by national governments and relatively easy to implement (OECD/EEA, 2012). Fuel taxes generate about 80-90% of all transport sector-derived public revenue globally, and vehicle taxes are the second largest revenue source from the transport sector (OECD/ITF, 2008c; Sakamoto *et al.,* 2010b). They constitute a good alternative to the polluter-pays principle. However, unlike revenue-neutral carbon prices, fuel taxes can generate perverse incentives as it is a major revenue source for governments, which do not provide incentive for governments to reduce fuel sales. Furthermore, unlike congestion charges (see forthcoming section), fuel taxes are levied uniformly on all private drivers regardless of area, time of day and congestion levels, which reduce their efficiency in addressing most non-GHG emissions such as carbon monoxide, particulate matter (PwC, 2008). Fuel taxes' effectiveness is also hindered by the cancelling effect of fuel subsidies, and by the fact that fuel taxes are typically lower on higher polluting fuels such as diesel (OECD, 2012a).

Reforming fossil fuel subsidies

75. *Reforming fossil-fuel subsidies* is a critical step to transition car users away from carbon-intensive options. This is particularly relevant in countries with high levels of car ownership. However, it requires consideration of the redistributive consequences of the reform. As such, changes in subsidies may need to be complemented with compensatory measures to strengthen social safety nets to protect vulnerable, lower income groups with little access to alternative transport modes, and to increase political and social acceptability, particularly in developing countries (OECD, IEA, OPEC and the World Bank, 2011; Sakamoto *et al.,* 2010b). Reforms can be introduced gradually, according to a predetermined schedule, and coupled with compensatory measures. Targeted subsidies towards lower-income population (*e.g.* targeted tax relief on staple food or lump-sum cash transfer) can for instance offset the impact of fuel subsidies removal. This was the case with Indonesia's fuel subsidy reduction, which was coupled with cash compensations and increased social benefits for vulnerable populations (staple food prices and education) (Sakamoto *et al.,* 2010a; UNEP, 2008a; UNEP, 2011).

76. In addition to carbon pricing and fuel subsidy removal, other pricing strategies targeting externalities such as congestion, in addition to GHG emissions, can provide strong incentives to shift to sustainable transport modes. Examples include congestion charges and parking levies.

Congestion pricing and other road user charges

77. *Congestion pricing and other forms of road user charges* (*e.g.* highway tolls) can help reduce congestion, vehicle use, local air pollution and GHG emissions. Congestion pricing internalises the travel time costs for the society of private vehicle use (since travel times increase with traffic volumes; OECD/ITF, 2010g). It is typically handled locally, and imposed for entry in downtown and business districts, and sometimes calculated based on the congestion level or time of the day (see Box 9). Differentiating congestion charges by vehicle types and exempting electric vehicles can support shifts towards smaller or low-carbon vehicles. The differentiation according to vehicle type is typically based on vehicle class (*e.g.* trucks, motorcycles, passenger cars) or on NO_x emissions.

Box 9. Selected urban congestion charges

Central London's Congestion Charge (2003) was originally set as an economic tool aimed at reducing congestion, before to evolve in 2009 into a mixed environmental and economic instrument, with the introduction of a £10 charge for cars emitting high CO_2 levels. It applies from 7am to 6 pm on weekdays in a central area well serviced by public transportation. It reduced traffic volumes by 60,000 daily car movements and fuel consumption by 20% (2008). Registered electric vehicles are exempted from the central London Congestion Charge.

Stockholm's congestion charging system (2006) was implemented as a cordon around the city, with gantries across all entries and exits. The system allowed the charge to vary depending on the time of day and exempted hybrid and electric vehicles. It decreased car use by 25%, congestion by 14% and local GHG emissions by 2.7%, and increased public transit use by 60,000 daily passengers. It generated a net social benefit of EUR 80 million per year. Stockholm congestion charge was paired with an increase in the frequency of public transport, thus providing a new price signal to encourage modal behaviour shift, while ensuring the quality of public transport alternatives.

Singapore's Electronic Road Pricing (1998) replaced the 1975 Area licensing Scheme. The system set toll charges for each trip into the Central Business District, using an electronic In-Vehicle Unit and a cash card. The charge varies as a function of daytime, congestion levels and vehicle type. Traffic volume in downtown areas has reduced by 10-15% during the ERP operating hours compared to the former ALS scheme.

Sources: OECD/ITF, 2010g*;* UNEP, 2011; Sakamoto *et al.,* 2010b; Tochtermann, 2008; PwC, 2008; Eliasson, 2006; Christiansen, 2006.

78. The application of congestion charges however remains limited due to the relative complexity in adopting such charges, and since congestion charges are politically challenging and often spark intense political opposition locally (Tochtermann, 2008). When introduced to reduce CO_2 emissions, it is critical to set them up in highly congested areas with visible impacts on congestion, to ensure acceptability (OECD/ITF, 2010g). In addition, congestion charging could be more easily accepted when paired with supply-side policies. For instance the Stockholm system paired congestion charging with an increase in the frequency of public transport, thus increasing cost on one hand to drive changes in behaviour, but improving the quality of public transport service on the other (see Box 9).

79. Though the report focuses on passenger transport, road pricing systems can also target trucks, to reduce GHG emissions from freight and encourage freight efficiency improvements and shift from trucks to rail. Such systems (*e.g.* fixed road network access charges, tolls and electronic kilometre charges) can differentiate charges according to NO_x emission level, or alternatively, fuel efficiency, road-wear, load factors and congestion level (OECD, 2011c).

Box 10. Pricing instruments in the transport sector and the challenge of revenue neutrality

Carbon and congestion pricing schemes are typically set to internalise external costs such as GHG emissions or travel time costs resulting from congestion. As such, those tools are designed to be demand management systems, rather than revenue-generating instruments. They should not be considered as a means to increase public revenue. Singapore's congestion charge for instance (see Box 9) was a traffic management system designed to be "revenue-neutral", *i.e.* with revenues that are recycled by reducing other taxes. Its revenue neutrality was achieved by reducing vehicle upfront taxes and recurring annual licence fees. Similarly, carbon prices are often intended to be revenue-neutral instruments meant to modify behaviour. The UK carbon tax for example returned tax revenues through income tax reductions. Indeed, according to the "double-dividend" theory, revenue neutrality brings a double benefit, as the environmental tax helps price externalities, while reducing income taxes can create new employment opportunities.

Pricing externalities however often requires creating a new instrument and raising new revenue, which tend to challenge commitments to revenue neutrality. This is first because some users (*e.g.* car drivers) will be worse off financially from the new tax or charge. Revenue neutrality is also challenged by the relatively high administrative costs required to run new taxes or charges. In the case of London's Congestion Charge (see Box 9), almost half of the revenues were used to cover administrative costs. The charge was not revenue-neutral; it generated more than USD 400 million in 2007/2008, and revenues were earmarked for transport improvements (mostly for bus services). Similarly, Stockholm congestion scheme's revenues were earmarked, which may suggest concerns to raise revenues. Sweden's carbon tax was also partly used to raise revenue for the government, though it was partly compensated by reducing existing energy taxes. Fuel and vehicle taxes are even less frequently revenue-neutral, and represent an important source of revenue for government. Parking charges are as well frequently used as sources of revenues by local governments, e.g. to finance public transport.

Sources: OECD/ITF, 2010g, 2001; Sakamoto *et al.,* 2010b; Sumner *et al.,* 2009.

Parking levies and charges

80. *Parking levies and charges* represent other useful demand management tools commonly used at the local level since they can be differentiated by time and place, although the use of parking charges is limited to publicly-owned or -regulated parking spaces. In Sibiu, Romania, for instance, differentiated parking charges and a complementary traffic management system helped optimise the impact of parking charges on transport modal split. Hourly parking fees typically need to be set higher than a single bus fare in order to encourage shift to public transport (Sakamoto et al., 2010b).

2.4 Regulatory and other policies to create markets and remove investment barriers

81. Carbon prices, fuel taxes, fuel subsidy reforms and road user charges are politically challenging to implement. As a result, pricing instruments can rarely be standalone options to support changes in transport demand, and thus create opportunities for sustainable transport infrastructure investments. They need to be embedded in a framework integrating command-and-control tools (Flachsland *et al.,* 2011). Carbon pricing strategies need to be complemented by sustainable land use and transport planning strategies, since sustainable transport alternatives to road transportation need to be available to enable users to shift away from passenger vehicle use as a response to a new market price signal (see section II.1). Other regulatory approaches include supply-based standards and public procurement procedures.

Performance-based and technology-based standards and other regulations

82. The relatively low price elasticity of passenger vehicle transport suggests that performance- and technology-based standards are an efficient supply-side approach to deliver fuel efficiency and/or other

technological changes required to address climate change and other pollution control issues. Standards, when announced with sufficient lead time and updated in a predictable way, can provide policy certainty to the private sector (Corfee-Morlot *et al.,* 2012).

83. Performance-based fuel economy standards for passenger vehicles can be useful when appropriate carbon prices cannot be implemented politically (OECD/ITF, 2010d). Empirical data shows for instance that US CAFE fuel economy standards (see Box 11) have increased new passenger car fuel economy by more than 30%, from 1978 until 1982 alone (Portney *et al.,* 2003). Despite the political appeal for increased fuel efficiency standards, economists have raised doubts on their efficiency. This largely stems from the presence of a rebound effect, whereby higher fuel efficiency can increase demand by reducing travel cost, thus offsetting up to one-third of the energy savings (Kverndokk and Rosendahl, 2010). Empirical estimates suggest the rebound effect offsets 10-20% or more of the initial fuel reduction from tighter US CAFE standards (Small and van Dender, 2007; Portney *et al.,* 2003; Bialik, 2009). Rebound effects can become particularly high in the long run.

84. Despite concerns, fuel economy standards can provide the certainty needed in terms of regulatory environment, for car manufacturers to invest in fuel efficient vehicles. Fuel economy standards need to be made technology-neutral to avoid technological lock-in. To encourage innovation, standards can be set to allow flexibility in the sales-mix (OECD/ITF, 2010d). The political economy of improved fuel economy however is challenging, as it leads to reduced fuel tax revenues (Crist and Van Dender, 2012).

Box 11. Examples of fuel economy standards

- **US** CAFE standards (1975): US Corporate Average Fuel Economy (CAFE) standards, revised in 2009, for cars, light trucks and SUVs, and under a new revision proposal as of April 2012. CAFE standards improved cars' fuel economy by 50% over the period 1975-1995 – from a very low starting point.
- **China**'s weight-based fuel efficiency standards for passenger cars and light-duty trucks (2004): China adopted targets to reduce energy consumption on a per unit basis by 16% for commercial trucks by 2020 from 2005. Targets were later updated (2011) to reduce energy consumption on a per unit basis by 16% for commercial trucks by 2020 compared to 2005. So far, China is the only non-OECD country with fuel economy standards - India's plans to introduce standards for passenger cars have been delayed until now.
- **EU**'s emission performance's Passenger Car Regulation (2009) for new light-duty passenger vehicles: Cap average CO_2 emission levels to 120 g CO_2/km by 2012.

85. Technology-based standards and regulations for electric vehicles (EVs) charging infrastructure can encourage positive network externalities, by ensuring interoperability in the interface between vehicles and electric grids, both in private and public charging stations (Beltramello, 2012a). Standards can also help governments support the deployment of charging infrastructure at the local level, such as: charging stations standards; standards for utilities' investments in EV-related infrastructure. A key challenge is to ensure nationwide standards suit local grid conditions. In addition to standards, local governments can use building codes to mandate EV charging equipment in new construction, permitting for EV charging stations, as well as zoning codes (see Section II.1).

86. Engineering and design standards and specifications for transport infrastructure may as well need to be revised, to account for climate change impacts and build climate-resilience of greenfield and

brownfield transport infrastructure projects. In rail sector for instance, high standards for rail could help prevent track buckling due to increased temperature. In the road sector, building codes could be used for new roads and drainage systems (Eichhorst, 2009). In the UK, the Highways Agency is considering the impacts of climate change on drainage standards for new highway projects, to improve drainage allowing for 20-30% increases in rainfall intensity (DEFRA, 2011). Similarly, in Denmark, existing road regulations and rail standards are being revised to account for expected climate impacts. In addition to the need to adjust existing standards, the lack of consistent standards can create information failures and limit the ability of private developers to identify affordable sustainable options, *e.g.* for drainage systems in the UK (CCC, 2012). Designing such standards requires on the one hand, considering transport infrastructure networks as a whole, to account for network interdependencies, and on the other hand, allowing for flexibility to tailor to local needs (Meyer, 2006; CCC, 2012).

87. Regardless of the regulatory option selected to support climate-resilient goals – standards, design codes or specifications – governments can encourage investment in climate-resilient road, rail and public transit infrastructure through public procurement and PPP tendering procedures.

Public procurement and PPP tendering procedures

88. Public procurement programmes for electric vehicles (EVs) and EV charging infrastructure play an important role in supporting the diffusion and uptake of EVs and EVs charging infrastructure. In 2011, the Mayor of London launched Source London, the UK's first citywide EV charging point network and membership scheme, which aims to create 1,300 public and workplace charging points by April 2013 (revised from a more ambitious 2009 programme). Purchasing programmes of green public vehicle fleets can also help mitigate demand risk for charging infrastructure investment, by providing a signalling effect to car manufactures, in addition to a demonstration effect (Beltramello, 2012a). Procurement rules can also help create markets for socially-inclusive transport vehicles, e.g. fully-accessible low floor buses, which can provide social accessibility benefits in addition to reduced GHG emissions and traffic congestion.

89. Governments could consider the possibility to support "sustainable" procurement procedures through traditional public procurement and public-private partnership (PPP) tendering procedures, for instance by mainstreaming climate-resilient goals in road and highways tendering procedures (see Kennedy and Corfee-Morlot, 2012).

3. Transitional financial measures and instruments

90. Creating enabling policies and incentives to invest in sustainable transport infrastructure is essential to address market and climate failures. In addition, a strong and transparent financial regulatory framework is essential to ensure the private sector has access to domestic and international well functioning finance markets. It is however rarely enough to attract private investment, due to the lack of available traditional sources of financing, and the relatively low risk-return profile of most sustainable transport infrastructure projects. Private investment in land transport projects such as rail and metros are often constrained by high upfront capital costs, low returns and long development and payback periods, compared to carbon-intensive investment alternatives such as toll highways (Corfee-Morlot *et al.,* 2012). Several traditional and innovative financial instruments can help improve the risk-return profile of projects and fill the "financing gap". This section explores the tools available to channel private capital and increase private sector participation in sustainable transport infrastructure. Those tools and instruments allow the public sector to re-allocate costs and benefits linked to transport project to the private sector.

3.1 Ensure a financial regulatory framework conducive to sustainable transport investment

91. Access to domestic private equity and project finance[7] debt capital markets is essential to mobilise long-term finance for transport infrastructure. The market for private infrastructure finance remains dominated by loan-based financing from commercial banks – loans amounted to 81% of global project finance in the first half of 2011 (Dealogic, 2011). Urban railways accounted for 13% (USD 11.6 billion) of global project finance in 2011, behind roads (23%) and energy (36%). The global economic and financial crisis has however challenged the financing of large-scale infrastructure such as metros and rails, by reducing availability of long tenor bank debt for project finance. The trend is towards a greater reliance on capital markets (*e.g.* equity and bond finance).

92. In addition to the global economic downturn and the sovereign debt crisis, new financial regulations on long-term lending have the potential to negatively impact the conditions for capital market flows. This is especially the case for long tenor debt, essential for driving project finance towards transport infrastructure projects (Freshfields, 2011; Corfee-Morlot *et al.,* 2012). By raising the amount of capital held on banks' balance sheets as a share of their risk-bearing assets (from 8 to 10.5%), the new Basel III banking regulations are likely to further constrain bank debt markets, already suffering from the economic downturn, deleveraging and sovereign debt crisis (Lloyd, 2012; Kaminker and Stewart, 2012; PwC, 2013). While having important over-arching objectives, these regulations are likely to increase the cost of capital for transport infrastructure projects' debt financing and refinancing, and reduce the availability of long tenor bank loans (Kaminker and Stewart, 2012*).* Other regulations such as the Solvency II Directive for European Union insurance firms, or the Alternative Investment Fund Managers (AIFM) EU Directive for asset managers, could also constrain long-term infrastructure-backed debt investment.

93. Increasingly stringent financial regulations may have at least two unintended consequences for the financing of transport infrastructure projects. First, financing large-scale projects such as new rail and subway networks or line extensions is likely to be constrained in the near term, since the growth and spread

[7] A technique to finance legally and economically self-contained projects, based on lending against the financial assets of a project rather than on the project sponsor; repayment is based on the project's future cash flows; Engel et al., 2010.

of PPPs are closely linked to project finance's availability. Second, given the strains on public finance and the commercial banking sector, institutional investors such as pension funds are being looked at as alternative sources of financing, but they may also be constrained by these regulations (Kaminker and Stewart, 2012; Freshfields, 2011).

3.2 Set innovative financial tools and instruments

94. A large number of traditional and innovative financial mechanisms are available to redistribute risks and returns across actors of transport projects and channel private investment towards sustainable transport infrastructure (see Table 3). This section reviews the financial toolkit for policy makers, with an emphasis on public-private partnerships and land value capture tools, given the traditionally high involvement of the public sector in transport infrastructure. Under limited public resources available for transport infrastructure, a strategic use of public finance mechanisms such as loan guarantees is also needed to leverage private investment flows**.** Those tools need to be tailored to specific country contexts and transport options.

Table 3. Financial tools to channel private investment in sustainable transport infrastructure

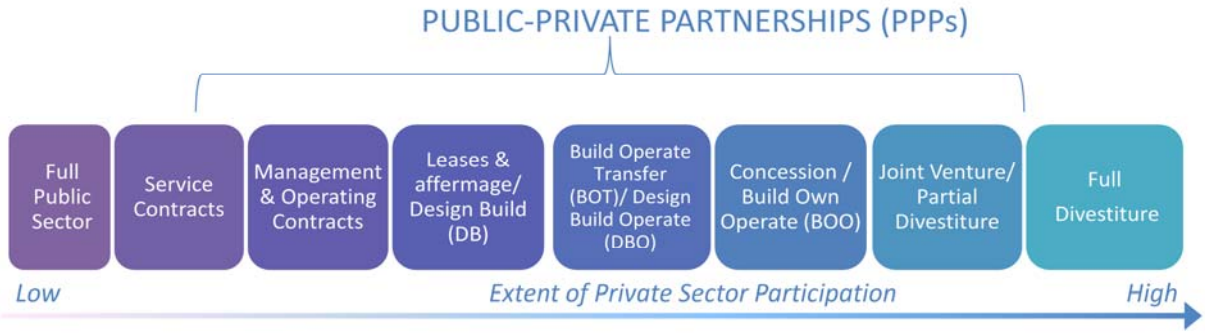
Type of instrument	Level of governance	Benefits for the private sector
Public Private Partnerships	Local/ National	Share and mitigate risk for private actors
Land value capture tools	Local	Reduce investment risk
Grants and loans	International/ National/ local	Reduce upfront capital costs for private sector
Loan guarantees and credit enhancement	International/ National/ Local	Reduce financing risk, lower the cost of capital
Green bonds	National/Local	Access capital from institutional investors for large-scale rail and metro projects
Carbon finance	International	Leverage private finance, access resources from IFIs and gain political support from local governments

Public-private partnerships (PPPs)

95. If set up appropriately and with a supportive regulatory environment (see Box 7), public-private partnerships can be effective procurement methods to ensure the provision of sustainable transport services, while encouraging private sector participation and risk sharing. Experiences to date suggest that PPPs are particularly suited for bus rapid transit systems, specific rail and metro links and shared-used vehicle and bicycle systems.

96. A PPP is a contractual arrangement between a public sector agency and a private sector party, involving private sector participation in the development, financing, construction, operation, maintenance and/or transfer/deconstruction/designation of a public infrastructure project (Corfee-Morlot *et al.,* 2012; GIZ, 2011). PPP contracts can cover different stages: design (D), construct/build (B), finance (F), maintain (M), own (O), operate (O) and transfer (T). Business models with private participation range from service contracts to full privatisation (divestiture) (see Figure 5).

Figure 5. Business models with private sector participation



Source: Authors.

97. PPPs have increasingly been used, largely through concessions, where the public sector owns the infrastructure but the private sector operates the infrastructure service and receives revenues deriving from it (OECD, 2006; UNCTAD, 2008; OECD 2007c). The public sector however still remains the main owner and operator of most land transport infrastructure, despite a variety of domestic policy contexts and frequent private provision of transport operations and maintenance (Amos, 2004). Unlike rail freight, private sector participation is relatively low in passenger transport such as passenger rail or urban public transit, largely due to their strong "public good" dimension (see Table 4). In developing countries, the domestic public sector accounted for 53% of transport infrastructure investment commitments on average over the period 1996-2006, versus 28% for domestic private sector, and 19% from foreign investments (comparable data is missing for OECD countries) (UNCTAD, 2008; UNEP, 2011).[8] In most developing countries however, public transport services (as opposed to infrastructure) are provided by the informal private sector.

Table 4. The nature of infrastructure services and main business models for land transport infrastructure

Sector	Passenger rail	Urban transport	Roads and highways
Public / private nature of services	Passenger rail systems are natural monopolies with strong "public good" dimension, unlike rail freight.	Natural local monopolies having a strong "public good" dimension.	Road services do not meet all criteria for private goods, unlike highways, which can generally be tolled; while they are rivalrous, they are not excludable in the business model that prevails in most countries. Road space is allocated to traffic on a first-come, first-served basis.
Main business models	Three main models: i) vertical integration under a "monolith" organisation still dominates passenger rail, e.g. in Germany, Japan (private) ii) owner-tenant model iii) vertical separation between the infrastructure and the operator, increasingly used in Europe, e.g. in Sweden and the UK in the 1990s.	Most systems are run as public monopolies. However, private sector participation occurs in some cases, *e.g.* for construction, operation, maintenance and upgrading of infrastructure.	Most roads in the world are owned and operated by the state. However, there is potential for private sector participation as concessionaires of toll highways or, in some cases, as owners and operators of private roads.

Source: Adapted from Kennedy and Corfee-Morlot, 2012 for urban transport and roads; OECD/ITF, 2008b, 2007b.

[8] Foreign investments include both public and private investments; UNCTAD secretariat calculations, based on data from the World Bank's PPIAF Database.

98. Some evidence indicates that the private sector is already seizing opportunities to invest in transport infrastructure. In 2010, "efficient transport"[9] is estimated to have received the third largest share of total low-carbon investment from private equity and venture capital (USD 1.2 billion), behind solar and wind (DBCCA, 2011). Opportunities for public-private initiatives (PPIs) and public finance initiatives (PFIs) are mostly in road, rail and urban railway projects. In the first half of 2011, most PFI/PPPs took place in Western Europe – the largest project was Tours-Bordeaux high speed rail PPP in France – and India, as with Hyderabad metro PPP project (Dealogic, 2011).

99. The choice of business model should be driven by *efficiency* and a proper *risk allocation.*

100. PPPs can improve the delivery and operating *efficiency* of transport infrastructure, however they are not a panacea, as highlighted by past failed PPP experiences (see Annex II). The private sector's pursuit of profitability can encourage a more efficient provision of sustainable transport infrastructure, assuming the PPP arrangement is set up appropriately (see Box 7). In particular, the PPP contract should set proper principal-agent incentives and encourage innovation (OECD/ITF, 2008b). PPPs rarely succeed if the sole objective is to move expenditures off of the public balance sheet or if their *value for money* (VfM) is insufficient, *i.e.* if PPPs provide a lower benefit-cost ratio than conventional public procurement (OECD/ITF, 2008b; Hawkesworth, 2011; Koppenjan, 2012; Kennedy and Corfee-Morlot, 2012). Design, Build, Finance and Maintain (DBFM) contracts for instance are sometimes seen as forms of private loans to governments, without sufficient VfM, which can prove cost inefficient and risk in the medium to long run. This is because PPP projects in rail and public transport are hard to set up and succeed, and face challenges such as regulatory barriers, low bankability and risk misallocation (Rouhani, 2009; Zegras, 2002). Key elements to consider when designing PPPs include: affordability; value for money; bankability; impact on public budgets; meeting service quality and provision objectives; risk allocation (EPEC, 2010).

101. *Risk allocation* is a key success factor of PPP projects in rail and public transit (see Box 13 and Annex II). A key challenge is to finance the construction of large-scale transport infrastructure projects before they become operational and generate revenue. The levels of upfront capital and risk entailed in transport infrastructure often deter private actors from engaging in risk-sharing models such as Build-Own-Operate (BOO). One way for transport planners to address this investment barrier is to assign each risk to the stakeholders best placed to manage it, and ensure that risk sharing is clearly stated in the PPP contract (Hawkesworth, 2011; OECD/ITF, 2008b).

Box 12. Balancing public and private sector goals

A key challenge for governments is to balance the potential contradiction between the social pillar of sustainable transport - *i.e.* welfare and affordability concerns - and the financial sustainability requirements of projects, to attract private sector investment. To overcome this potential contradiction, governments would have to measure the distributional impacts of their policies and develop appropriate social policies to protect the more vulnerable populations. Governments also need to ensure that sustainable transport infrastructure projects meet social, economic and environmental goals, while ensuring that projects with PPP procurement offer sufficient value for money and risk-sharing between private and public stakeholders (through risk-sharing mechanisms). Regarding urban transit user fares for instance, as user fares are often set too low to cover operating expenditures, governments and private stakeholders can use additional revenues from innovative sources of financing such as land value capture tools.

[9] Deutsche Bank Climate Change Advisors (DB CCA) terminology.

102. Experience across different country contexts suggest that *PPPs are particularly suited for the following sustainable transport options* (OECD/ITF, 2008b; Sakamoto et al, 2010a, b; UNEP, 2011; see Annex II for a detailed analysis of PPPs by transport modes; collective taxis and traditional bus systems are not considered in this report).

- *Bus rapid transit (BRT) systems;*
- *Highly-used, specific links for passenger rail and metro* systems, as opposed to entire rail or metro network systems (as well as intermodal transport); and
- *Shared-use vehicle and bicycle systems.*

103. Maintenance of PPP projects is another important issue, to ensure the public sector sets efficient monitoring of operation and maintenance.

Box 13. PPPs in the rail sector: the case of Sweden's Arlanda Express airport rail link

The case of Sweden's Arlanda Express demonstrates the complexity of a rail PPP project. In particular, it highlights the tradeoffs between transferring risk to the private sector and achieving profitability on the one hand, and ensuring affordable service provision on the other.

Sweden's Arlanda Express, a 22 km high-speed rail link between Arlanda Airport and Stockholm Central Rail Station, was the first PPP project in Sweden (1999). It was developed through a rare Build-Operate-Transfer (BOT) (45-year) concession, with an efficient and transparent competitive procurement. The winning private consortium established itself as A-Train, a special purpose vehicle (SPV). The contract was designed to achieve efficiency in construction and service supply.

Unlike most rail PPPs, the Arlanda project entailed a full risk transfer to the private contractor. In particular, A-Train carried all risks related to cost overruns during both construction and operations. Part of the project debt related to construction was however guaranteed by the government through a conditional loan subordinate to all private debt. The loan guarantee and delay in interest and debit retirement reduced the private operator's costs for debt service during the first years of operations.

By transferring demand risk, the contract between the government and the private agent provided the proper incentives for cost pressures and income generation; however it contributed to a high fare policy by A-Train to compensate for the post 11 September 2011 air travel slump, which mostly attracted business passengers. The presence of a monopoly franchise for A-Train, coupled with high user fares, proved detrimental for many potential passengers, especially local commuters.

In addition to a high demand risk, the full transfer of responsibilities prevented the firm's accountability to public actors and almost led to bankruptcy in 2002. The Arlanda Express case demonstrated that a high-quality, high-speed rail service is not sufficient to ensure profitability and high market share. Since, however, the 2004 acquisition of A-Train by Macquarie Bank, Arlanda Express has improved its performance in terms of profitability, service provision (notably regarding punctuality), innovation (in terms of design and speed) and environmental standards.

Sources: OECD/ITF, 2009b ; OECD/ITF, 2008b; Nilsson *et al.,* 2006; Stein, 2007.

Land-value capture tools

104. In order to ensure profitability of sustainable transport infrastructure projects, governments and private operators often need to consider innovative financing instruments as alternatives to debt financing and user fares, given strains on debt financing markets and since user fares are often set at a level insufficient to cover operational expenses, due to social affordability concerns. Unlike user fares, which

capture direct-use benefit from urban transit, land value capture tools capture the indirect and proximity benefits generated by transport infrastructure. They can be part of the capital financing mix as they can generate upfront revenues, thus reducing reliance on debt and fiscal risk (Peterson, 2012).

105. Land value capture tools provide revenues from the indirect and proximity benefits (positive externalities) generated by transport infrastructure, notably the increase in land and real estate value and economic activity near transport stations and along corridors (PwC, 2008). Tools include fiscal mechanisms such as land value tax, development charges and commercial development tax. There are also non-fiscal mechanisms, which enable joint development of transport infrastructure between public and private stakeholders, for example through benefit sharing, concession lease, connection fee, equity participation or voluntary developer contribution (Merk *et al.,* 2012; Suzuki *et al.,* 2013; Peterson, 2012; Milotti *et al.,* 2008).

106. Experience to date and studies highlight the strong potential of land value capture tools to help finance specific rail and metro projects (PwC, 2013; Merk *et al.,* 2012; Suzuki *et al.,* 2013; Martinez and Viegas, 2012). Most experience has been for roads, metros and rail, though nothing precludes such tools from being used for bus rapid transit systems. Land value capture tools include:

- **Tax increment financing** (TIF) districts and **assessment districts**. Also known as community revitalisation levies, TIFs are used in the United States and increasingly in Europe to revitalise and stimulate private investment in specific inner city projects, by earmarking future growth in property taxes to fund infrastructure investments and other economic development activities. Examples include the financing scheme used by New York City to finance the subway extension to Hudson Yards, using "payment in lieu of taxes" (PILOT) and tax equivalent payment (TEP), or the partial financing of Canary Wharf in London through business rights (PwC, 2013). Assessment districts are duty for residents of a specific area. TIFs are often used to complement federal and state grants. TIFs have been criticised however for having frequently supported the development of suburban areas (Merk *et al.,* 2012; PwC, 2013; Milotti *et al.*, 2008). Experiences to date show that TIFs are best suited for sites featuring outstanding parameters, such as proximity to highly developed areas, site underdevelopment, and public guarantees on debt servicing (PwC, 2013).

- **Development charges**, **impact fees and transportation utility fees.** Development charges are raised as betterment levies (*i.e.* one-time tax or charge on the land-value gain attributable to infrastructure investment) or through additional taxation on private developers, to finance capital costs associated with greenfield (and sometimes brownfield) development in areas experiencing growth. Development charges are commonly used by municipalities across the OECD (particularly in the United States) and in developing countries (*e.g.* Bogotá) to finance new infrastructure development. Impact fees are taxes linked to urbanisation plans and applied to new urban development. To help finance transit-oriented development, development charges and impact fees need to account for externalities associated with urban sprawl and for the full cost of transport services (Merk *et al.,* 2012; Peterson, 2012). Transportation utility fees are financing schemes in which the network is treated as a utility and properties are charged fees on infrastructure maintenance costs in proportion to their network use, and not as a share to their monetary value, as with property taxes (Junge and Levinson, 2012a)

- **Transferable development rights** from the rent of sales of public property land or building rights. Quantity-based, unlike priced-based development charges, transferable development rights can be traded by land owners to exchange the land needed to build new transport infrastructure for built-up areas elsewhere (Milotti *et al.*, 2008). In São Paulo for instance, property certificates of new built area (Certificados de Potencial Adicional de Construção, or CEPACs) are issued by São Paulo municipality and traded on São Paulo Stock Exchange, to finance public works encouraging accessibility and mixed-use development, such as subway extensions, under the city's master plan (Merk *et al.,* 2012).

- **Developer land sales**. They help shifting the financial responsibility of transport infrastructure investment to private developers. They were used to finance the extension of Copenhagen Metro (2008) in Ørestad, a new development area. One of Europe's most innovative infrastructure project financing, the metro line extension was entirely financed through developer land sales, user fares and tax revenues from assignment and urban valorisation. The planning process sequenced the construction and financing into phases, and synchronised the financial plan with the schedule needed to complete each part, to mitigate the time risk factor (Peterson, 2012; Milotti *et al.*, 2009; Sakamoto *et al.,* 2010b).

- **Joint development or "joint property development".** It is a formal arrangement, in which private stakeholders either pay public authorities or agree to share capital costs of development (Zhao *et al.,* 2013). Examples can be found in Hong Kong, Taiwan, Tokyo, Thailand, Washington, DC or San Francisco. San Francisco's Bay Area Rapid Transit (BART) was for instance built through equity participation of the Contra Costa Country Redevelopement Agency. Washington, DC Metrorail's joint development consisted in air-rights leases (i.e. rent of public property rights) and station connection fees. As with other value capture schemes, joint development requires a supportive institutional framework, to empower planning authorities; in DC, a unique transit authority, Washington Metropolitan Area Transit Authority was notably created with significant resources (Suzuki *et al.,* 2013). Joint property developments are mostly applicable to sites with strong commercial potential and sufficient construction space. They enable a transfer of risk and experience on private stakeholders, as well as upfront contribution from private actors, unlike TIFs (PwC, 2013).

- **Additional revenues from ancillary real estate development,** particularly within and around public transit stations, which can help finance part of public transport costs through additional revenues from real estate, retail or service activities. In Hong Kong for example, the city's metro operator, Mass Transit Railway Corporation (MTRC), established joint ventures with private real estate developer and retail outlets within and near subway stations, to finance the metro's fully-loaded costs of investment, operations and maintenance, in addition to selling development rights (Suzuki *et al.,* 2013; PwC, 2013). Similarly, in Japan, private railway companies own and manage a large share of properties located around the railways in metropolitan areas, with stores, hotels and shopping malls (Sakamoto *et al.,* 2010b). Tokyo's railway stations are models of transit-oriented development, operated profitably by private railways by diversifying into real estate, retail, and other business activities (Calimente, 2013).

107. As highlighted in preceding examples, land value capture tools offer opportunities for public-private partnerships, whether through the allocation of public land to private developers in exchange for private infrastructure investment, the sale of public land to private developers, or the sharing of land value benefits associated with transport infrastructure investment (Peterson, 2012).

108. The use of land value capture tools is however hindered by several challenges: (i) political challenges, to communicate to property owners the utility of it, and to achieve public acceptance. Improving the transparency and consistency of the communication process can help limit land owners' perception of unfairness in the taxed area (Sakamoto *et al.,* 2010b); (ii) administrative challenges in the implementation of land or property taxes; and (iii) perverse incentives, which exist when revenues from urban taxes are higher for low-density, suburban areas, or where cities depend on revenues from land sales and tax on new developments, which can favour urban sprawl. This explains in part the failure of TIFs, given US cities' incentives to use TIFs in affluent, suburban areas rather than in devitalised inner-city areas (Merk *et al.,* 2012). Finally, a key challenge with property taxes is that they are typically assessed both on land and buildings, while transportation only increases land value. A more efficient way to fund transport projects would be to tax land at a higher rate than buildings (Junge and Levinson, 2012b).

Direct loans and grants, loan guarantees and credit enhancement tools

109. Loans, grants and loan guarantees are traditional financial tools frequently used to support private sector participation in large-scale sustainable transport infrastructure projects that would otherwise be fully owned and operated by public stakeholders, for instance in rail and metros.

110. Upfront grants, loan guarantees and credit support are often needed across domestic context to improve the bankability of large-scale transport projects, by reducing the cost of capital and debt services for private investors and developers. Rail or metro projects typically require substantial public capital, in the forms of capital grants, loan guarantees or land grants in the initial planning and construction phase (and sometimes later if the project is not profitable) (Amos, 2004). The type of guarantees selected should be tailored to domestic context. In medium-income countries and LDCs for instance, partial risk guarantees (*i.e.* political risk insurance) can help cover losses from debt default resulting notably from expropriation, political unrest or currency/transfer risk, while blending instruments[10] can leverage private investment (Miyamoto and Muzenda, 2012). Such tools however may not be needed to support commercially viable transport projects such as BRT systems.

111. Loan guarantees can be particularly helpful to leverage private sector investment and encourage large-scale PPPs (Merk *et al.,* 2012; see Boxes 14 and 15 for examples).

[10] "A combination of concessional financing with market-based or IFI-based debt financing, which maximises the amount of overall financing available for infrastructure projects, to finance interest rate subsidies, technical assistance, and project costs" (Miyamoto and Muzenda, 2012)

Box 14. EU financing instruments to mobilise private involvement in TEN-T transport infrastructure

Several financing instruments are available to drive private sector participation in EU transport infrastructure.

As part of its goal to establish the Trans-European Transport network (TEN-T) the Loan Guarantee Instrument for TEN-T (LGTT) was set up in 2008 by the EIB and the European Commission to reopen the debt capital market to the financing of revenue-risk TEN-T greenfield projects. Managed by the EIB, it consists of transferring demand risk, inherent to transport PPP concessions, to the EIB, during the first operational years of the project. LGTT comprises a guarantee against traffic/demand risk and a source of mezzanine financing (*i.e.* subordinated debt). Though the instrument has served road and highway projects, it has also supported rail PPP projects, such as the South Europe Atlantic (SEA) high-speed rail line (EIB, 2011a, c; Freshfields, 2011; KPMG, 2005; OECD/ITF, 2008b; EPEC, 2010).

Other tools (from the TEN-T programme, the EIB and the Cohesion and Structural Funds) are available to support the procurement and implementation of TEN-T projects using PPPs arrangements, notably grants (*e.g.* construction cost-based grants) and equity participation in greenfield projects (*e.g.* through the Marguerite Fund (EPEC, 2010). Grants can be particularly helpful to assist in the overcoming of early stage challenges of projects to fund feasibility, technical or environmental studies, as well as costly geological explorations (EPEC, 2010).

TEN-T financing instruments are criticised by some as having failed to mobilise large scale private sector funding. This stems however from the lack of integrated EU legislative and regulatory framework to support PPPs, which limits the growth of PPPs as a share of TEN-T projects, particularly for rail (Helm *et al.,* 2009; PwC, 2005).

Sources: Freshfields, 2011; PwC, 2008; Helm *et al.,* 2009; EPEC, 2010.

112. Credit enhancement techniques, *e.g.* through capital grants or on the credit rating of bonds, are sometimes used to attract private capital in sustainable transport infrastructure. These can revive the debt capital market for infrastructure financing and attract long tenor private sector debt financing. This is because credit enhancement techniques provide stable and strong cash flows and reduce the risk for third party investors seeking long tenor investment opportunities. Examples of credit enhancement programmes include the Indian Viability Gap Funding (see Box 15).

Box 15. Credit enhancement to support PPPs: the Viability Gap Funding (VGF) Scheme in India

The Indian Viability Gap Funding (VGF) Scheme is an initiative using credit enhancement techniques to support PPPs in transport infrastructure projects. Set under the Scheme for Financial Support to PPPs in Infrastructure, the VGF is a onetime construction capital grant designed to support PPP infrastructure projects by subsiding the capital cost whenever costs cannot be recovered via user fees. The capital grant amounts up to 20% of total cost for urban transport, and up to 30% for rail-based MRTs.

To be eligible, private sector companies need to be, *inter alia*, selected using transparent and open competitive bidding. They also need to be responsible for financing, construction, maintenance and operation of the project during the concession term, with at least 40% of private equity in the project entity. The VGF scheme applies to projects in the transport, power, water and waste sectors as well as to international convention centres.

Source: Indian Ministry of Finance, 2006; Chawla, 2006; Freshfields, 2011.

Green bonds

113. Green bonds are broadly defined as fixed-income securities issued (by governments, multi-national banks or corporations) in order to raise the necessary capital for a project which contributes to a low carbon, climate resilient economy (Kaminker and Stewart, 2012). The debt capital market is currently underexploited for infrastructure investments. In this context, bonds have the potential to play a significant role in financing sustainable transport infrastructure projects (OECD, 2007a; Della Croce *et al.,* 2011a; Kaminker and Stewart, 2012; CBI and HSBC, 2012). Bonds may be particularly helpful for attracting institutional investors such as pension funds and insurance firms given that bonds remain the dominant asset class in portfolio allocations of pension funds (50%) and insurance companies (61%) across OECD countries (Kaminker and Stewart, 2012); however tapping the institutional investment market requires large-size investment grade deal flow (CBI and HSBC, 2012). Institutional investors typically look for long-term, fixed-income investments in their portfolio, prefer cash returns from operational or long-term "de-risked" projects, and avoid taking construction or development risk (Helm *et al.,* 2009; CBI and HSBC, 2012). At the same time, given the structure of their liabilities, institutional investors such as insurance companies or pension funds have the capacity to take on term and illiquidity risk prevalent in infrastructure investments.

114. According to a study by HSBC and the Climate Bond Initiative, low-carbon transport projects account for most of the bonds that are aligned to climate themes (USD 119 billion out of a USD 174 billion universe, while the energy sector accounts for only USD 29 billion) (CBI and HSBC, 2012). Transport-related bonds mostly target rail projects (95%) in Europe. Issuers include rail and subway operators, dedicated rail construction and infrastructure firms, and rolling stock manufacturers (*e.g.* Network Rail in the UK and SNCF in France).

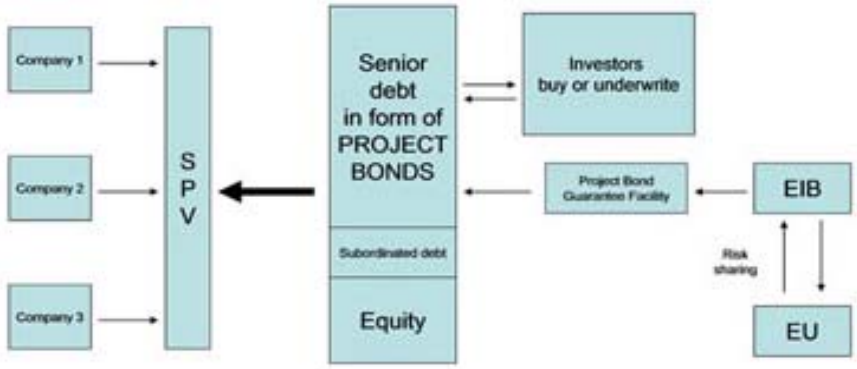
115. A key challenge to encourage the broader use of green bonds is to improve the risk-return value proposition for investors through the creation of a liquid, investment grade market. Perceived risks amongst investors tend to be greater than actual risk of infrastructure projects. The shortage of objective information and quality data makes it difficult to assess the risk of infrastructure deals and achieve investment grade rating. There is a room for expansion in the green bond market. For example, by providing guarantees on project bonds, the public sector can lower the investment risk for private investors (Kennedy and Corfee-Morlot, 2012). Examples of initiatives in the transport sector include the Europe 2020 Project Bond Initiative (see Box 16). In addition to governmental initiatives, financial innovation such as aggregation of portfolios and securitisation can provide investors with asset-backed securities with investment grade rating.

Box 16. Europe 2020 Project Bond Initiative

The Europe 2020 Project Bond Initiative was recently set up by the EIB (with funding from the European Commission) to re-open the debt capital markets to large-scale greenfield infrastructure in the EU, mostly in the transport, energy and broadband sectors (renewable energy projects are not being considered, except for some grid connections). Indeed, Freshfields estimates that there are 479 EU infrastructure projects (worth USD 232.6 billion), which are still at the tender level and could benefit from additional debt financing.

The initiative uses "credit enhancement" techniques from the EIB facility to raise the credit rating of bonds issues by projects companies to finance infrastructure. It aims at structuring projects that deliver "A" credit rated senior bonds and other similar senior debt, thus making such projects more attractive for private investors, in particular for institutional investors. The initiative's pilot phase (2012-14) will cover 5-10 projects, using a 230 billion Euros contribution from the EU budget (including 200 million Euros for TEN transport projects). Thanks to the "multiplier effect", the EIB estimates that the Initiative could unlock up to 3.45 billion Euros in senior debt funding for infrastructure projects (See Figure 6).

Figure 6. Structure of Project bond initiative



Source: EIB, 2012.

Sources: EIB, 2012; Freshfields, 2012; 2011; EPEC, 2012.

116. Local governments from developing countries can also explore the use of municipal bonds to support sustainable transport infrastructure development, particularly railways and metros. This could be particularly relevant in Southeast Asian countries such as Indonesia or Malaysia to finance metros and railways projects. Municipal bond markets are already well-developed in countries such as the United States, with many cities accessing the credit and bond market directly to finance infrastructure projects; however these markets have become more risk averse due to the global economic downturn (Puentes and Thompson, 2012). Another key challenge is the solvability of sub-national governments (OECD, 2012e).

117. In order to help investors mitigate long-term risks, governments can provide transparent and reliable indices and facilitate long-term risk management when issuing long-term instruments such as bonds for sustainable transport infrastructure projects. Government bonds could play a standard index in capital markets, and help develop local primary and secondary capital markets.

The role of transport infrastructure funds and banks to provide transitional financing instruments

118. Infrastructure banks or funds with a sustainable transport focus can play a transitional role to leverage public capital without crowding out private investment and implement sustainable transport policy goals both in developed and developing countries. In particular, they can help reduce incremental capital costs associated with the sustainable component of transport projects by providing subsidised loans or guarantees. By securing or increasing the share of public funding available for sustainable transport infrastructure, infrastructure funds and banks can also help provide stable, long-term support to the sector and ensure that public funds are available for the duration of the infrastructure's lifetime (OECD, 2012c; DEFRA, 2011). Examples include the German KfW Bankengruppe and the new UK Green Investment Bank (GIB). In the case of the UK, the GIB is aiming to "pump-prime" infrastructure projects and to match public funds (£1 billion) with private investments (£1 billion), with the potential to target plug-in vehicle recharging infrastructure and the rolling stock of UK rail network (UK Office of Low Emission Vehicles, 2011). Government-led infrastructure funds can be particularly helpful to support large-scale railways infrastructure investment projects both in developed and developing countries, *e.g.* with India Infrastructure Finance Company Limited fund (2006) and Building Australia Fund (2009) (OECD, 2012e).

Box 17. The case for a National Infrastructure Bank and innovative financing tools in the United States

In the United States, the creation of a National Infrastructure Bank (NIB) would help attracting private investment in multi-jurisdictional, large-scale transport projects. It would help coordinate strategic transport infrastructure planning and long-term funding, in complement to existing state-level institutions such as state infrastructure banks (SIBs). The current US system for funding transport infrastructure projects largely relies on states and localities. State infrastructure banks are dedicated to transport infrastructure projects and they are a subset of state revolving funds (SRFs), which are publicly regulated loan funds, capitalised through grants. Most of the support to transport infrastructure projects comes through revolving loans and loan guarantees below market, from SIBs. SIBs – or "transportation-targeted SRFs" – serve as intermediary between communities and credit markets to secure a stable capital pool for transport infrastructure investment, with state bond banks providing affordable financing for capital infrastructure projects. However the scale of projects supported has tended to remain small, and not targeted to sustainable modes. A key challenge is ensuring that projects are selected based on economic, social and environmental benefits. In the absence of a National Infrastructure Bank, a national public-private partnership (PPP) Unit would be a cost-effective first step.

Currently, the vast majority of US federal infrastructure spending is disbursed through grants (almost 90% according to an estimate). These grants however are not subject to competitive allocation process or need assessments, which result in inefficiencies and perverse incentives to design projects to receive a larger grant allocation. Instead, the use of innovative financial tools and funding programmes could usefully be expanded to encourage private sector participation in transport infrastructure programmes. Existing instruments include: the Build America Bonds (BABs) programme (2009-10), which provided tax-credit bonds (*i.e.* a tax credit on borrowing costs); the Transportation Infrastructure Finance and Innovation Act (TIFIA), which leverage federal funds with local and private investment by providing direct loans, loan guarantees and lines of credit under favourable terms; Those tools would need to target in priority sustainable transport projects, rather than traditional road and tunnel projects.

Sources: Puentes and Thompson, 2012; Galston and Davis, 2012; US Treasury Department, 2010.

119. Transport funds may be particularly relevant in complex, multitier administrative systems at the urban level to integrate transport infrastructure planning and financing and pool transport financial resources (including user fees, land value capture tools, road user charges, private funding, tax revenues and intergovernmental transfers) (World Bank, 2002). Funds geared towards sustainable transport could

mirror road funds fed by fuel and vehicle taxes, as in Japan. However, it is important to note that "the value of having an integrated urban transport fund does not depend on earmarking but on the clarity and coherence of its objectives, and the rigor and transparency of fund allocations" (World Bank, 2011, 2002; Sakamoto *et al.,* 2010a). Examples of urban transport funds include the infrastructure fund created to fund Copenhagen Green Transport Agreement (12 billion Euros), which secured sufficient project funding for the metro project, along with a stand-alone fund for the project (OECD, 2012c). In India, urban transport funds (UTFs) were set in Surat to fund a 130km BRT network, and in Pimpri-Chichwad Municipality Corporation (PCMC), to fund a new bus rapid transit system and improve existing public transit (PwC, 2008). Developing local institutional capacity is a prerequisite for local transport funds to work effectively (Leather *et al.,* 2009).

Box 18. The role of international finance institutions (IFIs)

IFIs have an important role to play in supporting sustainable transport infrastructure investment in developing countries. Experiences to date highlight key policies for IFIs to support sustainable transport, including:

- ***Shifting their transport portfolio towards sustainable investment***, by incorporating sustainable goals in their transport portfolio selection criteria (*e.g.* for grants and loans). This is particularly important given the current constraint on the banking debt market, likely to require further reliance on development banks (*e.g.* the EIB in Europe, Banobras in Mexico and the Brazilian development Bank, BNDES) to bring liquidity in those markets. Recently, 16 voluntary commitments towards sustainable transport were launched at the 2012 United Nations Conference on Sustainable Development (Rio+20) by organisations members of the Partnership on Sustainable, Low Carbon Transport (SLoCaT). In particular, eight development banks[11], led by the Asian Development Bank (ADB), committed USD 175 billion to scale up support to more sustainable transport systems in developing countries over the next decade.

- ***Using their resources and high credit rating to leverage private capital*** through commercial bank lending, mitigate financial risk, and support private operators. For the Brunswich rail project (2010-2011) in Russia for instance, the European Bank for Reconstruction and Development (EBRD) provided a USD 290 million A/B-rated loan to the private group Brunschwick Rail. The loan was composed of an eight-year A-rated loan of USD 160 million (using EBRD's own funds) and a USD 100 million five-year B-rated loan, syndicated to five commercial banks and overly subscribed with the International Finance Corporation (IFC), for the loan's A/B-rated part. In addition to traditional financing mechanisms such as loan guarantees, IFIs can leverage the use of climate finance to attract private sector participation (e.g. in CDM-registered projects).

- ***Allocating a larger share of their sustainable transport portfolio to risk-mitigating instruments such as loan guarantees for LDCs***, rather than direct loans, to maximise the use of their limited resources while addressing investment barriers. Other instruments include private risk insurance tools, particularly adapted to LDCs.

- ***Promoting PPPs by identifying bankable projects and sharing good practices*** (*e.g.* competitive tendering in rail and metro; sustainable goals included in procurement procedures). Agencies such as the World Bank's Public-Private Infrastructure Advisory Facility (PPIAF) can play an important role in promoting PPPs.

- ***Mainstreaming the use of impact evaluations*** of their investments and technical assistance in terms of emissions and climate resilience. IFIs can also strengthen their existing activities, including: best practice sharing; assistance to recipient countries to integrate sustainable transport goals in development strategies; capacity building and technical assistance; and help for local finance institutions access infrastructure markets.

Sources: Lloyd, 2012; ADB, 2010a; EBRD, 2011; Miyamoto and Muzenda, 2012; Sakamoto *et al.,* 2010a; Zegras, 2002.

[11] The African Development Bank (AfDB), the Asian Development Bank (ADB), the Development Bank of Latin America (CAF), the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), the Inter-American Development Bank (IADB), the Islamic Development Bank (ISDB) and the World Bank.

Greening export credits: the role of trade finance

120. Export credit agencies (ECAs) provide non-concessional loans to promote exports and project finance abroad, as well as sometimes investment insurance and guarantees (Miyamoto and Muzenda, 2012). ECAs have played a substantial role in driving private capital flows such as foreign direct investments (FDIs) towards transport infrastructure projects, particularly in developing countries. In the 1990s, half of new ECA commitments were in large infrastructure project financing, typically involving a mix of equity participation from project promoters, commercial bank loans, bond issuances, multilateral development banks and ECAs (WRI, 2000). In 2009, long-term official export credits reported by Annex II OECD member countries to non-Annex I countries amounted to USD 13 billion in the transport and storage sector (OECD Export Credit Secretariat, 2010).

121. Export credit and investment insurance agencies can help leverage private investment towards sustainable transport infrastructure and relevant transfer technologies, by increasing the provision of credit support to providers of sustainable transport infrastructure, vehicles and technologies (Sakamoto *et al.,* 2010a). Export credit agencies also have a role to play in designing an international monitoring system on the level, nature and impact of export credits on environmental sustainability, as well as in expanding the work led by the OECD in developing a shared "Arrangement on Officially Supported Export Credits" to account for climate change concerns. OECD countries have recently agreed new rules to: (i) strengthen environmental and social due diligence processes of officially-supported export credits[12]; (ii) create financially prudent incentives to support business projects with low-carbon emissions; and (iii) encourage support for advanced climate-friendly technologies[13]. Under the 2012 *Sector Understanding on Export Credits for Renewable Energy, Climate Change Mitigation and Water Projects*, transport infrastructure projects resulting in low to zero carbon emissions (or CO_2 equivalent) and/or in high energy efficiency, may qualify for the financial terms applicable to officially-supported export credits for mitigation projects.

The role of carbon finance mechanisms

122. Despite the large abatement potential in the transport sector, transport has so far benefited little from the Clean Development Mechanism (CDM) and other carbon market mechanisms such as the joint implementation (JI). Only seven transport projects had been certified under the CDM as of March 2013, under fuel switch, efficiency improvement or modal shift. Challenges to apply the CDM to the transport sector stem from the difficulty of elaborating methodologies and collecting data to measure the emission reductions, and to meet the additionality criteria (UNEP, 2008b; Sakamoto *et al.,* 2010a). However projects such as BRTs, rail-based public transport infrastructure, low-carbon vehicle fleets and charging stations, technology and/or fuel switch, transit-oriented development or modal shift for passenger transport, could qualify under the CDM (Grütter, 2007). Though limited, experiences show that the certification of transport projects under mechanisms such as the CDM or JI can sometimes contribute to leverage private finance (Clapp *et al.,* 2010). Several CDM projects were completely financed by additional private sector financing. In the TransMilenio Bogota case (phase II-IV) for instance, though CERs accounted for only 1-2% of total project costs. In the case of Metrobus, Mexico, CERs did not really impact the risk-return profile of the project, but provided a certification scheme for the emission reduction.

[12] The Recommendation of the Council on Common Approaches for Officially Supported Export Credits and Environmental and Social Due Diligence, adopted by the OECD Council on 28 June 2012; it replaces the 2007 Recommendation.

[13] Sector Understanding on Export Credits for Renewable Energy, Climate Change Mitigation and Water Projects, 28 June 2012.

123. Despite limited experience to date, carbon finance could become a significant source of financing for low-carbon transport infrastructure, provided that trading is scaled up across carbon markets and that a realistic price is put on carbon.

124. The implementation of Nationally Appropriate Mitigation Action (an instrument designed to encourage developing countries to reduce GHG emissions on a voluntary basis) in the transport sector could help attract private sources of financing for sustainable transport projects (GIZ, 2012). Key challenges for setting "transport NAMAs" include: designing financing vehicles to access private finance and public sources of climate finance; and establishing measuring, reporting and verification (MRV) of NAMAs (GIZ, 2012; see section 4.3).

3.3 Transitional direct support for sustainable transport infrastructure investment

125. Tax credits, fiscal exemptions and public subsidies can be used in the short run to support new technologies, foster innovation and compensate for network infrastructure bias towards high-carbon transport options. Though low-carbon technologies need to become fully competitive (*i.e.* without subsidies) in the long run, subsidies can provide transitional support to low-carbon options and technologies in the short run, to ramp-up production and cover large initial capital investments. Temporary subsidies can notably be used to support electric vehicles (EVs) and plug-in hybrid vehicles (PHEVs) (see Box 19). To be effective, subsidy programmes need to provide consistent and long-term policy signals and have long enough implementation timeline to build experience and support private investments; subsidies also need to be synchronised with the timing of new technology development to be effective (OECD, 2011b; Sakamoto *et al.,* 2010b). Despite the need for stability and predictability, governments should ensure subsidies are not captured by vested interest and rent seeking; this can be achieved by setting ongoing monitoring and evaluation, and limitations in time and volume (*e.g.* by including sunset clauses) (Beltramello, 2012a; Corfee-Morlot *et al.,* 2012). Governments also need to check the coherence of existing subsidy schemes (Kalamova *et al.,* 2011). Subsidies are also more efficient if they are technology or performance neutral, and if they modify supply rather than increase profits (OECD/ITF, 2010d).

126. Subsidies can be used in the short run to compensate imbalance across transport modes or when private operations using PPPs are competitive yet not profitable in railways and public transit (Sakamoto *et al.,* 2010b). The Korean government has for instance promulgated several financial and tax incentive policies to facilitate green growth PPP financing, in line with its First Five-Year Action Plan for Green Growth (2009). Examples of incentives include: construction subsidies to maintain user fees at affordable levels (up to 50% of total project cost for railways projects versus 20-30% for road projects); compensation for "base cost ", where the government shares investment risk within the limits of government's cost in case the project had been developed using public procurement; Infrastructure Credit Guarantee Fund (ICGF), providing credit guarantees to PPP concessions; and tax incentives on corporate tax, local tax, exemptions from charges and special taxation (for infrastructure bond, value-added tax, foreign investment zone and infrastructure funds) (Merk, *et al.,* 2012). More broadly, public subsidies can support PPPs by encouraging efficiency and risk transfer to the private sector, and deterring private operators from deteriorating passenger services, *e.g.* by selecting the private bidder requiring the least subsidies to operate. Efficient allocation of subsidies is a key challenge for governments (OECD, 2007a; ADB and World Bank, 2006).

Box 19. The case of electric vehicle charging infrastructure

2020 sales forecasts of electric vehicles (EVs) as a percentage of global car sales range between 2-4% in the more conservative scenarios and 10-12% in the more optimistic scenarios (Beltramello, 2012a; Frost & Sullivan, 2012). Current policy incentives to support low-carbon vehicles amount to USD 15-20 billion (IEA, 2011a; DBCCA, 2011; WEF, 2011; BCG, 2009). Global support could reach up to USD 100 billion (IEA, 2011a). The market expansion of electric vehicles (EVs) and plug-in hybrid electric vehicles (PHEVs) is highly dependent upon charging infrastructure investment. Policy support to EV/PHEV infrastructure investment is thus critical to unlock low-emission vehicle investment (IEA, 2011b). Table 5 summarises the necessary steps that need to happen to leverage private sector investments in plug-in vehicles' charging infrastructure.

Table 5. Measures and recommendations to support plug-in vehicles' charging infrastructure

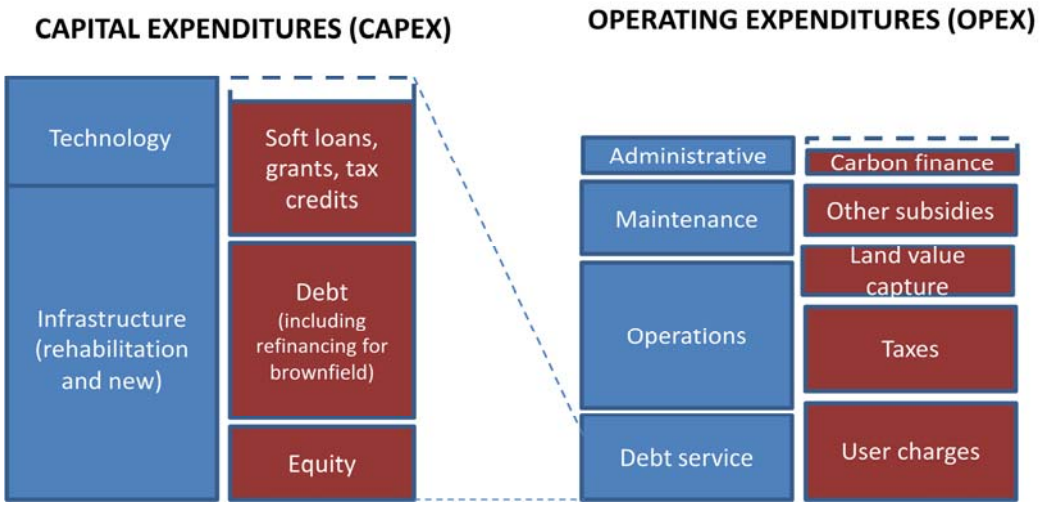
Policy checklist	Key measures and country examples
1. Strategic goal setting and policy alignment	• ***Targets***, *e.g.* French target to deploy up to 4 million charging spots to support 2 million electric vehicles by 2020; targets need to be credible to be effective; • ***Infrastructure strategic planning***, *e.g.* with the UK Plug-in Vehicle Infrastructure Strategy; importance to prioritise home recharging and develop local grid planning; • ***Alignment of policy goals*** at urban level, air pollution standards/air quality targets are key drivers for cities to support EVs in order to avoid non-compliance penalties; • ***Land-use planning***, *e.g.* by national governments to coordinate early adoption sites in urban areas with large recharging access; • ***Multilevel governance*** and coordination across local, regional and national levels;
2. Enable policies and incentives for charging infrastructure investment	• ***Policies to enable foreign investment***, *e.g.* in China's 12th five-year plan, allowing foreign investors to establish wholly-owned foreign enterprises without joint-ventures or equity participation restraints, in technology fields related to EVs; • ***Regulations***, *e.g.* with low voltage DC fast-chargers in Japan, which cut initial cost versus high voltage chargers by avoiding transformer costs; • ***Fuel and vehicles taxes*** to create disincentives for fossil fuel based vehicles; • ***Technology- and performance-based standards*** and regulations to ensure interoperability and provide long-term certainty and predictability to private operators. Key areas include: plug types, recharging and communication protocols, and regulations for public recharging, battery recycling and utility regulations; • ***Public procurement*** of EV/PHEV charging infrastructure, to help car manufacturers recover sunk costs, encourage adoption by private vehicle drivers thanks to network effects, and create a signalling effect and a demonstration effect to overcome psychological barriers and information asymmetries;
3. Financial policies and instruments	• ***New business models:*** Green cars alter automotive value chains and foster the emergence of innovative business models for charging infrastructure (public/private); • ***Integrated financial planning*** that is budget neutral for cities and will require a clear roadmap for positive return on investment to drive private investors; • ***Fiscal and financing incentives*** integrated within long-term planning and a stable policy framework - the stimulus effects of the US Green investment package under the American Recovery and Reinvestment Act were hindered by the absence of a stable demand-side framework to create private confidence in the green sector;
4. Harness resources and build capacity	• ***Remove administrative burdens*** in charging infrastructure deployment; • ***Information-based measures;*** • ***Support to R&D***, *e.g.* with the European Green Cars Initiative PPP to promote R&D in energy-efficient mobility, particularly electro mobility;
5. Promote green behaviour	• ***Network and partnerships*** to facilitate co-operation amongst stakeholders.

Sources: Beltramello, 2012a, b ; Patir, 2012; IEA, 2011b; Paturet, 2012 ; Zenghelis, 2012; Aldy, 2012.

3.4 Structuring and integrating financing instruments upfront in the planning process

127. Financing plans need to integrate the appropriate mix of traditional and innovative sources of financing. Governments can usefully consider a broad mix of innovative instruments and mechanisms to ensure projects are financially sustainable in the long run, *i.e.* that revenues cover capital and operating expenditures. The choice of instruments depends on country specificities and existing policy and regulatory environment. Figure 7 below presents a schematic overview of the revenues and expenditures associated with most sustainable transport infrastructure projects. Concessional loans, capital grants or loan guarantees can for instance be used to finance upfront capital investment or lower the cost of capital, while securing commercial loans (*e.g.* with support from AAA-rated development banks). Carbon finance, though rarely sufficient to cover capital or operating expenditures, can be used to cover part of operating expenditures, while leveraging private finance and ensuring domestic political support to the project.

Figure 7. Capital and operating expenditures in transport infrastructure projects



Source: OECD, adapted from Sakamoto *et al.,* 2012b.

128. Governments also need to better integrate financing plans into transport planning process. In the absence of integrated financing and implementation process, this can notably reduce project implementation delays due to lack of financing sources in the construction phase, or avoid the use of additional subsidies in PPP projects' operating phases due to lack of sufficient revenues. Poor institutional coordination and inadequate multilevel governance arrangements can lead to the fragmentation of sustainable transport infrastructure systems in terms of planning and financing (Sakamoto *et al.,* 2010b). Addressing those barriers require aligning the institutional processes behind sustainable transport infrastructure investments, which can help to integrate financing strategies upfront in the transport policy planning process (de Bruin et al., 2009; Leather *et al.,* 2009). Integrating infrastructure financing and planning can also improve otherwise ad-hoc and poorly coordinated investment decisions, for example by guaranteeing that the authority in charge of building the infrastructure has some level of control over the level of user chargers, or by ensuring that the appropriate stakeholder is responsible for collecting revenues.

4. Harness resources and build capacity for sustainable transport infrastructure

129. Beyond financial resources, several types of resources are needed to ensure the successful design and deployment of sustainable transport projects (IEA, 2012a). It includes technological, administrative, legal resources that have to be accounted for in transport planning process to ensure a proper project implementation. Securing technological resources also calls for fostering innovation, particularly to deliver the "Improve" side of the A-S-I strategy. Harnessing human and technical resources in support of sustainable transport is another challenge in public and private sectors, as inadequate administrative capacity creates hurdles for private sector participation and investments.

4.1 Foster innovation with R&D policies

130. Promoting sustainable transport requires policy support to foster innovative technologies for transport infrastructure and equipment, as well as process innovation (*e.g.* in the interface between urban and transport programmes) (EIB, 2011). Despite the importance for policy support to remain technology or performance neutral, the public sector can play an important role in overcoming specific failures and barriers (OECD, 2011f; Hasčič and Johnstone, 2011). These include the lack of innovation capability, the presence of a research and investment bias to incumbent technology and network infrastructure, the lack of capabilities for small and medium private enterprises to adopt green innovation, and limited incentive to innovate in transport modes characterised by natural monopolies such as railways, since innovation is more likely to come from new entrants (Johnstone, 2012).

131. Beyond R&D support to low-carbon vehicle technologies and charging infrastructure (see Box 19), R&D programmes can also support rail infrastructure, through reduced aerodynamic resistance and train weight, regenerative braking and more efficient propulsion systems (Kejun, 2010).

4.2 Training and human capacity

132. Gaps in terms of human resources capacity are often overlooked in policy efforts, yet governments, public authorities and the business community lack the institutional and technical capacity to integrate sustainable transport considerations into transport investment decisions, and to address information asymmetries arising from the presence of multiple stakeholders. Capacity is very dependent on the type of decision maker (Corfee-Morlot *et al.,* 2012). Whether at the national, regional or local levels, strengthening institutional capacity can improve the effectiveness of policy planning processes. For example, training relevant stakeholders and supporting agencies such as transit operators would increase awareness on policy goals and assist travellers when the programme or project is implemented (IEA, 2012a).

133. At the project level, information asymmetries are particularly challenging to implement projects using PPPs. Key barriers include a lack of experience in identifying viable projects, negotiating contracts and regulating PPP projects (Zegras, 2002). As PPP contracts can last from 10 to more than 90 years, it is important for public stakeholders to define appropriately their expectations to private operators (Merk, *et al.,* 2012).

134. More broadly, transport infrastructure planning requires multi-sector technical skills, including in design, planning, analysis and monitoring (Meakin, 2004). In Latin America for instance, low technical

capabilities to adequately design transport infrastructure projects is highlighted as one of the key challenges to improving the effectiveness of transport policies (OECD/ECLAC, 2012d). Furthermore, planning, financing and operating sustainable transport infrastructure requires additional support from education and training programmes that take into consideration challenges associated with sustainable dimension of policies, programmes and projects.

135. Private investors' capability gap is another key barrier to private sector investment in sustainable transport infrastructure projects. Private investors such as pension fund managers do not systematically have in-house expertise to invest in infrastructure. This stems both from the small share so far of infrastructure investment — estimated to less than 1% of pension funds' assets globally — and to the nature and risk involved with infrastructure investment, requiring due-diligence resources that often exceed the current capacity of smaller institutional investors (Kaminker and Stewart, 2012).

4.3 Administrative capacity for assessment, monitoring and enforcement

136. Inadequate administrative capacity creates hurdles for private sector participation and investments in sustainable transport infrastructure projects. Improving planning, regulatory and administrative capacity across levels of governments and within authorities in charge of transport operations can help transition away from informal, fragmented transport services operations. This has been shown to be true in several developing country cities, for example to reform urban bus systems, by replacing informal minibuses with centralised rapid bus transit systems, which require professional management services (Meakin, 2004). Administrative capability also helps managing efficiently sustainable transport infrastructure, e.g. to administer transport subsidies or to monitor performance.

137. Though important, monitoring and evaluation (M&E) of climate change impacts and GHG emissions are underdeveloped across domestic contexts. Developing methodologies and guidelines can help monitor the development of sustainable transport infrastructure projects and evaluate their impacts, *e.g.* in terms of emissions savings, modal shift, health benefits or congestion reduction (Sakamoto *et al.,* 2010a).

138. Robust M&E is particularly needed to scale up funding for climate change adaptation, to ensure that the potential benefits of climate-resilient actions are being realised and to inform the design of future actions (Lamhauge *et al.,* 2012). Available indicators can be used as proxies to measure climate-resilience in transport infrastructure projects. Governments can measure and share climatic change projections and local impact assessments (Leather *et al.,* 2009). Indicators are available at several levels: *impacts*, *e.g.* change in robustness of transport infrastructure with respect to flood management considerations; *outcomes* (*i.e.* the benefit or change resulting from the activity), *e.g.* percent reduction in road closures due to landslides or flooding, or improved transport planning and related decision making, particularly at the urban level; and *outputs* (*i.e.* the direct product of the planning process), *e.g.* climate-resilient transport planning or adaptation planning and strategies that take specific transport infrastructure issues into account, *e.g.* share of road or rail system built to withstand climate change impacts (ADB, 2011).

139. Existing information gaps to monitor and evaluate transport infrastructure projects in general hinder the ability to monitor and evaluate the climate resilience of transport infrastructure systems, In particular, in some countries, the absence of inventory on roads (especially secondary and tertiary roads)

limits the ability of stakeholders to assess the costs and benefits for building new roads (*e.g.* with improved drainage systems), versus maintaining existing ones (OECD/ECLAC, 2012d).

Climate risk and vulnerability assessment

140. Unsurprisingly, private investors also frequently lack the capacity to research investment risk associated with the sustainable component of transport infrastructure projects, *e.g.* to evaluate climate risk of roads and highways. Government support for research on climate change is essential for providing information and analytical tools to integrate climate change considerations into the public and private decision making process. In particular, climate modelling research, climate change impact analysis, and downscaling from global to regional models, can support the private sector's decision to invest in climate-resilient transport infrastructure (Agrawala *et al.,* 2011; Corfee-Morlot *et al.,* 2011). Governments can provide information support by creating climate risk assessment tools to familiarise private investors with the issue or facilitate investors' decisions by filtering and screening bankable projects in their countries, *e.g.* through national investment boards.

141. There are currently gaps in the information and guidance available to support climate-resilient transport infrastructure investments. Investing in climate-resilient transport infrastructure includes retrofitting existing assets and requires establishing the institutional capacity to assess, implement and monitor climate-resilient infrastructure (ADB, 2011). Whether at the project or programmatic levels, climate-risk assessment is rarely conducted, despite development in some countries of national adaptation assessments and/or plans. The public sector can support vulnerability and climate risk assessment by establishing policies at the national, regional and local levels that take into account adaptation objectives; developing climate risk-screening and risk-assessment tools, climate projections and guidelines for planning and action; encouraging greater transparency and disclosure of climate risk and adaptive measures by private companies and investors; requiring climate risk incorporation within firms' due diligence assessment processes; and setting an example through public procurement processes and financing criteria that require consideration of climate change vulnerability in design specific and programmatic design (DEFRA, 2011; IPCC, 2011).

142. Several risk-screening tools exist that can be of use at different levels and entry points for decision. Governmental use of these tools may occur in national transport infrastructure planning, in sub-national planning processes or at the local level in project design and implementation. International development cooperation is another area where there is increasing attention to climate risk screening. Examples include: the UK ORCHID[14] programme and the UK Department for International Development's Climate Risk Impacts on Sectors and Programmes; the Climate quick scans by the Netherlands' Foreign Affairs Ministry; and Climate Check by German International Cooperation (GIZ).

5. Promote green business and consumer engagement

143. Information, education, public awareness campaigns and business outreach programmes are necessary to address information barriers and promote changes in corporate and consumer behaviour encouraging the use of alternative investment in the transport infrastructure sector, and helping to shift

[14] Opportunities and Risks for Climate Change and Disasters.

investments towards sustainable transport infrastructure. Individuals need reliable information on which to base their travel decisions, and private actors to base their investment decisions.

144. Information, education, public awareness campaigns and business outreach programmes can address information barriers to use of transport infrastructure. The social benefits of shifting transport use to sustainable transport modes suggest that market-based instruments can efficiently alter behaviours provided that sufficient communication exists prior to setting the policy, particularly when transport price is not the only factor in mode selection (OECD 2011e; Weis, 2012; Lennox, 2011).

145. "Soft" policy tools can be particularly helpful to discourage private vehicle use and promote sustainable transport modes in terms of influencing the behaviours of consumers. For example, shifting the perception of private cars as a social status symbol (and thus limit private vehicle demand), raising profile for public transport which is often perceived as the transport mode of lower classes, especially in emerging economies can be useful (Leather *et al.,* 2009). Demand-side management can be achieved in part through increasing people's awareness of feasible transport alternatives and highlighting the co-benefits of sustainable transport, *e.g.* improved health, reduced fuel expenditures and commuting time (UNEP, 2011). By providing easily accessible information about the positive impacts of projects or programmes, policy makers will encourage broader participation. Research on behavioural economics has concluded that the best chance for behavioural transport modal shift is during periods on external context change (*e.g.* when households relocated, have children or change jobs) (Verplanken *et al.,* 2008). This can help target information and public-awareness programmes.

146. Moving to real-time information, particularly in an urban context, will enable a smoother management of both congestion and public transport systems. Mobility management, training and awareness campaigns can also support consumer behavioural changes to reduce overall transport usage, for example by encouraging the increased use of teleworking and videoconferencing.

147. It can also be helpful to package certain policy instruments along with public awareness campaigns, *e.g.* in the case of fossil fuel subsidy removal or of road user charges, in order to increase public acceptance (Leather *et al.,* 2009). Ensuring a high level of transparency and communication to the public is essential to help citizens and consumers compare their behaviours with more environmentally-friendly ones and ensure that they trust the legitimacy and fairness of policies such as pricing strategies, and understand the full costs behind fossil-fuel based transportation or subsidies (Sakamoto *et al.,* 2010b). Policy examples include: public-awareness campaigns; mobility management and marketing schemes to promote public transit and sustainable transport alternatives; labelling of new cars; and driver education and training, especially for truck drivers (UNEP, 2011).

148. Disclosure guidelines for companies constitute another relevant tool, *e.g.* with the US Climate Change Disclosure guidance by the US Securities and Exchange Commission (SEC); it outlines information publicly traded companies facing significant material effects from climate change must disclose, though companies have mostly focused so far on regulatory risk rather than actual climate risk (DEFRA, 2011; Riedel, 2012; SEC, 2010).

CONCLUDING REMARKS

149. This report identifies the key policies, tools and instruments available to policy makers to mobilise (*i.e.* scale-up and shift) private investment in sustainable transport infrastructure. This can be done notably through improving the risk-return profile of sustainable transport projects, by addressing market and government failures that fall short of accounting for the full costs of fossil fuel-based road transport and for the benefits associated with sustainable transport. The five-point policy checklist provides a non-prescriptive list of policy actions, tools and instruments available to policy makers.

150. At the national and sub-national levels, governments need to choose the right mix of policy tools and instruments, and to integrate instruments and strategies within a coherent and stable policy framework. Governments need to package and integrate instruments into a coherent policy mix, in order to effectively shift and scale-up investment in sustainable transport infrastructure. This report provides examples of policy packaging and coordination, notably:

- Pricing instruments such as congestion charges are generally more effective when packaged with regulatory tools such as land-use planning, as well as public awareness campaigns; in addition, congestion charges and carbon prices are politically challenging to implement, and typically require strong political leadership from local policy makers;
- Financing plans need to be integrated upfront in transport planning process;
- Transport infrastructure planning can usefully be integrated within wider land development programmes and projects, notably to capture the indirect or proximity benefits of transport services on housing development, property values, and commercial activities, using land value capture tools.
- Whenever appropriate, policy makers should complement traditional sources of financing with innovative financial tools such as land value capture, carbon finance or green bonds. Such financial tools can be particularly useful to decrease reliance on public funds to finance public transport infrastructure, and encourage private sector participation and respect of the user-pays principle. Financial instruments and procurement methods such as public-private partnerships also enable to better allocate investment risk between private and public stakeholders.
- Public-private partnerships (PPPs) projects require establishing and improving the policy and regulatory framework for PPPs.

151. In addition, there is no one-size-fit-all approach to mobilise private investment in sustainable transport infrastructure. Although the elements of good practice highlighted in this report are likely to be similar for all countries, country contexts do matter and policy mixes and designs need to be tailored to specific domestic country contexts and adapted to the policy and regulatory framework, both at the national and sub-national levels.

REFERENCES

Asian Development Bank (ADB) (2011), *Guidelines for Climate Proofing Investment in the Transport Sector – Road Infrastructure Projects.* Asian Development Bank.

ADB (2010a), "Sustainable Transport Initiative – Operational Plan", Asian Development Bank, *http://www.adb.org/sites/default/files/pub/2010/Sustainable-Transport-Initiative.pdf.*

ADB (2010b), "Sustainable Urban Development in the People's Republic of China - Urban Public Transport—A Case Study of Public–Private Partnerships (PPPs) in Beijing", *Urban Innovations and Best Practices,* Asian Development Bank, *http://www.adb.org/sites/default/files/pub/2010/urbandev-prc-nov2010-transport-beijing.pdf.*

ADB (2010c), "Urban Development Policy of India (Part 1): Mobility of People by Bus Rapid Transit", *Urban Innovations and Best Practices http://www.adb.org/sites/default/files/pub/2010/Urban-Dev-Policy-India-1.pdf.*

ADB and the World Bank (2006), *Best Practices for Private Sector Investment in Railways,* prepared by TERA International Group, Inc. Final Report, *http://www.adb.org/Documents/Reports/Consultant/best-practices-railways/Study-Report.pdf.*

Atomic Energy Authority (AEA) and UK Aid (2011), "Transport in a Low Carbon Economy"*, Low Carbon Development Summary Sheets*, funded by UK Department of International Development (DFID) and published by AEA Technology plc., *http://www.ricardo-aea.com/cms/assets/Uploads/DFID-Low-carbon-summary-sheets/DFID_low_carbon_development_transport.pdf*.

Agrawala, S., et al. (2011), "Private Sector Engagement in Adaptation to Climate Change: Approaches to Managing Climate Risks", *OECD Environment Working Papers*, No. 39, OECD Publishing. http://dx.doi.org/10.1787/5kg221jkf1g7-en.

Amaral, M., S. Saussier and A. Yvrande-Billon (2008), "Auction Procedures and Competition in Public Services: The Case of Urban Public Transport in France and London", paper submitted to the Working Party No. 2 on Competition and Regulation on 25 February 2013, Competition Committee, OECD, Paris.

Amos, P. (2004), "Public and Private Sector Roles in the Supply of Transport Infrastructure and Services", *Transport Paper TP-1*, World Bank Transport Sector Board, Washington, DC.

Baietti, A., A., Shlyakhtenko, R. La Rocca, and U.D. Patel (2012), *Green Infrastructure Finance: Leading Initiatives and Research,* The World Bank.

Bailey, S.J., D. Asenova and J. Hood (2010), "An Exploratory Study of the Utilisation of the UK's Prudential Borrowing Framework From the Private Finance*, Public Policy and Administration,* Vol. 25, No. 347, *http://ppa.sagepub.com/content/25/4/347.*

Banister, D. (2012a), "Critique of MACCs in Transport", note written for the OECD project on "Mobilising Private Investment in Low-Carbon, Climate-Resilient Infrastructure".

Banister, D. (2012b), "What is the price of carbon or size of subsidy required to transform infrastructure investment towards LCR", note written for the OECD project on "Mobilising Private Investment in Low-Carbon, Climate-Resilient Infrastructure".

Beltramello, A. (2012a), "Market Developments for Green Cars", *OECD Green Growth Papers,* No. 2012-03, OECD Publishing, doi: 10.1787/5k95xtcmxltc-en.

Beltramello, A. (2012b), "Market Developments for Green Cars - Preliminary findings of the CIIE project", Presentation for the workshop "The Green Road Ahead – What Role for Government Policy in Fostering Clean Vehicle Markets?", 16 April 2012, OECD, Paris.

Bialik, C. (2009), "Kicking the Tires on the 'Rebound Effect'", *The Wall Street Journal (WSJ), WSJ Blogs,* 26 May 2009, *http://blogs.wsj.com/numbersguy/kicking-the-tires-on-the-rebound-effect-698/.*

Bollen, J.C., C.J. Brink, H.C. Eerens and A.J.G. Manders (2009a), *"Co-benefits of Climate Policy", PBL Report* No. 500116005, Netherlands Environmental Assessment Agency (PBL), *http://www.unep.org/transport/gfei/autotool/understanding_the_problem/Netherlands%20Environment%20Agency.pdf.*

Bollen, J., et al. (2009), "Co-Benefits of Climate Change Mitigation Policies: Literature Review and New Results", *OECD Economics Department Working Papers*, No. 693, OECD Publishing. http://dx.doi.org/10.1787/224388684356.

Bowen, A. and J. Rydge (2011), "Climate-Change Policy in the United Kingdom", *OECD Economics Department Working Papers*, No. 886, OECD Publishing. http://dx.doi.org/10.1787/5kg6qdx6b5q6-en.

de Bruin, K., R. Dellink and S. Agrawala (2009), "Economic Aspects of Adaptation to Climate Change: Integrated Assessment Modelling of Adaptation Costs and Benefits", *OECD Environment Working Papers*, No. 6, OECD Publishing. http://dx.doi.org/10.1787/225282538105.

Bruzelius, N. (2005), "The Impact of Legal/Regulatory Frameworks on Transaction Costs for Private Sector Involvement in (Transport) Infrastructure Funding", *Report to the Joint OECD/ECMT Transport Research Centre,* Working Group on Transport Infrastructure Investment: Funding Future Infrastructure Needs, *http://www.internationaltransportforum.org/jtrc/infrastructure/Investment/ti1legalFramework.pdf.*

Calimente, J. (2012), "Rail Integrated Communities in Tokyo", *The Journal of Transport and Land Use* Vol. 5, No. 1, pp. 19-32.

CBI and HSBC (2012), *Bonds and Climate Change: The State of the Market in 2012,* Climate Bond Initiative (CBI) and HSBC, *http://climatebonds.net/wp-content/uploads/2012/05/CB-HSBC_Final_30May12-A3.pdf.*

The CBI (2011), "Risky Business Investing in the UK's Low-Carbon Infrastructure", The Confederation of British Industry (the CBI), *http://www.cbi.org.uk/media/1058629/cbi_low_carbon_investment_report_26_april_2011.pdf*

Chawla, A. (2006), "Viability Gap Funding, Indian Department of Economic Affairs", Presentation, Department of Economic Affairs, Government of India, *www.ibef.org/download/Viability_Gap_Funding.ppt.*

UN ECLAC (2010), "*Towards low-carbon transportation infrastructure", No.* 286, 06/2010, Facilitation of Transport and Trade in Latin America and the Caribbean, UN Economic Commission for Latin America (ECLAC), *http://www.cepal.org/usi/noticias/bolfall/5/42195/FAL-286-WEB-ENG.pdf.*

Christainsen, G.B. (2006), "Road Pricing in Singapore after 30 Years," *Cato Journal,* Vol. 26, No. 1, *http://www.cato.org/pubs/journal/cj26n1/cj26n1-4.pdf.*

Clapp, C., et al. (2010), "Cities and Carbon Market Finance: Taking Stock of Cities' Experience With Clean Development Mechanism (CDM) and Joint Implementation (JI)", *OECD Environment Working Papers*, No. 29, OECD Publishing. http://dx.doi.org/10.1787/5km4hv5p1vr7-en.

ClimateWorks (2012), "Transport Sector Overview", *http://www.climateworks.org/network/sectors/sector/?id=94067c68-ee84-8275-c566-f97a2f59b590*, accessed 21 June 2012.

Cochran, I. T. (2012), "The Local-Level Management of Climate Change: the Case of Urban Passenger Transportation in France », Thesis, Université Paris-Dauphine, 15 June 2012.

Cochran, I. (2009), "Transport Infrastructures in France: Climate Change Vulnerabilities and Adaptation Possibilities", *Climate Report*, No. 15, *Mission Climat de la Caisse des Dépôts*.

CCC (2012), "Climate Change – is the UK preparing for flooding and water scarcity?", *Adaptation Sub-Committee Progress Report 2012*, Committee on Climate Change (CCC), *http://hmccc.s3.amazonaws.com/ASC/2012%20report/1586_ASC%20Report%202012_Bookmarked_2.pdf.*

Corfee-Morlot, J., et al. (2012), "Towards a Green Investment Policy Framework: The Case of Low-Carbon, Climate-Resilient Infrastructure", *OECD Environment Working Papers*, No. 48, OECD Publishing. http://dx.doi.org/10.1787/5k8zth7s6s6d-en.

Corfee-Morlot J., I. Cochran, P.-J. Teasdale, and S. Hallegatte (2011), "Multilevel Governance and Deliberative Practice to Support Local Climate Action", *Climatic Change*, Vol. 104, No. 1, pp. 169-97.

Corfee-Morlot, J., et al. (2009), "Cities, Climate Change and Multilevel Governance", *OECD Environment Working Papers*, No. 14, OECD Publishing. http://dx.doi.org/10.1787/220062444715.

CRISIL (2009), "Urban Transport – Financing Urban Transport Projects by Unlocking Indirect Sources of Revenues", Presentation to the Second Annual Conference on Intra-City Transportation Systems, CRISIL Infrastructure Advisory, *http://www.crisil.com/pdf/infra-advisory/7-urban-transport-infra-financing-ut-projects.pdf.*

Crist, P., and K. Van Dender (2012), "Better balanced mobility and greener cars", Presentation for OECD STI Green Car Workshop, 16 April 2012, Paris.

Dalkmann, H. *et al.,* (2007), *Transport and Climate Change. A Sourcebook for Policy-makers in Developing Countries*, *Module 5e,* Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ).

Dalkmann, H. (2009), Policies for Low Carbon Transport, in – *Rethinking Transport and Climate Change - New Approaches to Mitigate CO_2 Emissions from Land Transport in Developing Asia.* Asian Development Bank, *http://www.adb.org/Documents/Papers/ADB-Working-Paper-Series/ADB-WP10-Rethinking-Transport-Climate-Change.pdf.*

Dealogic (2011), "Dealogic Project Finance Review – First Nine Months 2011", Press Release Presentation, 10 October 2011.

DECC (2009), *The UK Low Carbon Transition Plan: National strategy for climate and energy,* UK Department for Energy and Climate Change, *http://www.decc.gov.uk/assets/decc/White%20Papers/UK%20Low%20Carbon%20Transition%20Plan%20WP09/1_20090724153238_e_@@_lowcarbontransitionplan.pdf.*

DEFRA (2011), *Climate Resilient Infrastructure: Preparing for a Changing Climate - Synthesis of the independent studies commissioned by the Government's Infrastructure & Adaptation Project*. UK Department for Environment, Food and Rural Affaires (DEFRA), *http://www.defra.gov.uk/publications/files/pb13520-infrastructure-adaptation-supplementary.pdf.*

Della Croce, R., P. A. Schieb and B. Stevens (2011a), "*Pension Funds Investment in Infrastructure: A Survey", OECD International Futures Programme,* Project on Strategic Transport Infrastructure to 2030, http://www.oecd.org/sti/futures/infrastructureto2030/48634596.pdf.

Della Croce, R., C. Kaminker and F. Stewart (2011), "The Role of Pension Funds in Financing Green Growth Initiatives", *OECD Working Papers on Finance, Insurance and Private Pensions*, No. 10, OECD Publishing. http://dx.doi.org/10.1787/5kg58j1lwdjd-en.

De Nevers, M. (2011), "*Climate Finance – Mobilizing Private Investment to Transform Development", GEG Working Paper,* No. 2011/60, Global Economic Governance Programme, University College, Oxford, *http://www.globaleconomicgovernance.org/wp-content/uploads/Climate-Finance-for-Development_deNevers.pdf.*

Deng, T. and J.D. Nelson (2011), "Recent Developments in Bus Rapid Transit: A Review of the Literature", *Transport Reviews,* Vol. 31, No. 1, pp. 69-96, *http://dx.doi.org/10.1080/01441647.2010.492455.*

DBCCA (2011), "Investing in Climate Change 2011. The Mega-Trend Continues: Exploring Risk & Return", Deutsche Bank Climate Change Advisors (DBCCA), White Paper, *http://www.igcc.org.au/Resources/Documents/ExploringRiskAndReturn.pdf.*

DfT (2011), *Making the Connection: The Plug-In Vehicle Infrastructure Strategy,* UK Office of Low Emission Vehicles, Department for Transport (DfT), *http://assets.dft.gov.uk/publications/making-the-connection-the-plug-in-vehicle-infrastructure-strategy/plug-in-vehicle-infrastructure-strategy.pdf.*

DfT (2009), *Low Carbon Transport: A Greener Future - A Carbon Reduction Strategy for Transport,* UK Department for Transport (DfT), *http://webarchive.nationalarchives.gov.uk/+/http:/www.dft.gov.uk/pgr/sustainable/carbonreduction/low-carbon.pdf.*

European Bank for Reconstruction and Development (EBRD) (2010) "Transport Fact Sheet", *http://www.ebrd.com/downloads/research/factsheets/transport.pdf.*

EBRD (2011), "EBRD in Transport: Developing efficient, reliable and secure transport networks", *http://www.ebrd.com/downloads/sector/transport/General_Transport_Presentation_May_2011.pdf.*

European Investment Bank (EIB) (2012), "The Europe 2020 Project Bond Initiative", http://www.eib.org/infocentre/press/news/all/the-europe-2020-project-bond-initiative.htm?lang=en, accessed 11 March 2013.

EIB (2011a), "EIB support for Dutch High Speed Railway PPP Project", European Investment Bank, *http://www.eib.org/projects/press/2001/2001-093-eur-400-mio-for-high-speed-railway-ppp-project.htm.*

EIB (2011b), "EIB's 2011 Transport Lending Policy", European Investment Bank, *http://www.eib.org/attachments/strategies/transport_lending_policy_en.pdf.*

EIB (2011c), "Loan Guarantee Instrument for TEN-T Projects – Mid-term Review (2011)", European Investment Bank, *http://ec.europa.eu/economy_finance/financial_operations/investment/europe_2020/documents/annex_2a_en.pdf.*

Eichhorst, U. (2009), "Adapting Transport in Developing Cities to Climate Change", Module 5f, in *Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities*, Deutsche Gesellschaft für Technische Zusammenarbeit (BTZ) GmbH, *http://www.transport2012.org/bridging/ressources/files/1/621,521,5F-ACC-EN.pdf.*

Eliasson, J. (2006), *Cost-benefit Analysis of the Stockholm Congestion Charging System, http://siteresources.worldbank.org/INTTRANSPORT/Resources/StockholmcongestionCBAEliassonn.pdf.*

Engel, E., R. Fischer and A. Galetovic (2010), "The Economics of Infrastructure Finance: Public-Private Partnerships *versus* public provision" in *Public and Private Financing of Infrastructure: Evolution and Economics of Private Infrastructure Finance, EIB Papers,* Vol. 15, No. 1, *http://www.eib.org/attachments/efs/eibpapers/eibpapers_2010_v15_n01_en.pdf.*

The European PPP Expertise Centre (EPEC) (2012), "Financing PPPs with project bonds Issues for public procuring authorities", http://www.eib.org/epec/resources/Financing%20PPPs%20with%20project%20bonds%20-%20October%202012.pdf

EPEC (2010), *A Guide to Guidance: Sourcebook for PPPs in TEN-Transport*, European PPP Expertise Center (EPEC), http://www.eib.org/epec/resources/guide-to-guidance-in-ten-transport.pdf.

European Commission (2005), "Trans-European Transport Network: TEN-T priority axes and projects 2005", *http://ec.europa.eu/transport/infrastructure/maps/doc/ten-t_pp_axes_projects_2005.pdf.*

European Commission (2011), "Transport & Environment", *http://ec.europa.eu/environment/air/transport/road.htm*, accessed 11 March 2013.

Fjellstrom, K. (2002), "Introductory Module: Sourcebook Overview, and Cross-cutting Issues of Urban Transport", in *Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities*, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH.

Flachsland, C. S. Brunner, O. Edenhofer and F. Creutzig (2011), "Climate policies for Road Transport Revisited (II): Closing the Policy Gap with Cap-and-Trade", *Energy Policy* No. 39 (2011), *http://www.pik-potsdam.de/members/edenh/publications-1/CPFRTRII.pdf.*

Francke, E., J. Macías and G. Schmid (2012), "The Mobilisation of Private Investment for Low-carbon, Climate-Resilient Infrastructure: The Case of Metrobus Bus Rapid Transit System in Mexico City", draft case study prepared by CTS EMBARQ Mexico for the OECD.

Frankel, J. (2009), "Global Environment and Trade Policy," *Discussion Paper No. 09-01,* Belfer Center for Science and International Affairs, Discussion Paper Series, Harvard Kennedy School, *http://belfercenter.ksg.harvard.edu/publication/18968/global_environment_and_trade_policy.html.*

Freshfields (2012), *From Policy to Proof of Concept, and Beyond – Outlook for Infrastructure 2012,* Freshfields Bruckhaus Deringer, *http://www.freshfields.com/uploadedFiles/SiteWide/News_Room/Insight/Project_Bonds/Outlook%20for%20infrastructure%202012.pdf.*

Freshfields (2011), *Outlook for Infrastructure 2011: Getting Europe Back on Track – Will the 2020 Project Bond Initiative kick-start infrastructure investment?,* Freshfields Bruckhaus Deringer.

Freshfields (2010), *Outlook for Infrastructure 2010: a Radical New Road – Infrastructure delivery amid fiscal crisis,* Freshfields Bruckhaus Deringer.

Freshfields (2009), *Outlook for infrastructure: 2009 and beyond: Can project finance come to the aid of the global economy? - The need to radicalise infrastructure delivery,* Freshfields Bruckhaus Deringer.

Frost & Sullivan (2012), "Boosting the EV market in Europe. Consumer Acceptance, New Business Models and Value Chains", Presentation at the Public Policy Exchange Event "Recharging the European Electric Vehicle Market", 22 February 2012, Brussels.

Galston, W.A. and K. Davis (2012), "Setting Priorities, Meeting Needs: The Case for a National Infrastructure Bank", *Governance Studies at Brookings,* Brookings Institution, *http://www.brookings.edu/~/media/research/files/papers/2012/12/13%20infrastructure%20galston%20davis/1213_infrastructure_galston_davis.pdf.*

Garnaut, R. (2011), *The Garnaut Review 2011. Australia in the Global Response to Climate Change.* Cambridge University Press.

GEF-STAP (2010), *Advancing Sustainable Low-Carbon Transport Through the GEF,* A STAP Advisory Document (Scientific and Technical Advisory Panel) by Dalkmann, H., and Huizenga, C. Global Environment Facility. Washington, DC, *http://www.thegef.org/gef/sites/thegef.org/files/publication/STAP-Sustainable%20transport.pdf.*

GEF (2002), "Mexico: Introduction of Climate friendly Measures in Transport", Project Appraisal Document, http://www.thegef.org/gef/sites/thegef.org/files/gef_prj_docs/GEFProjectDocuments/Climate%20Change/Mexico%20Climate%20Friendly%20Measures%20in%20Transport%20(formerly%20Air%20Quality%20and%20Transport)/Mexico%20Transport%20CEO%20Document%2009%2019%2002.pdf.

Gilbert, A. (2008), "Bus Rapid Transit: Is *Transmilenio* a Miracle Cure?," *Transport Reviews,* 28:4, 439-467.

GIZ (2012), "Navigating Transport NAMAs: Practical handbook for the design and implementation of Nationally Appropriate Mitigation Actions (NAMAs) in the transport sector", draft v0.2, TRANSfer Project Towards Climate-Friendly Transport Technologies and Measures, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, *http://www.transferproject.org/images/Handbook%20v0.2/ManualNTN_V2_final_master2.pdf.*

GIZ (2010), "Sustainable Urban Transport: Avoid-Shift-Improve (A-S-I)", Factsheet, edited by GIZ, *http://www.transport2012.org/bridging/ressources/files/1/1437,fs_ASI_RGB.pdf.*

Gouin, T. (2011), "*Intervention of Private Sector in Financing, Building, Operating Urban Public Transport in France (1970-2010)",* Centre for Studies on Urban Planning, Transportation and Public Facilities (CERTU), Ministry of Ecology, Sustainable Development, Transport and Housing. http://www.ppptransport.eu/index.php?option=com_k2&view=item&task=download&id=47.

Grütter, J.M. (2007), : The CDM in the Transport Sector", Module 5 d in *Sustainable Transport: A Sourcebook for Policy-Makers in Developing Cities*, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH.

Hallegatte, S., et al. (2008), "Assessing Climate Change Impacts, Sea Level Rise and Storm Surge Risk in Port Cities: A Case Study on Copenhagen", *OECD Environment Working Papers*, No. 3, OECD Publishing. http://dx.doi.org/10.1787/236018165623.

Hallegatte, S., F. Henriet and J. Corfee-Morlot (2008), "The Economics of Climate Change Impacts and Policy Benefits at City Scale: A Conceptual Framework", *OECD Environment Working Papers*, No. 4, OECD Publishing. http://dx.doi.org/10.1787/230232725661.

Hamilton, C. (2010), "Revisiting the Cost of the Stockholm Congestion Charging System", *OECD/ITF Joint Transport Research Centre Discussion Papers*, No. 2010/05, OECD Publishing. http://dx.doi.org/10.1787/5kmjp68xl8kc-en.

Hammill, A. and T. Tanner (2011), "Harmonising Climate Risk Management: Adaptation Screening and Assessment Tools for Development Co-operation", *OECD Environment Working Papers*, No. 36, OECD Publishing. http://dx.doi.org/10.1787/5kg706918zvl-en.

Hasčič, I. and N. Johnstone (2011), "Innovation in Electric and Hybrid Vehicle Technologies: The Role of Prices, Standards and R&D", in OECD, *Invention and Transfer of Environmental Technologies*, OECD Publishing. http://dx.doi.org/10.1787/9789264115620-5-en.

Hawkesworth, I. (2011), "From Lessons to Recommendations for Public Governance of Public-Private partnerships", *OECD Working Paper,* Public Governance Committee.

Helm*, D.* J. Wardlaw and B. Caldecott (2009), *Delivery a 21st Century Infrastructure for Britain,* Policy Exchange, *http://www.policyexchange.org.uk/images/publications/delivering%20a%2021st%20century%20infrastructure%20for%20britain%20-%20sep%2009.pdf.*

Hill, N., T. Hazeldine, J. von Einem, A. Pridmore and D. Wynn (2009), "EU Transport GHG: Routes to 2050? Alternative Energy Carriers and Powertrains to Reduce GHG from Transport", *Paper 2* produced as part of contract ENV.C.3/SER/2008/0053 between European Commission Directorate-General Environment and AEA Technology plc; *http://www.eutransportghg2050.eu/cms/assets/UPDATED-EU-Transport-GHG-2050-Paper-2-Alt-energy-carriers-and-powertrains-21-12-09.pdf.*

HM Treasury (2011), *National Infrastructure Plan 2011,* Infrastructure UK, UK Treasury Department (HM Treasury), *http://cdn.hm-treasury.gov.uk/national_infrastructure_plan291111.pdf.*

HM Treasury (2012), "Transport: A Driver of Economic Growth, Infrastructure UK, UK Treasury Department (HM Treasury) website, *http://www.hm-treasury.gov.uk/iuk_transport.htm,* accessed 13 March 2013.

Huizenga, C. and S. Bakker (2010a), "*Applicability of post 2012 climate instruments to the transport sector*", Final Consultants Report, CITS Project, ADB, IDB and SLoCaT, *http://www.slocat.net/wp-*

content/uploads/2010/08/Application-of-post-2012-climate-instruments-to-transport-sector-ADB-IDB-SLoCaT-July-2010.pdf.

Huizenga, C., and J.A. Bakker (2010b), "Making Climate Instruments Work for Sustainable Transport in Developing Countries", *Natural Resources Forum,* Special Issue: Transport, Vol. 34, No. 4, *http:dx.doi.org/ 10.1111/j.1477-8947.2010.01315.x.*

International Council for Local Environmental Initiatives (ICLEI) (2002), "Curitiba - Orienting Urban Planning to Sustainability", *Case Study No. 77,* International Council for Local Environmental *Initiatives (ICLEI), http://www.iclei.org.br/polics/CD/P2_4_Estudos%20de%20Caso/1_Planejamento%20Urbano/PDF106_EC77_Curitiba_ing.PDF*.

International Energy Agency (IEA) (2013a), *Global Land Transport Infrastructure Requirements, Estimating road and railway infrastructure capacity and costs to 2050*, Insights Paper, IEA/OECD, Paris, *http://www.iea.org/publications/freepublications/publication/TransportInfrastructureInsights_FINAL_WEB.pdf*.

IEA (2013b), *A Tale of Renewed Cities: a policy guide on how to transform cities by improving energy efficiency in urban transport systems*, IEA/OECD, Paris.

International Energy Agency (IEA) (2012), *Energy Technology Perspectives 2012: Pathways to a Clean Energy System*, OECD Publishing. http://dx.doi.org/10.1787/energy_tech-2012-en.

IEA (2011a), *Clean Energy Progress Report,* OECD/IEA, Paris, *http://www.iea.org/publications/freepublications/publication/CEM_Progress_Report.pdf.*

IEA (2011b), Technology Roadmaps Electric and plug-in hybrid electric vehicles (EV/PHEV), http://www.iea.org/papers/2011/EV_PHEV_Roadmap.pdf.

IEA (2011c), *Energy Efficiency Policy Recommendations,* OECD/IEA, Paris.

IEA (2010), *Energy Technology Perspectives 2010: Scenarios and Strategies to 2050*, OECD Publishing. http://dx.doi.org/10.1787/energy_tech-2010-en.

IEA (2009), *Transport Energy and CO_2: Moving towards Sustainability*, OECD Publishing. http://dx.doi.org/10.1787/9789264073173-en.

IFC (2010), *Climate risk and financial institutions: challenges and opportunities,* IFC Sustainability, World Bank Group, Washington DC, *http://www1.ifc.org/wps/wcm/connect/444e0400488559418274d26a6515bb18/IFCClimate_RiskandFIs_FullReport.pdf?MOD=AJPERES&CACHEID=444e0400488559418274d26a6515bb18.*

Indian Ministry of Finance (2006), "Guidelines for Financial Support to PPPs in Infrastructure: Viability Gap Funding Scheme", Department of Economic Affairs *http://www.pppinindia.com/pdf/scheme_Guidelines_Financial_Support_PPP_Infrastructure-english.pdf.*

Institute for Transportation & Development Policy (ITDP) (2007), "Bus Rapid Transit Planning Guide", Wright L. and W. Hook (ed.), Institute for Transportation & Development Policy (ITDP), New York, *http://www.itdp.org/documents/Bus%20Rapid%20Transit%20Guide%20-%20complete%20guide.pdf.*

Jamet, S. (2011), "Enhancing the Cost-Effectiveness of Climate Change Mitigation Policies in Sweden", *OECD Economics Department Working Papers*, No. 841, OECD Publishing. *http://dx.doi.org/10.1787/5kghxkjv0j5k-en.*

Johanssen, B. (2000), "Economic Instruments in Practice 1: Carbon Tax in Sweden", Swedish Environmental Protection Agency, *http://www.oecd.org/science/inno/2108273.pdf.*

Johnstone, N. (2012), *Innovation and Infrastructure – Findings from OECD work.* Presentation at the OECD workshop on "Getting the Prices Right, 3 April 2012, OECD, Paris.

Junge, J.R. and D. Levinson (2012a), "Prospects for Transportation Utility Fees", *Journal of Transport and Land Use* Vol. 5, No. 1, pp. 33-47.

Junge, J.R. and D. Levinson (2012b), "Financing Transportation with Land Value Taxes: Effects on Development Intensity", *Journal of Transport and Land Use* Vol. 5, No. 1, pp. 49-63.

Kaminker, C. and F. Stewart (2012), *The Role of Institutional Investors in Financing Clean Energy,* A paper prepared by the OECD Round Table on Sustainable Development for the Clean Energy Ministerial, Lancaster House, London, UK 25-26 April 2012.

Kaufmann, C. (2008), "Engaging the Private Sector in African Infrastructure", NEPAD-OECD Africa Investment Initiative, *OECD Issues Paper.*

Kejun, J. (2010), "Mapping Climate Mitigation Technologies and Associated Goods within the Transport Sector", ICTSD Programme on Trade and Environment, *http://ictsd.org/downloads/2010/11/mapping-climate-change-mitigation-technologies-and-associated-goods-within-the-transport-sector-jm.pdf.*

Kennedy, C., E. Miller (2005), "The Four Pillars of Sustainable Urban Transportation", *Transport Reviews,* Vol. 25, No. 4, 393–414.

Kennedy, C. and J. Corfee-Morlot (2012), "Mobilising Investment in Low-Carbon, Climate Resilient Infrastructure", *OECD Environment Working Papers*, No. 46, OECD Publishing.

Klein, Huq, Denton, Downing, Richels, Robinson and Toth (2007), Inter-relationships between adaptation and mitigation. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Parry, Canziani, Palutikof, van der Linden and Hanson, Eds., Cambridge University Press, Cambridge, UK, 745-777.

Koppenjan, J. (2012), "Public-private Partnerships and Low-Carbon, Climate-Resilient Investments", draft paper written in the context of the expert meeting on "Mobilising Private Investment in Low-Carbon, Climate-Resilient Infrastructure", 6 February 2012, OECD, Paris.

KPMG (2005), "Financial Viability and Affordability of Off-budget Infrastructure Funding Models", Report prepared by KPMG for the OECD European Conference of Ministers of Transport (ECMT)/Joint Transport Research Centre (JTRC), OECD/ECMT/JTRC *http://www.internationaltransportforum.org/jtrc/infrastructure/Investment/TI1-KPMGreport.pdf.*

Kverndokk, S. and K.E. Rosendahl (2010), "The Effects of Transport Regulation on the Oil Market: Does Market Power Matter?", *Discussion Paper* No. RFF DP 10-40, Resources for the Future, *http://www.rff.org/rff/documents/rff-dp-10-40.pdf.*

Lamhauge, N., E. Lanzi and S. Agrawala (2012), "Monitoring and Evaluation for Adaptation: Lessons from Development Co-operation Agencies", *OECD Environment Working Papers* No. 38, OECD Publishing

Leape, J. (2006), "The London Congestion Charge", *Journal of Economic Perspectives* Vol. 20, No. 4. Pp. 157–176, *http://classes.igpa.uiuc.edu/jgiertz/London-congestion.pdf.*

Leather, J. and the Clean Air Initiative for Asian Cities Center Team (2009), "*Rethinking Transport and Climate Change", ADB Sustainable Development. Working Paper Series* No. 10, Asian Development Bank (ADB), *http://www.adb.org/sites/default/files/pub/2009/ADB-WP10-Rethinking-Transport-Climate-Change.pdf.*

Legacy, C. (2009), "Planning for Low Carbon Mobility: Exploring the Relationship between Stakeholder Engagement and Transport Policy", *World Academy of Science, Engineering and Technology* No. 54, *http://www.waset.org/journals/waset/v54/v54-155.pdf.*

Lennox, K. (2011), "The Impact of Australia's Carbon Pricing on Transport", The Tipping Point Institute.

Lloyd, C. (2012), "World Overview of the PPP Markets", PricewaterhouseCoopers Presentation at the 5th annual OECD meeting on Public-Private Partnerships.

Martínez, L.M.G. and J.M. Viegas (2012), "The Value Capture Potential of the Lisbon Subway", *Journal of Transport and Land Use* Vol. 5, No. 1, pp. 65-82.

McCollum, D., G. Gould and D. Greene (2009), "Greenhouse Gas Emissions from Aviation and Marine Transportation: Mitigation Potential and Policies", *Solutions White papers Series,* Pew Center on Global Climate Change, *http://www.c2es.org/docUploads/aviation-and-marine-report-2009.pdf.*

McKinsey & Company (2009a), *Pathway to a low carbon economy,* McKinsey & Company report.

McKinsey & Company (2009b), *Roads toward a Low Carbon Future,* McKinsey & Company report.

Meakin, R. (2004), "Urban Transport Institutions", Module 1b in *Sustainable Transport: A Sourcebook for Policy-Makers in Developing Cities*, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, *http://cleanairinitiative.org/portal/sites/default/files/articles-58714_Module_1b_Urban_Transport_Institutions.pdf.*

Menckhoff, G. (2005), "Latin American Experience with Bus Rapid Transit, World Bank Presentation at the Annual Meeting –Institute of Transportation Engineers, Melbourne, 10 August 2005, *http://siteresources.worldbank.org/INTURBANTRANSPORT/Resources/340136-1153689836373/ITEMelbourneBRT-LAExperience.pdf.*

Mercer (2011), "Climate Change Scenarios – Implications for Strategic Asset Allocation", Public Report by Mercer's Responsible Investment (RI) team, *http://www.mercer.com/articles/1406410.*

Merk, O., et al. (2012), "Financing Green Urban Infrastructure", *OECD Regional Development Working Papers*, No. 2012/10, OECD Publishing. http://dx.doi.org/10.1787/5k92p0c6j6r0-en.

Meyer, M.D. (2006), "*Design Standards for U.S. Transportation Infrastructure:* The Implications of Climate Change", Georgia Institute of Technology, *http://onlinepubs.trb.org/onlinepubs/sr/sr290Meyer.pdf.*

Milotti, A. and Patumi, N. (2008), "'Value Capture' as a Method to Fund Transport Infrastructure: Comparison of Three Cases", Bocconi University, CERTeT – Center for Research on Regional Economics, Transport and Tourism.

Ministry of Urban Development, Government of India (MoUD) (2012), "National Urban Transport Policy", *http://urbanindia.nic.in/policies/TransportPolicy.pdf,* accessed 13 March 2013.

Morgenstern, R.D. (2009), "Competitiveness and Climate Policy: Avoiding Leakage of Jobs and Emissions," *Congressional Testimony,* Prepared for the U.S. House of Representatives Committee on Energy and Commerce, *http://www.rff.org/RFF/Documents/RFF-CTst_09-Morgenstern.pdf.*

Miyamoto, K. and D. Muzenda (2012), "*Mapping Support for Africa's Infrastructure Investment",* Report part of the "Aid for Investment in Africa's Infrastructure" project, jointly managed by the Development Assistance Committee and the Investment Committee of the OECD within the framework of the NEPAD-OECD Africa Investment Initiative, OECD, *http://www.oecd.org/daf/inv/investment-policy/MappingReportWeb.pdf.*

Nash, C. (2009), "When to Invest in High-Speed Rail Links and Networks?", *OECD/ITF Joint Transport Research Centre Discussion Papers*, No. 2009/16, OECD Publishing. http://dx.doi.org/10.1787/5kmmr3gg21hk-en.

New York City Global Partners (2012), "Best Practice: Metrobus Bus Rapid Transit System", *http://www.nyc.gov/html/unccp/gprb/downloads/pdf/Mexico%20City_Metrobus.pdf.*

New Zealand Government (2011), *National Infrastructure Plan 2011*, *http://www.infrastructure.govt.nz/plan/2011.*

Nilsson, J-E., L. Hultkrantz and U. Karlström (2006), "The Arlanda Airport Rail Link – Lessons Learned from a Swedish PPP construction project", *Review of Network Economics* Vol. 7, No. 1, pp. 77-94, DOI *rne/vol7/iss1/5.*

US National Research Council (2002), "Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards", Committee on the Effectiveness and Impact of CAFE Standards, Board on Energy and Environmental Systems (BEES), Transportation Research Board, National Research Council, *National Academy Press,* Washington, DC, *http://www.nap.edu/openbook.php?isbn=0309076013.*

Organisation for Economic Co-operation and Development (OECD) (2013 forthcoming), "Transport Infrastructure Adaptation to Climate Change and Extreme Weather", *Chair's Discussion Paper,* Working Group on Infrastructure Adaptation to Extreme Weather and Climate Change, OECD.

OECD/International transport Forum (ITF) (2012), *Transport Outlook 2012: Seamless Transport for Green Growth,* OECD/International Transport Forum, Paris, *http://www.internationaltransportforum.org/Pub/pdf/12Outlook.pdf.*

OECD (2012a), *OECD Environmental Outlook to 2050: The Consequences of Inaction*, OECD Publishing. http://dx.doi.org/10.1787/9789264122246-en.

OECD (2012b), "Recommendation of the Council on Principles for Public Governance of Public-Private Partnerships", *OECD Recommendation* No. C(2012)86 (4 May 2012), *http://acts.oecd.org/Instruments/ShowInstrumentView.aspx?InstrumentID=275&InstrumentPID=281&Lang=en&Book=False*, accessed 12 March 2013.

OECD (2012c), *Strategic Transport Infrastructure Needs to 2030,* OECD Publishing. *http://dx.doi.org/10.1787/9789264114425-en.*

OECD/Economic Commission for Latin America and the Caribbean (ECLAC) (2012d), *Latin American Economic Outlook 2012: Transforming the State for Development*, OECD Publishing. http://dx.doi.org/10.1787/leo-2012-en.

OECD (2012e), *Southeast Asian Economic Outlook 2011/12*, OECD Publishing. http://dx.doi.org/10.1787/9789264166882-en.

OECD (2012f), *Compact City Policies: A Comparative Assessment,* OECD Green Growth Studies, OECD Publishing. *http://dx.doi.org/10.1787/9789264167865-en.*OECD/International Transport Forum (2011a), "Better Economic Regulation: The Role of the Regulator", *International Transport Forum Discussion Papers*, No. 2011/03, OECD Publishing. http://dx.doi.org/10.1787/5kg9mq55fpmv-en.

OECD/ITF (2011b), *Transport Outlook 2011 - Meeting the Needs of 9 Billion People,* OECD Publishing/International Transport Forum, Paris, *http://www.internationaltransportforum.org/Pub/pdf/11Outlook.pdf.*

OECD/ITF (2011c), *Moving Freight with Better Trucks: Improving Safety, Productivity and Sustainability*, OECD Publishing. http://dx.doi.org/10.1787/9789282102961-en.

OECD/ITF (2011d), *Trends in the Transport Sector 2011*, OECD Publishing. http://dx.doi.org/10.1787/trend_transp-2011-en.

OECD/ITF (2011e), *Greening Household Behaviour: The Role of Public Policy*. OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264096875-en.

OECD (2011f), *Fostering Innovation for Green Growth*, OECD Green Growth Studies, OECD Publishing. http://dx.doi.org/10.1787/9789264119925-en.

OECD (2010a), *Cities and Climate Change*. OECD Publishing. http://dx.doi.org/10.1787/9789264091375-en.

OECD (2010b), *Globalisation, Transport and the Environment,* OECD Publishing. http://dx.doi.org/10.1787/9789264072916-en.

OECD/ITF (2010c), *Improving Reliability on Surface Transport Networks*, OECD Publishing. http://dx.doi.org/10.1787/9789282102428-en.

OECD/ITF (2010d), *Stimulating Low-Carbon Vehicle Technologies*, ITF Round Tables, No. 148, OECD Publishing. http://dx.doi.org/10.1787/9789282102978-en.

OECD/ITF (2010e), *Reducing Transport Greenhouse Gas Emissions: Trends and Data 2010*, OECD Publishing International Transport Forum, Paris.

OECD/ITF (2010f), *Transport Greenhouse Gas Emissions: Country Data 2010,* OECD Publishing/International Transport Forum, Paris.

OECD/ITF (2010g), *Implementing Congestion Charges*, ITF Round Tables, No. 147, OECD Publishing. http://dx.doi.org/10.1787/9789282102855-en.

OECD (2010h), *OECD Territorial Reviews: Toronto, Canada 2009*, OECD Publishing. http://dx.doi.org/10.1787/9789264079410-en.

OECD (2009a), *GHG Reduction Strategies in the Transport Sector,* OECD Publishing/International Transport Forum.

OECD/ITF (2009b), "Competitive Interaction between Airports, Airlines and High-Speed Rail", *OECD/ITF Joint Transport Research Centre Discussion Papers*, No. 2009/07, OECD Publishing. http://dx.doi.org/10.1787/223853273815.

OECD (2009c), *Reducing Transport GHG Emissions: Opportunities and Costs,* OECD Publishing/International Transport Forum, Paris.

OECD (2009e), *Integrating Climate Change Adaptation into Development Co-operation: Policy Guidance*, OECD Publishing. http://dx.doi.org/10.1787/9789264054950-en.

OECD (2008a), *Public-Private Partnerships: In Pursuit of Risk Sharing and Value for Money*, OECD Publishing. http://dx.doi.org/10.1787/9789264046733-en.

OECD/ITF (2008b), *Transport Infrastructure Investment: Options for Efficiency*, OECD Publishing. http://dx.doi.org/10.1787/9789282101568-en.

OECD/ITF (2008c), *Road Taxation Database,* International Transport Forum (ITF), *http://internationaltransportforum.org/statistics/taxation/index.html,* accessed 13 March 2013.

OECD/ITF (2008d), *Privatisation and Regulation of Urban Transit Systems*, ITF Round Tables, No. 141, OECD Publishing. http://dx.doi.org/10.1787/9789282102008-en.

OECD (2007a), *Infrastructure to 2030 (Vol.2): Mapping Policy for Electricity, Water and Transport*, OECD Publishing. http://dx.doi.org/10.1787/9789264031326-en.

OECD (2007b), *OECD Principles for Private Sector Participation in Infrastructure*, OECD Publishing. http://dx.doi.org/10.1787/9789264034105-en.

OECD (2007c), "Competition Policy and Concessions." *OECD Observer,* http://www.oecd.org/dataoecd/12/47/38706036.pdf.

OECD (2006), *Policy Framework for Investment*, OECD Publishing. http://dx.doi.org/10.1787/9789264018471-en.

OECD (2003), *Voluntary Approaches for environmental Policy: Effectiveness, Efficiency and Usage in Policy Mixes,* OECD Publishing. *http://dx.doi.org/10.1787/9789264101784-en.*

OECD (2002), *Policy Instruments for Achieving Environmentally Sustainable Transport*, OECD Publishing. http://dx.doi.org/10.1787/9789264176249-en.

OECD (2002b), *Recent Privatisation Trends in OECD Countries,* OECD Publishing, Paris.

OECD (2002), *Governance for Sustainable Development: Five OECD Case Studies*, OECD Publishing.http://dx.doi.org/10.1787/9789264194748-en.

OECD (2001), *Environmentally Related Taxes in OECD Countries: Issues and Strategies*, OECD Publishing. http://dx.doi.org/10.1787/9789264193659-en.

OECD, IEA, OPEC and the World Bank (2011), *"Joint report by IEA, OPEC, OECD and World Bank on fossil-fuel and other energy subsidies: An update of the G20 Pittsburgh and Toronto Commitment,"*. Prepared for the G20 Meeting of Finance Ministers and Central Bank Governors (Paris, 14-15 October

2011) and the G20 Summit (Cannes, 3-4 November 2011), http://www.oecd.org/dataoecd/14/18/49006998.pdf.

OECD/EEA (2012), "Database on instruments used for environmental policy and natural resources management", OECD and European Environment Agency (EEA), http://www2.oecd.org/ecoinst/queries/index.htm, accessed 13 March 2013.

Patir, Z. (2012), "Drive the World Electric", Presentation for the workshop "The Green Road Ahead – What Role for Government Policy in Fostering Clean Vehicle Markets?", 16 April 2012, OECD, Paris.

Paturet, O. (2012), Presentation for the workshop "The Green Road Ahead – What Role for Government Policy in Fostering Clean Vehicle Markets?", 16 April 2012, OECD, Paris.

Peterson, G.E. (2012), "Unlocking Land Values to Finance Urban Infrastructure", *Trends and Policy Options* No. 7, The World Bank PPIAF, https://www.ppiaf.org/sites/ppiaf.org/files/publication/Trends%20Policy%20Options-7-Unlocking%20Land%20Values%20-GPeterson.pdf.

Petersen, R. (2002, revised in 2004), "Land-use Planning and Urban Transport. Sustainable Transport", Module 2a in *A Sourcebook for Policy-makers in Developing Countries,* Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH.

Portney, P.R., I.W.H. Parry, H.K. Gruenspecht and W. Harrington (2003), "The Economics of Fuel Economy Standards." *Discussion Paper* No. 03-44, Resources for the Future, http://www.rff.org/rff/Documents/RFF-DP-03-44.pdf.

Puentes, R. and J. Thompson (2012), "Banking on Infrastructure: Enhancing State Revolving Funds for Transportation", Brookings-Rockefeller, Project on State and Metropolitan Innovation, http://www.brookings.edu/~/media/research/files/papers/2012/9/12%20state%20infrastructure%20investment%20puentes/12%20state%20infrastructure%20investment%20puentes.pdf.

Public-Private Infrastructure Advisory Facility (PPIAF) (2011a), "Private investment in transport recovered but became highly concentrated on India in 2010", *PPI Data Update Note* No. 50, Public-Private Infrastructure Advisory Facility (PPIAF), World Bank Group, http://ppi.worldbank.org/features/September-2011/2010-Transport-Note-Final-8-31-2011.pdf.

PPIAF (2011b), "Urban Bus Toolkit", World Bank Group, http://www.ppiaf.org/ppiaf/sites/ppiaf.org/files/documents/toolkits/UrbanBusToolkit/assets/1/1e/1e.html, accessed 13 March 2013.

PPIAF (2011c), "Sector Data Snapshots", *PPIAF Database",* World Bank Group. http://ppi.worldbank.org/explore/ppi_exploreSubSector.aspx?SubSectorID=6, accessed 13 March 2013.

PricewaterhouseCoopers (PwC) (2013), "Quel Mécanismes de Financement pour les Gares Urbaines?", Étude réalisée par PricewaterhouseCoopers (PwC) pour La Fabrique de la Cité, petit déjeuner débat "Les mécanismes de financement des gares : comparaison internationale", 13 March 2013, Paris.

PwC (2008), *Urban transportation financing. A strong case for public-private partnership.* Government Reform and Infrastructure Development (GRID) practice of PwC India, PricewaterhouseCoopers (PwC).

PwC (2005), *Delivering the PPP Promise: A Review of PPP Issues and Activities.*

PwC Australia (2009), *Meeting the 2050 Freight Challenge*, prepared at the request of Infrastructure Partnerships Australia by PricewaterhouseCoopers Australia.

Quinet, E. (2010), "The Practice of Cost-Benefit Analysis in Transport: The Case of France", *OECD/ITF Joint Transport Research Centre Discussion Papers*, No. 2010/17, OECD Publishing. http://dx.doi.org/10.1787/5km4q8hpgwwd-en.

Ranger, N., R. Ward, C. Herweijer and R. Muir-Wood (2009), *Adaptation and Insurance: Reducing Risk and Maintaining the Insurability of People and Property in the Face of Rising Hazards,* Presentation for the Centre for Climate Change Economics and Policy, http://www.climate-insurance.org/upload/pdf/20090313_Ranger_Copenhagen.pdf.

Riedel, A. (2012), "Companies Should Recalibrate Climate Change SEC Disclosure Away from Regulatory Risks and Towards Adaptation Risks", Columbia Law School's Center For Climate Change Law.

Rothengatter, W. (2007), "European Investment and Regulatory Policy in the Transport Sector", Summary of the Keynote Address to BTRW Transport Colloquium, http://www.bitre.gov.au/events/2007/files/2007_Infrastructure_Colloquium_Prof_Rothengatter.pdf.

Rouhani, O.M. (2009), "Road Privatization and Sustainability" in *Sustainable Transportation: An International Perspective*, *Projections 9, MIT Journal of Planning,* MIT Department of Urban Studies and Planning, http://web.mit.edu/dusp/dusp_extension_unsec/projections/issue_9/issue_9_rouhani.pdf.

de Rus, G. (2008), "The Economic Effects of High Speed Rail Investment", *OECD/ITF Joint Transport Research Centre Discussion Papers*, No. 2008/16, OECD Publishing. http://dx.doi.org/10.1787/235171703148.

Sakamoto, K., H. Dalkmann and D. Palmer (2010a), "A Paradigm Shift toward Sustainable Transport: Financing the Vision ASAP", Institute for Transportation & Development Policy (ITDP), http://www.itdp.org/documents/A_Paradigm_Shift_toward_Sustainable_Transport.pdf.

Sakamoto, K. and S. Belka (2010b), "Financing Sustainable Urban Transport", Module 1f in *Sustainable Transport: A Sourcebook for Policy-makers in Developing Countries,* Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, http://www.sutp.org/index.php/component/phocadownload/category/23-1f?download=23:1f-fsut-en.

Schipper, L., H. Fabian and J. Leather (2009), "Transport and Carbon Dioxide Emissions: Forecasts, Options Analysis, and Evaluation", *ADB Sustainable Development Working Paper Series* No. 9. Asian Development Bank, http://www.adb.org/sites/default/files/pub/2009/ADB-WP09-Transport-CO2-Emissions.pdf.

Securities and Exchange Commission (SEC) (2010), "Commission Guidance Regarding Disclosure Related to Climate Change", No. 17 CFR PARTS 211, 231 and 241, , http://www.sec.gov/rules/interp/2010/33-9106.pdf.

Small, K. A. and K. Van Dender (2007), "Long Run Trends in Transport Demand, Fuel Price Elasticities and Implications of the Oil Outlook for Transport Policy", *Discussion Paper* No. 2007-16, OECD/ITF Joint Transport Research Centre.

Stacey, C. (2007), "Providing for Future Infrastructure Needs", OECD Joint Transport Research Centre.

Stein, P. (2007), "Swedish Experience with PPP", Presentation to MENA-OECD Investment Programme, Expert Roundtable on Private-Public Partnerships, Amman 6 September 2007, http://www.oecd.org/dataoecd/18/21/39303611.pdf.

Sterk, W. (2011), "South-North-South cooperation in the development of transport NAMAs: The TRANSfer project", Presentation at the COP 17 side event TRANSfer – Germany's support for developing countries' NAMAs in the transport sector, Durban, 2 December 2011, Wuppertal Institut for Climate, Environment and Energy.

Stern, N. (2010), "China's growth, China's cities, and the new global low-carbon industrial revolution", *Policy Paper,* Centre for Climate Change Economics and Policy and Grantham Research Institute on Climate Change and the Environment, http://www2.lse.ac.uk/GranthamInstitute/publications/Policy/docs/PPStern-china-industrial-revolution.pdf.

Sumner, J., L. Bird, and H. Smith (2009), "Carbon Taxes: A Review of Experience and Policy Design Considerations", *Technical Report* No. NREL/TP-6A2-47312, National Renewable Energy laboratory (NREL), http://www.nrel.gov/docs/fy10osti/47312.pdf.

Suzuki, H., R. Cervero and K. Iuchi (2013), *Transforming Cities with Transit: Transit and Land-use Integration for Sustainable Urban Development*, Urban Development Unit, Finance, Economics and Urban Department and Sustainable Development Network, The World Bank Group, Washington DC.

Tochtermann, L. (2008), "Congestion Charging: A tool to tackle congestion in UK cities?", Centre for Cities, http://www.centreforcities.org/assets/files/Congestion%20Charging.pdf/.

Trigg, T. (2012), "Clean Vehicles Markets", IEA Energy Technology Policy Division. Presentation for OECD STI Green Car Workshop, 16 April 2012, OECD, Paris.

Tynan, N. (1999), "Private Participation in the Rail Sector – Recent Trends", *Public Policy for the Private Sector Note* No. 186, The World Bank Group, Finance, Private Sector, and Infrastructure Network, http://rru.worldbank.org/Documents/PublicPolicyJournal/186tynan.pdf.

International Association of Public Transportation (UITP) (2009), "Assessing the Benefits of Public Transport", *Position Paper, http://www.uitp.org/mos/focus/FPBenefits-en.pdf.*

UK Climate Impacts programme (UKCIP) (2003), "Climate Adaptation: Risk, Uncertainty and Decision-making", Technical Report, http://www.ukcip.org.uk/wordpress/wp-content/PDFs/Risk.pdf.

United Nations Conference on Trade and Development (UNCTAD) (2010), *World Investment Report 2010: Investing in a Low-Carbon Economy,* New York and Geneva.

UNCTAD (2008), *World Investment Report 2008,* New York and Geneva.

UN Department of Economic and Social Affairs (DESA) (2010), "2010 Revision of the World Population Prospects*"*, Population Division,.

United Nations Environment Programme (UNEP) (2011), "Transport: Investing in Energy and Resource Efficiency" by H. Dalkmann and K. Sakamoto, in *Towards a Green Economy, http://www.unep.org/transport/lowcarbon/newsletter/pdf/GER_10_Transport.pdf.*

UNEP (2010), *Share the Road: Investment in Walking and Cycling Road Infrastructure*", UNEP and the FIA Foundation for the Automobile and Society, www.unep.org/transport/sharetheroad, accessed 13 March 2013.

UNEP (2008a), *Reforming Energy Subsidies. Opportunities to Contribute to the Climate Change Agenda,* http://www.unep.ch/etb/publications/Energy%20subsidies/EnergySubsidiesFinalReport.pdf.

UNEP (2008b), "A Reformed CDM – Including new Mechanisms for Sustainable Development", UNEP Risø Centre. *Perspectives Series 2008*, http://cd4cdm.org/Publications/Perspectives/ReformedCDM.pdf.

UN ESCAP (2001), "Emerging Issues in Transport, Communications and Infrastructure Development: Infrastructure Financing and Private Sector Participation", Note by the Secretariat, Expert Group Meeting on Preparations for the Ministerial Conference on Transport, Bangkok, 14 and 15 July 2011, http://www.unescap.org/ttdw/MCT2011/EGM/EGM1-7E.pdf.

UNFCCC (2007), "Climate Change: Impacts, Vulnerabilities, and Adaptation in Developing Countries." United Nations Framework Convention on Climate Change (UNFCCC) Secretariat. Bonn, Germany, http://www.preventionweb.net/files/2759_pub07impacts.pdf .

US Department of the Treasury (2010), "An Economic Analysis of Infrastructure Investment", Report prepared by the US Department of Treasury with the Council of Economic Advisers, http://www.treasury.gov/resource-center/economic-policy/Documents/infrastructure_investment_report.pdf.

Verplanken, B., I. Walker, A., Davis and M. Jurasek (2008), "Context change and travel mode choice : Combining the habit discontinuity and self-activation hypotheses", *Journal of Environmental Psychology* Vol. 28, pp. 121-127.

Viguié, V. (2011), "Modélisation des dynamiques urbaines, application à l'analyse économique du changement climatique", thèse soutenue le 5 janvier 2012, http://www.centre-cired.fr/IMG/pdf/resume_pour_site_web_francais-2.pdf.

Vinson & Elkins (2009), "Rules Governing Electric Vehicle Investment and Production in China", *PRC Electric Vehicles Investment Series – Part I*, V&E China Practice Group, http://www.velaw.com/uploadedFiles/VEsite/Resources/ElectricVehiclesSeriesOne.pdf.

Virtuosity Consulting (2005), "Successful Examples of Public-Private Partnerships and Private Sector Involvement in Transport Infrastructure Development*",* report for the OECD/ECTM Transport Research Centre (TRC), http://www.internationaltransportforum.org/jtrc/infrastructure/Investment/PPPsuccessStories.pdf.

Vivid Economics (2011a), "The Economic Impact of the Carbon Pricing Mechanism", Presentation, Australian Carbon Pricing Seminar, http://www.vivideconomics.com/uploads/reports/the-economic-impact-of-the-carbon-pricing-mechanism/Australian_carbon_presentation.pdf.

Vivid Economics (2011b), "The Green Investment Bank: Policy and Finance Context", Report prepared for the Department for Business Innovation and Skills, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/31757/12-553-green-investment-bank-policy-and-finance-context.pdf.

Vivid Economics (2011c), "The Economics of the Green Investment Bank: Costs and Benefits, Rationale and Value for Money", Report prepared for the Department for Business, Innovation & Skills,

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/31741/12-554-economics-of-the-green-investment-bank.pdf.

Ward, M. (2010), "Engaging the Private Sector at Scale in Financing Low-Carbon Infrastructure in Developing Countries", Report of the Private Sector Investment Project, Global Climate Change Consultancy (GtripleC), http://www.gtriplec.co.nz/assets/Uploads/papers/psi_final_of_main_report_full_version_31_may.pdf.

World Economic Forum (WEF) (2011), "Policies and Collaborative Partnership for Collaboration"

WEF (2012), "New Models for Addressing Supply Chain and Transport Risk. An Initiative of the Risk Response Network In collaboration with Accenture.

Weis, C. (2012), "Household Behaviour and Environmental Policy: Transport Related Data Analysis", Presentation at the OECD Meeting of the Advisory Committee, 2 April 2012, OECD, Paris.

Wood, P.J. (2008), "Market Failures and Climate Change Mitigation", Submission to Infrastructure Australia, http://www.infrastructureaustralia.gov.au/public_submissions/published/files/401_theaustraliannationaluniversity_SUB.pdf.

World Bank (2011), "Concessions, Build-Operate-Transfer (BOT) Projects, and Desgin-Build-Operate (DBO) Projects", http://go.worldbank.org/KYULLPIZB0, accessed 13 March 2013.

World Bank (2010), *The Costs to Developing Countries of Adapting to Climate Change: New Methods and Estimates – The Global Report of the Economics of Adaptation to Climate Change Study*. Consultation Draft, http://siteresources.worldbank.org/EXTCC/Resources/EACC-june2010.pdf.

World Bank (2009), "Deterring Corruption and Improving Governance in Road Construction and Maintenance", *Transport Papers* No. TP-27, Transport Sector Board, The World Bank Group, Washington, DC.

World Bank (2008a), "*Transport Lending Trends 1996-2007",* http://go.worldbank.org/KM9OPODLQ0, accessed 13 March 2013.

World Bank (2008b), "Safe, Clean, and Affordable…Transport for Development – The World Bank Group's Transport Business Strategy for 2008-2012", prepared by the Transport Sector Board, Washington, DC, http://siteresources.worldbank.org/INTTRANSPORT/Resources/336291-1211381200616/Transport_Business_Strategy_web.pdf.

World Bank (2006), "Clean Energy and Development: Towards an Investment Framework", World Bank, Washington, DC.

World Bank (2002), "Cities on the Move. A World Bank Urban Transport Strategy Review", Washington, DC.

World Resources Institute (WRI) (2000), "The Climate of Export Credit Agencies", *Climate Notes,* Climate Protection Intiaitive, http://pdf.wri.org/eca.pdf.

Zegras, C. (2002), "Private Sector Participation in Urban Transport Infrastructure Provision", Module 1c in *Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities*, GTZ, http://www2.gtz.de/dokumente/bib/05-0510.pdf.

Zhao, Z.J., K. Vardhan Das and K. Larson (2012), "Joint Development as a Value Capture Strategy in Transportation Finance", *Journal of Transport and Land Use,* Vol. 5, No. 1.

Zusman E., A. Srinivasan and S. Dhakal (2012), "Low Carbon Transport and Co-benefits in Asia" in Zusman E., A. Srinivasan and S. Dhakal (eds), *Low Carbon Transport in Asia: Strategies for Optimizing Co-benefits,* Earthscan, New York.

ANNEXES

Annex 1 - The challenge of using marginal abatement cost curves in transport

152. Marginal abatement cost curves (MACCs) are based on the costs of abatement per unit of CO_2 "saved", with abatement options ranked from the cheapest to the more expensive, with the objective of presenting a range of options that would be most cost effective to introduce. MACCs have been extensively used to examine the financial costs and benefits of different CO_2 abatement options in different sector (though carbon price needs to be set at an economy-wide level to be minimise abatement costs).

153. In the transport sectors, the IEA (2010) estimates that 23% of global abatement potential by 2050 can be achieved in the transport sector, at a marginal abatement cost below USD 50/MtCO_2e. However, marginal abatement costs rise up to USD 200/MtCO_2e for new transport technologies, to abate a total of 12.5 Gt CO_2e (IEA, 2010). In most studies, MACCs estimate abatement costs in transport systems to be higher than in other sectors. MACCs however do not fully reflect the abatement potential in the transport sector, for the following reasons:

- **Marginal abatement costs in the transport sector are substantially higher than those in other sectors** because most effort has been concentrated on a limited number of high-cost technological options, including biofuels and hybrids (Smokers *et al.,* 2009). More *ex-post* analyses might help understanding how new technologies can be effectively introduced and providing better cost estimates. Including a wider range of options would also increase the abatement potential, particularly in the longer run (2020 – 2030).**Abatement costs are highly sensitive to parameter variations with respect to the baseline situation**. Sensitivity is particularly high with: capital costs (especially for new technologies); energy and fuel savings from behaviour change and fuel and vehicle efficiency; oil prices; and discount rates.
- **Measures in the transport sector tend to require relatively large upfront capital costs**. The cost reductions take time to have a measurable effect (Smokers *et al*., 2009). The delays in impacts relate to the turnover rate of the vehicle stock, the time required for innovations to have an effect on the market, economies-of-scale from mass production, and the learning processes (diffusion of innovation). This means that actions are required now if targets are to be met in 2020 and 2030, and it also seems that the private sector is less likely to invest if the risks are perceived to be high and the payback periods lengthy.
- **There is a tendency to favour the technological solutions** over those that involve behavioural change, as the technical measures can be more easily quantified. Abatement cost estimates for measures such as smaller vehicles, traffic management schemes, intelligent transport systems, modal shifts and other structural changes in the transport system (including infrastructure and spatial planning) are all difficult to calculate. A whole range of possibly promising and cost effective reduction options tends to be ignored (Smokers et al., 2011).
- **MACCs give a static view of the costs at one point in time.** This limitation has strong consequences for path dependency and for discount rates that are used. The path dependency dimension suggests that it is only in the reduction of carbon from existing technologies that is of interest in the MACCs, rather than more fundamental changes in the ways in which mobility patterns are organised. The penetration rates used relate to the renewal rate of the fleet, and in transport this is about 10 years, so the initial impact is likely to be low, but the scale is likely to increase over time, as prices come down and as economies-of-scale are realised. This has implications for the discount rates used and the risk assessment.

- **The interaction effects across different policies are ignored.** For example, the introduction of CO_2 emissions standards will result in more fuel efficient cars being produced by manufacturers, and this in turn may result in consumers buying those vehicles. This is one type of causal path based on the assumption that consumers are aware and concerned about CO2 and reduce their travel rather than increase it (rebound effects). If the new standards are combined with higher fuel costs, then a more complex set of possible reactions might take place, including slower and more ecological driving, using public transport or the bike (instead of the car), using more locals facilities, or making less trips (combining trips or using the internet). If fuel prices do not increase, a stricter fuel standard will probably contribute to more driving.

Source: Adapted from Banister, 2012a; Smokers *et al.,* 2011.

Annex 2 - Experiences with public-private partnerships in different transport modes

Bus rapid transit (BRT) systems

154. BRT systems are often considered as cost-efficient "quick-wins" because their profitability and high social benefits deliver results in the short run for sustainable transport (Sakamoto *et al.,* 2010a). In terms of profitability, BRT capital costs are much lower than for metros or light rail transit (LRT), especially since BRTs are typically set up on specific lines with high passenger volumes (UNEP, 2011). Revenues from BRT systems can sometimes cover operational costs without requiring subsidies. In the case of Bogotá TransMilenio for instance (one of the six registered CDM transport projects as of May 2011), USD 100 million of private investment served to finance new buses in the first phase of the BRT project, while operations were entirely paid from fares. Bogotá TransMilenio carried more than one million daily passengers as of 2005, including 15% who previously travelled by car (Clapp *et al.,* 2010; Menckhoff, 2005). In terms of public benefits, BRTs display high benefits in terms of congestion and accessibility, as well as in terms of GHG mitigation. BRT projects can abate CO_2 emissions at a marginal cost of USD 66/$MtCO_2$eq (Hill *et al.,* 2009).

Passenger railways, metro and intermodal transport systems

155. Specific, highly used rail and metro links are more bankable and easier to set as PPPs than full rail or metro/mass rapid transit (MRT) networks. Overall, PPPs are harder to set up in railways and metros than in roads or BRTs. This is first of all because the scale, costs and technical challenges involved generate low internal rates of return for investors (UNEP, 2011). Urban rail systems for example often require subsidies up to 70% of the cost of each passenger trip (ITDP, 2007). Secondly, rail displays natural monopoly characteristics and is not as bankable as toll-roads, as rail is often managed on a full network basis, rather than on smaller segments (Virtuosity Consulting, 2005). As a consequence, reforms to increase private sector participation in rail networks have often had mitigated results.

156. In Latin American countries notably, such reforms did not always increase the effectiveness of railway infrastructure, or prevent underinvestment or delayed maintenance (OECD/ECLAC, 2012d). PPPs however, can suit rail or MRT links offering special services, easy to differentiate from the rest of the network, such as dedicated high speed rail lines, new freight lines, intermodal links and high-profile, highly used links (OECD/ITF, 2008b; Stacey, 2007). In an urban context, elevated rail and tramways may be easier to set up as PPPs than underground rail (whose construction is much more costly), whenever

segregation between rail type is feasible. As fast-growing cities increasingly develop metros/MRT projects, project finance using PPPs could be increasingly used by governments to encourage private sector provision of metro operations, while leaving the public sector to handle construction costs. Given the scale of rail or metro projects, devolutions or engineering-procurement-construction (EPC) contracts are more common PPP types than concessions; New Delhi metro, for instance (2002), was fully financed by the state and central government through EPC contracts.

Shared-use vehicle or bicycle systems

157. They offer private sector investment opportunities as well, though they may not be the highest priority for policy makers. Models commonly used include organised short-term vehicle rental, joint access to a vehicle fleet or use multiple times of vehicles by multiple users. Bicycle sharing stations offer profitable opportunities to develop non-motorised transportation (NMT) through PPPs. Examples include shared-use vehicle systems in Japan, which received strong support from the Japanese government to be developed by private firms. There are also examples of bicycle rental schemes built and operated through PPPs, including contracts with private advertising agencies (for example, JCDecaux in Dublin, Paris, Brussels, Lyon and Seville, and Clear Channel in Stockholm, Oslo, Barcelona, Perpignan and Zaragoza), or in partnerships with private car park operators (*e.g.* Vinci Park in France) and private bike sharing providers (*e.g.* Alta Bicycle Share in Boston, Washington DC and New York). Bicycle sharing systems however may not be the highest priority to achieve sustainable transport goals in countries with advanced public transport systems. This is because they can reduce the profitability of public transport systems and have a limited impact on urban carbon balance whenever it competes with public transport for modal share. Bike sharing schemes can however benefit cities with a public transport infrastructure gap., and are generally set as a complement to public transport systems, to reduce overcrowding of subway systems (e.g. in London) or to provide last-mile connectivity and serve as feeders onto BRT and rail-based public transport (e.g. in Guangzhou, China).