

Rethinking Transport and Climate Change

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No. __ September 2009

The report makes suggestions for the rethinking of the relationships between transport and climate change.

Clean Air Initiative for Asian Cities Center team was engaged to identify the five "think-pieces" on how to address transport and climate change issues.

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_____ 2009

ISSN _____

Publication Stock No. _____

This publication was prepared by consultants at the request of the Asian Development Bank (ADB).

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ABBREVIATIONS

ADB	–	Asian Development Bank
ASEAN	–	Association of Southeast Asian Nations
A-S-I	–	Avoid-Shift-Improve
ASIF	–	Activity-Structure-Intensity-Fuel
AWG-LCA	–	Ad Hoc Working Group on Long-term Cooperative Action under the Convention
BAP	–	Bali Action Plan
BC	–	Black Carbon
BRT	–	Bus Rapid Transit
CDM	–	Clean Development Mechanism
CDP	–	City Development Plans (India)
CER	–	Certified Emission Reduction
CIF	–	Climate Investment Funds
CNBL	–	Center for National Budget Legislation (Philippines)
CNG	–	Clean Natural Gas
CO	–	Carbon monoxide
CO ₂	–	Carbon dioxide
COP	–	Conference of the Parties to the Convention
CSD	–	Commission on Sustainable Development
CTF	–	Clean Technology Fund
CVAT	–	Carbon Value Analysis Tool
DfT	–	Department for Transport (UK)
DNA	–	Designated National Authority
EIA	–	Environment Impact Assessment
ESCAP	–	United Nations Economic and Social Commission for Asia and the Pacific
EST	–	Environmentally Sustainable Transport
ETS	–	Emissions Trading Scheme
EU	–	European Union
GDP	–	gross domestic product
GEF	–	Global Environment Facility
GHG	–	greenhouse gases
HGV	–	heavy goods vehicles
IBRD	–	International Bank for Reconstruction and Development
IDA	–	International Development Association
IEA	–	International Energy Agency
IES	–	Integrated Environmental Strategies
IMF	–	International Monetary Fund
IPCC	–	Intergovernmental Panel on Climate Change
ITS	–	Intelligent Transport Systems
JICA	–	Japan International Cooperation Agency
JNNURM	–	Jawaharlal Nehru National Urban Renewal Mission (India)
LCA	–	Life Cycle Analysis
MCA	–	Multi-criteria analysis
MEET	–	Ministerial Conference on Global Environment and Energy in Transport
METI	–	Ministry of Economy, Trade and Industry (Japan)
MLIT	–	Ministry of Land, Infrastructure, Transport and Tourism (Japan)
MRV	–	Measurable, Reportable, Verifiable
MtC	–	million tons of carbon
MVUC	–	Motor Vehicle User's Charge (Philippines)

NAMA	–	Nationally Appropriate Mitigation Action
NMT	–	non-motorized transport
NO _x	–	nitrogen oxides
NRDC	–	Natural Resources Defense Council
O-D	–	Origin - Destination
ODA	–	Official Development Aid
OECD	–	Organization for Economic Co-operation and Development
PFI	–	private finance initiative
PM	–	particulate matter
PPP	–	public-private partnership
PSUTA	–	Partnership for Sustainable Urban Transport in Asia
R&D	–	research and development
RMB	–	Renminbi (official currency of PRC)
SMC	–	Social Marginal Cost
SMP	–	Sustainable Mobility Project
TfL	–	Transport for London (UK)
TRB	–	Transportation Research Board
TRL	–	Transport Research Laboratory (UK)
UNCTAD	–	United Nations Conference on Trade and Development
UNDP	–	United Nations Development Programme
UNEP	–	United Nations Environment Programme
UNFCCC	–	United Nations Convention on Climate Change
VKT	–	Vehicle Kilometer Travel
VOC	–	Volatile Organic compounds
VOT	–	Value of Time
VTPI	–	Victoria Transport Planning Institute
WB	–	World Bank
WBCSD	–	World Business Council for Sustainable Development

WEIGHTS AND MEASURES

km	–	kilometer
l	–	liter
ppm	–	parts per million, a unit of concentration
Wm ⁻²	–	watts per square meter

Acknowledgments

The Asian Development Bank (ADB) considers sustainable transport a key requirement for economic growth and poverty alleviation in Asia and the Pacific and transport contributions to climate change are an important component of sustainable transport. ADB, as part of its lead role among multilateral development banks on transport and climate change, as assigned at the G8 Discussions on Climate Change at Gleneagles, Scotland in 2005 has prepared this document to rethink the roles and relationships of transport and climate change. ADB would like to thank the support offered by the Clean Air Initiative for Asian Cities (CAI-Asia) Center as an integral partner in this activity.

Concerns about the relative neglect of the transport sector in the current clean development mechanism and the ongoing climate negotiations for a new climate agreement sparked off the idea for five “think pieces” on how to address transport and climate change in developing Asia in the coming years.

The five “think-pieces” were (a) measurement of carbon in the transport sector, prepared by: Lee Schipper, Bert Fabian, Sudhir Gota and Wei-Shuen Ng; (b) policies for low carbon transport, prepared by Holger Dalkman; (c) co-benefits of transport and climate change management, prepared by May Ajero and Sophie Punte; (d) innovative financing of low-carbon and energy efficient transport, prepared by Ko Sakamoto; and (e) Institutional frameworks to address transport and climate change, prepared by Cornie Huizenga, who also prepared the summary report.

Initial versions of the think-pieces, or ideas contained in the think pieces were presented and discussed at the following meetings: (a) Consultation meetings on the drafting of a strategy for the future of CDM financing for Transport in January 2008 in Washington, DC and in June 2008 in Bonn, Germany, organized by the Clean Air Institute on behalf of the World Bank; (b) ADB Transport Forum in September 2008; (c) Better Air Quality 2008 workshop; (d) A low carbon transport under different regimes?, a side event at COP 14 in Poznan, organized by TRL, GTZ, UITP and UIC (e) Transport and Climate Change: An Urgent Call for Action, a side event at COP 14 in Poznan, Poland in December 2008 organized by the World Bank, the Carbon Finance Assist Program, Clean Air Institute, CAI-Asia Center and ADB; and (f) workshop on Achieving Global and Local Objectives through Sustainable Transport and Land Use: an agenda for 2009 and beyond, in Washington, DC in January 2009 organized by the Clean Air Institute, CAI-Asia Center, ADB, and EMBARQ/World Resources Institute. The authors would like to thank all the participants in these meetings for their comments and suggestions.

ADB financed the development of this report. In their capacity as project officers, James Leather and Sharad Saxena facilitated CAI-Asia’s preparation of this report.

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Executive Summary and Recommendations

1. Transport is currently responsible for 13% of all world greenhouse gas (GHG) emissions and 23% of global carbon dioxide (CO₂) emissions from fuel combustion are transport related. Transport-related CO₂ emissions are expected to increase 57% worldwide in the period 2005 – 2030. It is estimated that the People's Republic of China (PRC) and India will account for 56% of the global increase. The majority of these increased emissions will come from private vehicles, both for passenger and freight transport. Transport infrastructure investments in the next 5-10 years, to support the increase in motorization will lock in transport related CO₂ emission patterns for the coming 20–30 years in Asia.

2. To deal with the growing threat of climate change in Asia the challenge for the transport sector is to find and implement a sustainable pathway for transport. Sustainable transport should limit GHG-emissions from transport and minimize other negative externalities without compromising economic growth and social inclusion. To successfully address this challenge, Asia will have to ensure that transport is increasingly integrated in climate policies and that climate becomes a standard and accepted part of transport policies.

Based on the recommendations of the Intergovernmental Panel on Climate Change (IPCC), the international community is currently debating global economy wide CO₂ emission reduction targets of 25-40% by 2020 compared to 1990 for the developed countries and 15-30% below a business as usual scenario for developing countries by 2020. Limited attention has been given to the possible contribution of land transport (passenger and freight) in developing countries to such a relative reduction in CO₂ emissions. Yet it is clear that the transport sector will need to be part of such mitigation efforts also because much deeper cuts of 70-90% (compared to 1990) are required in the period 2020-2050. We believe that land transport could contribute well to mitigation, in a manner that is beyond present expectations if strong steps are taken to avert present trends towards more CO₂ intensive development patterns, vehicles and fuels. Such steps will in many cases be taken not primarily to reduce CO₂ but instead to improve the overall economic, social and environmental sustainability of the transport sector.

Leapfrogging towards Low-carbon Sustainable Transport

3. Innovative approaches are required for land transport in developing Asia to make a sizeable contribution to such emission reductions. The scope of climate focused transport policies and actions will have to be broadened from an emphasis on accomplishing emission reductions through technological improvement of vehicles and fuels to an approach in which policies and measures to avoid future emission by reducing the need for travel and by shifting travel to the most social, economic, and environmentally efficient mode of travel get as much attention as technological improvements. This approach is labeled “*Avoid-Shift-Improve*”, and will be central to achieving the aim of reducing future emissions.

4. In acknowledgement of the size of the challenge future policies and programs need to be sufficiently ambitious in scale and foster sector wide policies or system wide transport projects.

5. Developing Asia differs from Europe, the United States of America and Japan in that the transport infrastructure is still developing rapidly and private car ownership is still low compared to the developed world. This makes the “*Avoid-Shift-Improve*” approach an especially attractive

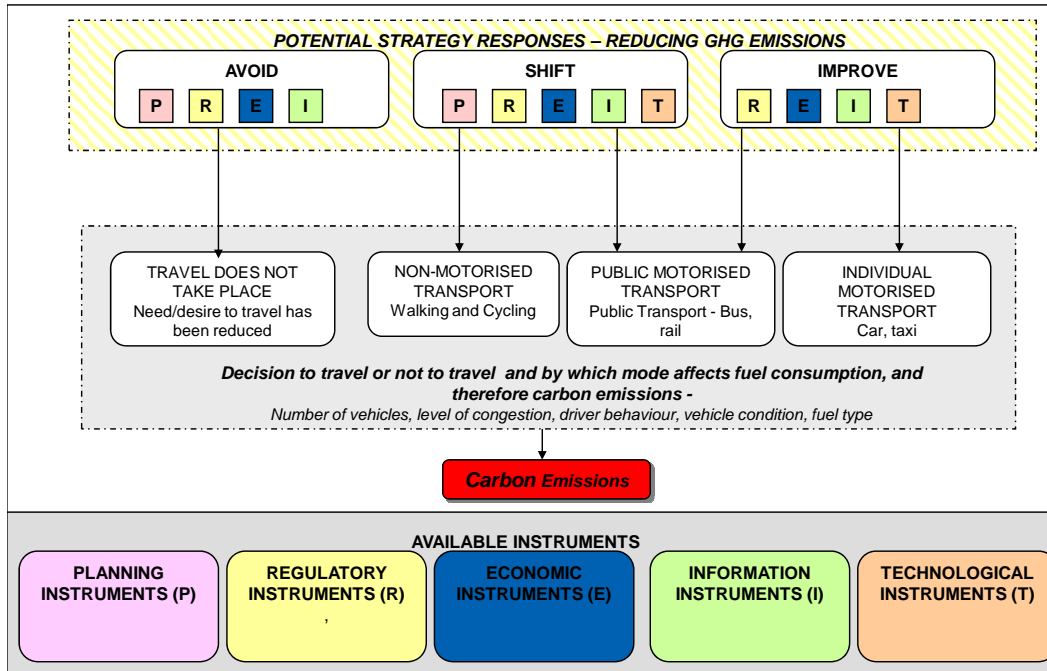
option for the developing countries. It will enable developing countries to leapfrog the high level of individual car dependency, and the associated high levels of energy consumption, and low transport efficiency experienced in the developed world. This now appears to be the most feasible way in which to avoid high increases in GHG emissions from developing countries in the future and realise the so called co-benefits of a sustainable low carbon transport system in a shorter period of time.

7. Asia has not yet committed in an irreversible manner to a transport system built around individual cars. This gives most of Asia an opportunity to move towards this “Avoid-Shift-Improve” approach in the transport sector. This implies a combination of policies and measures that avoid emissions-intensive car-based development patterns, shift to (or strengthen) less carbon-intensive transport modes (with development patterns supported by and supporting those modes), and improve the fuel efficiency of vehicles. The first two components of this approach yield net benefits to society independent of changes in fuel use and CO₂ emissions. Since continued rapid increases in individual car use are tied to increasingly worsening traffic and air pollution and demand very large sums of public and private funds for road infrastructure, shifting out of this mode will save the majority of travelers time and save society money. Properly developed, the first two approaches might cut the growth in emissions from land transport much more than just reducing the emissions per kilometer of vehicle travel through technological improvements is expected to do.

8. Moving towards an “Avoid-Shift-Improve” approach in the transport sector in developing Asia is critical. This implies a combination of policies and measures that avoid GHG emissions, shift to less carbon intensive transport modes, and improve the fuel efficiency of vehicles. Such an approach also should result in a critical re-appraisal of the Marginal Abatement Cost (MAC) Curves for mitigation of GHG emissions in transport. The current versions of these MAC Curves which are used to design mitigation strategies indicate high upfront costs for transport related mitigation options needed. This reflects the present bias towards technological improvements as the main preferred mitigation concept in transport and has contributed to an overall low priority for the transport sector in economy wide mitigation strategies and ignores the lock-in effects of a car oriented transport infrastructure driven policies. If most of the “saved” emissions arise from avoidance and shifting, then the evaluation of costs and benefits has to shift towards broader measures that include much more important transport variables, such as safety, security, travel time, and related issue such as air pollutant emissions and noise, the same outcomes that describe progress towards more sustainable transport.

9. The success of developing countries in Asia to adopt and implement Avoid-Shift-Improve oriented policies will be strongly influenced and determined by the policy instruments that countries and cities can put in place in the next 5-10 years. Such policy instruments can be divided in: Planning, Regulatory, Economic, Information and Technical instruments. Many of the potential policy instruments are available and have been already tested in specific countries and cities in Asia and can be replicated or scaled up. In few cases are financial resources the constraint for replication or scaling-up; rather the constraints are often political, particularly the difficulties of making large-scale, systematic and long-term changes to a region’s transport and development strategies.

Figure ES: Strategies and instruments to reduce carbon from transport



Source: GTZ (2007), Sustainable Transport, here: Module 5e, Transport and Climate Change, (Authors: Dalkmann, H. and Brannigan, C., TRL)

Post-2012: Transport as part of the solution not the problem

10. To have an effective 2012 climate agreement and provide a strong incentive for developing Asia to leapfrog towards a sustainable pathway, land transport will need to be an integral part in recognition of the fact that it is not just part of the problem, but also part of the solution. An analysis of the draft negotiation text for the post-2012 climate agreement and current submissions by Parties to the AWG-LCA and AWG-KP shows that there have only been a few attempts made to involve the transport sector at this stage of the negotiation. To be effective the potential role of land transport should be recognized by explicitly developing a broad variety of instruments to support its inclusion. The full applicability of an agreement reached in Copenhagen to the transport sector is a precondition for a comprehensive scaling up of the current mechanism, as well as planned new instruments such as National Appropriate Mitigation Actions (NAMAs), and their financing mechanisms, if it is to have any significant effects on the control of GHG emissions from developing Asian countries, and if it is also to provide any kind of incentive for leapfrogging in these countries.

11. External mechanisms like clean development mechanism (CDM), NAMAs and climate related funding mechanisms cannot replace domestic financing in developing countries. They can catalyze a comprehensive long term transformation of transport systems in developing countries and cities.

Improved Measurement as a pre-condition for tackling transport emission growth

12. Despite the recognition of the importance of CO₂ emissions, little is known about how much CO₂ is emitted by which kinds of vehicles in Asia while they are on the road. The current state of information on how people, vehicles, and freight move within countries and their major urban areas in developing Asia is poor. This means that over the next years it will continue to be difficult (a) to arrive at reliable global data baselines on transport activity, especially in the developing countries, (b) to make reliable forecasts on CO₂ emissions from the transport sector, (c) to develop mitigation strategies that have an empirical base and to monitor the impact of mitigation actions in the transport sector.

13. Most transport policies will act on CO₂ only through changes in transport patterns. These changes cannot be measured or imputed from changes in aggregate fuel sales or passenger/freight data unless all forms of access are covered, and call for another definition of “measuring carbon,” connecting changes in transport activity and fuel use caused by specific policies or other interventions.

14. Building on the current methodology and terminologies employed by the IPCC in measuring emissions, a three-tier scheme could be used for transport energy and emissions. Tier 1 would then use international “default” parameters for fuel use/mile by vehicle type for a first cut approximation of emissions. Tier 2 would correspond to taking actual national averages for fuel economy (fuel use/km) by fuel and vehicle type. Tier 3 corresponds to using fuel economy data by vehicle that reflect actual vehicles in a project or affected by a project, i.e. in its zone of influence. Adoption of this three-tier emission measurement approach can help transport policy and decision makers to arrive at better emission forecasts, and to assess the impacts of policies and specific projects including NAMAs and sectoral CDM.

Co-benefits as an enabler for low carbon transport

15. Contrary to the perception created by the growing public attention for climate change, concerns about climate change are not the key driver of transport policies and projects in developing countries. This is due to still limited policy priority for mitigation and because the potential financial earnings from GHG reduction are significantly lower than other earnings or cost savings associated with a good transport policy or project. It is important to note then that local benefits, such as reduced traffic congestion and air pollution, still play a bigger role in development of transport policies and investments over climate change mitigation.

16. So far the discussion on transport and climate change has focused mostly on the role of CO₂ emissions and other Kyoto gasses. More recently, the role of ozone (O₃) and Black Carbon (BC), which are both directly related to transportation, as a contributor to climate change have been highlighted. Policies and projects aimed at reducing GHGs and air pollutants such as O₃ and black carbon, in the transport sector will be much more persuasive and effective than those emphasizing GHG emissions only.

17. Transport policies and programs can have: (a) *Benefits* –the primary intentional goal of policies and project (e.g. reduced traffic congestion), (b) *Primary co-benefits* - other benefits that directly result from transport policies or projects (e.g. GHG and air pollution reduction), or (c)

Secondary co-benefits - benefits that indirectly result from transport policies or project (e.g. reduced health impact and costs from air pollution).

18. The *Avoid-Shift-Improve* approach will bring about different co-benefits, and these co-benefits may be different between developing and developed countries. In developing cities are dominated by large numbers of old high polluting vehicles and the co-benefits of policies focusing on “improve” will have relatively high co-benefits. With many cities in developing countries yet to develop a strong planning capacity, planning instruments such as efficient mix of land use-transport-environment can bring about higher co-benefits compared to developed cities. Similarly, in developing countries, regulatory and planning instruments targeting the freight sector can bring relatively large and immediate co-benefits compared to developed countries.

19. An important current barrier to the wide scale use of the co-benefit approach is the measurement of co-benefits. It can be difficult, costly and time-consuming to measure co-benefits in the transport sector, compared to the measurement of the direct benefits of transport policies and projects. Other barriers include low awareness, fragmented policies and institutions, limited tools and institutional capacity to apply such tools. A wider application of co-benefits approach will require that these methodological and institutional barriers are addressed.

20. To advance the use of a co-benefits approach it will be need to integrated in a more structured and quantified manner in policy analysis and the feasibility studies of individual programs and projects. This is more likely to happen if co-benefits are fully recognized and acknowledged in the new post-2012 climate agreement.

Interlocking financing and pricing

21. The growth of the transport sector in developing Asia up to 2020 and beyond will involve hundreds of billions of dollars of investment – it is important that this is aligned to sustainable transport objectives as described earlier. Effective financing needs to be supported by sound pricing policies, which can help change behavior, allocate resources efficiently, and raise revenue to invest in sustainable transport.

22. Current mainstream financing mechanisms and pricing practices do not support a sustainable transport system, both in terms of scale and scope. Prices do not reflect the full costs of transport, and must be reformed to take into account the full cost to society (i.e. the User Pays Principle), and investment (both public and private, domestic and foreign) is skewed towards a motorization model based on carbon-intensive private motor vehicles. Price structures for transport activities must be reformed to take into account the full cost to society, including congestion, accidents, infrastructure wear and tear, climate change, noise and air pollution externalities. Users must be asked to pay for at least the full costs of their activities (i.e. the User Pays Principle), and subsidies (e.g. on fossil fuels) that work in the opposite direction must be reformed. Fuel subsidies intended to assist the poor are badly targeted as wealthy are the main beneficiaries. Revised financing and pricing mechanisms should aim to provide funding of the various aspects of the sustainable transport strategy (not just technology), and addresses issues that expand beyond the transport sector, especially land use and urban sprawl.

23. There is an abundance of both traditional and innovative financing mechanisms to fund low carbon transport. Transport oriented financial mechanisms which feed into public sector funding, in particular the fuel tax, vehicle taxes and road pricing have the potential to play a central role in reducing motorized trips, shifting modes and improving the efficiency of various modes. However, most are not used to their full extent in supporting a sustainable transport system, and financing mechanisms designed for climate change mitigation, including the CDM, are very limited in their use.

24. Carbon generating consequences must be integrated into the decision making process for funding projects and programs. The current appraisal framework for transport infrastructure must be re-examined. A move towards Social Marginal Cost pricing is needed. Where first-best solutions are impossible to implement, the use of fuel taxation and other proxy measures need to be considered.

25. Whilst pursuing new/improved financing mechanisms in the Post 2012 framework is important, this needs to be matched by efforts to reform mainstream investments and financial flows into transport, including (traditional) transport taxes such as fuel tax, ODA, export credits and private investments which dwarf the former in size and scope.

26. A Sustainable Transport Fund may be viable at a local level, incentivized through national strategies and supported by a scaled-up Post-2012 international financing framework (e.g. with NAMA crediting) and private finance.

Developing institutions - the enablers of change

27. With few strong transport institutions in developing Asia it is difficult to put in place what are seemingly obvious and logical sustainable transport choices based on the “avoid-shift-improve” approach which is increasingly seen as the way forward to make a reduction of CO₂ emissions in the transport sector in Asia. Without major changes in the institutional performance of the transport sector in Asia it is unlikely that the emerging policy commitment towards sustainable transport in Asia will result in a significant lowering of greenhouse gases from the transport sector.

28. Institutional development in support of the newly emerging policy consensus on low carbon sustainable urban transport needs to take account of the scale required. To serve the needs of the approximately 2500 cities in Asia with a population of over 100,000 inhabitants, capacity needs to be created at the regional, national and the local level. A critical mass of well equipped institutions is needed to enable structural changes in policies. Institutional development in support of low carbon urban transport in Asia will require: (a) clarification of institutional mandates at all geographical levels (local, sub-national, national, regional and global, (ii) strengthening of institutional capacities within all sectors (government, civil society, academe and private sector, (c) improved coordination and cooperation between different sectors at, and between, different geographical levels.

29. Once Asian countries and cities start to intensify low carbon transport policies and programs there will be an increased need for effective and transparent consultation mechanisms to give concerned and affected sectors in society a chance to give their views. The absence of effective and transparent public consultation mechanisms will ultimately slow down decision making and its implementation and might reduce the rate in which changes in behavior are adopted. Therefore it is important to develop such mechanisms in a timely manner. Private

sector participation in the provision of low-carbon transport products and services needs to be encouraged as the private sector is better at mobilizing investments required to support the implementation of low carbon transport policies. To facilitate increased private sector participation appropriate regulatory frameworks need to be developed and put in place.

30. Development Banks, bilateral development organizations and international foundations in their efforts to promote low carbon transport systems in Asia should couple their increased support for individual low carbon transport projects increasingly to support for policy dialogues, institutional reform and capacity building, and the development of indigenous financing for low carbon policies, programs and projects with the aim to achieve a step change in the speed of development of policies and policy instruments and the coverage of Asian cities with locally owned, funded and implemented low carbon transport projects.

31. The trend towards more emphasis on mitigation in international climate agreements is expected to result in new instruments, such as NAMAs, a scaling up of carbon financing mechanisms and more attention for data gathering and assessment through the Measuring Reporting Verification (MRV) mechanism. All of these bode well for institutional development in non-Annex 1 countries. The transport sector should be able to benefit from this provided that transport is considered as a sector in its own right in the climate negotiations.

32. Over the last years a number of new regional policy forums on transport have emerged in Asia. These include a Ministerial Meeting on Global Environment and Energy in the Transport Sector and a Regional Environmental Sustainable Transport Forum. It is important to for these forums to prosper so that they can influence national and local transport policies. This can be best achieved if the different regional forums complement each other, rather than duplicate each other. These regional forums on transport also offer a viable way forward in integrating climate change in regional and national transport policies.

33. The realization of low carbon and sustainable transport in developing Asia is an ambitious undertaking but one which can help Asia in its efforts to realize sustainable development. It will require a combination of focus on measurement, policies, integration of co-benefits, financing and institutional development.

1. Introduction

1. Transport is currently responsible for 13% of all world greenhouse gas (GHG) emissions. 23% of global CO₂ emissions from fuel combustion are transport related, of which road transport (both passengers and freight) - 75%, aviation - 11.5%, and maritime transport - 10.3%. Private vehicles currently account for 10% of global CO₂. Transport related CO₂ emissions are expected to increase 57% worldwide in the period 2005–2030. It is estimated that PRC and India account for 56% of this increase. In the case of PRC it is expected that transport related CO₂ emission will increase four-fold in the period 2005-3030 from 19% of total emissions 27%. In the same time span the business as usual case for India is an increase from 8% to 13% of total GHG emissions.

2. Freight and logistics are an important contributor to CO₂ emissions and merit more attention. While at the world level freight emissions are well below those of passenger transport related emissions in most parts of Asia they are currently still larger than passenger transport related emissions. This might change in the future as private motorization continues.

3. Asia is a rapidly developing region and economic growth has been strong over the last 2 decades. Yet, a large part of the population in Asia still lives on less than US\$ 2 per day. Further economic and social development will be required and transport is expected to play a vital role the further development of Asia. A reduction of transport activities in Asia as a way to reduce emissions is therefore not an option and this report does not advocate this.

4. The report does advocate, however, proposing a break with past policies in the further development of the transport sector. The awareness on the need to tackle GHG emissions from transport sector has gone hand in hand with growing insights on what constitutes good transport. Transport is a system which is shaped by past urban development but which at the same time influences future urban development and urban life. Transport systems cover multiple modes: pedestrians, other forms of non-motorized transport, private motorized transport, public transport by bus and rail whereby each of these modes have distinct advantages and disadvantages in terms of sustainability. Transport includes both passengers and freight. Transport is about technology (vehicles, fuels) as well about the management of transport systems and behavior of the people making up the transport system.

5. The lack of sustainability of Asian transport systems has been widely commented upon and a range of international and local organizations have come forward with policy recommendations how to strengthen the sustainability of land transport in Asia. Almost all of these policy recommendations have been tested and proven to be effective in specific Asian countries and cities. This means that discussion can and should move forward from expressing continued concerns on limited sustainability to how new policy approaches can be applied in broad based manner in Asia.

6. Building on the experiences of both developed and developing countries on what constitutes good transport the report bases its analysis on the “avoid-shift-improve” approach. The “Avoid-Shift-Improve” approach implies that policies to limit GHG emissions in the transport sector will have to consist of a combination of measures aimed at (a) avoiding the need to travel. A reduction of the need for further travel can be best achieved by the integration of land use and transport; (b) shifting travel to the most efficient mode, which in most cases will be

either non-motorized or public transport; and (c) improving existing forms of transport through technological improvements to make engines and fuels less carbon intensive.

7. Concerns on the environmental sustainability of the transport sector in developing Asia extend beyond greenhouse gases and also include the pervasive air pollution that characterizes many of the cities in Asia. Environmental sustainability is closely linked to economic, financial and social sustainability and any recommendations to reduce CO₂ emissions need to be assessed for their impact and relevance on overall sustainability of the transport sector. This integrated approach is a continuation of conceptual thinking outlined in earlier reports by ADB and CAI-Asia on transport and Climate Change in Asia.¹

8. The scope of these think pieces is on land transport with an urban focus as well as the movement of persons. The report focuses on developing countries in Asia, yet the conclusions and recommendations are mostly formulated in a general manner which means that they might also be applicable to urban transport in developing Latin America and Africa.

9. The reports aims to inform and to influence two different types of discussions: (a) the integration of transport in global climate negotiations, and (b) the integration of climate in transport policy making at the regional, national and local level. An important direct reason for this report was the concerns on the relative neglect of transport within the ongoing climate change debate. Transport is part of the problem and transport should and can be part of the solution. The problem of transport and climate change in Asia is in fact a problem of overall lack of sustainability and one which requires comprehensive solutions. Policies, financing and institutional arrangements for energy efficient and low carbon transport cannot be dealt with in isolation from overall transport policies. Asian countries and cities will need to take the lead in overcoming the problem. A global post-2012 climate agreement which is fully applicable to the transport sector is important and a range of suggestions are presented in the report in support of this. Such a new agreement can, however, at best complement or reinforce local action in Asia and the bulk of the analysis and recommendations in the report deal therefore with the question of what the local action should consist off and how to support this.

10. The report has 5 main chapters. Chapter 2 looks at how to best measure carbon in the transport sector. It reviews the current methods and makes suggestions for an alternative approach that can generate more detailed, reliable and comprehensive numbers on GHG emissions from urban land transport to enable the formulation and implementation of low carbon transport policies at different geographical levels but also to generate the information required to implement second generation carbon financing schemes in the transport sector such as no-lose sector targets, Nationally Appropriate Mitigation Actions (NAMAs) and the Measuring, Reporting and Verification (MRV) mechanism.

11. Chapter 3 deals with policies for Low-carbon Transport in Asia. It acknowledges and explains the need for a leapfrogging approach to implement the Avoid-Shift-Improve approach and reviews the potential policy instruments that can be used to make this possible. It assesses the effectiveness of flexible mechanisms under the Kyoto Protocol as well as new mechanisms currently being discussed such as NAMAs and how their future relevance can be enhanced.

12. Chapter 4 addresses co-benefits of climate change and transport. It follows the above mentioned observation that the climate dimension is only one, albeit an important, dimension of

¹ ADB (2006a), Sustainable Transport in Asia, Making the Vision a Reality and ADB (2006b), Energy Efficiency and Climate Change Considerations for On-road Transport in Asia

the overall sustainability of the transport sector. It reviews the current application of the co-benefit approach in the transport sector and suggests a sustainable development based co-benefits model that can result in a wider application of the co-benefits approach. .

13. Chapter 5 on Innovative Financing of Low Carbon and Energy Efficient Transport reviews existing funding mechanisms for transport in Asia including dedicated climate change financing mechanisms and makes suggestions on how to increase funding of sustainable transport that follows the Avoid-Shift-Improve Approach.

14. Chapter 6 on Institutional Frameworks to Address Transport and Climate Change explains that making the transition towards a low carbon transport system will depend on institutions, their quality and capacities as well as the manner that these institutions interact. It assesses how institutions can be made to work better to catalyze and facilitate the large scale implementation of low carbon transport policies in developing Asia.

DRAFT

2. MEASUREMENT OF CARBON EMISSIONS FROM THE TRANSPORT SECTOR IN ASIA

2.1 Introduction

15. Activity in the transport sector in developing Asia is expected to continue to grow and as it does so, negative externalities relating to urbanization, motorization, and environmental challenges will continue to pile up. It is important to fully understand the present and future contribution of the transport sector in the business-as-usual scenario in order to develop strategies that can avoid and mitigate unnecessary carbon dioxide (CO₂) emissions.

16. Considering the current and future significance of the transport sector as a major source of carbon emissions in Asia it is surprising how poorly developed the knowledge base is on carbon emissions from the transport sector. The absence of a robust database on transport characteristics restricts the understanding and limits the development and implementation of a low carbon transport strategy. Information systems linking transport sector activity, like vehicle activity (in vehicle-km) or mobility (in passenger-kilometers) or goods mobility (in ton-km) to CO₂ emissions are important in order to know what kinds of changes in emissions to expect from both spontaneous and policy-induced changes in transport. Today only a handful of government authorities outside of major OECD countries routinely measure or estimate both disaggregated transport activity, and the fuel use that comes from each of those activities.

17. This chapter aims to better understand the measurement of CO₂ emissions from the transport sector and the factors that influence these emissions. It also proposes some measures to develop a regional database and national databases that can provide such information and suggest ways this can be adopted by developing countries in Asia.

18. Climate change costs have a high level of complexity due to the fact that they are long term and global and that risk patterns are very difficult to anticipate. As a result there are difficulties to value the externalities and damages to be allocated to national transport modes. Therefore a differentiated approach (looking both at the damages and the avoidance strategy) is necessary. In addition long term risks should be included. While a full treatment of damages from externalities is beyond the scope of this chapter, data on transport-related variables (trip and travel times and speeds; congestion; safety and accidents; emissions related to local air pollution, noise), quantifying all of these is important for estimating benefits and co-benefits of transport strategies.

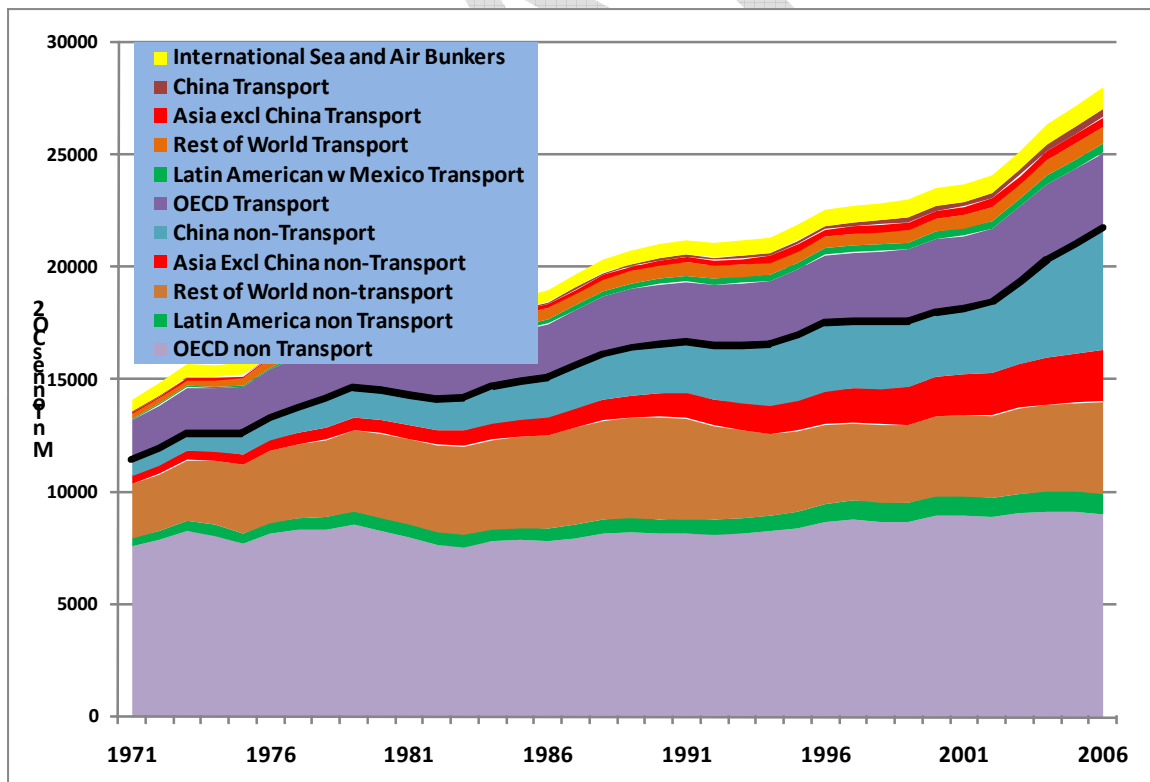
19. Quantifying and monetizing transport externalities are important for understanding the context and relative value of reductions in CO₂ emissions. Parry, Walls and Harrington argue that the range of monetized values of the CO₂ externality for the US is considerably less than that for accidents or congestion even for a high value of CO₂ (\$45/metric ton), while a Canadian government monetization (Transport Canada 2008) and an older survey of the UK and several European countries (Maddison et al 1997) get similar results even when a value of the CO₂ externality of \$85/ton (Stern 2006) is used. In other words, CO₂ is not a major externality in developed countries. In Asia, the value of time, which Small suggests is 50% of the wage rate in the US, is certainly much lower, but the damages from air pollution and accidents are much higher than in the developed countries. Hence we also expect that CO₂ cannot present a major damage cost in calculations related to transport. For that reason, understanding how other

transport variables (e.g., travel time, safety) is crucial to evaluating transport strategies. This in turn means that “counting carbon” requires measuring or estimating important transport variables not currently discussed in CO₂ negotiations.

2.2 Importance of the Transport Sector and Measurement of Transport Data

20. The transport sector contributes 25% of the total CO₂ emissions in the world according to the latest estimates of the International Energy Agency (IEA) (Figure 2.1). The transport sector’s direct emissions from combustion fuels over the 1971 to 2006 period represent a rising share of total global emissions. Road transport is responsible for the highest share of emissions globally. Within road transport, automobiles and light trucks produce well over 60% of emissions, but in low- and middle income developing countries freight trucks (and in some cases even buses) consume more fuel and emit more CO₂ than the aforementioned light duty vehicles. Road transport is also associated with emissions of criteria air pollutants, such as carbon monoxide (CO) and oxides of nitrogen (NO_x) as well as particulate matter (PM). These emissions have a high negative impact on human health, particularly in densely populated urban areas.²

Figure 2.1: CO₂ Emissions from Transport and Other Sectors in Various Regions



Source: IEA

² Wong, C.M. et.al. 2008. Public Health and Air Pollution in Asia (PAPA): A Multicity Study of Short-Term Effects of Air Pollution on Mortality. Available: <http://www.ehponline.org/docs/2008/11257/abstract.html>

21. An increasing share of CO₂ emissions is associated with road transport in and around cities. Many cities in Asia, which has still a high urbanization rate, will become a major source of CO₂ emissions in the future unless economic growth and urbanization is de-coupled from increasing demand for mobility. Or if increased mobility can be decoupled from a growth in energy use. If this were to be done, the transport sector could be one of the key sectors where existing CO₂ emissions could be mitigated and perhaps more importantly, future CO₂ emissions avoided.

22. In a post-2012 climate agreement, the quantification of the benefits arising from transportation policies and measures will be increasingly important. The United Nations Framework Convention on Climate Change (UNFCCC) commits to measurable, reportable, and verifiable reduction targets and the development of an appropriate Measuring, Reporting and Verification (MRV) mechanism is an important element of discussions on the follow-up on the Kyoto Protocol. In order to do this for the transport sector, there needs to be a common methodology that both developed and developing countries can apply in measuring changes in CO₂ emissions from the transport sector. Needed are both measures of how transport activity is changing and how as a consequence emissions change, both in the absence of any interventions and with interventions, whether at the local, city level or nation and region wide.

23. The Ministerial Conference on Global Environment and Energy in Transport (MEET) held in Tokyo in January 2009 called for: "the improvement of the accuracy, adequacy and comparability of statistics on environment and energy for transport to support effective policy making and assessment of progress as one of the elements necessary in order to achieve their shared long-term vision of realizing low-carbon and low-pollution transport systems that also ensure sustainable development".³

24. The Council of the European Union in the 29th Environment Council Meeting in March 2009 on the further development of the EU position on a comprehensive post-2012 climate agreement refers to the transition to a global carbon market in the post-Kyoto period.⁴ If transport were included this underscores the importance of the measurement of CO₂ emissions from the transport.

25. At a conference on Climate Change and Official Statistics, held in Oslo, Norway, from 14 -16 April 2008⁵, the United Nations Statistical Commission under the Economic and Social Council recognized the urgency to improve the collection and use of statistics relevant to and necessary for better understanding of the causes and impacts of climate change and related measures. Discussions and recommendations of the Oslo conference contributed to the formulation of a program to strengthen the use of official statistics on climate change-relevant data. A follow-up conference on Climate Change, Development and Official Statistics in the

³ Ministerial Declaration on Global Environment and Energy in Transport (January 2009) Available: http://www.mlit.go.jp/kokusai/MEET/documents/Ministerial_Declaration.pdf

⁴ Council Conclusions on the further development of the EU position on a comprehensive post-2012 climate agreement (Contribution to the Spring European Council) 2928th Environment Council meeting Brussels, 2 March 2009." Available: http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/envir/106429.pdf

⁵ The conference was attended by 115 participants from 55 countries and 15 international organizations. No experts in transport or transport ministries were represented among the attendees, an irony because Norway's own Transport Economic Institute itself does an excellent job in publishing a yearly compendium of bottom-up transport data (vehicles, activity, etc) from 1946 onward. Available: http://unstats.un.org/unsd/climate_change/default.htm.

Asia-Pacific Region discussed the recommendations of the Oslo conference with the aim to contribute to the finalization of a roadmap for mainstreaming climate change in official statistics. This roadmap was to be submitted to the 40th session of the UN Statistical Commission in February 2009 for further discussions.

26. Disappointingly there were no specific action points from these two conferences on how emissions from the transport sector can be better collected and documented and integrated in the national data collection efforts of National Statistics Office. A serious problem remains in that no agency, within the UN system or outside, has global responsibility for harmonizing transport statistics. The International Transport Forum of the OECD (formerly the European Council of Ministers of Transport) publishes a data set but this is focused mostly on OECD member countries and does not include developing countries. Given the time it takes to set up the required survey and analysis instruments, secure funding, it may take years or even decades before an internationally recognized data collection and analysis system is set up country by country. This means that over the next years it will continue be difficult (a) to arrive at reliable global data on transport activity, especially in the developing countries, (b) to make reliable forecasts on CO₂ emissions from the transport sector, (c) to develop mitigation strategies that have an empirical base and to monitor the impact of mitigation actions in the transport sector. With limited prospects of validation of the impacts of measures, few donors or lenders will be interested in supporting large-scale mitigation activities (through instruments like sectoral CDM, NAMAs or special Climate Funds) whose impacts cannot be seen, much less validated.

2.3 Restraining CO₂ Emissions from Transport in a Growing World

27. Transportation activity typically increases with economic activity and increasing GDP. Actions to slow and ultimately reverse that increase are warranted because of the need to mitigate local or national transportation problems, such as congestion, transportation related air pollution, high accident rates and high fatalities. Lower growth in vehicle kilometers traveled (VKT), particularly in individual vehicles, will reduce emissions because the CO₂ modal and vehicle intensities of light duty vehicles are so high compared with all other motorized vehicles.

28. In transport, three kinds of “reduction” of CO₂ emissions from a baseline can occur:

- a. Avoidance of growth in emissions through urban and rural development that maximizes access to housing, jobs, shopping, services, employment, sales, and leisure activities without requiring traversing of long distances in individual light duty vehicles. Singapore in Asia and Curitiba in Brazil are two examples of urban areas whose development policies favored land uses and development patterns less dependent on automobiles than any of their regional neighbors.
- b. Shifting transport to modes with intrinsically low carbon emission per unit of transport provided, e.g., from car or light truck to bus, rail, or metro, or maintaining high shares of those modes. While Singapore and Curitiba achieved and maintained these high shares of public transport as a result of the development of their transport structure, most other developing cities have seen that public transport share eroded by either motorized two wheelers or cars. New bus-based public transport systems such as Trans-Jakarta (Jakarta), Metrobus (Mexico City) and Transmilenio (Bogota) have

demonstrated that it is possible to attract some car drivers back to large buses which have lower CO₂ emissions per passenger-km delivered.

- c. Improving vehicles, fuels and operators to mitigate emissions in existing and future vehicles and traffic by improving operational efficiency and traffic (transport measures), as well as by selecting different fuels, more efficient vehicle technologies and less powerful, lighter vehicles, which are true “CO₂” mitigation measures. In the developing world, only China has so far promulgated fuel economy standards for new light duty vehicles.

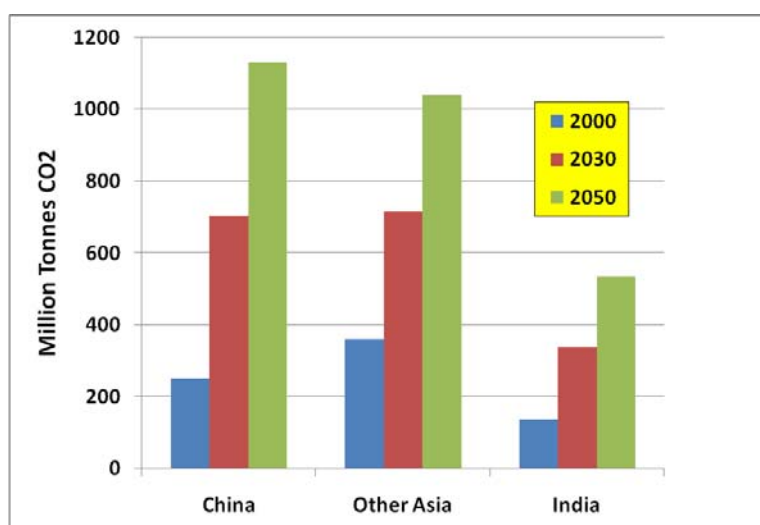
29. For each of these three approaches, imagine a counterfactual: Singapore (or Curitiba, Brazil) without the early government intervention that resulted in strong land-use planning, congestion pricing and a clear departure from common transportation conditions found in other urban regions of Asia (or Latin American respectively); Jakarta, if so many lines of Trans-Jakarta had not been built to relieve some of the pressure from car use in main arteries; Brazil, if ethanol had not been introduced to replace approximately 25% of the automobile gasoline, or more recently China, if fuel economy standards on new cars had not been introduced. In each case, how much higher would CO₂ emissions be in the absence of the measures cited? Quantifying the difference between actual and “counterfactual” is what in part “measuring CO₂ emissions” means. There is no doubt that a great deal of data, estimations, and modeling is required to answer this question.

30. Measuring, modeling or estimating the overall impacts of the first two kinds of transport changes (avoid future emissions and shift to the most efficient mode) requires a good set of data on transport conditions, data which today generally do not exist in the majority of Asian countries. The same lack of data makes it difficult to estimate the specific CO₂ benefits of these strategies. But even measuring the impact of mitigation effects of technological interventions requires good data on CO₂ emissions per vehicle-kilometer, data for which only exist for a few well managed fleets of trucks or urban buses in some Asian countries, e.g. Bangalore Municipal Transport Corporation. Since the majority of road-based emissions arise in private two wheelers, cars, and trucks, most of the impact of either transport or CO₂ focused measures cannot be seen, except in aggregate fuel sales. Thus, we cannot see the composition of CO₂ emissions in transport apart from a top down manner based on all the fuel consumed in a country or city. Even evaluating the real impact of fuel economy standards in China is difficult, because there are no real “data” on on-road fuel consumption of various kinds of cars, both from before the standards were enacted and after.⁶

31. The World Business Council for Sustainable Development (WBCSD) Sustainable Mobility Project (SMP) of transport and CO₂ foresaw a 3-5 fold increase in CO₂ emissions from transportation in Asian countries and regions in the period 2000 - 2030, as Figure 2.2 illustrates. This increase is driven principally by a 6-8 fold increase in the number of light duty vehicles and large increase in the number of trucks. Despite improvements in reductions in fuel use of approximately 20-25% for either mode, due to efficiency improvements, the overall growth in emissions is still very large. This growth is driven principally by the increased number of light duty vehicles, which carry the largest share of growth in mobility. Looking at existing congestion levels in Asian cities one wonders where the space will come from for this increased vehicle activity. This indicates that motorization in Asia is as much a general problem of transport and development as it is a CO₂ problem.

⁶ Schipper and Tax (1994) described the “gap” between the test fuel economy of vehicles and what is actually attained on the road, which may mean 25% higher actual fuel use than test.

Figure 2. 2: SMP Projections of CO₂ Emissions from Transport in Asian Regions 2000- 2030



Source: IEA.

32. To look more closely at this kind of projection, Ng and Schipper (2005) examined future car use in China, developing three scenarios for future mobility and car use in China. Their business-as-usual projection saw CO₂ emissions for cars rising from approximately 8.8 million tons of carbon (MtC) to 102 MtC in 2020 in their “Road Ahead” scenario for cars alone, a business-as-usual projection (Table 2.1). This increase was consistent with the 2003 IEA forecast shown in the World Energy Outlook (WEO 2007), as well as the SMP projections. Car ownership and use in 2020 is almost twenty times its 2003 value. These projections included other road transport whose 2000 values were much higher than those for cars and whose growth was expected to be much lower than that of cars alone. Hence the overall relative increase is less than the increase from cars alone.

Table 2.1: Transport and Vehicle Scenarios in 2003 and 2020

Scenarios	2003			2020		
	Road Ahead	Oil Saved	Integrated Transport	Road Ahead	Oil Saved	Integrated Transport
Number of Cars (Thousands)	7592	7592	7592	145733	131159	72866
Distance/Car (km/car/year)	18000	18000	18000	12500	10500	9000
Fuel/Distance (l/100km)	9.5	9.5	9.5	8.50	7.25	5.75
Fuel Mix (%)						
Conventional Oil	100	100	100	92.5	20	30
Electricity for Hybrids				5.0	50	25
Electricity				0.5	10	25
CNG				2	20	20

CO₂ Emissions (million tons)	8.84	8.84	8.84	101.74	51.28	21.74
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Source: Adapted from Ng and Schipper (2005).

33. In the second scenario, “Oil Saved,” improved fuel economy, largely because of a high penetration of hybrids and restraints in the size and power of cars, could reduce carbon emissions in 2020 by 50% over “Road Ahead. This is a “CO₂ mitigation” strategy, or rather one aimed at saving oil. Car use and ownership will grow slower, so that vehicle-km are only 8 times their 2003 level, but emissions are still 6 times their 2003 value in 2020 (Table 2.1).

34. The problem with either of these two scenarios, as well as the WBCSD/SMP scenario (and most other BAU projections of light duty vehicle ownership and use in most Asian countries) is that Chinese cities do not have enough space for 150 million cars, which still only represent 100 cars/1000 people in 2020, far below the levels Europe had in 1960. Thus the authors constructed a third scenario that recognized the space constraint. The result was only a tenfold of car ownership compared with 18 to 20 fold increases in the other scenarios, and cars in the third scenario were driven less than in the other scenarios, stimulated by thoughtful transport policies. The cars were also much smaller, since space constraints affect both driving and parking, reducing energy use by more than half over conventional cars. These conditions lead to 80% lower emissions in 2020 than in the baseline “Road Ahead” scenario. Policy assumptions in this scenario include strong urban transport and development policies that give access and priority to walking, cycling, and mass transit.

35. The scenarios illustrate two challenges facing the mitigation of CO₂ emissions from transport in Asia (and most other regions of the world). First, the current growth is driven by higher transport activity focused principally on individual vehicles, which is a trend that will continue to increase as income levels grow. High fuel prices can slow growth in vehicle use and certainly provoke the use of less fuel intensive vehicles. However, unless the growth in vehicle use slows, which is a transport planning matter, CO₂ emissions will still rise rapidly in Asia. Thus, the CO₂ problem is mostly a transport problem.

36. Current transport in Asia, particularly road transport, faces profound congestion and capacity problems, with far fewer vehicles on the road than projected. Clearly a radical change in transport policy is called for (Leather, 2009). Policies that will restrain growth in transport activities should be implemented by local and national authorities. The carbon co-benefits of such policies will gradually restrain the growth of CO₂ emissions, but can the impacts of such policies be measured?

2.4 How and Why Measure Carbon Emissions from the Transport Sector?

37. Despite recognition of the importance of CO₂ emissions, little is known about how much CO₂ is emitted by which kinds of vehicles while they are on the road. The vast majority of developing countries in Asia only collect data on sales of fuels, and only a minority of countries support surveys and other data collection that pinpoint how far vehicles move and how much fuel they consume (and hence carbon they emit) per kilometer of travel. Knowing only the aggregate sales of fuels is insufficient for measuring the impacts of policies, because most policies will act on CO₂ only *through* changes in transport patterns. These changes cannot be measured or imputed from changes in aggregate fuel sales, and call for another definition of

“measuring carbon,” connecting changes in transport activity and fuel use caused by specific policies or other interventions. Present data on road fuel use in Asia are too sparsely collected and aggregated to make this connection.

38. Because different kinds of vehicles use different fuels (gasoline and diesel, or CNG), there is no simple top-down formula relating a vehicle type to fuel consumed. And since vehicle fuel economy, usually defined as kilometers traveled/liter of fuel consumed (km/l) or liters of fuel consumed/100 km) is often the target of policies, measuring both fuel consumption and distance for each kind of vehicle-fuel combination is important for measuring policy outcomes and impacts. The number of vehicles may grow over time, the distance each vehicle travels may grow or shrink, and the fuel used per kilometer may change. Understanding how these components change is called the “bottom-up” approach of measuring fuel use and carbon in transportation.

39. This bottom-up approach of measuring carbon in transport means linking vehicles and vehicle activity, and personal and goods mobility by mode to fuel used by vehicle and mode, from which CO₂ emissions are calculated. The main purpose of measurement is linking transport activity and energy use to each other and informing the policy process – diagnosis, options, cures, outcomes, corrections, and dissemination of results. It is important to understand the present circumstances with respect to transport activity and fuel use in order to get the underlying mobility and fuels/environmental policies right and propose appropriate measures like restraining fuel use and fuel intensive modes.

40. “Measuring carbon” as described then permits policy analysts to carry out a number of steps important for reducing carbon emissions. Using a bottom-up approach permits estimation of the impact of changing part of the complex transport system that affects CO₂ emissions, whether transport activity, fuels or vehicles. This approach allows planning of technical research, as well as policy research on how to affect emissions from transport. The same approach allows estimation of how specific investments in new transport systems (e.g. metros or BRT) or technology (e.g. hybrid vehicles or signal timing systems) would affect emissions. A bottom-up approach allows policy analysts to isolate the impacts of various local and national policies such as fuel taxes, VKT taxes or congestion pricing from other changes. Finally, a bottom-up approach allows estimation of the impact of externally stimulated investments or incentives on transport, including the quantification of CO₂ “savings” from measured deemed eligible for NAMAs, CDM or other external funding. As we shall show, measuring carbon in transport or applying the bottom-up approach, cannot at present be carried out in the majority of Asian countries because of the profound lack of data on vehicles, transportation activity and fuel use by vehicle type.

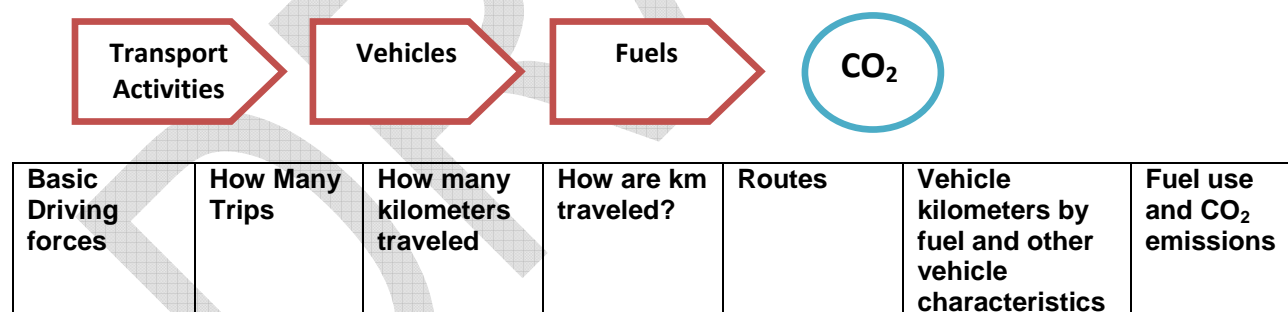
2.5 The “ASIF” Bottom-Up Approach to Summarize Emissions Changes

41. Measuring emissions from transport in a bottom-up framework has four components. First, the stock of motor vehicles by fuel type and vehicle type (e.g. car, SUV, light truck, two wheeler three wheeler) should be known on an annual basis. Second, the average annual number of kilometers each vehicle type traveled must be known. Third, the passenger or tonne-kilometers produce by each mode should be known. Additionally, fuel use/km for each vehicle and fuel combination will be derived from these three types of data. **A** defines total transport activity, in passenger and tonne kilometers, **S** defines the shares of these passenger and tonne

km by mode, **I** gives the fuel use/passenger km, tonne km, or vehicle km, and **F** gives the CO₂ emission coefficients. Other coefficients or parameters are used to relate vehicle characteristics and technology, vehicle occupancy or load factor, and traffic conditions, as well as vehicle-kilometers traveled to these four **ASIF** parameters, which are discussed in detail in the ADB Technical Note on Transportation and CO₂ Emissions; Folding Them into a Unified View for Forecasts, Options Analysis, and Evaluation (2009).

42. The **ASIF** approach summarizes a detailed set of data and estimates used in transport planning and analysis, as well as in traffic control and management. Table 2.1 summarizes these data and notes what data are required for authorities to collect, how to collect the data, or what means are available for collection. Trips and distance traveled, which are integral parts of origin-destination survey results, are sorted by modes taken. Routes may differ for a given mode choice. When the number of trips, the nominal distance and the actual route taken are combined, the number of passenger kilometers by mode is known. The results then is distributed over the vehicles that provide those passenger kilometers, e.g., two wheeler, car or light truck, bus, or some form of rail (air and long-distance rail are excluded). If the type of vehicles is known, then fuel consumption can be estimated, simulated, or in some cases measured from direct surveys or imputed from averages. Simulation may be necessary because actual driving conditions on a given route may be different from those that were the basis of previous estimates. Rogers (2004) showed that overall traffic conditions along the Insurgentes Corridor in Mexico City, where one lane in each direction was dedicated to BRT traffic, improved after implementation of the BRT system because so many mini-buses that made irregular stops were gone. The result was slightly shorter travel times and more even speeds for 60,000 cars per day, and thus, (from his simulation) a small reduction in fuel use for each car.

Table 2.2: Components of a Road Transport Model and ASIF Summary



Basic Driving forces	How Many Trips	How many kilometers traveled	How are km traveled?	Routes	Vehicle kilometers by fuel and other vehicle characteristics	Fuel use and CO₂ emissions
Land Uses, population, demographics, incomes and GDP	Activities that join origins and destinations, giving, trips. For example, employment generates a trip from home to work in the morning and back in the evening. A stop for food shopping might be made on the way	Separation of Originations and Destinations, but distance subject to actual route taken.	Mode Choices.	Route, network conditions, speeds that give actual distances traveled and actual distances vehicles move	Changes in vehicle activity and speeds over routes by vehicle type and fuel	Changes in km traveled by vehicle type, and changes in fuel use/km by vehicle type, for each fuel.
Driving Forces	Incomes, lifestyles, socio-demographic status	Profoundly affected by density and land uses, availability of modes, speeds	Choices affected by land uses, incomes, locations of "O" and "D", incomes, relative speeds and travel times, safety, and overall service	Relates to traditional traffic engineering and transport planning	Costs of a vehicle km (fuel, tolls, parking); traffic conditions, i.e., speed and congestion	Engine technology, driving style
Best Data Sources	Origin Destination surveys and commodity flow surveys for freight	Same as previous	Same as previous, but also data from passenger and freight operators, on board surveys of travelers	Visual observations, traffic counts, speed measurements	Surveys of individual vehicle use; data from fleet operators (taxi, bus, truck)	Fuel use can be measured from surveys, estimated according to simulation models adjusted to local traffic conditions, or imputed from fuel sales, vehicles and vehicle kilometers
Where in ASIF?	Combined, these data give passenger kilometers (or tonne kilometers) by mode.				Do not appear directly in ASIF	Fuel use appears as numerator in "I"; fuel use multiplies carbon coefficient "F" gives the CO ₂ emissions intensity by mode.

Source: Authors

43. ASIF also represents a simplified summary of the results of a good transport model based on activities that generate trips, trip distribution (origins and destinations) mode choice, and route choice over the network. If an entire O-D matrix has been calibrated for small travel zones in an urban region against observations, surveys, and traffic counts, then these data can be aggregated to summarize activity for the entire region, with details kept separate. When such a travel model is coupled with an emissions simulation routine that estimates fuel use and local emissions for a given vehicle technology and vehicle type/fuel combination over the vehicle's trip as estimated by the transport model, the results are a simulation of CO₂ emissions. Averaged over an entire region, the average annual emissions can be simulated. More importantly, the model will show what key measurements can verify model predictions.

44. Table 2.2 also suggests how key driving forces can affect each of the components of transport activity and fuel use. These forces tend to increase total travel, total traffic and total emissions. Policies and measures aimed at counteracting these forces are discussed elsewhere in this volume. Measuring carbon means discerning the stimulating impact of higher incomes and other forces increasing transport activity from measures designed to restrain CO₂ emissions.

45. The ASIF approach focuses on CO₂ generated in the combustion of fossil fuels in vehicles and in power-plants supplying electricity to rail and other electric vehicles. Various analysts have shown that both petroleum based fuels and their substitutes have important greenhouse gas emissions beside those associated with their final combustion in vehicles (Macleán and Lave, 1998; Wu et al., 2007). This "Life Cycle Analysis" (LCA) has been applied more broadly to the investment and operation and maintenance of roads, bus, and rail systems in general (Chester, 2008). For heavily utilized systems, the energy and CO₂ embodied in such activities may be small compared to that for operations, but are more important for operations in expensive rail and metro systems that are not heavily utilized. LCA is also applied to understand the long-term CO₂ and GHG implications of some biofuels, whose production is land-intensive and may involve releases of GHG from soil. Equally important, some biofuels may indirectly cause large GHG emissions by displacing farmland, forcing cultivation of other, less agriculturally promising land for food production. These issues considered, the better biofuels such as sugar cane ethanol make significant positive contributions without major side effects.

46. The bottom row of Table 2.2 showed how the more complex transport modeling data are summarized by ASIF. In the ASIF disaggregated approach, multiplying the number of trips/day by the distance per trip gives the total distance a person travels. These must be disaggregated further by mode, with more than one mode possible for each trip. The total person-km traveled on each mode is then compared with the total fuel use and vehicle kilometers that mode provides. Dividing fuel used in each mode by vehicle kilometers in that mode gives the vehicle fuel intensity. Dividing fuel used by travel (passenger-km, freight in ton-km) gives the modal energy intensity of travel or freight by mode.

47. The best way to measure the transport-related components of CO₂ emissions if there is no detailed travel survey or origin-destination data is to survey both vehicle usages (distance traveled per year) and the movements of both passenger and freight from origin-destination travel surveys and commodity flow surveys. Alternative estimates can be made by surveys of passenger operators (urban bus, intercity bus, urban and intercity rail, taxis, and mini-bus operators) and freight carriers, as well as intercept surveys (truck weigh stations, passenger counts on different modes) and even visual observation of passenger car and light duty truck occupancy.

2.6 Measuring CO₂ Emissions from Changes in Transport Activity

48. In the section above, we outlined the importance of measuring transport and vehicle activity. Once the data for these measures of transport are established, a variety of techniques and surveys permit estimation of fuel use by mode and vehicle type. Once this is known, then the fuel used can be converted into CO₂ (and potentially other greenhouse gases) according to conventions established by the Intergovernmental Panel for Climate Change (IPCC).

49. The basic equation used in estimating greenhouse gases as prescribed by IPCC Guidelines for National Greenhouse Gas Inventories (2006) is: emissions = activity data x emission factor. In the case of transport, the national communications of governments submitted to the UNFCCC use fuel consumption as the activity data and the mass of CO₂ emitted per unit of fuel consumed as the emission factor. This equation can be regarded as a Tier 1 method, which represents the basic level of methodological complexity. The Tier 1 method focuses on estimating emissions from the carbon content of fuels supplied to the country as a whole or to the main fuel combustion activities. From the foregoing discussions, this level of information is far too aggregate to be tied to changes in transport data. A Tier 2 method would involve emission calculation by source types, based on fuel use for each industry and sector of the economy and a Tier 3 method uses source-specific data and can be used for a small representative sample of principal emission sources.

50. The IPCC approach is top-down, which develops CO₂ emissions based only on reported fuel sales as estimated in national energy balances. However, a bottom-up approach is necessary in order to better understand the transport system, through gaining transport activity and characteristics data. This gives the link to transport policy options. Since transport policies may have a large impact on CO₂ emissions through affecting total vehicle, passenger, and tonne kilometers. Such policies could be as “Nationally Appropriate Mitigation Actions” (NAMAs), for which a key co-benefit will be lower CO₂ emissions. Tying changes in emissions to the outcomes of these NAMAs requires the bottom-up approach. This is particularly true if a particular quantitative outcome of a transport measure or policy is desired, such as reduction in car use or reduction in pollutant emissions from a particular kind of vehicle. A reduction cannot be measured without a baseline and measurements taken after the measure is implemented! Most transport policies will only affect part of total vehicle or transport activity, and usually relatively slowly. Without good transport activity observations and models, it is almost impossible to discern changes in activity caused by policies alone than from the overall changes in activity as economies grow.

51. Measuring changes in fuel sales cannot be used to impute changes in travel, freight, or vehicle activity, because more than one type of vehicle uses each fuel. In Asian countries, for example, cars, some light trucks, motorcycles, and small buses use gasoline, while some cars, most buses and trucks use diesel fuel. Small amounts of compressed natural gas and LPG may be used for smaller buses, larger, buses or cars. Because of this mix, there is no one to one correspondence between changes in fuel and changes in transport activity. No fuel is used uniquely by a given kind of vehicle, and in no country have the proportions of fuel type used by each vehicle type been consistent over time.

52. The basic problem is that fuel data are collected by fuel and broad categories – road, rail, domestic water transport, domestic air travel, international marine bunkers and international air bunkers. Within the road transport sector, there is no official breakdown of fuel use data by vehicle type, e.g. two-wheeler, car, SUV, light truck, medium and heavy truck, bus etc. For a

majority of Asian countries, there are also no published data on vehicle-km or passenger and tonne-km by the main modes. Thus, it is not possible to associate CO₂ emissions to each major activity within the transport sector.⁷

53. Compounding this problem is that there is no meaningful measurement of transport activity at any level in the majority of Asian countries. “Vehicle Activity” is measured in vehicle-kilometers per vehicle and total vehicle kilometers by vehicle type (i.e. two-wheeler up to large articulated truck or bus) and further distinguished by fuel type, e.g. veh-km/year for diesel, CNG, and gasoline cars. Passenger travel is measured in passenger-kilometers, and freight haulage in tonne-km. While these data may be available for rail and air modes, they are almost never collected for urban transport, and only partly for road transport, usually for common carrier bus and trucking. These quantities are growing rapidly in most Asian countries, propelled both by greater numbers of vehicles in operation and in some cases greater km/vehicle per year.

54. Since CO₂ emissions depend on emissions per vehicle kilometer or emissions intensity and distance traveled, relating the impact of transport policies to CO₂ emissions requires good knowledge of these activity parameters. At the same time, reductions in emissions/km are also expected through a number of improvements in technology and improvements in traffic conditions themselves. Measuring these improvements requires knowledge on which vehicles consume which fuels and how far they are driven. Finally, the possibilities of switching to fuels that emit both less CO₂ when burned and processed, e.g. biofuels. While not a transport measure by itself, this information also requires knowledge on how far vehicles go and how much fuel/km these vehicles emit. Such data will then enable a comparison of emissions from vehicles using the different fuels – the distances the vehicles are driven before and after fuel changes are not the same, as a comparison of diesel and gasoline cars in Europe has shown (Schipper 2009; Schipper, Fulton and Marie 2002).

2.7 Measuring Changes in Transport and CO₂ Emissions Caused by Policies and Measures

55. Policies and measures are designed to influence the way the transport system behave and how it emits CO₂. Therefore, the goal of measuring CO₂ in transport is really one of measuring changes from a moving (usually growing) baseline. This goal can only be satisfied by a bottom-up approach because policies typically aim at only some of the many variables related to CO₂ emissions. A policy, such as a carbon tax on fuels, can have one impact on travel, another on vehicle activity, and a third on the CO₂ emissions per kilometer of vehicle travel. Understanding each of these changes is important for policy analysis.

56. It has been stated earlier that there are three ways to reduce CO₂ emissions from transport – avoidance through development, shifting away from high CO₂ modes (automobiles) or keeping their share low, and improving the carbon intensity of vehicles. Whatever combination of these types of measures, it is important to be able to measure and model not simply “before/after” measures, policies, or technologies are implemented, but rather three specific cases:

- Business as usual or the base case projected forward with no policy measures.

⁷ While aggregate energy sales by fuel to the road sector by fuel is known with reasonable accuracy, details are sometimes confused by fuel that is smuggled from low to high priced (or taxation) countries, and taxed fuel adulterated by untaxed or lower taxed fuel.

- Modeled and predicted evolution of transport activity and emissions when policies and measures have been applied.
- Actual activity and emissions as measured or estimated to compare with both predicted outcomes and the BAU case with no measures.

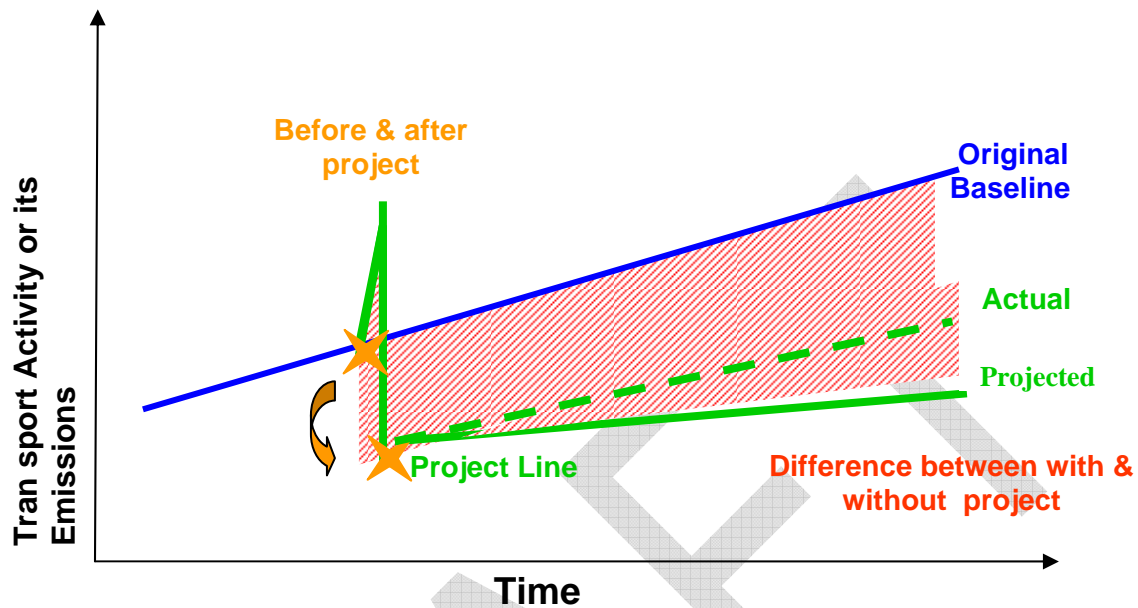
57. With this approach, it becomes possible to separate spontaneous evolution in transport activity and emissions driven by higher incomes and changing land uses. Armed with these data, analysts can estimate the impacts of any particular mitigation measure over time against the background of growing emissions. Many of the outcomes that reduce the carbon footprint of transport slow the growth rate, but do not necessarily reduce the absolute level of emissions. Consequently, good transport activity data and fuel use data are both needed to be able to distinguish what happened because of a policy from what “would have happened” without the policy. These data permit evaluation of how each component of ASIF changed against both prediction and under the influence of other forces.

58. Over time, every country and region has experienced the same evolution of transport activity as income levels have grown, resulting in increases in trip distances and travelers shifting from feet/pedals/animal power to collective transport and ultimately to private cars. In China, private car trips in cities still accounts for less than 10% of trips and 20% of travel, while in the US, car trips account for almost 90% of trips and roughly the same share of distanced traveled (NHTS, 2003). The shifts towards motorized transport and cars raise the fuel use per passenger-km traveled. The increase in distance traveled, in part facilitated by car use, increases the total distances traveled. This is because in un-congested parts of the city car travel is faster than that by other modes, facilitating longer trips in a given amount of time. In OECD countries, increased car ownership and shifts of travel on other modes to cars together account for almost all the increase in per capita fuel use and CO₂ emissions for travel (Schipper and Marie, 1999). The same is true for developing countries (WBCSD, 2003). Business-as-usual projections foresee continuation of these trends, as individual automobile ownership is made possible by higher incomes (or falling costs for owning and using cars).

59. In this framework, “savings” from a policy intervention will usually lead to lower fuel use or CO₂ emissions than would have occurred in a business-as-usual situation, i.e. without the actions implemented that would lead to changes in emissions. Figure 2.3 illustrates the kind of comparison to make. The diagram could symbolize a specific transport corridor, a part of a city, or an entire metro region.

60. The solid blue line in Figure 2.3 represents transport activity or emissions as projected under business-as-usual baseline, i.e., no new projects or policies. This baseline is calculated bottom-up using ASIF. Fuel intensity estimates or measures transform vehicle movement to fuel use. The spike where the project is initiated illustrates what often happens when projects themselves cause temporary disruptions during construction or during their initial phase. The bottom-up approach requires the analyst to specify how many vehicles, of what type, travel how far, and using how much fuel. Some of the vehicles counted may not be used if travelers switch to another mode. It is this level of detail that is required for the immediate before/after analysis.

Figure 2.3: A Moving Baseline Depicting a Business-as-usual Scenario and a Project Outcome



Source: Rogers and Schipper, 2005; Schipper, Cordeiro and Ng, 2007.

61. Cities, regions, and countries are not static. Emissions rise over time when incomes and population rise, more individuals use cars, traffic worsens, and the urban region itself may expand (increasing trip lengths).

62. A project or intervention can change both the absolute level of emissions - the “project line” in green shown in Figure 2.3 - quickly and the slope of the change in emission over time. What is illustrated in Figure 2.3 has been exaggerated to differentiate the baseline from the actual development because of a project or policy. Note, however, that the slope of the project line has been drawn to be less than the slope of business as usual. This illustrates another, perhaps more important outcome, namely, projects and policies slow the rate of growth of CO₂ emissions relative to the rate of growth in the business as usual case. Some projects might lower the absolute level of emissions briefly, only to see growth return at the same rate as before. The bottom-up data described previously are required in order to calculate how much “less than otherwise” measures saved. This is true whether the measures are imposed as national policies or locally, and whether the measures are broad, such as taxes and fees, or specific transport projects. Quantitative understanding of vehicles, vehicle use, flows of people and goods, and vehicle fuel use is also necessary.

63. The reason why bottom-up data are so important is that most transportation measures affect how people and goods move, and thereby how fuel use changes. Fuel sales data are too aggregate to reveal how transportation activities changed from specific measures. If one examines the United States NEMS model,⁸ the total for national transport fuel use or emissions

⁸ More information on US NEMS Model is available on the ADB Technical Note on Transportation and CO₂ Emissions Folding Them into a Unified View for Forecasts, Options Analysis, and Evaluation (2009). For publication.

is modeled bottom-up from a dozen modes of travel and freight and even more technology-fuel combinations. If a policy intervention or project affects a particular mode, fuel, or region, its impact is unlikely to be discernible within the aggregate fuel sales. And without a reasonable accurate business as usual projection, there is nothing with which to compare the outcome of imposing such policy intervention or project to.

64. Consider now the various kinds of interventions related to CO₂. A project only aimed at public transport vehicles' fuel type or consumption would in principle be easy to monitor if the operators were cooperative. Comparing actual activities with a counterfactual would be straightforward. Unfortunately, such a project would only have a small impact on a region or country's emissions, because the public transport sector represents such a small share and diminishing share of total emissions.

65. A project such as a new BRT line aimed at shifting car users to buses could also be relatively straightforward to monitor in terms of methodology. A good data base on fuel use in buses and private cars would be necessary. On-board surveys could establish which bus riders used to travel by cars and determine how far they used to drive. Over a number of years, however, a model of "business as usual" without the project would be needed to see if the overall results tend to increase or decrease over time. Whether the project was a NAMA, CDM or financed in part by GEF or another international mechanism, the process of estimating CO₂ savings does involve many steps, as Rogers' work for the Mexico City BRT line shows (Rogers, 2004).

66. The most important projects in terms of potential CO₂ savings must aim at restraining the growth of private cars use and reductions in the emissions/km of all vehicles. To measure these impacts, both national and regional models of traffic and transport activity are needed, as well as good measures of real fuel economy of all road vehicles. It is clear that this is more complicated and time-consuming than previous examples of interventions.

67. Considering the discussions above and building on the current methodology and terminologies employed by the IPCC in measuring emissions, a parallel scheme could be used for transport energy and emissions. Tier 1 would then use international "default" parameters for fuel use/mile by vehicle type. Since these figures vary by a factor of two according to vehicle size and efficiency, Tier 1 is useful only for a first cut approximation. Note that per passenger or tonne-km of travel or freight, the variation is closer to a factor of five, so there can be no substitution of numbers. Local vehicle activity or travel/freight estimates must be made, as there are no "default" parameters.

68. Tier 2 would correspond to taking actual national averages for fuel economy (fuel use/km) by fuel and vehicle type. Simulations of on-road (in-use) fuel economy are only useful if these have been validated by detailed comparisons to actual fuel use records.

69. Tier 3 corresponds to using fuel economy data by vehicle that reflect actual vehicles in a project or affected by a project, i.e. in its zone of influence. Simulations may be used if they have been carefully validated for the types of vehicles in the project.

2.8 Data Requirements: A Three Tiered Approach?

70. Almost no developing countries in Asia have or use data at present that provides a thorough understanding of the transport sector. What is published is total transportation fuel use, by fuel type and whether the usage is for road transport, rail, domestic water-borne shipping, passenger traffic, or domestic air traffic. We define “data” as information generated regularly by surveys bottom-up or by top-down tabulations where possible. There are many one-time, disaggregated estimates of vehicle activity, passenger and freight activity, and energy use made for studies, but these are rarely repeated in any consistent way. Hence, leaders and planners in developing Asian countries cannot easily see the connections between transport and CO₂ emissions. They can only measure emissions arising from aggregate fuel sales by the type of fuel.

71. In most Asian countries, information and data collection related to transportation generally fall within the jurisdiction of the ministries of transport and energy. In some instances, the ministry of environment also collects information related to transport. Needless to say, the regularity and consistency of data collection mostly, if not at all, are not present. Categories are not carefully defined and in some cases sources or years applicable are not even given.

Table 2.3: Data Required for a Three Tiered Data Collection Approach

Data Category	Tier One: Known Today	Tier Two: National Bottom Up	Tier Three: Urban Region I or Project Specific	Best Practices for information gathering	Complementary Data Sources
	Little information except slowly changing averages	Allows estimation of social and regional impacts of policies	Allows estimation of impact of local project on regional		
Vehicles	Total registrations by country and state, sometimes by city or metro region	From surveys, stratified by where vehicle is garaged, socio-demographic characteristics of private owner or characteristics of firm		Annual survey for vehicle owners coupled to vehicle registry.	Household income surveys; business surveys
Vehicle Use		From surveys, stratified by where vehicle is garaged, socio-demographic characteristics of private owner or characteristics of firm	From surveys, stratified by where vehicle is garaged, socio-demographic characteristics of private owner or characteristics of firm	Annual survey of vehicle owners, reading of odometers and other sources of data	Household survey. Police and insurance data on accidents. Collect at time of resale of vehicle.
Passengers or Freight output by mode (including non-motorized modes for both travel and freight)	Some data intercity common carrier of road freight and bus. Good data on intercity rail. Poor data on urban travel (in passenger/km) by mode. No data on	Complete specification of passenger and freight mobility by mode and distance interview, i.e., trips by length of trip.	Complete specification of passenger and freight mobility by mode and distance interview, i.e., trips by length of trip.	National and local travel survey (trips by distance, mode, and purpose); Truck utilization survey and commodity flow survey over all freight modes.	Common carrier operators' own data on passenger-km for intercity rail, bus, and urban modes. Note that non-motorized modes should be included even if there is no direct fuel use or CO ₂

Data Category	Tier One: Known Today	Tier Two: National Bottom Up	Tier Three: Urban Region I or Project Specific	Best Practices for information gathering	Complementary Data Sources
	car or motor cycle.				contribution.
Fuel Use/km by vehicle type to get CO₂ emission per kilometer and per passenger and tonne-km	Unknown. Multiplicity of fuels (e.g. diesel used for cars, vans, buses, and trucks) invalidate any common rules of thumb.	Fuel use/km for each kind of fleet vehicle		Vehicle use and fuel consumption survey	Trade associations for urban bus, intercity bus, taxi, trucking. Electric utility for sales to electric traction customers (trolley bus, urban and intercity rail)
Total fuel use for a given vehicle type to get total CO₂ emissions by mode	Unknown	Each fuel for each vehicle, e.g., gasoline, diesel, CNG, LPG for passenger cars, other light duty vehicles etc.			
Best Practices		Bottom-up survey "Australian Transport Task"; Mixed surveys and top down: MLIT and METI transport and energy data, Canadian vehicle use and fuel consumption survey	Occasional Metro household travel surveys, e.g. Hanoi 2003. Vehicle activity survey in Pune, 2003.		

72. In the table above, "Best Practices" refers to survey-based data gathering aimed at quantifying ex ante the impacts of a project, rather than applying data from a larger part of the urban region or country as an approximation to a zone where a project is expected to have an impact. In Rogers (2006), for example, films of the cars using the Insurgentes corridor were used to identify the differences between those cars and the "average" vehicle in the Mexico City region. "Best practices" may be expensive if used for a single transport project, but inexpensive if it is based on a wider set of data or observations gathered to improve transport planning (vehicle use) and environmental monitoring (vehicle emissions).

73. For Asian countries, Japan has the most thorough approach to collecting and analyzing data on all branches of transport, with particular emphasis on road transport data. The information on each mode of road transport (vehicles, vehicle-km/year, passenger-km per year, fuel use by fuel, fuel use per passenger, and vehicle kilometer) contributes to a bottom-up picture of road transport. Similar information is available for passenger and freight rail, domestic air travel, and domestic (e.g. coastal and inter-island) shipping, including ferries. Australia has a similar system with even more details published. Unfortunately, these are the most complete data collection and publication efforts in the greater Asia Pacific region.

74. Many countries in developing Asia have not institutionalized data collection, management and the updating process. For example, in India, the Ministry of Shipping, Road Transport and Highways maintains the database on registered vehicles. They collect data from various regional transport authorities, but since vehicle registered data is neither updated

periodically nor categorized by fuel use, it cannot be used for the ASIF methodology. Activity level data is collated generally at corridor level and are maintained by the National Highways agency. These data represent vehicle volumes, not veh-km/vehicle that can be used for annual averages. Data at city levels is collected, processed and maintained at city and regional level without having these compared or cross-checked with data at the national level. In addition, the Ministry of Urban Development conducts periodic surveys in big cities to capture some of the important activity and trip patterns. Almost no data on freight, passenger travel, or vehicle kilometers traveled in private trucks, cars, or two-wheelers in urban regions are collected regularly.

75. In China, the main source of data is the National Bureau of Statistics, who acts as the common repository of data from various agencies. It has the passenger level estimates, freight tonne estimates, average distance traveled etc. But the number of vehicles is not categorized by mode and fuel type. Data at city levels are often available at research agencies and not related to the national government. The Chinese data situation is similar to the situation in most other developing Asian countries. For Pakistan, Thailand, South Korea, and Indonesia, the main source of data is the statistics division, which collates the vehicle registration database. But again it has the disadvantages of not maintaining the vehicle registration database and the failure to collect more specific data on vehicle activity and fuel type.

76. In the Philippines, Nepal, Sri Lanka, Malaysia and Bangladesh, the transport ministries and research institutions act as main repositories of the transport database. They have the vehicle registration accounts, which are updated regularly for a few countries such as Philippines but for some, such as Nepal, it is rarely done. They again do not collate information at the corridor level, activity and fuel type.

77. The national centers of statistics or census clearly play a major role as there are some parameters they routinely collect over a period of time that benefits the analysis of the transport sector.

78. The main issues relating to the collection and maintenance of data necessary for measuring CO₂ emissions from the transport sector are (i) dedicated institutions and capacity conducting the measurement, surveying and analysis, (ii) the parameters collected, and (iii) the means of publication and sharing among agencies. Since transport and energy data tend to involve a number of national authorities (e.g. Ministries of Communication and/or Transport, Energy, Environment) and major regional/local authorities with similar responsibility, weaving together a working group with agreed upon periodic information exchange is complicated, as experience in OECD countries has shown.

79. OECD country experience shows it takes several years to set up the required vehicle, passenger and freight surveys, fund data collection and analysis, and maintain the surveys over a long period of time. Once a data system has been established it needs to be maintained. Recently, in the USA, the Vehicle Inventory and Utilization Survey, which covered all trucks (including household SUVs and pickups) was discontinued after 2002, leaving the USA, the largest road fuel consumer in the world, with no instrument measuring how its vehicles consume fuels. Because action to reduce emissions from transport will take place in small steps over any years, it is important that national authorities understand the importance of securing funding for a long-term effort.

2.9 Next Steps: What Is Needed?

80. The current state of information on how people, vehicles, and freight move within countries and their major urban areas in developing Asia is poor. The available information does not permit the discerning of how much fuel vehicles, people, or goods are required to use over a given distance. The broad information available in fuel sales is not tied to the vehicles that use the fuels. This means that the impacts of policies designed to influence transport, including NAMAs, as well as policies aimed directly at fuel use and CO₂ emissions, such as fuel economy standards, cannot be measured with any accuracy against the background of rising aggregate transport activity and fuel use. While blunt instruments like large price increases or strict fuel economy standards will show up in national aggregate fuel statistics, most of the key measures that affect CO₂ emissions will act through impacts on transport activity, vehicle use, and only secondarily on direct fuel consumption.

81. What is needed is a broad program of capacity building to increase the ability to collect and analyze data on transportation activity, fuel use, and the resulting CO₂ emissions. Countries need to assess what they do know at present, what gaps can be filled by using available information, and what new information needs to be gathered on a regular, accurate, reliable, and transparent basis. Such capacity building efforts need to be linked to a better institutional framework that defines the responsibilities for data collection and sharing, analysis and dissemination.

82. In most Asian countries and cities, the majority of information necessary to assess CO₂ and air pollutant emissions can be found only in individual projects, while even in these cases travel activity and characteristics are not sufficiently covered. Those parameters, which cover predominantly vehicles, vehicle activity, transport activity, and fuel use associated with each kind of vehicle/fuel combination, must be gathered as part of regular surveys undertaken by transport, energy, environment, and commercial authorities at the national level. Since the same data are required for good regional/local transport policy and environmental policy, we recommend that local authorities also work together to collect such data. The data currently collected by the Ministry of Land, Infrastructure and Transport in Japan form a good starting point (MLIT, 2008), and the details on vehicles and usage as collected for Australian authorities⁹ form an even more detailed approach that is laudable. These must be supplemented by personal travel surveys that measure how people (and why, and where and when), not vehicles, move, and commodity flow surveys that show how goods move in the economy.

83. Public and private authorities and stakeholders in each country have to ask certain key questions:

- What level of accuracy is required to “measure carbon”? In general, the sample size and measurements should permit enough accuracy to resolve at least 10% of the current or expected growth in transport emissions. This level is about what is required to discern a single year change in new vehicles because of fuel economy standards or changes in vehicle use if there is a sizeable increase in fuel prices. To measure the impacts of local transportation policies accuracy may need to be greater, but as Rogers (2006) suggests, the focus can be in a zone of influence where the impacts of those measures is expected.

⁹ Australian Transport Facts, 2007. Prepared by Apelbaum Consulting Group Pty Ltd.

- What level of accuracy periodicity, what is ideal and workable? This depends on how fast a country's transport activity is growing and to what extent a country wants to use these data to validate measures that will affect transport and thereby restrain CO₂ emissions. If surveys are only carried out every 5 years, then the most current information at hand when policies and measures are enacted will be 3-4 years old on average, given the delay to process data. At current rates, China's private car fleet doubles in that period of time, so data will be "old" when they are available.
- How much funding is required to collect the ASIF parameters of vehicles, vehicle movement, person and goods movement, and fuel use for each vehicle/fuel type combination? This can only be answered in detail by each national or local authority. However, instrumentation to measure vehicle activity and fuel use, simple GPS systems to monitor vehicle activity and even personal travel, sensors to measure ambient air quality, etc. are much cheaper than when OECD countries began to monitor traffic, transport, and fuel use in the 1960s. And collecting and handling large data sets, such as survey responses, is much cheaper today with the wide proliferation of both laptop computers and wireless and other means of transmitting data. A good pilot project could take an urban region or an entire country as a test case to design a transportation data system and data collection from the bottom-up, as an alternative to simply adding marginal information to existing surveys and other data collection methods not designed for the present low cost of data collection and monitoring.
- How can costs be shared among different branches of government? How can surveys be combined and sample frames are shared? As an example, why not put certain questions in at least a sub-sample of the national census? The best approach considers together vehicle, traffic, transport, fuel, and emissions data and develops a systematic approach with costs shared among authorities and coordination of frequencies, etc. so that the efforts of different authorities, the data collection and processing itself, and analysis all takes place in a coordinate fashion.
- Since most Asian countries will be interested in third-party funding for transport related projects, countries should realize that good baseline data need to be collected in advance, not simply when a project appears on the horizon. Fortunately most of the data required for good transport/CO₂ monitoring are important to transport planning, environment assessment, and energy planning as well. We recognize that national statistical agencies have traditions or well established national practices. However, the International Energy Agency has demonstrated with its collection and harmonization of energy data that such harmonization can occur.
- Building a data base is a long-term process. One step that could be taken almost immediately is to provide some seed grants for selected Asian countries to begin the careful steps to develop data collection, not on a project-by-project basis but as a long-term responsibility of each government. Having such data developed could then be a prerequisite for all transportation-related assistance after a number of years.
- The most important step towards harmonization would be increased transparency of present national data sets. For example, when authorities publish passenger kilometers or road transport data, the definition of what is included and what collection method was

used should be presented clearly. As far as we can ascertain, this is not the case for the majority of Asian countries.

- Additional efforts could be led by the International Transport Forum (ITF), the International Road Federation, the Global Road Safety Partnership and other authorities to harmonize definitions, weight and power classes and other vehicle characteristics so stocks, sales, and vehicle activity are truly comparable across countries and between Asia, Latin America, and other regions.

84. In the short term the following steps should be taken. A standard set of transport data can be developed, in three tiers much like the IPCC has done for CO₂ data. This should lead to surveys of what data are and are not available in each country. At the same time, a clear message needs to go to governments that data collection has a high value for development purposes. Funding needs to be structural and not project driven or dependent on foreign assistance apart from capacity building to strengthen local efforts. One financing scheme might involve a small tax on fuels and transport ticket sales or freight bills of lading. Other funding sources can be explored, but funding should not be an issue when in fact only a very small fraction of the national transport bill (which itself is between 10 and 20% of most economic activity) is used for data gathering.

85. A clear challenge is selecting an agency or other institution to manage data collection, analysis and publication, including the analysis and publication of indicators. This must be an institution with a good background in both statistics and transport, as well as credibility in the transport community. We advocate that candidate institutions be selected as part of the task of analyzing existing data and determining data needs. A long term commitment is required and the organization selected should have the required institutional mandates and operating budgets to conduct its work well.

86. In the medium-term, the selected institutions in a number of countries should work with authorities to analyze data needs and field test surveys to determine what the real costs of the transport and fuel use surveys will be. With this information, authorities can determine the real costs of regular data gathering and processing. And governments can develop partnerships among national and local authorities to both share data gathering costs and in the analysis with the host institution.

87. International organizations and development organizations can play an important role in strengthening the capacity to collect, analyze and manage data required to arrive at well chosen policies and programs to develop the transport sector manner in a sustainable manner and one which will slow down the growth of CO₂ emissions.

88. At the same time, a longer term process must be started to appoint an international authority to coordinate data gathering and train national and local authorities much as the IEA has done for energy data. Regional authorities need to be established (or authority vested in an existing regional authority, such as ESCAP) to work with countries and key cities in each geographic region.

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DRAFT

3. Policies for Low-Carbon Transport

3.1 Introduction

89. Economic activities cannot take place without a transport system. Transport is therefore fundamental to the economic and social development of Asian countries. This is evident from the rapidly proliferating transport sector across the developing world, where governments are expanding their transport infrastructure in a drive to modernise.

90. The rapidly increasing demand for goods and services and for access to them in the developing world has been met with a corresponding increase in transport infrastructure. This is compromising both international environmental sustainability and the long-term economic sustainability of these countries. It is therefore imperative that international action is taken to help to ensure that Asian countries pursue low-carbon mobility rather than develop a dependency upon energy intensive transport networks that have severe and wide ranging negative environmental impacts.

91. In this context, this chapter aims to discuss low-carbon transport policies. It assumes that the transport sector has an important role to play in climate change mitigation. Using “leapfrogging” in terms of both technology and knowledge as a central notion, it outlines the available transport policy instruments developing countries can apply to reduce the growth in transport related CO₂ emissions. It also explores the limited role that the flexible mechanisms introduced in the Kyoto Protocol (UNFCCC, 1992) have played in the development of low-carbon sustainable transport systems and networks and discusses post-2012 instruments that could be used to bridge the gap between climate and transport policy at all levels from the local to the national.

92. The chapter assesses the barriers to achieving low-carbon mobility and discusses the steps needed to realize optimal low carbon mobility scenarios. The barriers and concepts detailed are relevant to both the passenger transport and freight sectors. The examples of policy instruments provided focus upon those implemented in relation to land passenger transport, but many of the principles can also be applied to enhance the sustainability in the freight sector and across modes.

3.2 Leapfrogging as an approach towards low carbon mobility

93. In the developed world the negative environmental impacts of transport have increased in prominence on the policy agenda over the last decade; and more lately the impacts upon climate change have gained particular prominence. The negative impacts of a transport infrastructure based on individual motorization are therefore starting to be recognised, with increasing international awareness that a good transport system cannot be one which emits an unsustainable level of GHGs.

94. The transport systems of Asian countries, as throughout the developing world, are showing signs of emulating the same pattern of development as those in the developed world. Transport in urban areas is shifting away from non-motorized to motorized forms of transport, and whilst public transport patronage is increasing in absolute terms its overall modal share is generally decreasing.

95. Car ownership is aspired to, although actual levels are still low. In China, for example, in 2002 car ownership was approximately 1.4%. There is a marked difference in car ownership levels in urban and rural areas, however. In urban areas, levels of motorisation are relatively high (estimated to be 165 vehicles per 1,000 inhabitants in 2003), and private vehicles are now causing considerable congestion in urban areas. The number of motorised agricultural vehicles is growing in rural areas, although private vehicles remain unaffordable for much of the rural population with only 14 vehicles per 1,000 inhabitants in 2003 (Fulchuri, 2005 in Dalkmann et al, 2007). It has been estimated that by 2020 70% of car ownership will be in urban areas, whilst 30% will be in rural areas (Zhongyuan et al, 2002).

96. Now that levels of private car ownership are still relatively low in developing countries there is still the opportunity to intervene to help ensure that more sustainable and accessible forms of transport are pursued rather than the car friendly transport policies that have dominated transport policy in the developed world for the second half of the 20th Century. The quick rate of motorization in developing countries and the associated lock-in effect of CO₂ emissions and other negative externalities for the next decades combined with the experiences of the developed countries highlights the importance of the adoption of a 'leapfrogging' approach to development, which would see climate change considerations integrated into transport policy and planning from a more early stage and in a scaled-up manner.

97. The concept of leapfrogging is derived from theories of economic growth in which technological innovations developed by established organisations are adopted by other organisations, which enables them to 'leapfrog' ahead rather than to reproduce development processes (Dalkmann et al 2004). This term is being increasingly used in the context of sustainable development. It is used to describe a development path that would enable developing countries to modernise but to minimise the associated problems experienced by the developed world, such as polluting technologies and rapid motorisation. An example of leapfrogging in the communication sector is a setting up of a mobile phone system instead of building a new cable network.

98. In terms of the low carbon transport agenda it is an approach which could enable developing countries to use the development process as a means to leapfrog ahead of developed countries to a heightened level of sustainable transport provision. The application of a leapfrogging approach would bypass the decades of transport policy in developed countries which saw the needs of car users being catered for. It would instead begin at the 'new realization' stage that the developed world only entered in the mid 1990s, enabling transport infrastructure to be developed in an integrated manner conducive to high quality and widespread public transport provision and more sustainable forms of personal mobility, such as cycling and electric motorcycles.

99. The leapfrogging notion was based originally on the application of low carbon technological developments but there are no major reasons why it cannot be widened to a social and ecological perspective. 'Sustainable leapfrogging' is comprised of the following elements;

- Strategy to improve the social and ecological dimension of sustainability through extending the knowledge-base about their interdependencies;
- Integrated supply- and demand-side strategies; and
- Viewing infrastructures and structures of demand as sustainable innovations of technology, rather than simply as behavioural structures.

100. The social dimension is fundamental to the concept of sustainable leapfrogging. For example, technologies and structures that support climate change mitigation are also likely to have positive impacts upon health, quality of life and access to resources. They can also stimulate economic development, which can in turn increase equity and wellbeing (see also Section IV for a discussion of co-benefits).

101. The leapfrogging approach can have positive impacts on transport development on two levels: On the one hand, developing countries can adopt individual policy instruments, or components of them, that have been implemented in developed countries. In practice there can be numerous barriers to achieving this (which will be discussed later in the text), but in theory it is a fairly straightforward notion that developing countries can adopt best practice policies and practices from the developed world. The traditional leapfrogging concept relates largely to technology transfers, although there is increased emphasis on an 'enhanced' leapfrogging strategy, which focuses also on knowledge based transfers and softer measures. On the other hand, developing countries can benefit on a higher level from adopting the wider strategies implemented by developed countries. This can lead to a systematic shift that can result in demand for travel being reduced, or demand being shifted to more sustainable modes of transport. This approach will support low carbon mobility thereby leapfrogging the heavy motorisation phases that tend to precede it.

102. The following section provides an overview of different types of transport policy instruments that have been implemented in the developing world to support low carbon mobility and which, subject to certain conditions being met, could be adopted by Asian countries as part of a leapfrogging approach to low carbon mobility.

3.3 Policy instruments

103. The implementation of various transport policy instruments in the developing world that are modelled on those currently being used in developed countries could help to realise the potential benefits of the leapfrogging approach to low carbon mobility. This would enable them to fully benefit from the technological and conceptual advances that have arisen from the experience of the 'western' world, thereby reducing many of the social, economic and environmental problems caused by transport such as air pollution, congestion, and road safety incidents.

3.3.1 Criteria for effectiveness of policy instruments

104. It is important that policy interventions fulfil the following criteria if they are to effectively reduce carbon emissions;

- Rational – they must relate clearly to objectives, both overall (i.e. reduce carbon emissions), and specifically;
- Transparent – it must be clear to all parties how the policy will help to achieve the relevant objective(s); and
- Equitable – there should be a transport alternative for those who are unable to travel by one mode, or for whom the policy measure incurs an additional cost (Buchan, 2007).

105. Experience has also shown that there are a wide range of other considerations that need to be taken into account as well when considering the potential effectiveness of policy interventions. The key success factors include;

- Coordination between all levels of governance;
- Effective working relationships between key stakeholders;
- Capacity to apply policy instruments;
- Ensuring the availability of the necessary finance for the implementation and maintenance of the intervention over its lifecycle;
- Political support and commitment at all levels (Dalkmann and Brannigan, 2007).

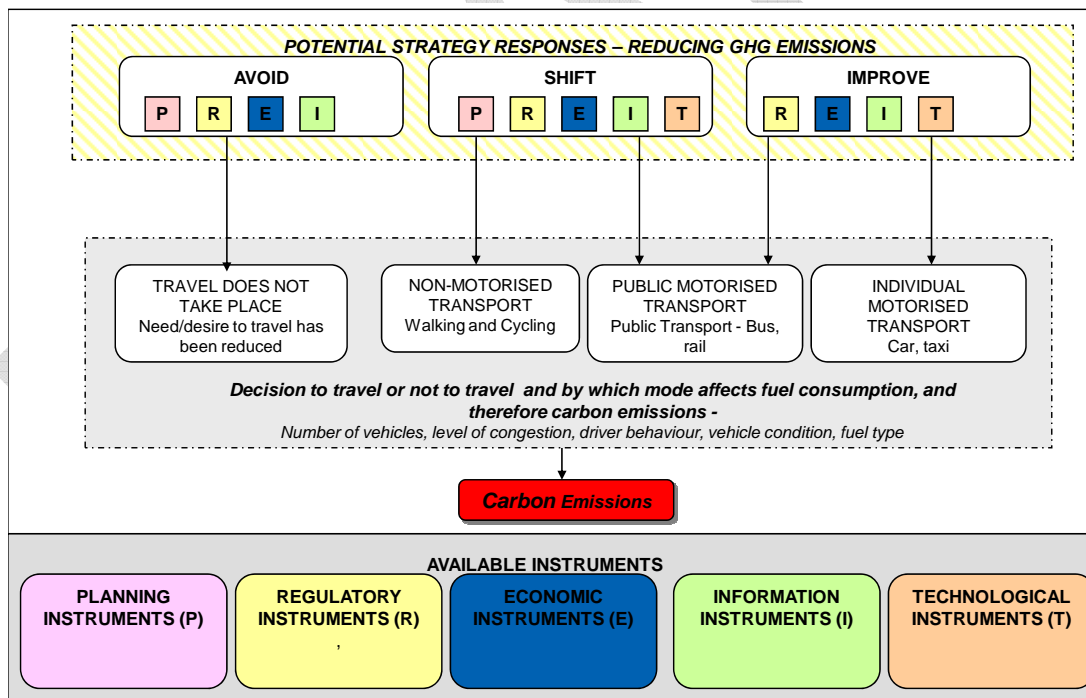
3.3.2 Transport policy instruments

106. The nature of sustainable transport policy measures varies, but they can generally be seen to contribute to at least one of three fundamental strategies;

- Avoiding the need to travel (Avoid);
- Shifting travel to more sustainable modes (Shift); or
- Improving the sustainability of modes (Improve).

107. These three strategies, and the broad types of policy instruments that can support them, are outlined in Figure 3.1 below.

Figure 3.1: Strategies and instruments to reduce carbon from transport



Source: Dalkmann and Brannigan (2007).

108. The 'Avoid' strategy is particularly well suited to Asian cities, most notably those that are at a relatively early stage of economic development, and has the potential to be a major contributor to mitigation efforts. The key element of an Avoid strategy is land-use planning, for

which there is considerable scope for improvement in both the procedures for land-use planning and the institutions who have responsibility for overseeing this process in developing countries. In many Asian countries development has occurred on a relatively unplanned and ad-hoc basis and therefore opportunities for capitalising upon the typically higher population densities of these cities to reduce the need to travel have not been realised. The opportunities and limitations to this policy measures do, however, vary considerably based upon specific context. There has been relatively little research conducted into this area although Creutzig et al (2009), for example, discuss this issue in relation to Chinese cities where the incentive structure for policy-makers could pose a challenge for the implementation of land-use planning to support a low carbon transport strategy.

109. The 'Shift' component of the ASI strategy relates primarily to modal choice, with the emphasis being away from private car use to lower carbon alternatives. The density and design of many Asian cities, which grew without infrastructure to accommodate private cars, increases the practical necessity for ensuring that a shift is achieved. In the developed world the emphasis of Shift strategies is from private car to public transport, walking and cycling, although unlike the developed world motorcycle use is prolific in many Asian cities. Strategies are therefore more likely to comprise of shifts from private cars to motorcycles, a low-carbon alternative to the private car, and from motorcycles to cycling and walking.

110. This paper does not focus on the role of vehicle technologies or the type of fuels in a low-carbon mobility strategy, but these form the basis of the 'Improve' strategy approach. Experience in the developed world has shown that as with other measures solutions are highly context dependent, with electric vehicles, biofuels, hybrids and hydrogen fuel technologies all examples of related approaches being researched and adopted globally. In 2007, for example, California enacted a GHG standard for transport fuels, the Low-Carbon Fuel Standard (LCFS), which takes a life-cycle approach to evaluating the carbon intensity of transport fuels (see the California Energy Commission, 2009). On an international level the Global Fuel Economy Initiative have launched a '50 by 50 challenge' – 50% fuel economy improvement worldwide by 2050 – to take 'Improve' strategies forward (see FIA Foundation et al, 2009).

111. The five categories of policy instruments listed in Figure 3.2 are very broad, and each plays a different role in reducing carbon emissions (Dalkmann and Brannigan, 2007):

- Planning – can reduce the need to travel by bringing people and the activities that they need to access closer together. It can also enable the implementation of new transport infrastructure, including for public transport, cycling and walking.
- Regulatory – can be used to restrict the use of certain motorised vehicles, but can also influence the types of vehicles used and the standards that they should adhere to (both in terms of vehicle performance and road regulations).
- Economic – can discourage the use of motorised vehicles, which encourages the use of alternative modes, or reduces the need to travel. Instruments can also improve accessibility and mobility for those without a private vehicle, through investment in public transport infrastructure.
- Information – provision of information in easily accessible formats can increase the awareness of alternative modes, leading to a modal shift to walking or cycling. Information can also be provided relating to improving driver behaviour and reduced fuel consumption.

- Technological – when travel by motorised transport is necessary, it can be used to reduce the impact on carbon emissions, for example through developing cleaner fuels and improving vehicle efficiency.

112. These categories each comprise of a diverse range of measures that can form a key component of low carbon transport strategies. Table 3.1 below, which is based upon the expert judgement of the author, gives examples of each of these types of intervention. The interventions vary considerably even within categories and so the potential impact and ease of administration of each of them also differ.

113. When developing a low carbon transport strategy it is imperative to realize that not one policy intervention will provide an appropriate solution on its own. A package of measures, often comprising of a range of the different types of measures, will inevitably be required to obtain synergies with a number of measures reinforcing the impact (and off-setting the disadvantages) of others. The overall strategy must therefore be comprehensive, integrated across all modes, and involve an element of land use planning. It is also worth noting that certain strategies will see their full effects come in place after a prolonged time period, for example land use changes that arise from planning, but that this should not deter practitioners from investment in them as their impact can be considerable

114. The administrative level at which low carbon transport policy interventions are implemented will vary depending upon the measures used. If low carbon policy is to be fully integrated in the transport sector then associated policy instruments will need to be implemented at all tiers of government policy. This will require an analysis and understanding of the role of climate change and transport policy at all administrative levels.

115. Different policy measures are implemented on different levels. Different actors and agencies therefore have responsibility for different policy measures, and this will be reflected in the transport strategies devised at the city/local, regional and national level.

116. The majority of measures tend to be implemented at the national or municipal level. Local governments devise strategies that are appropriate to the local context, and these are enabled or complemented by low carbon transport policies enacted or implemented at the national level. Measures at each level will need to have required support within the relevant constituencies. See Chapter 6 'Institutional Frameworks to address Transport and Climate Change' Think Piece for a detailed discussion of the current and recommended role of governments on these levels in relation to the development of low carbon mobility.

Table 3.1: Types of Policy Instruments and their Potential Impact

	Avoid			Shift			Improve		
	Potential impact	Examples	Ease to administer	Potential impact	Examples	Ease to administer	Potential impact	Examples	Ease to administer
Planning Instruments	★★★	High density mixed land-use development. Parking standards.	Difficult	★★	Integrated public transport planning. Land use planning	Moderate	N/A	N/A	N/A
Regulatory Instruments	n/a	n/a	n/a	★	Parking restrictions. Road space allocations. Restrictions on the type of vehicles that can be used. Direct charges (such as congestion charging, low emission zones)	Moderate	★★★	Set standards that vehicles should adhere to (such as vehicle emissions, Low Carbon Fuel Standard). Set speed limits. Regulate production processes.	Difficult
Economic Instruments	★★	Fuel taxes, Vehicle taxes;	Difficult	★★	Subsidise alternative modes (i.e. rail, bus). Fuel taxes. Road pricing. Purchase taxes. Emissions Trading.	Moderate	★★	Investment in more carbon efficient energy and vehicles.	Difficult
Information instruments	★	Increase awareness of the real costs of travel by car. Mobility management and marketing.	Easy	★	Increase awareness of alternatives. Mobility management and marketing. Co-operative schemes.	Easy	★	Improve driver behaviour (eco-driving schemes). Public awareness campaigns.	Moderate
Technological instruments	★	Develop alternatives to travel (i.e. ICT).	Moderate	★	Improve quality of public transport.	Moderate	★★★	Carbon efficiency improvements. Fuel improvement. Cleaner technologies. End of pipe control devices. Cleaner production. Targeted bio-fuel production	Difficult

★ Some influence ★★ Moderate influence ★★★ Large influence

Source: Authors

3.3.3 Key barriers to implementing low carbon transport policy

117. There are a number of barriers that can be faced when seeking to develop and implement low carbon transport policies. These barriers can result in policy instruments not being implemented, or being implemented in an ineffective manner. In Asian countries, these barriers can therefore compromise their ability to leapfrog and skip unsustainable phases in transport policy. This makes it important for Asian countries to recognise these barriers so that their potential impacts can be planned for and mitigated against in strategy development at an early stage.

118. Monzon et al (2001) explored the barriers to the implementation of policy instruments. They identified the following key barriers:

- Legal and institutional – such as the division of responsibilities between different agencies, which can be subject to poor co-ordination, co-operation and integration, the lack of legal power to influence the activities of the private sector, such as developers, and inefficient or insufficient legal frameworks;
- Financial – primarily restrictions on expenditure and budget, which has a particular impact upon resource intensive measures;
- Political – including low or wavering levels of government commitment to certain measures, which can be linked to the following barrier;
- Social - poor public acceptance of an instrument, perceptions of public transport being for lower classes, and of the private car as a status symbol, which create aspirations to own private vehicles; and
- Practical and technological – such as the need for land acquisition, enforcement and administration, inadequate skills, including management capabilities, and poor availability of technology.

119. The existence of these barriers does not make it necessary to reject certain policy instruments, but instead reinforces the importance of adopting an informed and systematic approach to strategy development. Key to this is effective planning and management, which can in itself directly reduce political and institutional barriers and can also reduce the severity of the other barriers identified. Integral to this is the need for individuals with skills suitable to establish and maintain joint working and co-operation, which can form the basis for effective and sustainable strategy development. Monzon et al (2001) for example state that in many instances local leadership, working in close partnership with higher levels of government and public transport authorities and operators, can lead to the development of policies that are effective at reducing the need to travel and instigating modal shift. The institutional structure of Asian cities should therefore incorporate where relevant devolution of power, finance and skills to regional and local government. This approach is advocated by the United Nations Centre for Regional Development (UNCRD) (see UNCRD, 2009).

120. While it is important to take note of the possible barriers and the need to address these to come to a large scale deployment of the policy instruments listed it is important to take note that several developing countries have taken measures which can be considered as resulting in lower CO₂ emissions. As explained by Huizenga et al (2009) these are however not documented and reported for a combination of reasons. They are not taken with a climate change mitigation objective as main driver. Many developing countries lack the measurement capacity to determine exact CO₂ reductions. Lastly, developing countries have an ambivalent attitude when it comes to discussing mitigation activities. There appears to be a perceived fear

that too much attention could lead to a demand to institutionalize such actions further and the adoption of sectoral or economy wide targets. At the same time however developing countries do want the rest of the world to know that they are taking action.

3.3.4 Importance of packaging

121. The barriers to effectively implementing a policy measure are often overcome by developing a package of measures. Road pricing schemes, for example, are often met with high levels of public, and as a result political, resistance. When accompanied by a programme of public transport improvements and awareness initiatives (which road pricing revenues can reduce financial barriers to implementing), these barriers can be minimized. This relates to the concepts of synergy and co-benefits, whereby the impacts of certain policy measures can reduce the disadvantages, or reinforce the positive impacts, of each other.

3.3.5 Transferability

122. There can also be unforeseen barriers to implementation which can arise from seeking to adapt policy measures from the developed world to a different context. These potential challenges suggest that leapfrogging should focus more on planning and information measures to enhance the role of public transport. These approaches do not require relatively high levels of financial investment, and nor do they require as much institutional capacity as measures that are economic or regulatory, for example.

123. In the longer term the barriers need to be addressed by capacity building in developing countries. Capacity building initiatives should help developing countries to increase their ability to judge the suitability of available policy instruments, and to integrate them within broader land use and sustainable development strategies to maximize their effectiveness. This will complement and provide a framework in which technology transfer can be more successfully integrated within developing countries. The potential for technology transfer to support the leapfrogging process is expected to be reflected in the Post 2012 Climate Agreement.

124. There is a demonstrable need to build capacity on both the national and on the local scale, and the key component of any strategy to do so will require a reform of institutional frameworks in developing Asian countries. Local, regional, national and international tiers of government will need to work more closely, and all levels will need to have adequate knowledge mechanisms, appropriately trained staff and stakeholders if effective policy instruments are to be mainstreamed. This capacity will need to be accompanied by the necessary political will, if low carbon mobility is to be achieved.

3.4 Role of the flexible Kyoto mechanisms for transport – status-quo

125. To support the development and implementation of a leapfrogging strategy in Asian countries and to help overcome the barriers detailed above, there is a need for support in the form of capacity building, technology transfer and financial support. To avoid a major increase in GHG emissions from the transport sectors of Asian countries the role and requirements of a future climate change agreement need to be analysed. The carbon finance mechanisms under the Kyoto protocol, which are introduced below, currently fail to effectively support the development of sustainable transport policies (for either passenger or freight transport) and technologies.

3.4.1 Introduction to the Kyoto Protocol flexible mechanisms

126. The suite of policy measures available to transport decision makers was extended by the Kyoto Protocol, which entered into force in 2005. The Kyoto Protocol (UNFCCC, 1992), which commits countries to limit or reduce GHGs, introduced three market based mechanisms to help countries to achieve binding GHG reduction targets and to supplement national initiatives. These are:

- Emissions Trading Scheme (ETS);
- Joint Implementation (JI); and
- Clean Development Mechanism (CDM).

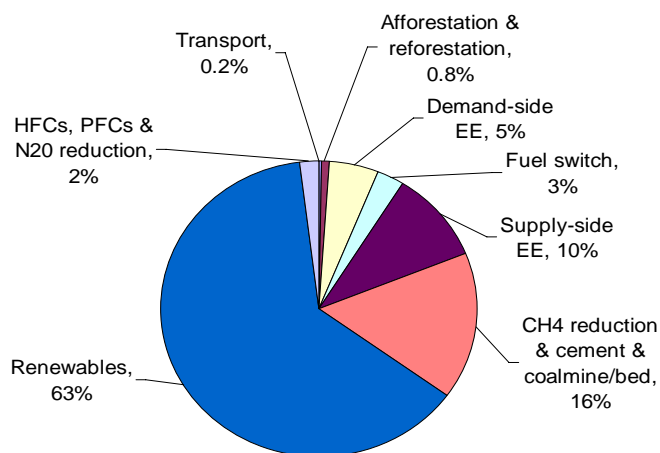
127. It is now widely recognised that none of these flexible mechanisms are a viable option under their current rules for the realisation of low carbon mobility in developing countries. This is reflected in the emphasis of the negotiations, which has moved to other additional approaches such as NAMAs, which are discussed below. Of the flexible mechanisms CDM is the only current mechanism that allows the support low carbon mobility in these countries, although as detailed in the next section even this has had limited application in the transport sector. This is because the ETS enables countries that have reduction commitments under the Kyoto Protocol (known as Annex 1 countries) who will not emit their permitted level of GHG emissions to sell them to countries that have exceeded their targets. JI enables Annex 1 countries to earn 'Emission Reduction Units' (ERUs) by implementing emission reduction projects in another Annex B country.

128. The CDM is similar to JI, although with relevance to developing Asian countries as it enables Annex 1 countries to earn Certified Emission Reduction (CER) credits from emission reduction projects within developing countries (known as non-Annex 1 parties). These CERs can count towards the Kyoto emissions targets of Annex 1 countries. CDM was set up as a first global environmental investment and credit scheme (UNFCCC, no date a) to generate emission reductions while stimulating sustainable development.

3.4.2 Limited application of flexible mechanisms to transport

129. These flexible mechanisms introduced under the Kyoto Protocol currently have limited potential to contribute towards low carbon transport policies. Even though transport was already a key GHG emitter in the 1990s, no special consideration was paid to making these mechanisms applicable to the transport sector. The result is a very low level of applicability of all three mechanisms, not only in Asia but across the world. The RISØ Centre (2009) details that none of the JI projects that were in early 2009 in the pipeline are related to transport. A few applications were made by the transport sector, but these methodologies were not accepted owing to the lack of proof of additionality.

130. With regards to the CDM, only nine of the 4,474 CDM projects in the pipeline are transport related, and only two of these have been registered (out of 1,515 registered projects at March 2009) – the other seven are at the validation stage (UNEP RISØ Centre, 2009). This is shown in Figure 3.2 below.

Figure 3.2: CDM Projects by Category

Source: UNEP RISØ Centre (2009)

131. The two projects that incorporate urban transport are a Bus Rapid Transit (BRT) scheme, called TransMilenio (Phase II to IV) in Bogota, Columbia (project number 0672 using methodology AM0031), and a project improving energy efficiency through the installation of low GHG emitting rolling stock, which uses a regenerative braking system (implemented by the Delhi Metro Rail Corporation) (project number 1351 using methodology AMS-III.C.ver.10).

132. The Indian scheme which seeks to reduce the emission of GHGs from rolling stock is a small scale project that it is expected will lead to a reduction of 41,160 tonnes of CO₂ a year. The TransMilenio project is, however, of a larger scale and was initially expected to reduce emissions of CO₂ by 246,563 tonnes a year (CAI, 2008). It aimed to achieve this through enhancing resource efficiency (fuel consumption and emissions per passenger trip), and by creating a modal shift within its catchment area (UNFCCC, 2007b). In reality the emission reductions achieved by the project have, however, been lower than forecast. In the crediting year 2008 it was estimated that total emission reductions achieved were 68,813 tonnes CO₂ equivalent. The mismatch between actual and anticipated emission reductions has been attributed to a lower than forecast level of modal shift (Grütter Consulting, 2009).

3.4.3 Key barriers for CDM in transport

133. The barriers outlined above can be experienced when seeking to implement a wide range of policy instruments, although a number of barriers relating specifically to the effectiveness of CDM have also been identified. Kieskamp et. al (no date) contends that the following factors are all barriers that have contributed to the limited number of CDM transport projects:

- The difficulty in determining what change would have occurred in the absence of the project;
- Emissions from individual sources are relatively small;
- Emissions are very dispersed;
- Extensive linkages to other economic activities (makes it more difficult to give boundaries to a project); and

- Transport's strong relationship with human behaviour (which can make evaluation difficult).

134. The CAI (2008) identified a number of additional barriers to the role of the transport sector in the CDM:

- The relatively small amount of CDM revenue available relative to total project costs; and
- Transport projects are primarily designed to achieve goals other than GHG reduction.

135. The CAI (2008) and Dalkmann et al (2007) state that the barriers listed above make methodological development, data collection and verification difficult. As highlighted previously, this makes it necessary for significant reforms to the CDM, and other flexible mechanisms, to achieve more reductions in GHG emissions from the transport sector.

3.5 Post-2012 Process

3.5.1 Framework

136. The Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report (2007) states that Annex I countries will need to reduce their emissions by between 25 to 40% to below 1990 levels in 2020 to achieve a target of 450ppm CO₂ equivalent, between 10 to 30% for 550ppm, and between 0 to 25% for a target of 650ppm. Lately, opinions have started to converge on the need to focus on the lowest and most stringent target of 450ppm CO₂ equivalent. It is now assumed that at the same time emissions in developing countries will have to deviate substantially (15-30%) from their business as usual scenarios by 2020 to achieve the global target of 450ppm CO₂ equivalent. These ranges are likely to vary between countries, but nevertheless highlight the necessity for the transport sector to intensify its contribution to mitigation. The status of the current climate change negotiations indicate that rather than this being realised through the adaptation of existing flexible mechanisms alternative approaches, such as those detailed in the Bali Action Plan (BAP) (UNFCCC, 2007a) will need to be pursued.

137. The BAP was developed at the COP 13 in Bali in December 2007. It sets the framework for the current negotiations and should lead to a new global agreement in December 2009 when a follow-up to the Kyoto Protocol will be agreed. It was the first time that developing countries agreed to consider adopting associated measures.

138. Apart from the general acknowledgement of the need for a significant reduction of GHG, the BAP contains several elements which should be taken into consideration in a final agreement. These are currently being discussed by the AWG-LCA subsidiary body under the Convention (see Box 3.1 below). The key issues under discussion are:

- Sectoral approach – the BAP calls for co-operative sectoral approaches and sector-specific actions to implement the Convention;
- NAMAs (Nationally Appropriate Mitigation Actions) – by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building. This should be co-ordinated with the MRV approach;
- Technology transfer – this should play a role in the pursuit of NAMAs to support both mitigation and adaptation. Technology development and transfer should, for example, be used to enhance deployment, remove barriers, and to enhance the effectiveness of mechanisms in specific sectors.

- MRV (Measurable, Reportable and Verifiable) approach – including quantified emission limitation and reduction objectives by all developed country Parties, while ensuring the comparability of efforts among them and taking into account the different national contexts.
- The request for industrialised countries to commit to economy wide reduction targets.
- Finance – adequate and appropriate financing arrangements are required to support mitigation and adaptation actions.

Box 3.1: Ad Hoc Working Groups

The Conference of the Parties established two working groups in 2005. The groups were established as subsidiary bodies under the Convention, and they are due to report the outcome of their work at the COP15 in December 2009. They are:

- AWG-KP (Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol). This group will discuss the next commitment period of the Kyoto Protocol and the responsibilities of the industrialised countries under this Protocol. Key topics include reduction targets for industrialised nations (with the exception of non signatories to the Kyoto Protocol as the USA) and further development of flexible mechanisms such as CDM.
- AWG-LCA (Ad Hoc Working Group on Long-term Co-operative Action). This group is tasked with supporting the full, effective and sustained implementation of the Convention through long-term and co-operative action beyond 2012. It will negotiate a complementary agreement under the UNFCCC, which is likely to include the USA's reduction targets, climate protection obligations of emerging economies, REDD, adaptation, large-scale technology cooperation, and financing.

There are a number of fundamental overlaps between the two negotiating streams, and their convergence of these will be a central issue at COP15.

139. The Bali Action Plan refers to the importance of tackling different sectors that can play a role in reducing GHG emissions. The BAP also gives an indication of the type of instruments that might be used in the future to help the transport sector to more effectively fulfil this potential. If these instruments are to support a leapfrogging development trajectory and the implementation of an Avoid-Shift-Improve strategy in developing countries then they will, however, need to overcome the barriers to creating a low carbon transport system.

140. The only specific sector mentioned by the Bali Action Plan is the forest sector. The initiative that addresses this sector is known as REDD (Reducing Emissions from Deforestation and forest Degradation in developing countries). It was introduced into the COP agenda in 2005 in recognition of the need to reduce emissions from the sector (see UNFCCC, 2009b). Reference to specific sectors is also missing from the vast majority of other official documents like the work under the AWG-LCA that contain suggestions for new mechanisms. As has been argued in the former section, key lessons that must be learned from Kyoto are that if there is no specific discussion over whether instruments can work for a certain sector, then there is a risk of the sector being excluded. This is therefore something that needs to be addressed.

141. An analysis of the current submissions by Parties to the AWG-LCA (see UNFCCC, 2009b) shows that there have only been a few attempts made to involve transport at this stage

of the negotiation. UNEP with support of several other organisations¹⁰ is the only organisation that has made a recent submission which supports the full recognition of the role of transport in a COP15 agreement. It encourages the promotion and development of workable policies and measures that reduce CO₂ emissions from the sector. The submission was jointly developed with a wide range of international organisations who also support the initiative (UNEP, 2009).

3.5.2 Overall direction

142. For a post 2012 agreement to be effective, transport will need to be an integral part in recognition of the fact that it is not just part of the problem, but also part of the solution. It is important that any such agreement incorporating targets and future mechanisms and instruments will be reached in Copenhagen is fully applicable to the transport sector. This is a precondition for a comprehensive scaling up of the current mechanism, as well as planned new NAMAs, if it is to have any significant effects on the control of GHG emissions from Asian countries, and if it is also to provide any kind of incentive for leapfrogging in these countries. A consortium of organisations has initiated a programme of ongoing research and policy activities to support this aim and to provide substantial inputs into the debate (for more information see www.sutp.org/bridging_the_gap).

143. There is a need for a broad variety of action to be taken on all levels from the local to the national if a leapfrogging strategy is adopted to support the implementation of a low carbon transport system in developing countries. With the increasing awareness that transport has to be part of the solution to tackle climate change the potential of a new international Climate Change Agreement supporting a sustainable transport strategy needs to be explored. This needs to be made an international priority, with progress needing to be made before Copenhagen at the end of 2009 when a new Climate Change Agreement will be adopted.

144. The CAI (2008) and Wittneben et al (2009) recommended that to overcome barriers experienced in relation to the existing flexible mechanisms any new instrument of use to the transport sector should:

- Use a sectoral system wide rather than project based approach;
- Incorporate the co-benefits of transport projects, such as reduced pollution and congestion; and
- Integrate with other processes, such as national and local regulatory processes.

145. To be effective the potential role of transport should be recognized by explicitly developing a broad variety of instruments to support its inclusion. This would facilitate a leapfrogging strategy for transport development in developing countries. The effective integration of transport and climate change strategies Post 2012 will also depend upon the ability to address the following three issues:

- Measurability - unless a very conservative base-line is set then emission reductions could be overstated;
- Price of carbon – unless a system is created in which the demand for credits keeps going up the price would decrease and therefore make it more difficult for developing countries to invest in sustainable transport systems; and
- Governing the process – in the absence of a suitable governance and institutional framework then the effectiveness of the approach will be compromised.

¹⁰ Transport Research Foundation (TRF), the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), the International Association of Public Transport (UITP), ICLEI-Local Governments for Sustainability, Energy Research Centre of the Netherlands (ECN), and the Institute for Global Environmental Strategies (IGES).

146. More specifically the following are key principles that should be used as the basis for climate policy and land transport in developing countries (GTZ et al, forthcoming):

- Support a paradigm shift to a low-carbon transport system where negative externalities are fully internalised;
- Realise co-benefits (see Section IV of this report);
- Ensure environmental integrity;
- Strengthen political will;
- Consistency across the short to long-term;
- Cost-effective;
- Shared effort (i.e. technology and knowledge transfer);
- Context specific;
- Predictable and adequate funding support;
- Support cross-sector effects;
- Strengthen institutional capacity; and
- Ensure transparency and accountability.

3.5.3 Upscaling

147. Only a comprehensive upscaling strategy can sufficiently catalyze the contribution of the transport sector towards low carbon mobility (Sanchez 2008, Wittneben et al 2008). This section will briefly describe the different opportunities presented by an up-scaling scenario before analyzing the potential link between this approach and the different sustainable transport instruments and the implementation of leapfrogging.

Table 3.2: Two Qualitative Post 2012 Alternatives: Trend and Potential

Post 2012 - Status Quo	Post 2012 – Upscaling
Weak link between Post 2012 agreement and (Sustainable) Transport.	Strong Link between Post 2012 instruments and Sustainable Transport.
Extended flexible mechanisms (PoA CDM) but no major transport recognition.	No lose sectoral targets in place/NAMA as a framework
Carbon Finance as a minor driver for Implementing Sustainable Transport Policy (Low Incentive)	Carbon Finance as an important driver for implementing Sustainable Transport Policy (High Incentive)
New methodologies, additionality no further barrier	Targets established, and commitments made to them, at both the national and the urban level
Adaptation Fund plays no role for transport	Adaptation Fund ¹¹ combined with mitigation actions.

Source: Authors

148. The 'Post 2012 Trend' qualitative scenario outlined in Table 3.2 above suggests that without intervention specifically related to the transport sector then the exclusion of the sector from associated flexible mechanisms will continue. If this scenario is experienced and if upscaling is not achieved, the link between the transport sector and the Post 2012 agreement will not be fully recognized.

149. The adoption of an upscaling approach is required as the mainstreaming and promotion of instruments and strategies is necessary if they are to have the optimal level of impact.

¹¹ The Adaptation Fund is not discussed in this paper, but for recommendations please see Dalkmann et al (2009).

Upscaling is, however, a practical and efficient approach that can help to broaden participation on a global scale and therefore to increase awareness about ways in which to pursue low carbon mobility. Implementation of this approach would simplify the negotiation process and lead to efficiency gains by targeting efforts and pooling resources, thereby addressing competitiveness.

150. The upscaling scenario outlined in Table 3.2 is based on the currently discussed options for sectoral approaches under the AWG-LCA. This is the working group which is responsible for the effective and sustained implementation of the Convention. Baron et al (2009) differentiate between domestic sector based efforts, sector based technology cooperation and transnational sectoral approaches. The focus of the upscaling scenario detailed here will be on domestic options for a sectoral approach, which is seen as the most feasible one for transport.

151. Huizenga et. al. (2009) suggest that rather than to look at external mechanisms like CDM, NAMAs and climate related funding mechanisms as a means to replace domestic financing or to achieve short term emission reductions developing countries would be better served if they try to optimize the use of these external mechanisms to catalyze a comprehensive long term transformation of transport systems in their countries and cities.

152. While these upscaling options are currently being discussed for the new post-Kyoto climate regime, there is also a discussion about the current instruments and how these can be improved (AWG-KP- see Box 3.1 above). One of the options being discussed by the Programme of Activities (PoA) is the so-called Programmatic Approach for CDM.

153. The Programmatic Approach for CDM enable a number of projects, potentially relatively small scale initiatives, to be scaled up into a larger project that is viable for CDM. Projects using this approach, which can involve a range of projects implemented in separate locations and across sectors, are already being accepted under the current regime (Ellis, 2006). A future application of the programmatic approach in transport would enable the development of several similar activities in different cities, such as BRT. This would increase the amount of available credits and achieve economies of scale, leading to reduced costs, risk and administrative burdens and the potential to generate CERs across an entire region.

154. Some recommendations to the current project CDM rules could be implemented under the Kyoto Protocol as well. Consultations undertaken by the CAI (2008), for example, led to the following recommendations for the modification of flexible mechanisms to enhance their applicability to the transport sector:

- Make more use of the 'first of its kind' approach to demonstrating additionality;
- Develop a standard methodology that could be adopted in multiple cities;
- Create a fund to finance data generation, collection and assessment for the transport sector; and
- Enable co-benefits of projects to increase the value of CERs.

155. A sectoral approach would be a key component of an upscale scenario and could enable the implementation of sustainable transport policy instruments. There is indeed widespread consensus that a sectoral approach could be an effective way to help to support the reduction of CO₂ emissions from the transport sector. One option is that a transport mitigation action plan could be linked to National Transport Plans, which could include all modes of transport and cover the variety of available policy instruments. The key advantage of such an implementation

is the flexibility in choosing the options which can be adopted for the specific country requirements. However, an important issue for transport would be to link national actions to local activities. This is owing to the fact that without strong commitment at a local level, instruments are unlikely to achieve any improvement.

156. Browne et al (2005), Wittneben et al (2009) and Sanchez (2008) state that a sectoral approach would help to overcome the methodological challenges faced by the transport sector in relation to the current approach (i.e. the complexity of the transport sector compared to stationary sources of GHG emissions). They also state that it could help to incorporate activities or strategies outside the local context, such as spatial or transport planning.

157. Baron et al (2008) recommend the adoption of the following domestic options for a sectoral approach:

- Non-credit efforts, such as policies and measures or other 'nationally appropriate mitigation actions' (NAMAs). These are being considered as a framework for countries undertaking mitigation actions in a particular sector either with or without seeking crediting for estimated emission reductions;
- A sectoral crediting mechanism either through the extension of the CDM or the establishment of a new mechanism. This proposed sectoral CDM approach would see emission reductions credited when emissions are below a baseline established for the sector as a whole;
- Application of 'no-lose' or 'non-binding' targets. This would mean that the only emissions benefits credited are those which are below a target established at a relatively ambitious level; and
- Sector wide emissions commitments that allow the possibility to trade.

158. The scaling up of a CDM or any other future mechanisms towards a sectoral level could, however, also exacerbate some of the barriers experienced. Wittneben et al (2009) caution that such an approach is not likely to reduce the methodological difficulties associated with CDM transport projects, but could instead increase the complexity of projects and the uncertainties surrounding baseline development, project monitoring and the emission reductions achieved. The associated implications of conducting a CDM project developed on a false premise are that it could allow more GHGs to be emitted from developed countries. It is suggested therefore that if policy makers decide to take a sectoral approach the following steps should be taken:

- Quantify the uncertainties that transport projects face, and discount CERs based on the calculations;
- Use highly conservative estimates when calculating the baseline;
- Implement rigorous ex-post assessments to estimate which part of the emissions reduction is likely to be due to the project activity, and which is external; and
- Reach an understanding that not all emission reductions will be credited.

159. The potential characteristics of a sectoral approach that could effectively contribute towards an 'upscaling' strategy and contribute to overcoming some of the discussed barriers are detailed in the following section. It is also indicated in Table 3.3 below, which suggests the relative potential for mechanisms to contribute to reductions of carbon from the transport sector based upon the expert judgement of the author. The potential opportunities specifically include increasing vehicle efficiency, obtaining modal shift and reducing demand, mirroring the avoid-shift-improve paradigm presented earlier. These opportunities need to be fully exploited to realise the full low carbon potential that can be delivered by the flexible instruments introduced under the Kyoto Protocol.

Table 3.3: The Potential of Proposed Flexible Mechanisms to Contribute to a Low Carbon Transport System

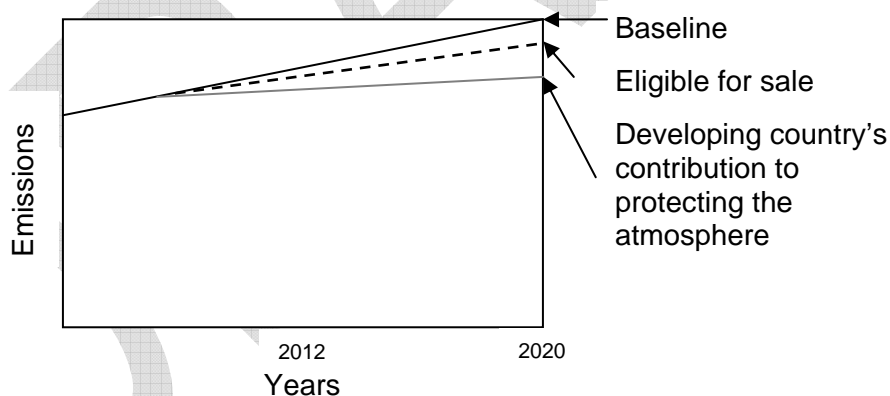
	Status-Quo	Post 2012
Project CDM	★	★
Programmatic CDM	★	★★
Sectoral no lose*	0	★★★
NAMA*	0	★★★
Sectoral CDM	0	★★★

Notes: ★ Some potential ★★ Moderate potential ★★★ High potential

Source: Authors

160. The UNFCCC negotiating text currently contains provisions for three different types of NAMA; unilateral, tradeable and non-tradeable (UNFCCC, 2009a). It also provides the scope for a sectoral CDM to be incorporated into tradeable NAMA. This could work by actions undertaken being eligible to acquire carbon credits, something which could be enacted through a crediting scheme such as an upscaled CDM. An option to link NAMAs with sectoral no-lose target could be an interesting approach for transport (see Dalkmann et al, 2009). If the no-lose target approach (see Figure 3.3 below) was further developed for the city level, then there would be an option to support the leapfrogging strategy. Having an incentive to implement sustainable transport strategies and receiving credits for the additional activities could have a major impact.

Figure 3.3: The potential impact of a sectoral no-lose approach (for illustrative purposes)



Source: Author

161. The dotted line in Figure 3.3 above indicates what is achievable when Parties have voluntary commitments, whilst the lines below indicate what could be achieved if additional mechanisms were adopted and credits made eligible for sale. This therefore gives decision-makers an enhanced incentive to pursue a strategy of leapfrogging.

162. An 'Avoid' strategy seems unlikely to be credited to a programmatic approach, which would cover modal shift as well as improvement strategies. While a sectoral CDM could intend similar effects to a programmatic approach, it also support avoidance strategies via a better integration of land-use and transport planning.

3.6 Conclusions

163. There is widespread growing recognition that there is the need for transport to play a strong role in the post-2012 agreement. This has been acknowledged in the context of both the developed and developing world. In relation to the developing world, this is due to the urgent need to help Asian countries leapfrog the high level of car dependency, and the associated high levels of energy consumption, experienced in the developed world. This now appears to be the most feasible way in which to avoid high increases in GHG emissions from developing countries in the future. An immediate recommendation for the AWG LCA might therefore be to take steps to increase the priority of supporting a low carbon trajectory for land transport in developing countries. This will require an integrated transport and climate change strategy that incorporates policy instruments that avoid, shift and improve transport demand and the performance of modes of transport. It will also require the role of transport within the flexible mechanisms of the Kyoto Protocol to be analysed, and the benefits for modifying these mechanisms, notably the CDM, to be realised.

164. If leapfrogging is to be an effective approach to reducing carbon emissions from the transport sector, governments need to be committed to embedding low carbon transport into their overall strategy of sustainable development and they will need to take an integrated approach to development, which is economically, environmentally and socially accountable. The process can occur naturally, but to ensure that the optimum trajectory is followed government intervention, with international support, will be necessary. It will also require a framework of transparent decision-making, which can effectively and sustainably accommodate and reconcile multi-stakeholder interests.

165. The success of developing countries to adopt and implement Avoid-Shift-Improve oriented policy instruments will be strongly influenced and determined by the institutional frameworks and capacity that countries and cities can mobilize in the next 5-10 years. A large part of the investment decisions which will lock in transport related emission patterns for the coming 20 to 30 years will be taken in the next 5 years.

166. The development of low carbon mobility within developing countries will require strong commitment from all institutions on levels from the local to the international. Table 3.4 outlines the role of international, national and local government post-2012 both in relation to the current trajectory and if 'upscaling' is possible. The upscaling approach outlined in Table 3.5 below details three key factors that will need to be realized as a minimum if post-2012 policy is to become a success. These factors emphasise the fact that incorporation of the transport sector in the post-2012 process is not enough (although steps listed in the 'post-2012 Trend' column below would have a positive impact on the sustainability of the transport sector), but that concerted actions must be taken on all levels. The implications of this not being achieved are that GHG emissions will increase in developing Asian countries and opportunities for leapfrogging the car dependent development of developed countries will be missed.

167. Table 3.4 presents two options for Post 2012. The 'Post 2012 Trend' represents a continuation of the current approach and practices supported by the UNFCCC, which the authors contend are not working for transport or carbon finance. We therefore suggest that for the full potential of Post 2012 to be realized finance will also need to be made available outside of the Convention and the 'post-2012 Up-scaling' approach summarised in Table 3.5 followed. The national level is likely to play a significant role in this.

Table 3.4: Future actions for a low carbon mobility under different scenarios

Post 2012 Trend	Post 2012 Success - Up-scaling
Main responsibilities on national level – strong support from donor organization needed	Key role for international community – Implementation and Monitoring
Strong shift of national financial investment towards low carbon transport solutions (carbon tax etc.)	National government and urban decision-maker to set framework to combine carbon finance with local/national actions
Integrate Climate Change into Transport Planning and Policy	National Action Plans, Local Transport Plans needed

Source: Authors

168. The overarching requirement for post-2012 will be that a process is developed that provides a framework in which national and international stakeholders can implement a low carbon mobility strategy. Any such strategy and its components should be developed around the MRV approach advocated by the BAP, which is widely recognized as being crucial for both a better understanding of the problems currently faced and for the development of any future carbon mechanism. The MRV approach will have implications for data collection, institutional requirements and governance structures, which will provide a framework in which action that is more appropriate for the transport sector can be taken within.

169. To help determine the feasibility of an MRV approach, and to identify any potential risks associated with an upscaling approach, a pilot phase in 2009/2010 could be implemented. This could lead to the development of solutions to overcome any risks and barriers that may be faced, and for these lessons to be effectively addressed within a Post 2012 agreement. Some form of acid test will inevitably be required to ensure that any mechanisms or approach modified or adopted work for the transport sector.

170. This chapter has outlined numerous barriers, both in relation to flexible mechanisms and the capacity of developing countries, and it is clear that joined up action across all tiers of government and with key institutions will be required to overcome them. The success of any such actions will depend upon the availability of finance to support this process, but more fundamental than this will be strong political will and commitment to achieving low carbon mobility in developing Asian countries. All action taken will, however, need be taken based on an understanding that mechanisms adopted will have to work for transport.

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4. Co-Benefits of Transport and Climate Change Mitigation

4.1 Introduction to Co-benefits

171. Policies and actions in the transport sector usually have a range of objectives. For example the implementation of a Bus Rapid Transit corridor will usually reduce the travel time for bus passengers but it will also reduce the number of accidents that busses are involved in, the newer busses will often have lower emissions and because of the higher average speed have lower CO₂ emissions. While many definitions of co-benefits exist,¹² in the past years the concept of co-benefits is increasingly used in the context of climate change mitigation and promoted as an essential part of the post-Kyoto Protocol negotiations (see Box 4.1). From this perspective, co-benefits are additional benefits beyond greenhouse gas (GHG) reductions resulting from climate mitigation measures. Examples include reduced air pollution and associated health benefits, and improved energy security through reduced energy use and costs.

Box 4.1: The importance of co-benefits in the context of climate change mitigation especially for post-Kyoto Protocol negotiations

"We should go further and adopt environmental policies that promote health benefits... We should do the same as we tackle the inter-related challenges of climate change, public health, food security and growing energy demands". – Ban Ki-moon UN Secretary General, 2009

"International climate change policy is based on the polluter pays principal. It clarifies that the party responsible for any environmental damage should also be responsible for paying the cost for cleaning it up. Internalization of these external costs will show the full price tag of freight and passenger transport". - Yvo de Boer, Executive Secretary. United Nations Framework Convention on Climate Change, 2009

"On launching negotiations for establishing the future framework, there are three elements which are essential...we should include the elements of a global long- term goal; efficiency, energy security and co-benefits" - Ichiro Kamoshita, Minister for Environment of Japan, 2007

"Efforts are needed to pursue sustainable development, as climate change is ultimately a development issue and it can only be addressed in the course of sustainable development. We should optimize the energy structure, promote industrial upgrading, develop low-carbon economy, build a resources-conserving and environment-friendly society and thus address the root cause of climate change" – Hu Jintao, President of People's Republic of China, APEC meeting 2007

¹² Huizenga, Cornie, C.K. Castillo, M. Ajero, and D.J.C. Sanqui. 2008. The Co-benefits Approach: An Integrated Policy Response to Climate Change and Development in Asia. In Climate Change Negotiations: Can Asia Change the Game?. Chapter 3, edited by Christine Loh, Andrew Stevenson and Simon Tay: Civic Exchange. [http://www.civic-exchange.org/eng/upload/files/200810_ClimateBook\(1\).pdf](http://www.civic-exchange.org/eng/upload/files/200810_ClimateBook(1).pdf). For a full discussion of the different definitions of 'co-benefits', refer to: Castillo, C. K. G. et al. (June 2007) "The Co-Benefits of Responding to Climate Change: Status in Asia", US EPA, Manila Observatory, and CAI-Asia. <http://www.cleanairnet.org/caiasia/1412/article-71843.html>

172. The aim of the co-benefits approach is to maximize the intended impacts of a policy or intervention (e.g. GHG or air pollutant reductions or traffic congestion) at reduced overall costs to society through integration of multiple objectives in policies and projects. The possibility to maximize the developmental returns on climate change mitigation investments was specifically acknowledged by the International Panel on Climate Change (IPCC) in its most recent Assessment Report: “Integrating air pollution abatement and climate change mitigation policies offers potentially large cost reductions compared to treating those policies in isolation”.¹³

173. The co-benefits approach:

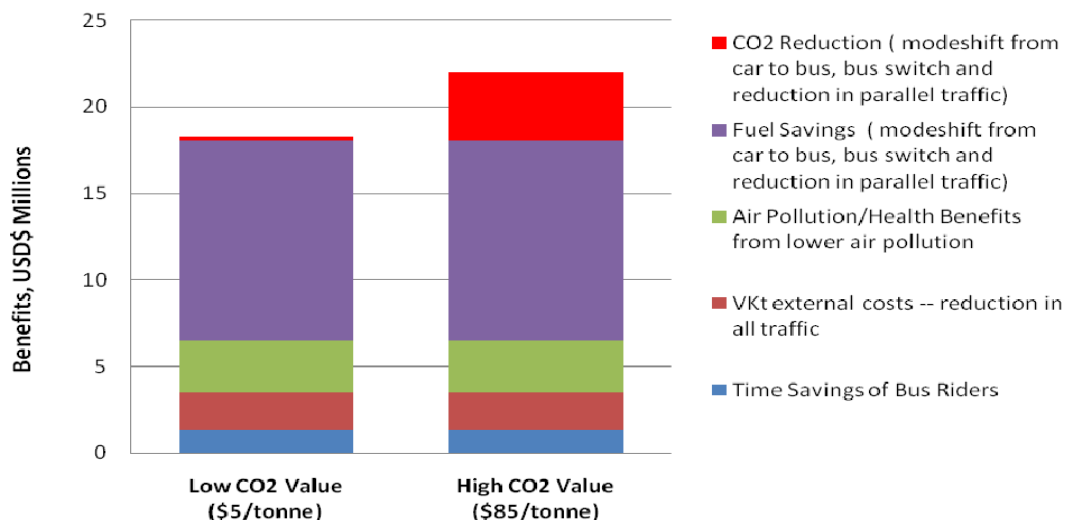
- Intentionally internalizes co-benefits at the conception of a policy or project to maximize co-benefits, as opposed to ancillary or secondary benefits of a policy or project that are coincidental.
- Takes into account measures leading to benefits over a shorter time period (called transitory benefits) as well as measures resulting in long term GHG reductions and other benefits.
- Considers co-benefits and trade-offs, to ensure that a policy or project intended to maximize co-benefits in one problem area does not adversely cause another problem, or if it does, at least the trade-offs can be minimized.

4.2 Climate Change Mitigation as a Co-benefit of Transport Policies and Projects

174. When applied in practice, however, climate change is often not the key driver of developmental policies and projects, but rather GHG reduction is the co-benefit. This is certainly the case for the transport sector, where transport policies and projects are traditionally aimed at reducing traffic congestion, improving road safety, reducing vehicle operating costs, reducing air pollution or improving access.

175. Important reasons for this are that the majority of developing countries have not yet adopted economy wide or transport sector specific CO₂ reduction objectives and potential financial earnings from reduced CO₂ emissions sold as carbon credits are significantly lower than earnings or cost savings associated with reduced traffic congestion and vehicle operating costs. Figure 4.1 provides an example of earnings/cost savings from CO₂ and fuel reductions for a bus rapid transit system in Mexico City. The figure shows that even when the price of carbon is increased from \$5 to \$85 that the CO₂ benefits are very modest.

¹³ IPCC (2007a) ‘Summary for Policymakers’, in “*Climate Change 2007: Mitigation of Climate Change. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.*” <http://www.ipcc.ch/SPM040507.pdf>

Figure 4.1: Fuel savings and CO₂ savings of a BRT corridor in Mexico City¹⁴

Source : Rogers, 2006 for CO₂, INE for health, and Lee Schipper, Global Metropolitan Studies, UC Berkeley for assembling the data, estimating the value of saved fuel and the value of saved CO₂.

176. With this in mind, benefits for transport policies and projects can be categorized as follows:

- ***Benefits*** - are the primary intentional goal of policies and project, which in many cases are reduced traffic congestion (measured as increased vehicle speed, level of service and capacity of persons/goods, etc.) but depending on the specific policy or project can differ.
- ***Primary co-benefits*** - are other benefits that directly result from transport policies or projects, for example, increased productivity through travel time savings, reduced GHG emissions, reduced air pollutant emissions, reduced noise levels, improved equity, improved safety, and reduced fuel subsidies paid by governments. These primary co-benefits are sometimes accidental but in the case of a well developed strategic capacity of policy makers can be intentional.
- ***Secondary co-benefits*** - are benefits that indirectly result from transport policies or projects, i.e. as a consequence only of the primary co-benefits. For example, improved public health and reduced health costs due to reduced air pollution or increased physical exercise, and reduced other pollution (to soil, water and as waste).

177. Although climate change may not be the key driver of transport policies and projects, it is important not to neglect the potential influence of climate change on future transport policies and projects. The growing pressure to mitigate GHG emissions will increasingly influence and put pressure on broader policy frameworks in society (such as urban planning and energy management) to increase the role of climate change in the design and implementation of transport policies and programs. A post-Kyoto agreement with a strong emphasis on mitigation and an acknowledgement of the important role that transport in developing countries should play will undoubtedly help in raising the profile of CO₂ reduction in the transport sector. Similarly,

¹⁴ Source EMBARQ, based on Instituto Nacional de Ecologia (INE), May 2008, "The benefits and costs of a Bus Rapid Transit System in Mexico City".

as climate change adaptation gains political momentum, government policies will increasingly consider the impact of climate change on transport infrastructures, witnessed by recent events, such as the buckling of rail tracks in Melbourne in Australia due to extreme heat or damages to transport infrastructure due to increased flooding and typhoons in various parts of Asia.

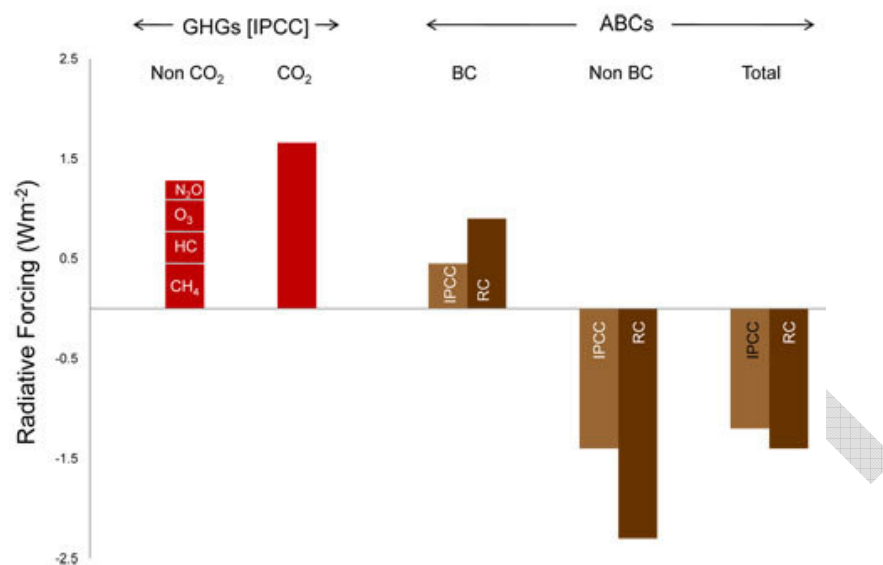
178. So far the discussion on transport and climate change has focused mostly on the role of CO₂ emissions and other Kyoto gasses.¹⁵ More recently the role of two other pollutants which are directly related to transportation is being highlighted more. This concerns ozone (O₃) and black carbon (BC). O₃ is being formed in hot weather from carbon monoxide (CO), Nitrogen oxides (NO_x) and volatile organic compounds (VOC). All three of these pollutants are closely associated with the rapid motorization in Asia.¹⁶ As shown in Figure 4.2, air pollutants can have a cooling effect (negative radiative forcing) or a warming effect (positive radiative forcing). Special attention should be given to black carbon, which is now considered the second most important contributor to global warming, after CO₂. Black carbon deposits on Himalayan snow accelerate the melting process set in motion by global warming. On the ground, especially in cities, black carbon and ozone causes ground temperatures to rise. Furthermore, air pollution, in particular that coming from Asia, has intensified the Pacific storm track and aerosols are thought to contribute to Arctic and Himalayas warming.¹⁷ While CO₂ stays in the atmosphere for longer term (a hundred years), black carbon and ozone are short-lived pollutants. Due to the increased emissions contribution from diesel trucks for black Carbon and gasoline vehicles for ozone, BC and O₃ are pollutants of concern in the transport sector. The implication is that integrated policies and projects aimed at reducing GHGs and air pollutants such as O₃ and black carbon, in the transport sector will be much more effective than those emphasizing GHG emissions only. In many parts of Asia while there is no tradition yet of policies and programs on CO₂ mitigation there is a tradition of air pollution control which can be tapped into.

¹⁵ Kyoto gases include – Carbon dioxide (CO₂), methane (CH₄), Nitrous oxide (N₂O), Sulphur hexafluoride (SF₆), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).

¹⁶ The mean anthropogenic radiative forcing resulting from all GHGs is estimated to be +3.05 W m⁻² of which tropospheric ozone for +0.35 W m⁻². In addition, it is estimated that black carbon accounts for +0.34 W m⁻² in the atmosphere and an additional +0.1 W m⁻² on snow. Regionally, however, black carbon heating effects can rival that due to CO₂ increases, for example in the Arctic and the Himalayan-Tibetan glacier regions. (Source: http://www.sei.se/gapforum/conf/Stockholm_Co-benefits_Main_Conclusions.pdf)

¹⁷ Zhang, Renyi, Guohui Li, Jiwen Fan, Dong Wu and Mario Molina. Intensification of Pacific Storm track linked to Asian pollution. PNAS March 27, 2007 vol. 104 no. 13 5295-5299
and Voiland, Adam. 2009. Aerosols May Drive a Significant Portion of Arctic Warming. http://www.nasa.gov/topics/earth/features/warming_aerosols.html

Figure 4.2: Global Radiative Forcing due to greenhouse gases (GHGs) and atmospheric brown cloud components (ABCs), including black carbon (BC)¹⁸



Source: Ramanathan, V. and G. Carmichael (2008).

4.3 Status of the Application of the Co-benefits Approach in Transport

179. The application of the co-benefits concept is increasing worldwide especially at the policy level. However, this is still mostly at the level of policy intentions, rather than integrated in detailed actual policy or project design. The policy intentions are mostly based on assumed or modeled data rather than measured data. It is noted that different policies in the *avoid–shift–improve* model described in the previous chapter on policies and policy instruments will bring different co-benefits, and these co-benefits may be different between developing and developed countries. For example, because the motorized per capita trip rates (e.g. number of trips per person in a day) in developing cities are dominated by old high polluting vehicles then the co-benefits of planning instruments focusing on “improve” will have relatively higher impacts than policies oriented towards “shift” where people from low carbon NMT would move to motorized public transport. With many cities in developing countries yet to develop a strong planning capacity, planning instruments such as efficient mix of land use-transport-environment can bring about higher co-benefits compared to developed cities. Similarly, in developing countries, regulatory and planning instruments targeting the freight sector can bring relatively large and immediate co-benefits compared to developed countries.

180. So far, co-benefits in the transport sector has been assessed and studied in different manners:

¹⁸ Ramanathan, V. and G. Carmichael (2008). Global and regional climate changes due to black carbon. *Nature Geoscience*, 1, 221-227.

- *Multi-criteria analysis (MCA) as part of determining the feasibility of transport projects* – this involves the assessment of transport projects against a broader range of criteria that may include the co-benefits (synergies and trade-offs) of transport projects mentioned earlier, and usually involves a combination of cost-benefit analysis, cost-effectiveness analysis, and qualitative analysis. Bilateral and multilateral development agencies, such as the Asian Development Bank (ADB), World Bank, and Japan International Cooperation Agency (JICA), as well as several developed countries, such as the UK, increasingly apply MCA. However, MCA is not widely institutionalized, especially in designing projects in developing countries.
- *Environmental impact assessments (EIA) of transport projects* – EIAs are mandatory for transport infrastructure and other projects in most developing countries. However, EIAs tend to focus more on mitigating adverse impacts rather than on enhancing potential benefits, and are usually conducted too late for co-benefits to be integrated in the planning and design of transport projects.
- *Research studies on co-benefits of transport policies and projects* – this involves the assessment and quantification of co-benefits (e.g. reduction in CO₂ or air pollutant emissions), and sometimes the conversion to earnings (e.g. carbon credits) or savings (e.g. reduced health costs resulting from air pollution reduction). Research institutions and universities, often in partnership with development agencies, conduct such academic studies or impact evaluations as separate exercises and mostly after the policy or project has been implemented. This limits the ability to influence decisions made during the design and planning phase and thus reduces the co-benefits potential. Examples of such studies are: (a) Co-benefits of the bus rapid transit (BRT) system in Mexico City, which included time savings, CO₂ reductions, and PM₁₀ emission reductions and associated potential earning or cost savings of USD 12.3 million per year;¹⁹ (b) Co-benefits for GHG (CO₂) and air pollution (PM₁₀) for transport improvement projects in various Asian cities;²⁰ and (c) Co-benefits of GHG reduction in transport-related plans and projects (including railway projects and transport master plans) funded by Japanese ODA loans.²¹

181. Table 4.1. also gives an overview of a series of studies that have attempted to identify and quantify co-benefits in the transport sector.

Table 4.1: Overview of Recent Studies Related to Co-Benefits in Transport Sector

Study/ Research/ Project	Benefits Quantified/Results
Creutzig and He (2009)	In Beijing, social costs of climate change amount to 1.4 billion RMB per annum which was valued higher than Noise (0.9 Billion RMB/annum), accidents (1 billion RMB/a) but less than air pollution (19.8 Billion RMB/annum) and Congestion (22.8 Billion RMB/annum).

¹⁹ Instituto Nacional de Ecología (INE), May 2008, “The benefits and costs of a Bus Rapid Transit System in Mexico City”.

²⁰ US EPA Integrated Environment Strategies Program - <http://epa.gov/ies/index.htm>

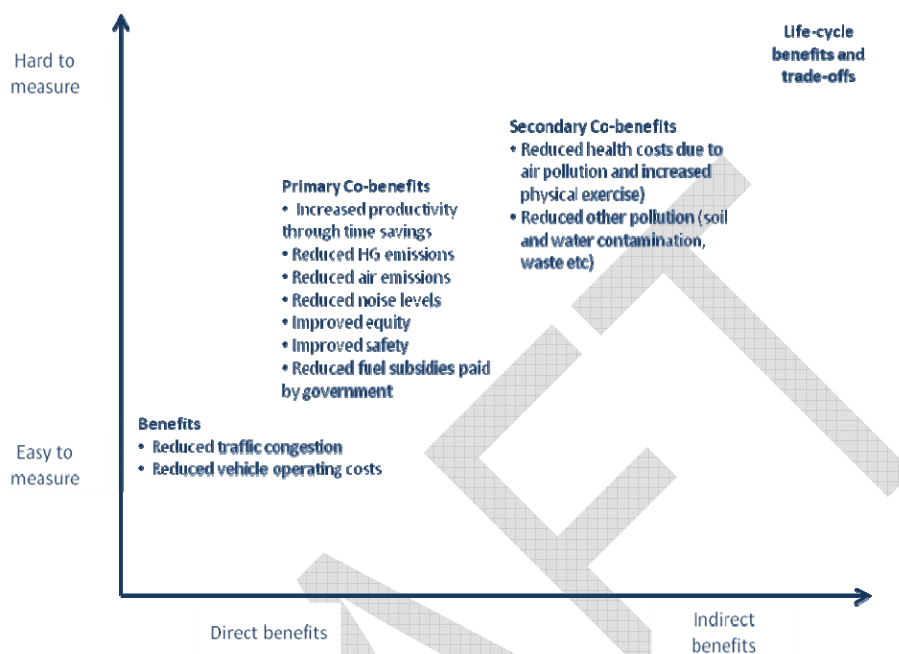
²¹ Masato, Kawanishi 2008. Co-benefit Approach to Mitigation in Transport Sector and Uchida, Tsutomu 2008. Co-benefit of Railway Development Funded by Japanese ODA loans. Both presented at the Third Meeting of the Regional Environmentally Sustainable Transport Forum in Asia, 17-19 March 2008, Singapore.

Maibach (2008)	<p>This research has generated good research on estimating the external costs of transportation. The handbook covers all environmental, accident and congestion costs and considers all transport modes. The handbook derives its findings from research generated in European countries. It recommends</p> <ul style="list-style-type: none"> • Methods for calculating external cost figures. • Best available input values for such calculation (e.g. value of one life year lost). • Estimated default unit values of external cost for different traffic situations (e.g. air pollution cost of a vehicle in Euro per km).
den Boer et. al. (2009)	<p>The environmental, safety and congestion impacts of lorries in the EU – in this study CE Delft has the contribution of heavy goods vehicles (HGV) in the EU-27 to emissions of CO₂ and air pollutants, noise, traffic accidents and congestion. The total external costs associated with HGV transport was around €144 billion, with infrastructure costs (51%), traffic accidents (30%) and congestion (24%) making up the bulk of these costs. The authors found the costs of noise (18%) and air pollution (16%) as comparable to congestion and other costs, while those of CO₂ emissions (5%) made the smallest contribution.</p>
Delhi Metro Corporation (2008)	<p>Central Road Research Institute study on the Delhi Metro has quantified the benefits of Delhi metro. If the social and economic benefits are quantified, then the Delhi Metro Rail Corporation has helped the city of Delhi to save Rs. 20,725.1 million by 2007, of which the travel time savings constitute 35%. Delhi Metro has also prevented 28,800 tons of carbon dioxide from being emitted into the atmosphere every year.</p>
Murthy et.al (2006)	<p>This research suggests that accounting for benefits from the reduction of urban air pollution due to the Metro has increased the economic rate of return by 1.4%.</p>
TERI and WBCSD (2008)	<p>At the start of the project, Bangalore Metro Rail Corporation estimated the benefits of the Bangalore Metro Rail including the potential co-benefits. The benefits quantified amounted to 11,550 million Rupees where the share were</p> <ul style="list-style-type: none"> • Traffic decongestion (33.79%) • Reduced fuel consumption (24.63%) • Savings in travel time (28.14%) • Reductions in accidents (7.59%) and • Reduction in air Pollution (5.84%)

4.4 Challenges to the Application of the Co-benefits Approach

182. There are several challenges to the successful application of the co-benefits approach.

- Measurement of co-benefits in the transport sector can be difficult, costly and time-consuming, compared to the measurement of the direct benefits of transport policies and projects (reduced traffic congestion and vehicle operation cost. As shown in Figure 4.3, the situation is worse for secondary co-benefits, such as reduced health costs resulting from reduced air pollution, and the co-benefits across the life-cycle of a transport policy or project if such a life-cycle approach were to be considered. As indicated in Table 4.1 each of the previous studies typically has designed its own methodological framework and there are so far few standardized methodologies.

Figure 4.3: Level of difficulty in measuring transport benefits

Source: Authors

- Limited awareness, knowledge and capacity with regard to the co-benefit approach among policy makers, transport planners and engineers, and funders leads to the limited application of co-benefits in the transport sector. In cases where they are already being applied, the co-benefits concept was used mostly as post-project assessment and not as part of the planning process (e.g. analysis on Japanese ODA loans). This may be attributed to the concept of co-benefits in transport only being introduced fairly recently and poor documentation of case studies. Although there are some methodologies that exist, co-benefits approach in the transport sector has also not been mainstreamed as a policy²².
- The policy and institutional framework in the transport sector is fragmented (see also chapter 6 on policies and institutions) and therefore limits the ability to integrate multiple issues into policies and programs/projects. While government plans and strategies often refer to integration, in practice, individual government agencies focus on their direct area of responsibility. Therefore, a transport ministry may focus on minimizing costs of a transport policy or project, rather than minimizing the overall costs to government or society through integrating CO₂ and other issues in transport policies and projects.

183. Transport projects are not well represented in CDM. However even if transport projects would be better represented in the future there are problems with the manner that co-benefits

²² The Harmonized Emissions Analysis Tool (HEAT) and GAINS-Asia are quantitative models incorporating air pollution with greenhouse gas emission reduction, while Carbon Value Analysis Tool (CVAT) helps estimate carbon emission reductions into energy-related projects. The Integrated Environmental Strategies (IES) methodology provides a framework that can be used for evaluating measures that reap potential co-benefits.

are operationalized in CDM. While the CDM identifies both GHG reduction and achievement of sustainability as explicit objectives, and many developing countries have prepared criteria for sustainability, there is no real incentive so far to integrate co-benefits into CDM projects. The Marrakech Accord gave the host country the prerogative to confirm whether the CDM project activity really assists in achieving its sustainable development goals. For the aspect of air pollution, for example, the criterion in the Designated National Authority (DNA) approval process is quite weak in Asian countries (see Table 4.2). Even for emission reduction, which can be quantitatively measured, the DNA approval criteria does not include criteria in absolute terms (minimum tons of pollutant reduced) nor relative terms (minimum ratio with GHG reduced). A potential CDM project which can reduce 10 tons of PM₁₀ emissions and another project which can reduce 1 tons of PM₁₀ will then share the same chance for approval. If proposed negotiation text for the climate convention were to be considered, there is possibility however that co-benefits could be represented more in Climate agreement including in proposed future mechanisms.²³

184. Some countries, however, have implemented policy measures that encourage more CDM projects in areas that reap a lot of co-benefits (e.g. energy efficiency, renewable energy, etc) by taxing these projects less than those which do not have clearer contributions to sustainable development goals, as in China²⁴ or by incorporating sectoral criteria into national sustainability criteria, including transport indicators, as in Indonesia.

Table 4.2: Air quality criterion as identified in DNA Approval Process in some Asian Countries

Country	Air quality criterion
Bangladesh	Reduction of pollutants (Oxides of N, S, C, heavy metals, solid and liquid waste)
Cambodia	Reduction in air pollution compared with baseline scenario stated in the Project Design Document
Indonesia	Not exceeding the threshold of existing national, as well as local, environmental standards (not causing air, water and/or soil pollution)
Malaysia	Air quality benefits
Philippines	Improves local environment (eg. AIR, water, soil) quality
Thailand	Reduction of air pollution by SO ₂ , NO _x , PM ₁₀ emissions
Vietnam	Non GHG air pollution emissions

Source: Authors

²³ Revised negotiating text of the Adhoc Working Group on Long-term Cooperative Action Under the Convention (UNFCCC) - <http://unfccc.int/resource/docs/2009/awglca6/eng/inf01.pdf>

²⁴ China collects revenues from different CDM projects depending on 65% CER transfer benefit from HFC and PFC projects; 30% CER transfer benefit from N₂O project; 2% CER transfer benefit from CDM projects in priority areas (energy efficiency improvement, development and utilization of new and renewable energy, and methane recovery and utilization) and forestation projects. Measures for Operation and Management of Clean Development Mechanism Projects in China (<http://cdm.ccchina.gov.cn/english/NewsInfo.asp?NewsId=905>)

4.5 Proposed co-benefits model

4.5.1 Sustainable Development as basis of the Co-benefits Model

185. A co-benefits model applicable to the transport sector must be based on the concept of sustainable development, rather than centered on climate change mitigation alone. Such a co-benefits model should aim to integrate climate change into transport, especially CO₂ and black carbon and other air pollutants directly contributing to warming and move towards a sustainable transport model.

186. The current development model is centered on economic development and has little consideration for social development and environmental protection. As a result, transport policies in Asia tend to focus on increasing private vehicle ownership because it is believed that this stimulates the economy. As described in the previous chapter our approach to transport planning needs to be revised and be more oriented towards sustainable transport. Such a re-orientation needs to be part of a wider re-orientation of the economic model. Without such a wider reorientation of economic thinking, the required investments in sustainable transport measures (i.e. measures to improve public transport, non-motorized transport, transport demand management, clean fuels and vehicles, and fuel economy) will not be made because these measures are perceived as a cost to the economy. A recent McKinsey Report suggestion that reducing CO₂ emissions in the transport sector is highly capital-intensive is directly related to outmoded focus on private vehicles.²⁵ The McKinsey report and its conclusions reinforces the need for moving to less-vehicle centered transport policies with high co-benefits if developing countries want to be effective in reducing the contribution of their transport sector towards global warming.

187. Climate change mitigation is perceived as standing in the way of economic growth. This explains why some governments argue that climate change mitigation commitments are put on hold due to current economic crisis. In reality the current economic crisis could be an opportunity to change our current development model to a more sustainable one.

188. An important underlying reason why we want to mitigate climate change is that climate change threatens the sustainability of our society and planet. Without placing climate change in the broader context of sustainable development, other important development issues (e.g. air pollution, health) risk being pushed aside. Similarly the low carbon transport model of improve-shift-avoid can be more easily achieved if centered around sustainable development framework because the driver in transport is not climate change. The development community and developed countries are overemphasizing climate change, often combined with a specific focus on CO₂ reductions only, this tends to antagonize the developing countries who point at the historical responsibility of developed countries to address climate change and who rightfully argue that their scarce resources are equally needed to promote economic and social development.

189. There is already an overall sustainable development framework that we can build on, most notable the Agenda 21 and the Millennium Development Goals 26 as well as several

²⁵ McKinsey. 2009. Roads toward a low-carbon future: Reducing CO₂ emissions from passenger vehicles in the global road transportation system. March 2009. Available: http://www.mckinsey.com/clientservice/ccsi/pdf/roads_toward_low_carbon_future.pdf

²⁶ About 192 United Nations member states and at least 23 international organizations have agreed to achieve the eight MDGs by year 2015.

global and regional forums which confirm the co-benefits approach to transport (see Box 4.2). If a model for the transport sector was to be climate-centric then a new framework needs to be built and this is difficult given the limited time and funds available. Existing sustainable development frameworks at the global and national levels include institutions; policies and strategies; indicators, monitoring and reporting systems; guidelines; documented good practices; networks, etc.

190. Traffic congestion (or level of service) and vehicle operating costs are the main drivers for transport development rather than climate change. Therefore low-carbon transport should be considered as a subset of sustainable transport. Both transport and climate change are covered by Agenda 21.

Box 4.2: Co-benefits model for transport based on existing frameworks

Agenda 21 (1992)

Agenda 21 was adopted by more than 178 Governments during the United Nations Conference on Environment and Development in 1992 and intends to trigger action at international, national, regional and local levels. Some national and state governments have legislated or advised that local authorities take steps to implement the plan locally, often known as 'Local Agenda 21' or 'LA21'.

Transport is considered in several chapters of Agenda 21, including, among others, [Chapter 9 on Atmosphere](#) and [Chapter 7 on Human Settlements](#). In undertaking the five-year review of the implementation of Agenda 21 during its nineteenth Special Session in 1997, the General Assembly noted that, over the next twenty years, transportation is expected to be the major driving force behind a growing world demand for energy. It is the largest end-use of energy in developed countries and the fastest growing one in most developing countries. Furthermore, adequate, efficient, and effective transport systems are important for access to markets, employment, education and basic services critical to poverty alleviation. Current patterns of transportation development are not sustainable and may compound both environmental and health problems. The [Indicators of Sustainable Development \(2007 version\)](#) also cover indicators for transport, specifically: modal split of passenger transportation, modal split of freight transport and energy intensity of transport.

Climate change is considered in [Chapter 9 \(Protection of the atmosphere\)](#), recognizing that activities that may be undertaken in pursuit of the objectives defined therein should be coordinated with social and economic development in an integrated manner with a view to avoiding adverse impacts on the latter, taking into full account the legitimate priority needs of developing countries for the achievement of sustained economic growth and the eradication of poverty.

Aichi Statement (2005)

Recognizing that the efforts to promote environmentally sustainable transport will result not only in the improvement of human health through the reduction of urban air pollution but will also have important complimentary benefits, including the reduction of greenhouse gas (GHG) emissions, the reduction of deaths and injuries from road accidents, the reduction of harmful noise levels, and the reduction of traffic congestion levels, the International Conference on Environment and transport agreed to establish a Regional EST Forum for the promotion of environmentally sustainable transport in Asia.

Leipzig Statement (2008)

The Key Message of the International Transport Forum – Leipzig was to promote strategic approach to meeting the energy and climate change challenge, based on a package of policy measures which includes integrated mobility management, technology development, strengthened research into new technology and fuels, increased use of information technology and as well as a wide variety of

nontechnology policy tools with potential to improve economic efficiency and reduce emissions.

MEET Declaration (2009)

The Ministers present at the Ministerial Conference on Global Environment and Energy in Transport recognized that while transport is responsible for considerable emissions of Carbon dioxide (CO₂), which impacts global climate, and air pollutants, which impact public health and the environment of many urban areas, declared their commitment to a long-term global vision of realizing low-carbon and low-pollution transport. The Ministers also recognize the effectiveness of a co-benefit approach where a measure to address climate change may at the same time address other objectives such as air pollution mitigation, congestion reduction, energy savings, health and safety benefits.

191. The upcoming 2010-2011 sessions of the Commission on Sustainable Development (CSD) are important in this context because transport will be the main sectoral priority in 2010 and 2011.²⁷ The CSD process is crucial because it will be for the first time since 1997 that a global policy statement on transport will be formulated. Since 1997 more emphasis is being placed on sustainable transport. The CSD process has the potential to establish a new global transport paradigm which integrates Climate Change concerns with other developmental concerns. Such a global policy consensus can build on regional policy agreements and help developing countries integrate Copenhagen consensus on transport and climate change in their transport policies while at the same time pursuing a larger sustainable transport policy agenda.

4.5.2 Application of the co-benefits model to Transport and Climate Change

192. For a co-benefits model for transport to be successful, there is a need to have a strong supporting policy and institutional framework. The co-benefits Model is focused on the application of the co-benefits approach to individual policies and projects, and follows a 5 step approach²⁸:

Step 1: Country Policy Framework Analysis. The existing policy framework of a city or country is analyzed including any existing regional or global agreements that the country adheres to, to determine plans and priorities relevant to transport, climate change and other transport co-benefits, such as air pollution and safety. The areas included in Agenda 21 should be included. This is an important first step, because it will only be possible to truly integrate co-benefits into transport policies and projects if the government has recognized its importance.

Step 2. Policy and Project Analysis. The primary objective of the proposed policy or project is described, and the potential (primary and secondary) co-benefits and trade-offs (in the remaining steps we refer to aggregated co-benefits only) are identified and categorized as direct and indirect. It is then checked whether and how the potential co-benefits are covered by relevant policies at the local or national levels identified under step 1.

Step 3. Measurement of benefits and co-benefits. All benefits and potential co-benefits are quantified where possible, either as absolute terms or relative terms (percentages or ratios). For air pollutants and GHGs, (refer to the measurement

²⁷Commission on Sustainable Development Multi-Year Programme of Work. Available: http://www.un.org/esa/dsd/csd/csd_multyearprogwork.shtml

²⁸ The proposed co-benefits model will function within the larger institutional and policy frameworks described in Chapter 3 (Policy) and Chapter 6 (Institutions).

approach suggested in Chapter 2) and for other co-benefits make use of existing data collected by government such as statistics on trends of traffic accidents to measure safety, or share of transportation in household expenditure surveys. As mentioned previously, it may not always be possible to quantify all co-benefits due to practical, time or financial constraints. Models may be applied to obtain the required data, but this should take into consideration the influence of assumptions made and inherent errors in models. The accuracy and limitations of data for each co-benefit should therefore be indicated.

Once measured, co-benefits should be expressed in monetary terms (e.g. the potential income of the tons CO₂ reductions in a city are sold as carbon credits) are reduced through a policy or project). However, not everything can be expressed in monetary terms, and this can pose bias or different interpretations of the relative importance of each co-benefit. For example, should premature deaths and other health effects associated with air pollution be expressed as the medical and hospitalization costs only, or should lost-income opportunity be included also. For secondary co-benefits the risk is greater that costs can either not be determined or are merely guesstimates.

For this reason, co-benefits should also be expressed qualitatively indicating the scale of contribution to government policy objectives. Each benefit and co-benefit is given a rating of ++ to – (minus in case of trade-offs). Because the rating is determined by the policy priority of a city or country, this reduces the risk of subjectivity or manipulation to achieve a desired outcome. This may mean the potential co-benefit of “air pollution reduction” is given a low rating, even if the amount of air pollution reduction is high, if a city or country has no clear policy or plan and targets for air quality. Therefore the qualitative assessment is in fact a reality check, as in practice co-benefits will not be truly valued if these are not important to the government. The outcome of the qualitative assessment can also be a positive one: it reinforces existing or provides an incentive for new policies on climate change, air pollution, health, safety and other relevant areas. Assessments can also be used as a tool to rank, approve/ disapprove or help improve scope of projects.

Step 4. Mitigation and Improvement Measures. The initial assessment is carried out ideally prior to the design and implementation of a policy or project, and it should still be possible to make changes based on the outcomes of the assessment. Measures can be identified that minimize trade-offs and maximize co-benefits. Next, the financial and practical feasibility of the measures is assessed, which could include a determination of the cost-effectiveness of the measure, that expresses how much of a co-benefit was obtained for the amount of funds spent on the measure (e.g. \$/ton of CO₂ reduced). Measures that are feasible can then be incorporated in the proposed policy or project. As the assessment included a check against government policies, the model provides a basis for monitoring of achievements of a much broader range of policy objectives through the transport policy or project than was previously possible.

Step 5. Monitoring. Following implementation of the policy or project it is important that the actual co-benefits achieved are monitored. Indicators thus need to be established for each co-benefit and this can be based on how the co-benefits were measured in step 3, of the indicators can be decided upon as part of step 3 already. Including monitored co-benefits in reports to government and other stakeholders describing progress of the policy or project will help raise awareness of co-benefits and increase the likelihood that co-benefits are institutionalized in government agencies and thus integrated in more future policies and projects.

4.6 Conclusions

193. An effective and comprehensive strategy is needed to ensure that the transport sector is able to significantly reduce GHG (mostly CO₂ and O₃) emissions and black carbon to mitigate climate change. This especially applies to Asia where GHG and black carbon emissions are growing fastest. The adoption of a co-benefits approach will maximize the intended impacts (e.g. GHG or air pollutant reductions or traffic congestion) at reduced overall costs to society through integration of multiple areas in policies and projects.

194. Contrary to the perception created by the large public attention for climate change, climate change is not the key driver of transport policies and projects in developing countries because of the still limited policy priority for mitigation and because the potential financial earnings from GHG reduction are significantly lower than other earnings or cost savings associated with a good transport policy or project. It is important to note then that local benefits still play a bigger role in development over global benefits (such as climate).

195. While the co-benefits approach is not a new concept in the climate change discussions and is in fact increasing recognition as a viable approach, it has not been internalized. In the transport sector, a wider application of co-benefits approach has been hindered by various methodological and institutional challenges too.

196. It is proposed that the application of the co-benefits approach is further integrated into the transport sector as follows, and further discussed in the respective think pieces on:

- (i) Measurement. A range of co-benefits should be measured for the transport sector, including the appraisal, evaluation and monitoring of transport projects. In particular, if baseline data for quantifying CO₂ emissions is available, then it is in most cases possible to also quantify air pollutants, such as PM and NO_x. Where measurement is more difficult or data is less available, such as for O₃ and black carbon, a phased approach to measurement could be applied that start with CO₂ measurement and air pollutants are gradually added.
- (ii) Policy. It is proposed that a 5-step model be used in the application of the co-benefits approach to individual transport policies and projects, which (a) is based on the concept of sustainable development, rather than centered on climate change mitigation alone; and (b) aims to integrate climate change into transport, especially CO₂ and black carbon and move towards a sustainable transport model. Furthermore, the co-benefits approach should be integrated in a post-Kyoto agreement, with a particular emphasis on black carbon and O₃ given the direct enhancing effect on global warming. The success of NAMAs will depend on the degree in which local benefits (many of which are co-benefits of climate change) are considered.
- (iii) Financing. Quantification of co-benefits, especially if these can be expressed in monetary terms, would aide in getting the attention of financiers in the public and private sector to direct investments to and increase investments in sustainable transport projects.
- (iv) Institutional framework. Strengthen the relationship between government agencies responsible for transport, climate change, environment/air pollution, and energy to ensure faster scaling up of co-benefits across the transport sector.

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5. Innovative Financing of Low-Carbon and Energy Efficient Transport

5.1 Introduction

197. To finance is “to provide the money needed for something to happen”.²⁹ The existence of adequate and effective financing is a necessary condition to enact the various aspects of sustainable transport, including both the “hardware” (e.g. infrastructure, technology, and vehicles) and the “software” (e.g. policies, institutions, management, information and operations). Closely linked is the topic of pricing and taxation, which affects the level and mixture of funding sources available, influences the behavior of participants in the transport system and helps allocate/rationalize the use of scarce resources.

198. The effects of financing and pricing on the sustainability of the transport sector (both intended and unintended) are readily observed. For instance, the decision to fund a BRT system instead of extending an urban motorway changes the relative attractiveness of those two modes. When tax on petrol is increased, drivers may respond by reducing trips (or trip lengths), choosing more fuel-efficient vehicles, or relocating their homes closer to work.

199. The importance of financing is amplified by the amount of resources involved, covering a multitude of stakeholders. Transport can take up 15 to 25% of developing city budgets, and typically between 8 to 16% of household income in developing cities (World Bank, 2001), and is a major sector targeted by foreign aid.

200. Currently however, practices surrounding funding and pricing are generally unsupportive of the goal of achieving sustainable transport and thereby lowering CO₂ emissions from the transport sector. Both public funding and official development aid (ODA) are focused on the provision of large and expensive infrastructure for private motor vehicles rather than a focus on providing sustainable, inclusive mobility for all citizens which are also often less cost intensive. Prices of transport activities do not reflect the true costs of travel such as the effects on the environment (see for example INFRAS, 2004). Furthermore, financing mechanisms specifically designed to fund carbon mitigation projects such as the CDM have so far had very little application in the transport sector. These conditions call for an open and serious discussion amongst policy makers,³⁰ transport professionals and civil society on ways of reform during the Post 2012 negotiations.

201. As part of this process, this chapter aims to provide a rough overview of the current situation surrounding transport financing and pricing, the currently available options for funding low-carbon sustainable transport, the necessary direction for change, and future considerations for financing a sustainable transport sector in developing Asia. Recognition is given to the fact that the region encompasses a multitude of countries and areas, each with their unique geographic, political and economic conditions.

²⁹ Cambridge Advanced Learner's Dictionary, 2008

³⁰ A module for the GTZ publication “Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities” on urban transport financing is currently being developed by the GTZ, to be published in the Summer of 2009 through www.sutp.org. The module was developed jointly with this chapter. The author thanks GTZ for making available key references, which has also enriched this think piece.

5.2 Current funding practice

202. Although developing Asia is a diverse region with differences in political, economic and social conditions, the current funding for transport can be generalized by the following characteristics;

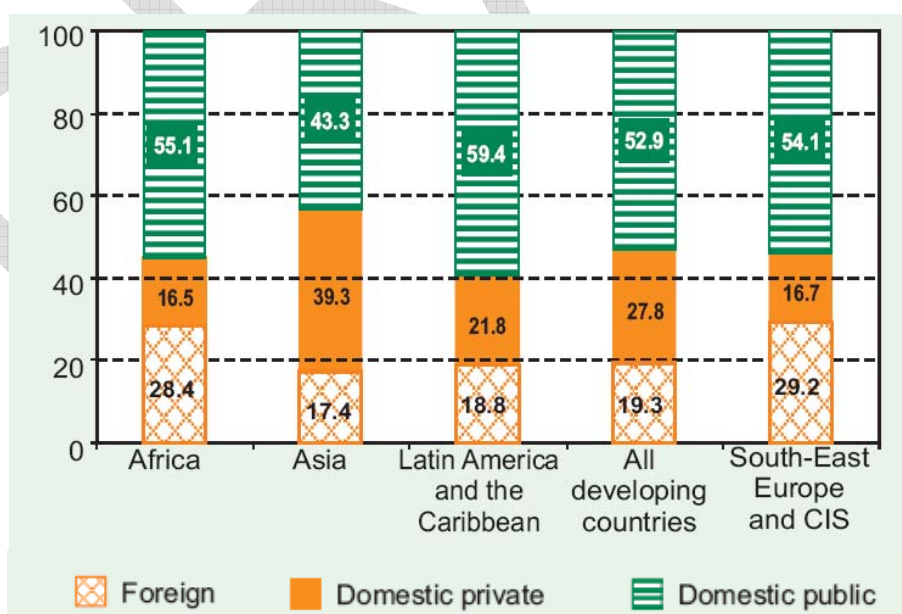
- A strong prevalence of public sector funding for transport infrastructure
- Strong preference by international donors for the road/highway sector
- High level of private and informal provision of transport services
- Limited recognition of, and options for funding low-carbon transport

5.2.1 Strong prevalence of public sector funding for transport infrastructure

203. Transport infrastructure funding has traditionally been the realm of the public sector, although there has been a trend towards private sector involvement. In Asia where private investments are higher compared to other regions, (domestic) public funding is still the largest source (see Figure 5.1). Transport forms a major component in the public budget of most countries. Statistics from the IMF (2001) suggest that outlays for transport typically constitute 10% of national public spending.

204. Figures illustrate the strong bias towards national (vs. regional and local) funding for transport, with typically more than 80% spent at national level (IMF, 2001). Hine and Fouracre (2001) note that even for local roads, there continues to be dependence on national budgets due to the weak revenue base of local governments. This often leads to a low credit-worthiness, which coupled with the administrative structures of these countries, often make it difficult for local governments to enter into loans.

Figure 5.1: Transport infrastructure investment commitments by source (1996–2006)

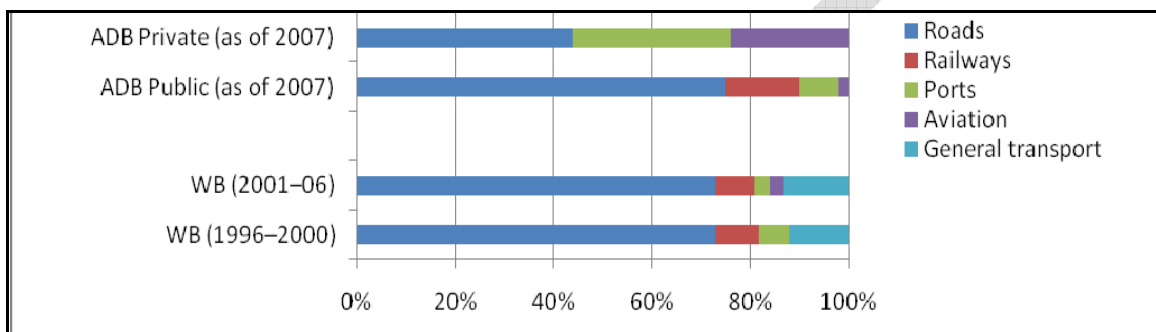


Source: UNCTAD, 2008

5.2.2 Strong preference by external donors for the road/highway sector

205. Transport also attracts a major share of external donor funding. For example, nearly 20% of the total \$24.7 billion lending by the IBRD/IDA was targeted at the transport sector in 2008³¹. Both the World Bank and the ADB commit roughly three fourths of their transport lending towards roads and highways, reflecting the priorities of donors as well as the way transport option generation and appraisal are conducted.³²

Figure 5.2: External transport commitments by mode



Source: World Bank (2008) and ADB (2009b)

5.2.3 High level of private and informal provision of transport services

206. On the other hand, transport services in developing Asia are often provided by private operators, many of whom operate informally and outside the regulation framework. Formalized (regulated) public transport is generally funded by a combination of fare revenue and subsidies. The exact way in which these revenues are attributed to the operator heavily depends on the regulatory framework. The World Bank (no date) notes a trend in favour of an inclusive public-private framework, where private operators compete for the right to serve services in a particular area/route.³³

1. Informal services range from pedicabs and motorcycle taxis to van-type minibuses and minibuses. Whilst often attributed to many of the transport-related problems in developing cities (e.g. poor driving leading to severe accidents, poorly maintained vehicles with excessive emissions) they often fill the gap in formal, regulated public transport services especially for citizens with lower incomes (see World Bank, 2001 and Cervero, 2000). The informal nature of these services is also reflected in how they are financed. As Cervero (2000) points out, much of the capital assets (i.e. the vehicles) are financed either through the savings of the drivers themselves, or through family assistance.

³¹ World Bank Annual Report 2008.

³² Current (economic) appraisal of transport project focuses primarily on time savings and vehicle operating cost savings.

³³ For a comprehensive discussion on the relationship between financing and regulatory frameworks, see Gwilliam (2005)

5.2.4 Limited recognition of and options for funding low-carbon transport

207. The development of a sustainable transport system also suffers from the fact that in the majority of countries and cities, climate change and sustainability are relatively low on the policy agenda. Political support is often given to large infrastructure projects that cater for private motor vehicles, rather than pedestrians, cyclists and public transport.

208. Also, as the next sections will show, financing mechanisms designed to promote low carbon development are not working sufficiently, or are very limited in terms of scale and scope.

5.3 Current pricing practice

209. Economic efficiency requires prices of a good or activity to match its social marginal cost (SMC) including all external costs. The importance of efficient pricing in land-based transport is already well argued, with many pointing out the need for transport prices to include costs imposed on society through congestion, accidents, infrastructure wear and tear, air pollution, noise and climate change so that choices made by the users of transport will take into account these costs (World Bank 2001, Button 1993, etc).

210. The scale of external costs depends heavily on the geographical context as well as the preferences of society. Studies show that in developing cities, congestion, accident and pollution externalities make up a significant proportion of the overall externalities from transport, amounting in some cases to over 10% of national or regional GDP (see Figure 5.3). The numbers presented in 5.3 in many cases describe the situation in the 1990s. Considering the rapidness of motorization in which vehicle fleets in many countries double in 5-7 years (and in some cities even within 3-5 years) it is safe to assume that the levels of negative externalities have only increased since then. For instance, a recent study by Creutzig and He (2009) estimates for Beijing that the social costs induced by motorized transportation are equivalent to roughly 7.5–15.0% of the city's GDP.

211. Despite the above, most countries fail to capture these external costs in transport prices and in most cases do not measure them on a regular basis, if at all. This results in motorized private transport users not meeting their real costs to society. Instruments such as parking charges and vehicle taxes, which can be designed to reflect at least some of the external costs onto the users, are used infrequently in developing Asia. In addition to a general lack of awareness by policy makers on the importance of internalizing externalities, such measures are often perceived to be costly in both political and economic terms.

212. In the majority of areas, prices for fuels are not set according to their environmental effects, rather they are often subject to low levels of taxation and even subsidies and price controls. Examples are seen in oil-producing nations such as Indonesia, and until recently in China.

213. The effects of inadequate pricing can be directly observed, through the sprawling and congested cities in China, to the shift of freight transport from rail to road in India and other Asian countries.

Figure 5.3: External costs of transport in different countries

Country or city	Year	Source	Road costs	Land and parking	Con-gestion	Accidents, net of insurance	Pollution				Sub total	Revenue from road users	Net sub-total	Others	Total
							Noise	Local air	GHGs	Other					
United States 1	1989	WRI	1.64 ^a	1.56	—	1.00	0.16	0.18	0.50	—	5.04	^a	5.04	0.46	5.5
United States 2 ^b	1990	NRDC	1.25 ^a	0.43–1.74	0.19	1.71	0.05	2.09–3.83	—	0.07	5.69–8.84	^a	5.69–8.84	0.78–2.61	6.47–11.45
United States 3	1991	Lee	1.76	2.41	—	0.24	0.19	0.73	—	0.26	5.59	0.88	4.71	0.87	5.58
EU1	Early 1990s	ECMT	1.75	—	0.74	2.40	0.30	0.60	0.50	—	6.30	1.67	4.63	—	4.63
EU2	Early 2000s	ECMT	1.49	—	0.75	1.20	0.30	0.15	0.47	—	4.36	1.67	2.69	—	2.69
United Kingdom	1993	CSERGE	0.24	—	3.03	0.46–1.49	0.41–0.49	3.12	0.02	—	7.28–8.39	2.60	4.68–5.79	—	4.68–5.79
Mexico City	1993	Ochoa	—	0.08	2.56	2.32 ^c	—	0.64	—	—	5.60	—	5.60	—	5.60
Poland	1995	ISD	1.14	—	0.30	1.60	0.10	0.30	—	—	3.44	2.81	0.63	—	0.63
São Paulo	1900	IRBD	—	—	2.43	1.11	—	1.55–3.18	—	—	—	—	5.09–6.72	—	5.09–6.72
Buenos Aires	1995	FIEL	0.73	—	3.42	0.5–2.00 ^d	—	0.97	—	—	5.62–7.12	1.01	4.61–6.11	—	4.61–6.11
Bangkok	1995	Misc.	—	—	1.00–6.00	2.33	—	2.56	—	—	5.89–10.89	—	5.89–10.89	—	5.89–10.89
Santiago	1994	Zegras	1.37	1.92	1.38	0.94	0.15	2.58	—	—	8.35	1.64	6.71	—	6.71
Dakar	1996	Tractebel	—	—	3.37	0.16–4.12	—	5.12	—	—	8.65–12.61	—	—	—	8.65–12.61

— Not available.

Note: GHGs = greenhouse gases; EU = European Union. In most cases, congestion costs are calculated in comparison with either a free-flow speed or an "acceptable" traffic performance, and not with a calculated "optimum" level of congestion. The calculated values may thus overestimate what it would be economic to eliminate.

a. Road costs given net of revenues from road users.

b. Cars only.

c. Gross of insurance compensation.

d. Calculated on nationwide basis and gross of insurance compensation.

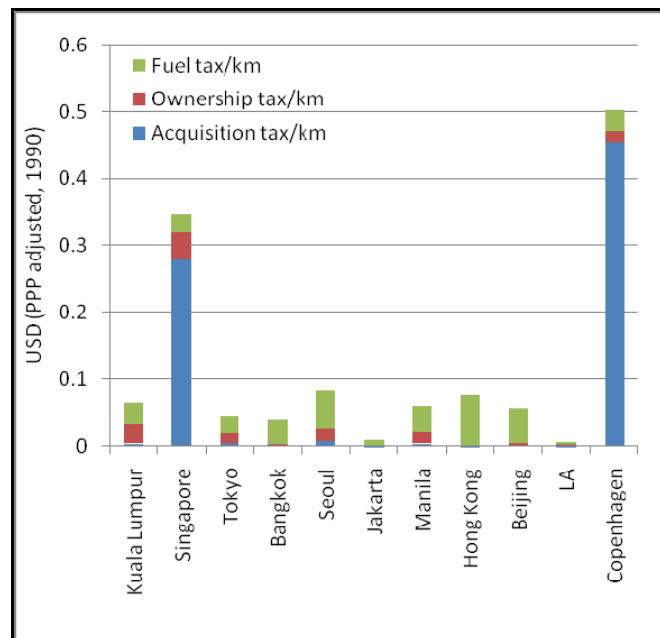
Source: Willoughby 2000a.

Source: World Bank 2001.

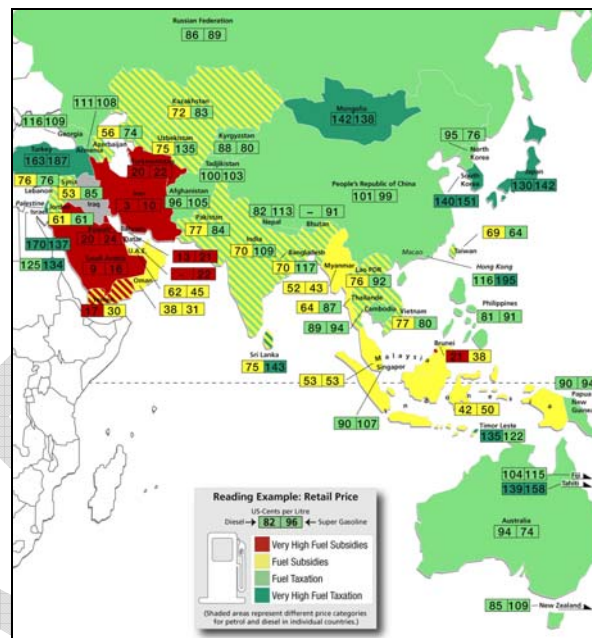
214. Although some subsidies and lower taxes are provided with good intentions, or argued to be supportive of the poor (e.g. in rural communities), this dampens incentives for both consumers and industry to improve the energy efficiency and reduce the carbon intensity of their transport activities. Litman (2008) and UNEP (2008) argue that redistribution of wealth through fuel subsidies is inefficient and that targeted subsidies towards the lower income groups would achieve the equity objective in a better way. The availability of smart ICT technologies makes it increasingly easier to implement such targeted subsidies.

215. Here, lessons can be learnt from the recent reduction of fuel subsidies in Indonesia, which is coupled with cash compensations and increases in other types of social benefits for vulnerable groups such as staple food prices and education (Bank of Indonesia, 2008).

216. Prices for vehicle acquisition and ownership are also not linked to their environmental and social impacts, and a large discrepancy is seen amongst countries (see Figure 5.4). Various studies such as Hirota and Minato (2003) confirm however, that car usage (pkm) is negatively related to the level of such taxes, especially fuel tax.

Figure 5.4: Differences in vehicle tax rates for selected Asian cities

Source: Hirota and Minato, 2003

Figure 5.5: Fuel prices and subsidies in Asia

Source: GTZ, 2008

5.4 Assessment of transport funding mechanisms

217. These are numerous funding mechanisms relevant to the transport sector. They are diverse in their nature, and range from local schemes to international arrangements. For convenience, these are split between transport-oriented mechanisms – i.e. mechanisms which have traditionally been found in the transport sector, and carbon-oriented mechanisms, or those whose primary aim is to reduce carbon emissions.

5.4.1 Transport-Oriented Funding Mechanisms

218. Firstly, a short introduction to some representative financing mechanisms which have traditionally been found in the transport sector is given below. A simple assessment of their relevance to sustainable transport is also provided.

Fuel tax – constitutes a stable and significant source of income (either for the general account or earmarked for a transport/road specific fund) in both developed and developing countries. Since fuel use is closely correlated to environmental and partly to congestion externalities, it can be seen as a second-best policy instrument for efficient pricing. (Button, 1998)

Vehicle taxes and permits – are levied on the acquisition or ownership of vehicles. According to Metschies (2005), they typically form the second largest source of transport

revenue after fuel tax. Singapore and Shanghai auction vehicle licenses, the latter raising an estimated revenue of \$600 million per year (Huizenga, 2009). The Philippines use revenues from the vehicle tax for various transport-related funding (see Box 5.2). They can be graduated to account for differences in carbon emissions as is the case in the UK since 2007). Differentiation can also be based on engine size (as in China), or by vehicle weight, both of which can be considered proxies (albeit suboptimal) for carbon emissions (see China Car Times, 2008 and Creutzig (2009).

Box 5.1: Road Funds

Road funds replenished mainly by fuel tax revenue have played a large role in countries such as Ghana to overcome the consistent shortfall in maintenance funding (see Gwilliam and Kumar, 2003).

A major advantage of such funds is the relative stability and predictability of the funding stream, as fuel consumption is relatively inelastic to price changes in the short run. This does not imply that fuel tax is ineffective in changing travel behaviour. Empirical studies show that in the long run, increases in fuel price can lead to a significant reduction in vehicle based travel (see Litman, 2009).

The objective of a fund can change to follow new policy approaches in the transport sector. In Japan for example, there is a significant debate on the extent to which the usage of its road fund be widened, to cover not only its traditional role of road building and maintenance, but also public transport.

Box 5.2: The Motor Vehicle User's Charge (MVUC) of the Philippines

The MVUC, established in 2000, is collected as part of the annual registration fee of a vehicle that is paid to the Land Transportation Office and used to replenish 4 special funds dedicated to specific purposes, as shown in the table below. Recently, it has been agreed that resources from this fund will be used to fund a feasibility study of a BRT scheme in the city of Cebu (Huizenga, 2009)

Account	Share	Exclusive Purpose
Special Support Fund	80.0%	Maintenance of National Primary Roads (70% of the 80%)· Maintenance of the National Secondary Road (30% of the 80%)· Improvement of drainage system
Special Local Road Fund	5.0%	Maintenance of Local Roads· Traffic and road safety devices of city and provincial governments
Special Road Safety Fund	7.5%	Installation of road safety devices throughout the country
Special Vehicle Pollution Control Fund	7.5%	Programs for prevention, control and management of air pollution from mobile sources

Source: CNBL, 2008

Parking charges - In the urban context, parking charges can make up a significant share of the total cost of the trip. Hence they may be regarded as analogous to an area or cordon-based road pricing scheme. (Toner, 2005)

Road pricing - whereby a motorist *directly* pays for driving on a particular link or in a particular area. (VTPI, 2006c) Road pricing can be designed to reflect the different levels of externalities by location, time and distance, and offers the largest potential for full “user pays” pricing. Revenue can be used to fund elements of local transport as in London (see Box 5.5). Carefully designed schemes may improve public acceptability of such taxes.

Fare revenue – which in some large Asian cities can sufficiently fund public transport operations, and in some exceptional cases the necessary infrastructure as well. They also support paratransit operators such as rickshaws and motorbike taxis, which play a large role in providing mobility in developing cities (World Bank, 2001)

Public transport subsidies – which augment shortfalls in fare revenue and are often justified as a “second best” option, when private road transport is not priced efficiently, and may divert private vehicles off the road. Although likely to be context-specific, the World Bank (2001) notes that user-targeted subsidies are more effective and less distortive compared to supply-side subsidies.

Business taxes – such as the French “Versement Transport” which imposes a levy a tax on payroll to fund improvements to local public transport..

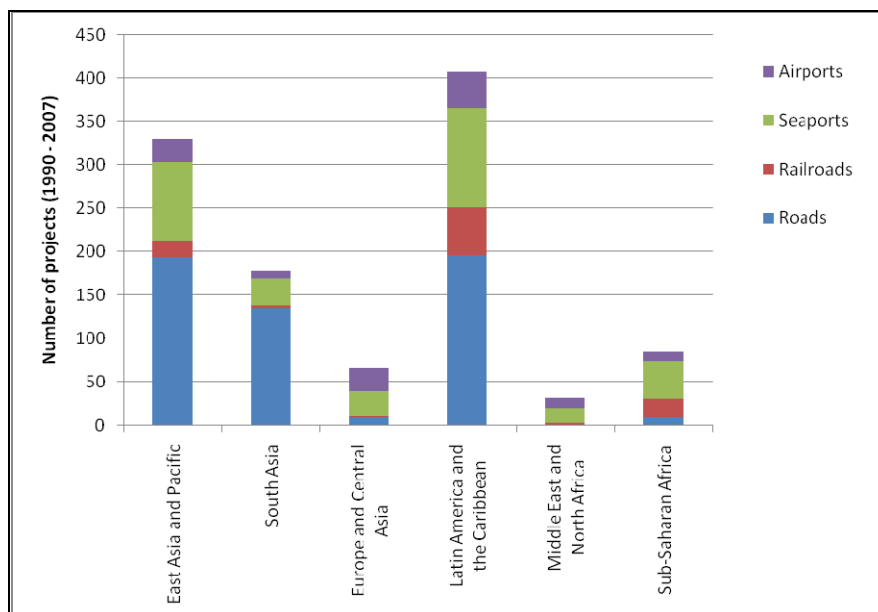
Advertising – on infrastructure (e.g. public transport waiting areas) and vehicles (e.g. buses), which can be used to help bridge financial shortfalls (especially for non-capital expenditures)

Land related taxes and charges – where the beneficiaries of a transport development are asked to contribute towards the cost of developing transport infrastructure (e.g. railway lines and BRT corridors), often through property taxes or purchase of land development rights. More generally, land related charges such as impact fees are often suggested as a way to control urban sprawl and support land use planning (see Carrion and Libby, 2004), which has direct consequences on transport patterns.

Grants, loans and tax transfers – including foreign aid and transfers from national to local government, which can be used parts of the transport system which require a large upfront payment (i.e. investment in large infrastructure projects) or to fund shortfalls in revenue at local level. These are often aligned to the agendas of the providing party, which are not always in line with sustainability objectives.

Private sector investments – which takes place in infrastructure (PPP/PFI), operations (e.g. franchised public transport services), and technology (e.g. vehicle manufacturing). As noted in the previous section, the importance of the private sector in developing countries is witnessed through the large proportion of private operators in public transport provision, including informal/paratransit services (Cervero, 2000). The development and manufacturing of vehicles (including paratransit and non-motorized) is also predominantly in the private sphere. As Figure 5.6 shows, infrastructure is also increasingly being built, operated and maintained by private contractors through various concessionary agreements.

Figure 5.6: Number of transport projects with private sector participation (1990-2007)



Source: World Bank (2009)

Private resources can also be mobilized to provide sustainable transport services, provided a good regulatory environment which creates incentives to invest in low-carbon modes and infrastructure. Many lessons can be learnt from experience in developed countries in terms of risk sharing, privatization and franchising (Nash et al, 2001).

5.4.2 Assessment of carbon-oriented funding mechanisms

219. Financing options targeted specifically at funding low-carbon transport can be found at national, local and international level³⁴. Below is a short introduction to some representative mechanisms. Box 5.3 also provides a discussion on emissions trading schemes (ETS).

Environmental taxes – are typically leveraged on energy or fossil fuel use. These are found in many European countries, an example of which is the UK Climate Change Levy. Revenues from these taxes may or may not be earmarked for a certain use. If earmarked, these taxes could provide a mechanism similar to road funds, except for that the intake could be spent on carbon mitigation projects and programs.

The Clean Development Mechanism (CDM) – has been a main instrument for the funding of climate change mitigation projects in developing countries. However, its application to transport has so far been very limited, with only 2 projects being approved. Discussion regarding its reform is currently under way, with suggestions being made on using 1) a “first of its kind” approach, or 2) programmatic/sectoral approaches to make it more applicable to the transport sector (see Chapter 2 for a detailed discussion).

³⁴ Also see Bongardt et al (2009) for a good discussion on the differences between carbon market/crediting mechanisms and fund-type arrangements.

The Global Environmental Facility (GEF) – provides funding for piloting/demonstrating innovative technologies, removing barriers to transform markets, and building capacity (WB, 2008). During the period from 1999 till now, the GEF has approved 35 transport projects and allocated approximately \$185 million with an average of \$ 5.3 million per project. (See Tables 5.1 and 5.2). Key sustainable transport objectives are made explicit in their goals, but its complex project approval process has often been noted as a barrier to wider uptake.

Table 5.1: Regional distribution of the GEF portfolio in transportation sector

Region	Number of projects as of April 2009*
Latin America and Caribbean	9
East Asia and Pacific	9
Africa	6
South Asia	3
Eastern Europe and Central Asia	4
Middle-East and North Africa	1
Global	3
Total	35

Note: This includes projects under preparation (PIF approved).
Source: GEF Secretariat.

Table 5.2: Level of financing in transportation sector (as of April, 2009)

\$M	GEF financing	Cofinancing	Total
GEF 2	30.60	30.36	60.96
GEF 3	33.05	249.32	282.37
GEF 4	81.07	1574.55	1655.62
GEF 4 preparation	40.51	566.34	606.85
Total	185.23	2420.57	2605.8

Source: GEF Secretariat, Units: Million USD.

Multilateral funds – including:

- The World Bank Clean Technology Fund (CTF) which forms part of the Clean Investment Fund (CIF) and intended as an interim measure until a new UNFCCC financing architecture comes into effect. 5-10 billion USD (total) is proposed, which would include transport (e.g. clean vehicles and modal shift) as a target. Details on its actual application to transport are still limited, although the funding of a national BRT scheme in Mexico is currently being discussed. (Huizenga, 2009)
- ADB Clean Energy Financing Partnership Facility (CEFPF) – which was recently launched to promote renewable energy and energy efficiency, with a target of \$250 million. So far one transport project in China has been funded.

Bilateral funds – such as the Japan “Cool Earth Partnership” with mention of applications to the transport sector (including urban planning). Again, details are unclear at this stage regarding their scope and size.

220. Needless to say, developments around the above measures are occurring quickly, and changes are expected to accelerate in the coming months and years. Of particular interest/importance is how they would relate to the implementation of Nationally Appropriate Mitigation Actions (NAMAs). For example, the Republic of Korea is active in advocating the idea of a NAMA registry, and the crediting of NAMAs through an enhanced CDM which would take a programmatic or sectoral approach (Yoo, no date, and Kwon, 2009).

221. Bongardt et al (2009) warns against a reliance on carbon markets, mainly due to the difficulty in proving the additionality of NAMAs – if measures that would have taken place irrespective of the climate regime were credited, this would allow further emission increases in developed countries. They advocate the use of fund-based approaches including a potential Mitigation Fund under the UNFCCC, with streamlined provisions for determining the incremental costs of mitigation actions.³⁵

5.4.3 Summary and key observations from the assessment of existing funding mechanisms

222. Table 5.3 below summarizes the mechanisms listed above, with information added on their level of administration, current application/usage in transport, political acceptability, and the strengths and weaknesses in relation to supporting a sustainable transport system.³⁶

223. The above-listed mechanisms have at least the potential to contribute to the development of a sustainable transport system via;

- **Avoiding** or reducing travel activities;
- **Shifting** transport activity to more sustainable modes; or
- **Improving** the efficiency/sustainability of transport modes.

224. These three pillars of a low-carbon transport strategy can be combined to reduce the overall emissions from the transport sector (see Dalkmann and Brannigan, 2007).

³⁵ Existing climate funds such as the GEF are designed to cover the incremental costs of mitigation actions, i.e. the difference in costs between an existing (more polluting) option and a more expensive but environmentally friendly option. As Bongardt et al (2009) makes clear, the calculation of these incremental costs poses a similar challenge to assessing the additionality of CDM projects.

³⁶ The qualitative assessment contained in this and succeeding tables reflect the judgment of the author, informed in part by Victoria Transport Policy Institute (2009), EEA (2008) and Dalkmann and Brannigan (2007). The tables are meant to provide a framework for further debate. Readers are invited to use the framework provided to assess the situation in the context of their country/local area. Although beyond the scope of this paper, these assessments can be further enriched by Delphi surveys among experts and practitioners.

Box 5.3: To tax or to trade

Emissions trading (cap-and-trade) and carbon taxation are both measures that have the potential to internalise externalities. The former can set an absolute cap on emissions and allow the market to find the most cost-effective way of reaching the target, whereas the latter directly controls the marginal cost of the polluting activity. Trading transport emissions could occur at three levels: fuel producers, car manufacturers, and individual motorists and hauliers (DfT, 2009)

Although the potential to trade road transport emissions upstream (at the level of transport fuel producers/importers) have been advocated as a workable solution by some (see for example Hacker, 2008), the lack of political will, together with the (perceived) difficulty in allocating permits, limiting administrative costs and eliminating leakage have so far prohibited this from happening.

Difficulties are amplified in developing countries, where carbon markets are still in their infancy, and where institutional capacity may be inadequate.

The prospect for emissions trading to be applied to the transport sector at a large scale is therefore currently very limited, in both developed and developing countries. This is not to say however that such a scheme is impossible in the future, and efforts to strengthen the institutions that enforce and manage tax collection would also work in favour of a workable trading scheme.

Existing trading schemes can also be linked to international efforts – for example it has been suggested that the EU ETS may use its proceeds from auctioning permits for the aviation sector to fund climate change actions in developing countries (see Major, 2008).

225. There are considerable differences between developed and developing countries in terms of composition and growth of the transport sector, which suggests the need for a different approach to the mitigation of transport emissions in the latter group. The transport sector in most developed countries is mostly mature, and there is relatively little change in modal split in both passenger and freight transport. This limits to some extent the possible application of Avoid and Shift related measures. The situation in most developing countries is however radically different. The demand for mobility is still rapidly growing and the modal split is still very much changing, which suggests a larger potential for influencing their future state.

226. The table below indicates how the various funding mechanism outlined earlier may, when applied in a proper manner, contribute to these three strategic components.

Table 5.3: Overview of financial mechanisms and their strengths and weaknesses in supporting sustainable transport

Financing Mechanism	Level of implementation	Current usage in transport sector	Political Acceptability	Strengths (Support for sustainable transport)	Weaknesses (Barriers to implementation)
Transport oriented funding mechanisms					
Fuel tax (road funds)	National	Infrastructure (maintenance)	Low	<ul style="list-style-type: none"> • Stability and ease of administration • Can be considered a tax on carbon 	<ul style="list-style-type: none"> • Fuel currently under-priced and subsidized • Increase of tax rate unpopular with public • Subject to political pressure for reduction
Vehicle taxes	Local	Infrastructure	Medium	<ul style="list-style-type: none"> • Reduces incentive to buy/own a car • Often progressive 	<ul style="list-style-type: none"> • Currently not linked to level of externalities • Subject to political pressure for reduction
Parking charges	Local	Local infrastructure, operations, institutions	Low – Medium	<ul style="list-style-type: none"> • Supports traffic management • Benefits local government 	<ul style="list-style-type: none"> • Often not properly enforced • Affects mainly short journeys only
Road pricing	Local	Local Infrastructure, operations, institutions, policy	Low (existing roads) Medium (new schemes)	<ul style="list-style-type: none"> • Reduces congestion and other externalities • First-best (most economically efficient) pricing mechanism 	<ul style="list-style-type: none"> • High administrative/ technological burden • Low political acceptability
Fare revenue	Local/ Private	Local public transport operations	Medium	<ul style="list-style-type: none"> • Consistent with user pays principle 	<ul style="list-style-type: none"> • May price poor off of services
Public transport subsidies	National/ Local	Local public transport operations	High	<ul style="list-style-type: none"> • May readdress distortion between public/private modes 	<ul style="list-style-type: none"> • Creates inefficiencies and urban sprawl if improperly applied
Business taxes	National/ Local	Local public transport operations and infrastructure	Medium	<ul style="list-style-type: none"> • Lowers cost of public transport at point of use • Provides stable source of revenue 	<ul style="list-style-type: none"> • Requires strong institutional capacity
Advertising	Local/ Private	Local public transport operations,	High	<ul style="list-style-type: none"> • Assists in reducing financial shortfalls in maintenance/operations 	<ul style="list-style-type: none"> • Lack of enforcement of advertising rights may lead to free-riding (and lost potential revenue)

Financing Mechanism	Level of implementation	Current usage in transport sector	Political Acceptability	Strengths (Support for sustainable transport)	Weaknesses (Barriers to implementation)
		maintenance of infrastructure			
Land related taxes and charges	National/Local	Local public transport operations and infrastructure	Medium	<ul style="list-style-type: none"> • Supplements low tax base for public transport • Can reduce urban sprawl 	<ul style="list-style-type: none"> • Requires strong institutional capacity and political support
Grants, loans, tax transfers	Global/National	Infrastructure, policy, institutions	High	<ul style="list-style-type: none"> • Supplements shortages at local level • Can leverage other funding • Assists knowledge/technology transfer 	<ul style="list-style-type: none"> • May reduce local political autonomy • May contain conflicting agendas/priorities if sources are multiple
Private sector investments	Private	Technology, operation, infrastructure	High	<ul style="list-style-type: none"> • Scale up investments in technology, operations and green infrastructure • Improve efficiency and quality of services if regulated correctly 	<ul style="list-style-type: none"> • May jeopardize public objectives if poorly regulated/coordinated
Carbon Oriented Funding Mechanisms					
Environmental taxation	National/local	Carbon mitigation projects and programs	Low - Medium	<ul style="list-style-type: none"> • Relative ease of administration • May already exist in the form of traditional taxes, e.g. fuel tax 	<ul style="list-style-type: none"> • Little political understanding and support
CDM	Global	Limited application	High	<ul style="list-style-type: none"> • Robust methodological basis for carbon reduction 	<ul style="list-style-type: none"> • Limited applicability to transport in current form
ETS	Global	Aviation sector in EU (2012)	Medium (low on agenda)	<ul style="list-style-type: none"> • Similar effect to carbon taxation • Ensures pre-set emission target to be reached if enforced • Proceeds of permit auctioning could be spent on tackling climate change (Major, 2008) 	<ul style="list-style-type: none"> • Difficulty in incorporating road transport (see Box 5.3.) • Necessitates strong institutional capacity to administer markets • Revenue difficult to predict • Difficulty in internalizing other externalities
GEF	Global	Technology, capacity building, market development	Medium	<ul style="list-style-type: none"> • Good recognition of sustainable transport 	<ul style="list-style-type: none"> • Administrative burden for applicants • Limit in absolute scale
Multilateral funds, e.g.	Global	TBC	High	<ul style="list-style-type: none"> • May support modal shift, fuel economy standards, fuel switch 	<ul style="list-style-type: none"> • Limit in absolute scale • Potentially limited to technological

Financing Mechanism	Level of implementation	Current usage in transport sector	Political Acceptability	Strengths (Support for sustainable transport)	Weaknesses (Barriers to implementation)
<ul style="list-style-type: none"> • WB CTF • ADB CEFPF 				<ul style="list-style-type: none"> • Details yet to be confirmed 	<ul style="list-style-type: none"> • options • Details yet to be confirmed
Bilateral funds, e.g.: <ul style="list-style-type: none"> • Japan Cool Earth Partnership) • German International Climate Initiative 	Global/ National	TBC	High	<ul style="list-style-type: none"> • May support technology transfer • Details yet to be confirmed 	<ul style="list-style-type: none"> • Limit in absolute scale • Potentially limited to technological options • Details yet to be confirmed

Source: Authors

Table 5.4: Funding mechanisms and relation to Avoid-Shift-Improve

Funding mechanism		Avoid	Shift	Improve
Transport oriented funding mechanisms				
Public Sector Funding	Fuel tax	✓✓✓	✓✓	✓✓✓
	Vehicle taxes	✓✓	✓✓	✓✓
	Parking charges	✓✓	✓✓	
	Road pricing	✓✓✓	✓✓✓	✓
	Fare revenue*		✓	
	Public transport subsidies		✓	
	Business taxes		✓	
	Land related taxes and charges	✓✓✓	✓✓	
	Grants, loans, tax transfers	✓✓	✓✓	✓✓
	Advertising		✓	
	Private sector investments	✓	✓	✓✓✓
Carbon oriented funding mechanisms				
	Environmental taxation	✓	✓✓	✓✓
	CDM	P	PP	PP
	ETS	P	P	✓/ P
	GEF	P	✓	✓
	Multilateral/ bilateral funds	P	✓ / P	✓ / P
	NAMA related funding**	P	PP	P

✓✓✓: High contribution; ✓✓: Medium contribution ; ✓: Low contribution;

P: Low future potential, PP: Medium future potential, PPP: Large future potential

** Fare revenue in many cases also accrues to the private sector, if the transport operator is private.

* *Funding NAMAs could potentially be linked to the Avoid-Shift-Improve paradigm

Source: Authors

227. As the table above suggests, transport-oriented financial mechanisms which feed into public sector funding, in particular the fuel tax, vehicle taxes and road pricing have the potential to play a central role in reducing trips, shifting modes and improving the efficiency of various modes. As previously mentioned, various empirical studies have shown that the price of fuel (which in part is influenced by fuel taxes) is a key determinant of the overall carbon efficiency of the transport system, as it encourages people to purchase more efficient vehicles, make public transport more competitive, and reduce the traveling distance between home, work and other activities. Road pricing, vehicle taxes and parking charges can have similar effects, especially when they are related to external costs. Unfortunately, these instruments are currently not used to their best advantage, partly due to the perceived low political acceptability in their wider application.

228. Business taxes may also play a large role in supporting the viability of public transport, whereas land-related taxes and charges have a large potential to address the externalities

associated with urban sprawl and poor land use. The extended role of private finance in light of sustainability also needs consideration.

229. On the other hand, carbon-oriented financial mechanisms, particularly those administered internationally, currently tend to focus on the elements of Shift and Improve, with limited attention given to the issue of managing the overall demand for transport. Their contributions are also constrained by the absolute amount of funding available as well as the limited scope in application.

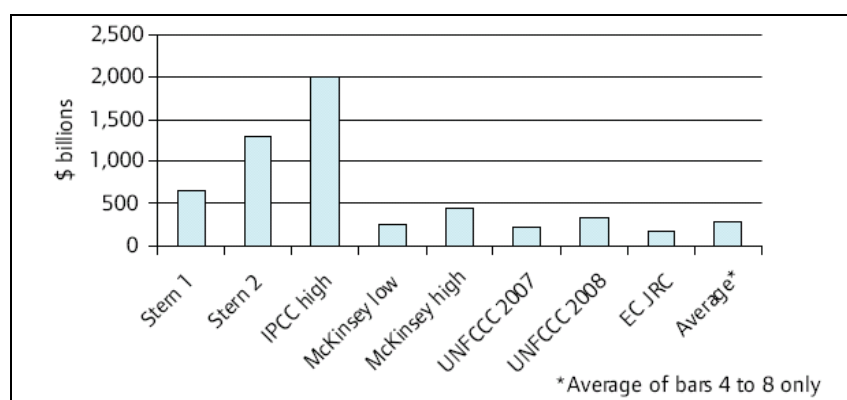
230. The above analysis suggests that a better application of existing transport-oriented funding mechanisms (oriented to support the user-pays principle), together with the scaling-up of carbon oriented financial mechanisms would be needed.

5.5 Shifting the Direction towards Sustainability

231. The previous section explored the limitations of current funding and pricing practices in enabling a sustainable transport system. Here we explore how a shift can take place in both financing and pricing to realize this objective.

5.5.1 Financing requirements for a sustainable transport system

232. We begin with the consideration of the financial resources needed to move towards a sustainable transport system. As Pendleton and Retallack (2009) note, various studies including McKinsey & Co (2007), UNFCCC (2008) and EC JRC (2008) point to the need of roughly US\$100 billion to \$200 billion per annum in the developing world, or globally at \$200 to \$400 billion in the years 2020-2030. These figures are not specific to the transport sector, and are calculated via various methodologies which are not always comparable. However, they do provide an indication of the order of magnitude of funding that is required for mitigation.

Figure 5. 7: Estimation of global mitigation costs (per annum)

Source: Pendleton and Retallack (2009)

233. Translating this into the financial requirements for the transport sector is not a trivial exercise, as it would be dependent on various important aspects including:

- The global emissions reduction requirement (across all sectors and countries)
- The required timing of emission reduction and the existence of interim targets
- The relative commitments between industrialized and developing countries, as well as between specific regions/countries³⁷
- The relative contribution of transport in relation to other sectors (this could be expressed in the form of a sectoral target)
- The abatement costs in the transport sector, and how this changes over time (e.g. due to changes in city structure, land use and technological breakthroughs etc)

234. Attempts at placing a “dollar sign” specifically on transport requirements have to the author’s knowledge been very limited, partly owing to the above uncertainties.

235. Furthermore, some have interpreted Stern (2006) and McKinsey and Co (2007 and 2009) to suggest that the (marginal) abatement costs in transport are too high to warrant early efforts in this sector, thereby severely limiting the debate on how transport can play a role in reducing global carbon emissions.

236. The information available in the public domain with regards to the estimation of these marginal abatement curves is too limited to judge whether the estimated impact and cost of different measures to reduce CO₂ is valid. Goodwin (in UKERC 2007) also suggests that carbon abatement costs in transport are often calculated presuming growth in transport levels as inevitable, thereby making abatement expensive. As pointed out in Chapter 1, databases required to make reliable estimates of this type of disaggregated analysis are generally lacking, especially in developing countries. As such, the assumptions being used in constructing such marginal cost curves need to be further scrutinized.

237. Huizenga et. al. (2009) points out in this context that the mitigation of transport emissions has often been subsumed as part of efforts by the energy sector within the larger climate discussions. Treating transport as a sub-sector of the energy sector is likely to have contributed to a situation in which the discussion on mitigation in the transport sector has had a bias towards technology related solutions rather than on non-technological and behavioral

³⁷ Note recent developments in the UNFCCC meetings and communications, suggesting developing countries to reduce 15-30% of their emissions below the baseline.

change related solutions such as avoiding or reducing the need for travel by better land-use planning or by shifting emissions to the most efficient mode of transport.

238. As a result, the potential of Avoid and Shift measures to mitigate transport emissions in developing countries has received limited attention in UNFCCC guided discussions. This is unfortunate because in many cases Avoid and Shift measures could be cheaper than the traditional approaches these measures would replace: for example fewer motorways, subways and fly-overs, replaced by more NMT, BRT, and better land-use planning. This opens up a pathway to reducing transport related emissions at a lower cost of ton CO₂ removed than in the case of technology focused measures.

239. Cost-effectiveness, which marginal abatement curves aim to represent, is clearly an important aspect of transport and climate policy. However, this and other chapters have highlighted the importance of systematic changes to the way transport is coordinated, and how the related topics of infrastructure provision, city structures, land use and provision of alternative modes to the private car can fundamentally affect people's travel patterns (and thereby carbon emissions), especially in developing countries. Questions arise as to whether the cost effectiveness of such systematic changes (which are difficult to place in marginal/incremental terms) can fully be captured under existing approaches. For instance, Anable (2008, and in UKERC, 2007) in the UK context point out inter alia that single cost effectiveness figures do not represent the time dimension (e.g. changing costs over time), that existing cost-effectiveness figures cannot assess packages of policies (which are often more important than individual instruments), that comparing across studies and sectors is fraught with difficulty, and that the evidence for non-technological transport solutions has been neglected/overlooked. There is no doubt that these issues would greatly benefit from further and urgent debate.

240. In order to help structure such a debate, it may be useful to firstly provide some indications on the scale of resources involved, and what may be achieved if they are directed towards sustainable transport. A hypothetical example is provided in Box 5.4 below.

Box 5.4: Hypothetical calculations on what extra funds can provide

Were we to assume conservatively that financial flows of \$100 billion is required globally per annum, and that the transport sector is in need of its "fair share" of resources based simply on its fraction of emissions (or roughly 13% of GHG emissions), then \$13 billion would be made available.

This amount of resources could provide in every non-Annex 1 country either:

- The salary of 5,200 sustainable transport professionals (at \$25,000 USD p.a.);
- University courses on sustainable transport for 13,000 students (at \$10,000 USD p.a.);
- 657,000 bicycles (at \$200 each);
- 13,000 kilometers of on-road cycle lanes (at \$10,000 per km); or
- 260 hybrid buses (at \$500,000 each)

Note that similar amounts of resources could also be made available through shifting existing resources, such as those for motorway building coupled with correct pricing of road transport. For example, the same magnitude of resources would be available annually from an extra US\$ 0,10 rise in fuel taxes in China, India, Brazil and Indonesia alone (calculations based on figures from Zietlow, 2006, which advocates the use of fuel tax revenues on measures to improve road safety).

Although in the form of lending, another \$10-20 billion currently committed by the major MDBs including World Bank, ADB, JICA/IBIC and KfW on transport (mainly in the form of highways and intercity roads) can be made available subject to partial reallocation for more sustainable forms of transport.

5.5.2 Shifting financing towards a low carbon sustainable transport strategy

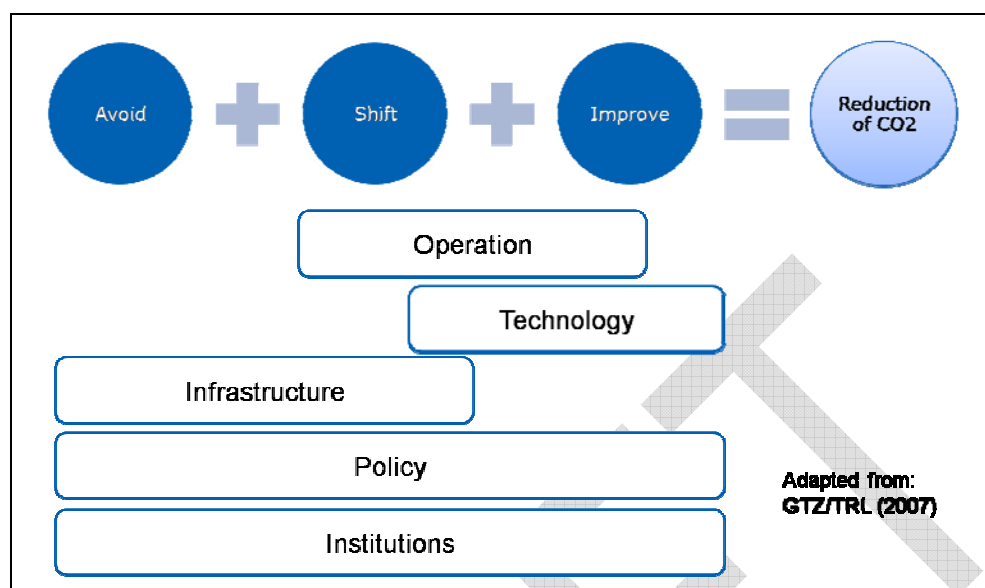
241. As the examples from the previous section highlights, a major consideration would be in shifting away from projects and programs that contribute to an energy-intensive transport and land-use structure, such as suburban highways and urban trunk road expansion, to those that deliver sustainable transport, including urban public transport and non-motorized transport. Again in relation to McKinsey & Co (2007), there may even be areas of current transport funding from which resources could be disinvested on grounds of damaging long-term effects on the climate, allowing for a negative (marginal) abatement cost. It is vital for these decisions to be made in a systematic and transparent manner taking into account the other objectives of transport investments such as poverty reduction and local environmental protection, rather than relying on ad-hoc processes. This links directly with the need for a review of current investment decision making processes, including the economic appraisal of transport projects.

242. Additional funding may be necessary where there is currently no provision, which could in part be brought by UNFCCC related funding such as a programmatic or sectoral CDM post 2012 or by a possible Mitigation Fund to support the implementation of NAMAs. Either in redirecting existing funding or utilizing new sources, funding must be optimized to allow the most effective use of scarce resources.

243. Consideration must also be given to ensure that the various aspects of sustainable transport are adequately funded. These include, and are not limited to;

- **Policies** – including their development, implementation and enforcement
- **Institutions/Governance** – including capacity building and staff training
- **Infrastructure** – including those for cyclists and pedestrians. Funding also needs to adequately cover their maintenance.
- **Operations** – including those for public transport, paratransit and non motorized vehicles.
- **Technology** and R&D – of vehicles, systems (e.g. ITS) and infrastructure

244. Sound coverage of the above elements allow the overall strategy of CO₂ reduction (i.e. reducing overall transport demand, shifting towards less emitting modes, and improving emission factors) to be enacted, as Figure 5.8 below depicts.

Figure 5.8: Supporting the overall carbon reduction strategy

Source: Authors

5.5.3 Pricing according to social and environmental cost

245. As previously discussed, price structures for transport activities must be reformed to take into account the full cost to society, including congestion, accidents, infrastructure wear and tear, climate change, noise and air pollution externalities. Users must be asked to pay for the full costs of their activities (i.e. the User Pays Principle), and subsidies that work in the opposite direction must be reformed.

246. Some of the existing financing mechanisms explored in the previous chapter can be combined to allow this to happen. For example, fuel taxes are essentially a tax on carbon emissions, and can internalize at least a part of the externalities caused by transport. Other mechanisms such as road pricing have the potential to address congestion and other types of externalities, as depicted in the Table 5.5 below.

Table 5.5: Road transport externalities and potential measures for internalization

Externality	Instruments
Infrastructure operation, maintenance, depreciation	Infrastructure charge, road pricing
Air Pollution	Standards, environmental charges, road pricing
Noise	Noise charge, road pricing, VED
Climate Change	Carbon tax, road pricing, fuel duty, VED, airport tax
Congestion	Road pricing, public transport subsidies

Source: Sakamoto (2006)

247. The importance of pricing can be highlighted through another statistic from IEA (in UNEP, 2008) suggesting that energy subsidies, the majority which is on fossil fuels, runs into the order of \$300 billion per annum. This matches the magnitude of estimated financial

requirements explained earlier of \$200-400 billion per annum in total mitigation efforts globally and not only the transport sector.

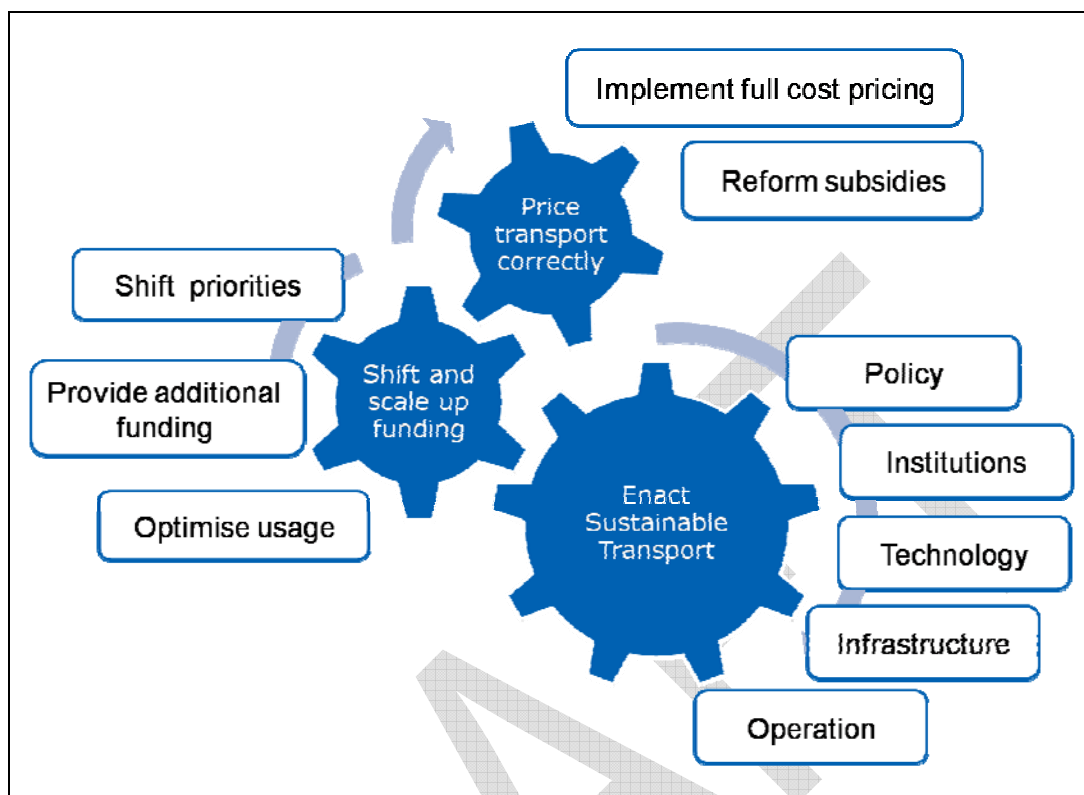
5.5.4 Interlocking financing and pricing to enact sustainable transport

248. The changes in pricing and financing can be designed in such a manner that they enforce each other, whereby the revenues from a full-cost-priced transport system can be used as sources of funding the various aspects of sustainable transport. This is shown in the below figure, which depicts how pricing and funding can leverage each other to move the “larger wheel” of sustainable transport.

249. As the examples in Box 5.4 highlighted, existing transport oriented taxes can provide a significant, indigenous and thereby more sustainable contribution to the resources currently being demanded at world level for mitigation. Reforming energy subsidies and pricing transport so as to reflect externalities are therefore a crucial starting point for the large-scale reforms necessary for realizing the sustainable transport vision. Bearing in mind the limited scale of current and potential external funding sources (e.g. carbon financing or ODA), these modifications to energy subsidies and pricing are crucial in scaling up mitigation efforts in a sustainable manner.

250. The revenues raised through correct pricing, augmented with extra funds from future carbon-related funds such as the proposed Mitigation Fund under the UNFCCC, crediting mechanisms such as an upscaled CDM, and resources redirected from less desirable investments can then provide the required resources for the policies, institutions, technology, infrastructure and operations necessary to actually implement a low carbon, sustainable transport system on the ground.

251. In no way does the above argument suggest that all transport revenues be earmarked for a specific usage, and the importance of rigorous appraisal in determining how resources are spent should again be stressed. It is also a matter of local contexts in how exactly these components are linked.

Figure 5.9: Interlocking pricing and financing

Source: Authors

Box 5.5: London's Congestion Charge

In London, roughly 80% of the net revenue from the Congestion Charge (excluding costs of running the scheme) is used to fund the improvement of local bus services. (TfL, 2007) This has been a major factor in improving the public acceptability of the scheme, and is one example of how pricing and funding can be effectively interlocked.

Source: Authors

5.6 Future Options

252. Following the direction of change laid out in the previous chapter, here we discuss possibilities for future financing/pricing frameworks. After a brief examination of the main aspects that need to be considered, we discuss the applicability of a Sustainable Transport Fund in Asia.

5.6.1 Considerations for a new financing framework

253. When considering options for the future, it is firstly important to recognize that transport financing never operates in a vacuum. It is constantly shaped by the properties of various actors, including national government priorities, local conditions, the overall international

framework on carbon finance (i.e. post-Kyoto), the motivation of external donors, and market conditions. Furthermore, transport patterns are shaped by developments in sectors outside of transport (see EEA, 2008).

254. Each of these actors has a role to play in a new financing framework that emphasizes sustainability. For example, national governments can reform central taxes (in particular fuel taxes), create and participate in carbon markets and develop nation-wide strategies for carbon reduction. The international community can support policy development, transfer knowledge and technology, and reform the carbon financing architecture, taking into account the mistakes learned for example from the low take-up of CDM (Dalkmann et al, 2007, Bongardt et al, 2009). More investment from the private sector can be encouraged, for example in the provision of low-carbon vehicles (including non-motorized transport), high-quality public transport services and infrastructure for sustainable modes.

255. The role of local governments is particularly paramount. Although their institutional capacity is currently limited, they have the potential to coordinate the various transport modes, link infrastructure provision with operations, and ensure that pricing and financing are fully integrated at the level of implementation (World Bank 2001 for further discussion). This is even more so given the increasing variety of financing arrangements currently available, most of which have direct effects on more than one aspect of sustainable transport. Effective, locally oriented financing mechanisms are illustrated by examples such as the London Congestion Charge (see Box 5.5), and the French “Versement Transport” (See Box 5.6).

Box 5.6: The French “Versement Transport”

The “Versement Transport”, first introduced in 1971, is a tax levied on worker’s salaries (usually 0.55 to 1.72% of the total wages of each eligible company) which is used to pay for local public transport improvements. Organizations with more than 9 workers in a district with more than 10,000 inhabitants are required to pay the “Versement Transport”. (OSMOSE, 2007). Employees are given subsidized or free travel on public transport in return.

Revenues from the “Versement Transport” have played a major role in funding the upgrading and expansion of the Paris Metro, as well as the LRT and metro systems in many French cities (Enoch et al, no date). The revenue raising potential is estimated at roughly £100 million for an urban area the size of Lyon (PTEG, 2004).

256. In supporting a sustainable transport system, the new framework would collectively need to consider the following main criteria:

- The ability to generate the level of funding required to shift the emphasis towards sustainable transport.
- Financial sustainability and stability of funding – allowing the sustainable transport strategy to be continuously implemented and long term goals to be pursued.
- Efficiency – ensuring that resources are allocated to their best use, and reducing transaction costs throughout the system.
- Equity – both horizontally (i.e. fair treatment of all transport users) and vertically (i.e. across income groups, ensuring support to those who are most deprived)
- Practicality – both in terms of political acceptability and technical feasibility, taking into account local conditions and priorities.

- Measurability and transparency – to ensure that the effects of the new funding arrangements on carbon emissions can be monitored and evaluated against various criteria including cost effectiveness (see Chapter 1).

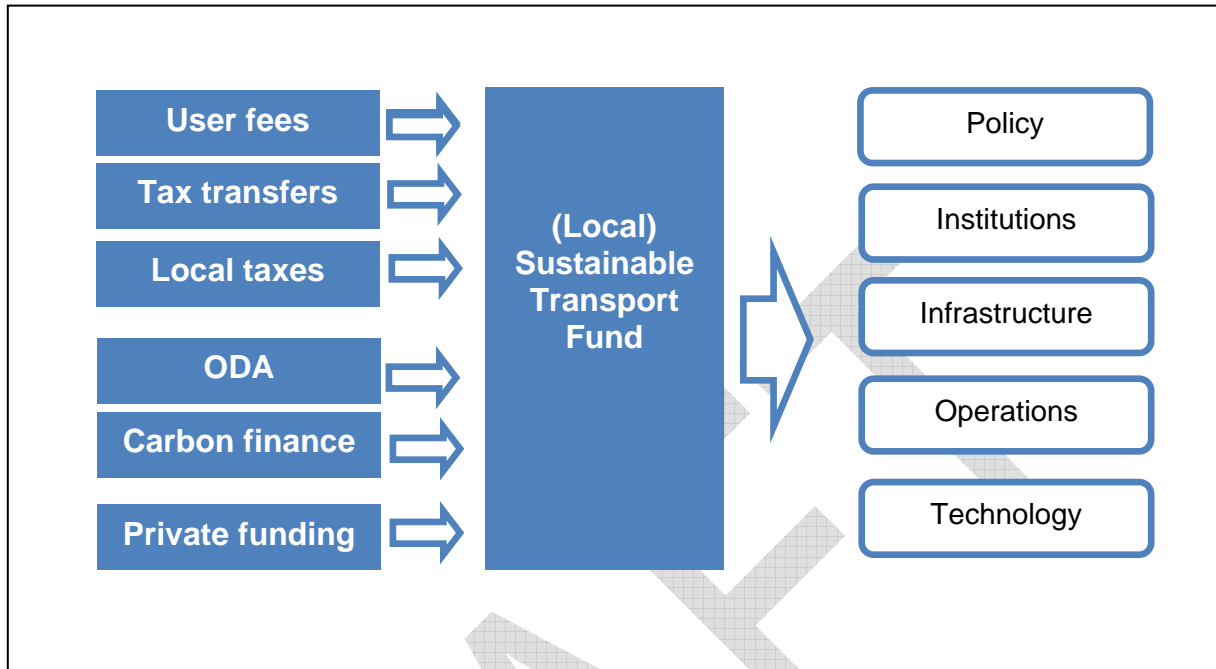
5.6.2 Proposition of Local Sustainable Transport Funds

257. As previously discussed, an effective funding scheme would need to cover all aspects of a sustainable transport system and thereby support the overall transport and climate change strategy. The above suggests the possibility for some type of integrated financing scheme, which allows the effective channeling of diverse funding sources to the various aspects of sustainable transport based on the overall strategy. Such a scheme would help tackle the main problems of urban transport finance identified by previous studies such as World Bank, (2001)

258. One of many options would be Local Sustainable Transport Funds (hereafter referred to as LSTFs), administered at the local level.. Such funds would administer parts of revenue from user fees, local taxes, transfers from central government (e.g. part of the fuel tax revenue), ODA, carbon financing mechanisms and private funding, and allocate it to the various components of the sustainable transport strategy.

259. Local transport funds are already in existence in countries including India (see Box 5.7) and are also proposed in Pakistan (see Box 5.8). They have the potential to support sustainable transport objectives in a manner consistent with local priorities and fulfill the criteria listed in the previous section. The emphasis on the local level also reflects the lessons learnt by the development community over the past few decades. For example, the key role of the local government in determining fares and coordinating franchises have been highlighted by Gwilliam (2005).

260. A prerequisite of such a fund working effectively is the strengthening of local institutional capacity, which is discussed in the next chapter. The management of the LSTFs would need to be conducted/facilitated by a body that is capable of administering the various inflows of financial resources, as well as one that has an oversight of the local transport network and land use planning. This is likely to vary according to the institutional setup and capacity of each country/region. For example, large cities with a dedicated development agency may rely on these as “host organizations”, steered by a joint committee consisting of those responsible for transport, urban planning, environment and finance.

Figure 5.10: Concept of a local sustainable transport fund

Source: Authors

261. Strategic plans and programs at national level can also be designed to stimulate local initiatives and changes. For instance in India, the Jawaharlal Neru National Urban Renewal Mission (JnNURM, see Box 5.7) provides financial assistance as soft loans, grant-cum-loans or grants to Urban Local Bodies and parastatal bodies via state-level Nodal Agencies, in return for formulating City Development Plans (CDPs) and detailed project reports for urban infrastructure development. Furthermore, grants for urban buses have recently been made available, subject to the set-up of Dedicated Urban Transport Funds at state and city levels (see Box 5.7 for further details). Sectoral climate mitigation plans/roadmaps such as those being currently developed in Indonesia and India could also identify and support local initiatives.

Box 5.7: Transport funds in India

Examples of local transport funds in action can be seen in India, where recently two urban areas have adopted such an approach. In Surat, vehicle taxes, parking charges and advertisement fees are fed into a dedicated urban transport fund, which is used to support its urban mobility plan, including the expansion of bus services and modification of three-wheelers to power on CNG. In Pimpri-Chinchwad, a 130km BRT network is being developed through an urban transport fund, funded by fares, monthly passes, advertisement and land related taxes (e.g. development rights around the BRT corridor, and property tax). (Centre for Science and Environment, 2009)

India also possesses the Jawaharlal Neru National Urban Renewal Mission (JnNURM) which at national level provides assistance to megacities in their efforts to improve urban infrastructure. Sustainable transport is one focus of this ambitious scheme. The philosophy behind the JNNURM is one of cost-sharing between national and local level, in design, construction and operation of infrastructure.

Recently, as part of the Indian government's economic stimulus package, a one-time assistance grant of \$58 billion to has been provided to the states under the framework of the JnNURM for the purchase of urban buses (WRI, 2009). This provision is subject to various conditions, including the setting up of a Dedicated Urban Transport Fund at both the State and city level. Revenue sources suggested for the Fund at State level include sales tax on petrol, vehicle registration fees, renewal fees for driving licenses, congestion taxes and green taxes. For the Fund at the city level, betterment levies on land, parking fees, property development taxes, advertisement revenue and

Source: Authors

Box 5.8: Suggestions for traffic and transport funds for cities in Punjab, Pakistan

In Pakistan, the Punjab Planning and Development Department has suggested through its new urban transport policy the development of traffic and transport funds for the cities of Rawalpindi, Lahore, Gujranwala, Faisalabad and Multan (Punjab Planning and Development Department 2009).

These funds would allow road related taxes (currently collected and allocated by several different agencies) to be collected into one source, More specifically, sources of revenue for the fund would include;

- Transfers from Federal/Provincial Governments/ donors / private sector
- Share from commercial fees, development charges, value addition taxation and other sector related collections
- Road / transport related taxation i.e. fuel charges, congestion charges, road
- User charges and share from various form of tolling on commercial goods

The fund would cover infrastructure development, maintenance and the administrative costs of operating the fund.

The creation of new taxes to balance road usage among various modes of transport is also advocated. Also, to support the role of the private sector, the establishment of several endowment funds for e.g. investments in buses, rolling stock for mass transit system and parking plazas is also being suggested.

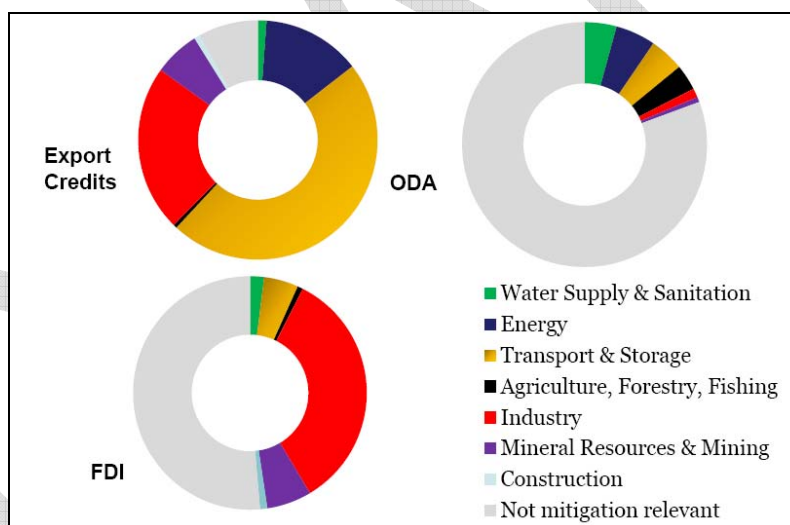
262. There are several ways in which these locally-oriented funds can be linked to global frameworks and mechanisms. For example, components of the sustainable transport strategy which can be measured, reported and verified (MRV) to meet UNFCCC requirements could be submitted through national governments as elements of a NAMA registry, and receive funding through future UNFCCC financing mechanisms (such as the suggested Mitigation Fund, upscaled CDM or a dedicated Low Carbon Transport Facility³⁸). The UNFCCC framework could allow for such funding to be combined with indigenous funding, through the LSTF.

263. Other sources of international funding, such as ODA, could feed into the local funds for use in supporting capacity building, technology transfer and policy development. Loans and grants can also be made available to partially finance sustainable transport (pilot) projects.

264. It would be beneficial for various international funding bodies to establish common criteria and/or a more joined-up approach towards financial assistance, so that conflicting funding priorities, duplication of effort, and administrative burdens on local governments can be minimized.

265. This would need to be linked to a wider re-evaluation of ODA, Export Credits and other avenues through which transport investments are made and/or influenced. As the below analysis by the OECD suggests, transport is a major component of mitigation-relevant financial flows from developed to developing countries.

Figure 5.11: Mitigation relevant ODA, export credits and FDI (2003-05 average)



Source: OECD (2009) in Morlot (2009)

266. On the other hand, thought needs to go in before opting for a large, overly-ambitious scheme (e.g. an Asian Regional Sustainable Transport Fund) that aims to administer and reform all aspects of financing at all levels. Although the need for drastic reform remains, there may also be a few risks of establishing such a scheme, including a top-down framework that discounts local concerns, a large bureaucracy with large transaction and administrative costs, and duplication of already existing mechanisms. This is an area that would benefit from significant debate, involving stakeholders at all levels.

³⁸ For a full discussion on future UNFCCC financing mechanisms, refer to ADB (2009a), Dalkmann et al (2009) and Bongardt et al (2009)

267. It is therefore felt that at this stage, a better approach would be for national governments and the international community to assist local sustainable transport funds by creating a favorable environment and strong incentives for them to develop and to grow. The effectiveness of local initiatives can be increased through complimentary national policies such as proper fuel taxation and (intercity) road user charging. For such purpose, there will be no shortage in the need for financial, human and political resources.

268. It must again be stressed that transport funding is not isolated from developments outside the sector – nor the specific requirements of each country and region. It is therefore crucial for any approach to provide flexibility in its implementation as well as the continuous monitoring of its relevance to the cause.

5.7 Conclusions and Recommendations

269. Below are the main conclusions and recommendations that follow from this analysis.

- Current mainstream financing mechanisms and pricing practices do not support a sustainable transport system, both in terms of scale and scope. Prices do not reflect the full costs of transport, and investment (both public and private, domestic and foreign) is skewed towards supporting carbon-intensive private motor vehicles.
- There is an abundance of traditional and innovative financing mechanisms to fund transport. However, most are not used to their full extent in supporting a sustainable transport system, and financing mechanisms designed for climate change mitigation – including the CDM – are very limited in their use.
- A holistic and integrated package of reforms needs to be ensured - consisting of financing mechanisms that collectively allow the funding of the various aspects of the sustainable transport strategy (not just technology), and addresses issues that expand beyond the transport sector, especially land use and urban sprawl.
- A move towards Social Marginal Cost pricing is needed. Where first-best solutions are impossible to implement, governments should consider the use of fuel taxation and other proxy measures.
- Carbon generating consequences must be integrated into the decision making process for funding projects and programs. Governments and development agencies must re-examine the current appraisal framework for transport investments.
- Although there is a large role for central governments and international institutions, top-down frameworks that discount local conditions will not be sustainable. Local initiatives need to be empowered. Lessons must be learnt from the GEF and CDM experience to see what works and what doesn't.
- A Sustainable Transport Fund may be viable at a local level, incentivized through national strategies and supported by international financing frameworks (e.g. ODA, carbon funds/crediting) as well as private finance.
- The UNFCCC process should pursue new/improved financing mechanisms in the Post 2012 framework which would work for the transport sector, including upscaled CDM, a transport window for the suggested Mitigation Fund, or a dedicated Low-Carbon Transport Facility.

- This needs to be matched by efforts by governments and the international community to reform mainstream investments and financial flows into transport, including (traditional) transport taxes such as fuel tax, ODA, export credits and private investments which dwarf the former in size and scope.
- There is a need for governments to establish and share data on transport financing, pricing and investments in the Asian region to help identify funding gaps, good/bad practice and monitor progress. International donors and the research community can help such efforts, as part of a larger mission of strengthening institutional capacity for data collection.

DRAFT

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6. Institutional Frameworks to Address Transport and Climate change

6.1 Introduction

270. Effective institutions are critically important in advancing action on CO₂ emissions reduction from the transport sector in Asia. Institutions are important to improve the measurement of carbon in the transport sector; the implementation of the emerging “Avoid-Shift-Improve” approach; promoting a co-benefits approach to catalyze the implementation of such a policy agenda; and implementing new finance frameworks to enable its realization.

271. This chapter reviews the existing institutional frameworks for making transport in Asia more climate-friendly and describes how the institutional framework could develop to realize the new approaches to transport and climate change outlined in this report.

272. What kinds of institutions are relevant to Transport and Climate Change in Asia? Based on the crosscutting nature of Transport and Climate Change, relevant institutions are wide ranging and include:

- a) Traditional transport related institutions who are already integrating climate in their activities, or that should be interested to do so;
- b) Dedicated institutions working on Climate Change who are already addressing transport, or that should take an interest in Transport as part of a climate change mitigation strategy;
- c) Other institutions working on issues that have a transport and climate relevance, e.g. air quality community, energy community, financial institutions as well as organizations focusing on e.g. urban development.

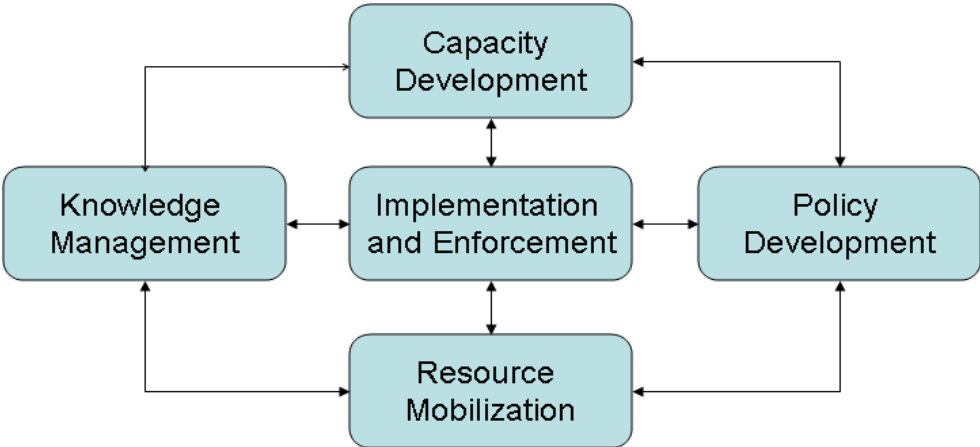
273. These different types of institutions are either part of government, civil society, private sector, academe, or the development community. Reducing CO₂ emissions from the transport sector in Asia will require stronger institutions at the local, national, regional and global level which need to learn to work better together. This chapter argues that national and local level institutions should have the lead role in promoting and implementing low-carbon transport and should be at the heart of the discussion on institutional development for low carbon transport. Global and regional institutions should support the national and local institutions that are key to the successful development and implementation of a sustainable, low carbon transport strategy.

274. The chapter is divided in three sections. The first section deals with the different functions to be performed by a successful institutional framework for low-carbon transport in developing countries. After that an assessment is made on how the different stakeholders are currently performing their roles. Based on the identified functions and assessment of current performance of these functions the last part of the chapter lays out directions for modifying the institutional structure and how different types of institutions can function better.

6.2 Role of Institutions in advancing Low Carbon Sustainable Transport

275. Effective strategies to reduce CO₂ emissions from the transport sector in Asia need to combine knowledge management, capacity development, policy development, and resource mobilization. These 4 elements and their mutual synergies will determine the ultimate success of the implementation of policies, strategies, programs and projects as well as enforcement of regulations and standards.

Figure 6.1: Functions Institutional Framework



Source: Authors

6.2.1 Knowledge Management

276. Having up-to-date, detailed, knowledge on the transport sector and likely scenarios for its development is a prerequisite both for effective general transport policies as well as for effective mitigation strategies. As explained in Chapter 2, the general knowledge base on the composition of the transport sector and its functioning in most of the Asian countries is so far not well developed compared to the knowledge base on transport in developed countries. Also, the transport sector lags behind other important greenhouse gas emitting sectors in developing countries like power generation, cement or steel industry in the availability of data.

277. In many countries or cities there is no reliable information on the actual number of vehicles on the road or on the activity patterns of different vehicle types. Emission inventories both for greenhouse gasses and criteria pollutants are in many cases not available, not up to date or not reliable. The only reporting of climate-data for the transport sector for developing countries so far is through the national communications to the UNFCCC. At present the majority of non-Annex 1 countries are preparing the second generation national communications which will report on emissions from the transport sector in 2000. Not only do the national communications report on old data, in the majority of the cases this will be in a top-down approach. These two factors together make them unsuitable for policy making.

278. It is unlikely that the availability of transport data, including the detailed information on Greenhouse gasses will improve in the short term as there are no major initiatives under way to

improve data availability in most of the Asian countries.³⁹ The poor data availability is contributed to by the absence of organizations at the local, national, regional or global level that have a clear mandate and capacity to coordinate the collection, analysis and reporting on transport statistical data. This in contrast to the energy sector where the International Energy Agency has developed a comprehensive and authoritative data system.⁴⁰

279. Another important part of knowledge management is the documentation, analysis and dissemination of policies, programs and projects that have introduced new approaches to make transport in Asia more sustainable and less carbon intensive. Such information forms the evidence base that can make a key difference in convincing decision makers to agree to certain policy changes and investment proposals. Different countries and cities in Asia have successfully introduced specific elements of the Avoid-Shift-Improve approach to make the transport sector more climate-friendly. Singapore has valuable experience in land-use planning; Jakarta has the largest BRT system in Asia; India has recently introduced an innovative approach to funding urban public transport systems and PRC has been implementing fuel economy standards for light duty vehicles for more than three years. Efforts to document these experiences in a systematic manner are mostly ad-hoc in character and have not focused extensively on their climate impacts. They are driven mostly by regional or international organizations and the results have not been well disseminated to Asian policy makers. Few institutions in developing Asia have currently the resources and capability to undertake such research.

6.2.2 Capacity Development

280. Making transport less carbon intensive requires a general shift to sustainable transport. Sustainable transport is in the majority of Asian countries and cities still very much a new and untested approach. Policy makers increasingly make references to sustainable transport but this has not yet resulted in a comprehensive reorientation in the manner in which transport professionals in Asia are being trained. The majority of transport departments in Asian universities has not yet made sustainable transport the cornerstone of the teaching syllabus and in most cases actually lacks trained faculty to do so. Capacity development on sustainable transport is at present still more often done through ad-hoc training courses for in-service staff rather than through a systematic approach which makes training a compulsory requirement for being able to exercise specific functions and tasks.⁴¹ It is clear that the current approach will not sufficiently be able to generate in any manner the number of sustainable transport professionals that Asia will require in the years to come.

³⁹ A positive exception in China where the Ministry of Environment is in the process to introduce a Total Emission control approach. In support of its introduction a bottom-up emission inventories is being composed for all major emission sources, including the transport sector.

⁴⁰ Transport is included as a sector in the IEA statistics but the level of detail is inadequate so far to allow for detailed policy transport policy analysis and policy development. The Asian Development Bank and the World Bank have recently intensified their efforts to improve data availability on transport but this has been mainly in support of its own operations and is not done (yet) in a coordinated manner and aimed at improving policy making by the Asian countries.

⁴¹ The GTZ-Sustainable Urban Transport Program is currently the leading regional organization undertaking such training. As part of the Sustainable Urban Mobility in Asia program GTZ-SUTP and CAI-Asia are working to build a training infrastructure for sustainable transport in China and India, rather than conducting individual training courses.

Box 6.1: Capacity Building for CDM

The emphasis of the international community on the identification of Clean Development Projects has resulted in very active capacity building efforts both by international organizations and also by national governments. Many countries have created separate CDM units or task-forces and large numbers of people have been trained and retrained in CDM basics. The availability of possible income from CDM projects was in this case a sufficient stimulus to develop concerted capacity building efforts. Unfortunately the transport sector was unable to develop CDM methodologies or projects in any meaningful number to benefit from such capacity building efforts.

Source: Authors.

281. India is currently developing a large scale and well funded in-service training program on urban development which will include transport as part of the Jawahl Nehru Urban Renewal Program (JNURM). It is too early however to make an assessment of its potential impact.

282. Capacity extends beyond knowledge and skills, it also refers to the numbers of staff positions, the operating budgets and other facilities required for an effective translation of sustainable transport from concept to practice. Little thought has been given to this part of capacity development on sustainable transport so-far and there is no overview of what capacity exists in different countries and cities.

6.2.3 Policy Development

283. Sustainable transport as a concept is currently making its way into transport policy at the regional, national and local level in Asia and it is increasingly rare to see transport policy documents or statements which do not make some reference to the need for sustainable transport. The national urban transport policy in India is widely acknowledged as a visionary yet realistic document.⁴² Guidelines on the planning of urban transport in China by the National Development and Reform Commission also have started to influence Chinese cities and have contributed to a shift towards a better balance between public transport and individual privatized transport.

284. International organizations play an important role in creating this shift towards sustainable transport through awareness raising activities and in other cases hands on assistance in policy development or by supporting sustainable transport projects. In Asia the ADB, often in cooperation with the CAI-Asia Center, has played a major role in this respect, and so have organizations like GTZ-SUTP and ITDP.

285. Although sustainability is becoming a key component of transport policies in most cases this does generally not yet include climate change considerations. The majority of Asian countries have so far not made climate change mitigation an explicit objective for the transport sector. Some countries have included energy efficiency, or better public transport as policy objectives but this is mostly done for other reasons than reducing CO₂ emissions. Asian governments generally are hesitating to make climate change mitigation an explicit policy objective until an agreement has been reached on global climate governance in the post 2012 period. First, they expect developed countries to commit to deep cuts in emissions and agree on financial and capacity building support to developing countries as well as mechanisms for the transfer of technology. The transport sector lags behind other sectors especially the energy

⁴² MOUD. 2006. National Urban Transport Policy. Government of India. Ministry of Urban Development. Available: http://urbanindia.nic.in/moud/quickaccess/imp_links/nutp.pdf

sector which has a large number of successful CDM schemes that can form the basis of possible policy approaches to reduce greenhouse gas emissions.

286. The co-benefits approach described in Chapter 4, is so far only partly reflected in policy making. The status of policy development on land-use, urban development, and energy security resembles somehow that of transport policies. Sustainability is increasingly mentioned as key policy driver but the linkages to sustainable transport are in many cases still more implicit than explicit. Although the co-benefits approach has made some headway, policy making for the transport sector which integrates different policy objectives in different sectors is still rare.

287. The development of policy instruments (as described in Chapter 3), which is probably the most important next step in translating policies into actions has progressed less than the formulation of sustainable transport policies itself. While there are several examples of effective policy instruments that have been developed, e.g. congesting pricing in Singapore, vehicle licensing schemes in Shanghai, and financing of urban busses in India; their replication is still limited. The development of policy instruments, both for sustainable transport in general as well as for low carbon transport, is taking on some more interest as is shown for example by the establishment of a global initiative on fuel economy standards⁴³ and by the recommendations made in the declaration of the first Ministerial Meeting on Global Environment, Energy and Transport⁴⁴.

6.2.4 Resource Mobilization

288. Chapter 4, describing financing of low-carbon urban transport, concluded that the resource mobilization for low carbon transport in specific and sustainable transport in general is entirely inadequate compared to the scale of required investments. The first recommended priority in strengthening the financing of low carbon transport was adjusting the pricing mechanisms in the transport sector to ensure that negative externalities, including greenhouse gas emissions are included in the price drivers pay for driving. Also subsidies which reward unsustainable behavior, e.g. fuel subsidies, need to be redirected to behavior that rewards sustainable behavior.

289. Such changes in approach to resources mobilization can follow from the adoption of relevant policies. In many cases they will also require changes in the mandates, capacity and functioning of relevant institutions that administer such policies. In most Asian countries, although there is a re-orientation towards sustainable transport and an acknowledgement of the need to address greenhouse gas emissions from the transport sector, the civil service in most cases does not yet have the skills and experience to develop and apply financial policies that can generate the resources required. This is a challenge for the transport departments but also the finance departments who are usually responsible for the tax code and who are in charge of subsidies. Also in those sectors where policy development on climate change has advanced further, such as the energy sector, Asian countries have not yet been able to institutionalize pricing and subsidy mechanisms which adequately reward sustainable behavior and punish unsustainable behavior. Such changes will require a strong political will.

⁴³ See: www.50by50campaign.org

⁴⁴ See: <http://www.mlit.go.jp/kokusai/MEET/documents/PressRelease20090116.pdf>

290. It is important therefore not only to focus on the need to raise funds for on-the-ground investments but also on raising the budgets for knowledge management and capacity development. The latter is an important step towards realizing the former.

6.2.5 Implementation and Enforcement

291. To reduce future emissions of greenhouse gases in the transport sector in Asia large scale investments will need to be combined with the consistent enforcement of policies, regulations and standards. As long as institutions in the transport sector do not have adequate knowledge management mechanisms and well-trained staff is scarce; sustainable transport policies will not lead to detailed policy instruments and innovative financing mechanisms will not be mainstreamed.

6.3 Stakeholder Assessment

292. Stakeholders can be government, civil society, academe, private sector, media, financial institutions or development organizations. The responsibilities for sustainable transport are typically divided between the national and the local level. In some countries, depending on its size and administrative structure the province or State level acts as an intermediate with certain discretionary powers in regulation, policy making and financing of transport. In these cases the national government has the lead in setting regulatory standards for vehicle technology and fuel economy standards; overall national policies on urban transport, freight and logistics; and financial instruments with a fiscal character (e.g. vehicle and fuels pricing and taxes). Generally, there is however considerable space for lower administrative levels to develop and implement their own policies and activities on sustainable and low-carbon transport. Cities generally have the responsibility for initiating and financing the expansion of their transport sector.

6.3.1 Local level Institutions

293. Some cities in Asia have shown in a very clear manner that cities can be game-changers and have thereby inspired new thinking on sustainable transport. Singapore demonstrated this through its integrated transport planning which has become a model for the whole Asian region. Jakarta through the Trans-Jakarta became an example for many other cities in Asia which are considering or planning a BRT system. Shanghai through its vehicle licensing system, in which potential car owners have to bid for a license to own a car, has demonstrated that it is possible to replicate Singapore's efforts to reduce the growth of the vehicle fleet while improving the overall accessibility.

294. So far, local institutions – at city level – are more much interested in transport than climate change. The interventions mentioned (Singapore, Jakarta and Shanghai) were all made for a number of reasons; congestion, air quality, or limited city finances. In none of the cases climate was a direct objective although in all cases the changes introduced will result in lower greenhouse gasses than in the case of non- intervention. These are good examples of the co-benefit approach described in Chapter 3.

Box 6.2: The use of National Policy and Financing Modalities to create institutional change at the local level

India passed National Urban Transport Policy to (re)direct urban transport planning towards sustainable urban transport. Jawahri Nehru Urban Renewal Mission creates financial mechanism for implementation on NUTP. Under JNURM central government in 2009 decided to provide 50% of costs of busses for BRT schemes on following reform conditions:

- Creation of a UMTA (Urban Mass Transit Authority)
- Setting up an Urban Transport Fund
- Assigning a Nodal Department
- Encourage Private Sector Operations
- Set up Separate Special Purpose Vehicle for managing city operations
- Exemption from taxes

Source: O.P. Agarwal, UMTC India

295. A common problem experienced by Asian cities has been the dependence on the national level for financing, the availability of which is often decided on an ad-hoc basis. The national urban transport policy in India and the associated Jawahri Urban Renewal Mission are now being used to test an approach where a more predictable and transparent mechanism of financing local transport projects by the national level is linked to requirements for institutional restructuring and improvements at the local level (see Box 6.2). This is however still an exception in Asia and initial experiences indicate that disbursement of national funds is actually low due to delays in realizing the local funding contribution by the cities.

296. The institutional reform conditions imposed under JNURM financing address institutional problems that are characteristic for the public transport sector in many, if not most, of Asian cities: (a) institutional fragmentation on the side of operators and regulators, (b) lack of predictable and transparent regulatory frameworks for private sector participation in public transport, and (c) no forward looking funding mechanisms of public transport. Signals received by cities in Asia from the national level on the need to make changes in transport planning and associated processes of land-use planning and urban development are generally weak and often not linked to specific policies to influence or strengthen local level institutions.

297. A particular difficulty in institutional development for sustainable transport is posed by the large share of paratransit in public transport⁴⁵. Such operators operate in the (semi)-informal sector and are often undercapitalized. They are not easy to integrate in governmental programs for fleet renewal to reform the transport sector and make it less carbon intensive.⁴⁶ The institutional fragmentation of the informal operators can be a barrier in increasing the capitalization of companies which is required to upgrade technologies.

⁴⁵ In South Asia this includes the motorized three wheeled rickshaws, in the Philippines locally assembled jeepneys and busses built around imported second hand truck engines, in the Indonesia the Bemo.

⁴⁶ Because they operate in the informal sector they often do not keep formal books, have formal franchises, or pay taxes on a regular basis which can be a guarantee to benefit from financial assistance programs.

Box 6. 3: Role of Media in Delhi BRT

Following the opening of the first Bus Rapid Transit (BRT) corridor in Delhi, India several newspapers and websites came with reports in which the BRT was judged to be a failure. The designers of the BRT corridor were judged to be technical incompetent and calls were made to scrap the expansion of the BRT in Delhi and reconsider BRT programs in other Indian cities in favor of rail based public transport schemes. Yet, surveys among the users of the BRT indicated satisfaction with the service provided, notwithstanding shortcomings in the original design and its implementation. Also, in State elections, constituencies along the BRT corridor voted in larger numbers for the incumbent Chief Minister who had made support for the BRT a key plank in her election campaign.

Source: Authors

298. There are pronounced differences between primary and secondary cities in terms of structure and other characteristics of the transport sector in Asian cities. Most of the secondary and tertiary cities lack organized public transport, and depend largely on informal public transport systems which often make use of motorized 2-3 wheelers. The priorities of these cities are usually not how to clean up greenhouse gas and other air pollution related emissions but to get some form of public transport system in place while protecting the interests of the informal transport operators who can exercise substantial political pressure.

299. Capacity to plan and manage transport also varies widely between cities. Only a small number of cities in developing Asia are able to formulate and implement an integrated transport. Only a handful of cities, including Bangkok (2008) have so far a Climate Change (mitigation) Action Plan in place. It is expected however that more will follow shortly. The speed in which this catching-up takes place will depend on how quickly countries will document the experiences of the early movers on transport and climate; translate this into policies backed up by appropriate policy and financing instruments, and build capacity at the local level. Recent research by the CAI-Asia Center indicates that the twenty nine largest cities in India contribute only 22% of total CO₂ emissions from land passenger transport of India. This underscores the need to speed up the capacity development in secondary and other small cities to develop more sustainable transport systems.

300. The proposed policy paradigm of "Avoid-Shift-Improve" has special relevance for Asian cities because of the expected growth in urbanization in Asia. It is expected that in the next 25 years about 500,000 million persons will be added to the urban population in China and India. This will lead to a sizeable number of new cities, increasing the physical footprint of many of the cities and generally result in increased motorization. At the same time this offers however the possibility to implement land use policies like Transit-oriented-development which can considerably reduce the need for transport compared to the urban-sprawl model that can be seen in many of the current Asian cities. In several cases urban growth in Asia will result in the creation of urban agglomerations consisting of different administrative units. This will add additional institutional challenges to the institutional reform agenda which is already large and challenging.

301. The transport sector has for international development organizations traditionally been an important sector but as described in Chapter 5 most of the lending and other assistance of multilateral development banks (MDBs) has been for road construction, mostly between cities

and for rural roads. MDBs are now increasingly re-orienting their transport lending towards urban and sustainable transport. It will take time however before this change in approach is fully mainstreamed and even then it is questionable how many cities will be able to benefit.⁴⁷

302. Not only capacity of government is often weak, most of the Asian cities do not have an active civil society which is influential and knowledgeable enough to successfully lobby for large scale sustainable transport investments or to ensure that investments made actually deliver what they are supposed to do. The absence of a strong civil society and informed media opens the possibility that sustainable transport initiatives like the BRT in Delhi (see box 6.3) become the subject of ill informed media campaigns which can slow down the replication of projects to other cities.

6.3.2 National Level Institutions

303. Climate is not yet a major issue yet in national transport policies. This is closely related to the manner that climate is emerging on the political agenda in developing countries, which is mostly at the request, or as some argue the insistence, of developed countries. Climate change is handled more as a foreign policy issue than as a developmental, or sector, issue. This is also reflected by the hands-on role taken by central government such as the Prime Minister's office in India and NRDC in China. In neither case has the transport ministry so far come out with a dedicated policy statement on transport that outlines how to deal with climate change although both countries now have policies or guidelines which are expected to make especially urban transport more sustainable and both have overall climate change policies.

304. In an earlier section, the different components of institutional performance on transport and climate change were analyzed. It was observed that while policies are becoming more sustainable and transport oriented that knowledge management, capacity development, policy instruments and financing are still weak. These weaknesses can be traced back to weak organizational capacity and they make it more difficult to have an effective dialogue and cooperation between relevant government departments. Such a dialogue is a first required step in developing institutionalized coordination mechanisms between the transport ministry and other departments such as environment, energy, commerce and industry, finance, urban development, and health. As the experience from the United States (see Box 6.4) shows, it is not only the developing countries which have problems in putting in place institutional capacity to implement new policy directions.

Box 6. 4: Funds for Green Cars still untapped in United States

Having positive policies on transport and climate change is not enough as is shown by the example of the US. The US Energy Department has \$ 25 Billion to make loans to speed up the arrival of the next generation of automotive technology – electric-powered cars. 75 Applications of up to 1000 pages each were submitted since 2007. The agency tasked to review proposals has only a dozen of part-time and full-time employees and has not been able to approve one application as of February 2009.

Source: International Herald Tribune, February 28 – March 1, 2009

⁴⁷ There are an estimated 2500 cities with more than 100,000 persons in Asia. MDBs typically are able to do about 10-15 transport loans per year. This would mean that ADB, JICA, KfW and the World Bank, the 4 largest MDBs can cover 40-60 cities per year. In a best case scenario this means that in the period that vehicle fleet size doubles (7 years), about 300 cities can be supported by MDBs. This shows clearly that countries and cities will have to take the lead in promoting sustainable urban transport and that they can not depend on MDBs.

305. National Asian NGOs with a demonstrated track-record on sustainable transport are few and generally their organizational capacity is low. Environmental NGOs have had an impact in some countries in reducing tailpipe emissions. Some of these NGOs (e.g. Center for Science and Environment in India, Partnership for Clean Air in the Philippines) have started to move beyond this narrow focus and are now also increasingly promoting policy options which are more part of the “Avoid and Shift” part of the new paradigm to urban transport described in earlier chapters of this report. In several countries (e.g. China and Indonesia) universities perform partly the role of civil society in lobbying for policy changes and partly that of consultants working for the government on design of new policies and implementation of specific sustainable transport programs and projects.

Source: Authors

Box 6. 5: BRT and the private sector in Asia

The BRT sector is a good illustration of the limited capacity that the national private sector has in Asian countries to capitalize on new trends in transport planning. So far, the bulk of BRT schemes in Asia have been planned by international NGOs, local Universities and international private sector in descending order of importance. Although over 70 cities in Asia are now operating, constructing, planning or thinking about BRTs none of the 70 cities have depended solely on national private sector consultants.

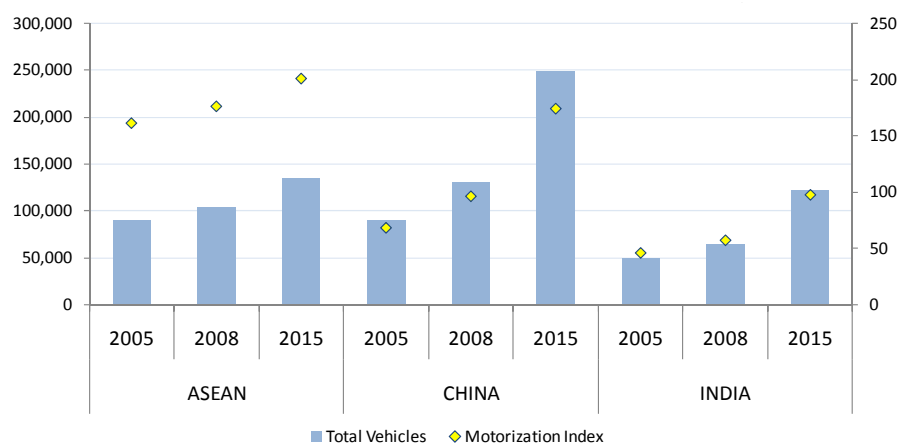
306. The private sector in Asia is still struggling to define its role in urban development, land development and provision of public transport. In several cases private sector involvement is being implemented in the absence of relevant national policies and regulatory frameworks. Land developers often develop new settlements by successfully requesting governments to provide the transport and infrastructure to service their new developments which are often on the city fringe and not conducive to public transport. Within cities government investments in transport rail based infrastructure have in several cases created increases in land value which was captured by the private sector, rather than the public sector. This raises important questions on how to regulate the role of the private sector play in land development in a manner that keeps the private sector sufficiently interested in investing and increasing its engagement in transit oriented development.

307. The private vehicle industry in some Asian countries has started to actively lobby the government to block or slow down legislation which would promote low carbon transport, as in the case of the vehicle industry in India in its recent efforts to slow down and weaken legislation on fuel economy standards. A worrying trend has been that while the interest in public transport among policy makers is increasing that the capacity of the regional bus industry to produce high quality busses has not increased at the same rate. This has for example in the case of India resulted in delays in procurement of new high quality busses.

308. External organizations on transport and climate change have shown a bias towards India and China in terms of assistance programs. Their argument for this is that this is where the GHG's are and where they are growing fastest. The institutional capacity in these countries however is already relatively well developed. There is a danger is that the gap with other Asian countries that receive less assistance and which have lower capacity will increase. While this might result in maximizing of GHG emissions reductions on the short term it has the potential to undermine the global negotiations on climate change; the implications of which might outweigh

the advantages of the short term gains.⁴⁸ As Figure 6.2 indicates the combined Association of South East Asian Nations (ASEAN) have a larger motorization index and their combined vehicle fleet will continue to be larger than that of India for the years to come.

Figure 6.2: Vehicle Population and Motorization Indexes in the ASEAN region, China and India



6.3.3 Regional Level Institutions

309. Regional level intergovernmental institutions have a valuable role to play in transferring new policy insights on sustainable transport and low-carbon transport policies into national and local level policies. There are a number of ongoing initiatives in Asia of which so far the Environmentally Sustainable Transport (EST) Forum has been the most important in terms of policy dialogue. The EST Forum, through the Aichi Statement and the Kyoto Declaration (see Box 6.6) have led the way in coming up with regional policy statements on sustainable transport. The EST Forum which had initially no specific focus on climate change is now increasingly discussing climate change; this very much as part of a co-benefits approach. The Economic and Social Commission for Asia and the Pacific (ESCAP) will organize the first Asian Transport Ministers Forum in December 2009. Climate Change and Environment will be part of the agenda. At the sub-regional level ASEAN, with leadership from the Philippines, is now positioning itself to give more attention to climate change as part of a more general re-orientation towards sustainable transport. The most recent regional development has been the Ministerial Meeting on Global Environment, and Energy in Transport (MEET) for the G8 and Asian countries in January 2009 which resulted in a joint Ministerial Declaration on Global Environment and Energy in Transport.⁴⁹

⁴⁸ UNFCCC operates on a one country one vote principle. Also, while the emissions of India and China are the largest, the size of the transport fleet of the ASEAN countries together is larger than that of India and will remain so in the foreseeable future.

⁴⁹ See http://www.mlit.go.jp/kokusai/MEET/documents/Ministerial_Declaration.pdf.

Box 6.6: UNCRD EST Forum

The Asian Environmentally Sustainable Initiative is a joint initiative of UNCRD and the Ministry of the Environment, Government of Japan. Initial participating countries included the members of the Association of South East Asian Nations (ASEAN); Mongolia, People's Republic of China, Republic of Korea, and Japan. In 2008 the EST Forum was expanded to include South Asian Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka.

The First Regional EST Forum was conducted in Aichi, Japan in August 2005 and resulted in the Aichi Statement (<http://www.uncrd.or.jp/env/est/docs/Aichi-Statement-29Aug05-FINAL.pdf>)

In 2007 an Asian Mayors' Policy Dialogue for the Promotion of EST in Cities was held in Kyoto, Japan in April 2007 and resulted in the Kyoto Declaration (http://www.uncrd.or.jp/env/est/docs/20081112_BAQ%202008%20Special%20Event/Kyoto%20Declaration_12Nov08-with%20city%20name.pdf) which has now been signed by over 35 mayors.

310. So far the various initiatives: EST, ESCAP, ASEAN, MEET exist in parallel, each with its own champions. It is in the interest of the Asian governments and other groups supporting these initiatives that the relationship between the different initiatives be clarified and to strengthen convergence between the different initiatives. Another challenge encountered is the limited capacity of the different initiatives to follow up on policy agreements reached. The EST Forum and ASEAN, due to their organizational set-up have very limited capacity to do so but in the case of ESCAP and MEET potential capacity does exist but has not been fully mobilized yet.

311. The multilateral and bilateral development banks: ADB, JICA,⁵⁰ KfW, and World Bank are all in a state of flux with respect to their transport lending and have all indicated that they are willing to consider a considerable engagement in sustainable urban transport. They will do so partly from their own resources but transport is also expected to be part of the Clean Technology Fund a trust-fund overseen by the World Bank. To advance the transport and climate change agenda as outlined in this report substantial policy work will be needed to accompany lending to ensure that the transport sector in developing countries is re-oriented towards an "avoid-shift-improve" approach. At present, development banks are still largely locked in to a project approach and policy related assistance, although often part of the overall assistance package, receives less attention. See Box 6.7 for a description activities on sustainable, low carbon transport and its sustainable transport initiative.

312. National and regional Asian NGOs on transport are few and have not broken out of their local or national base. In general there is a continued dependence on international NGOs like ITDP, Energy Foundation, IGES, and ICCT. The localization of these organizations in terms of decision making, operational independence and funding has received mixed attention. The establishment of the Climate Works Foundation could potentially result in an important strengthening of the capacity of international and national NGOs working on transport and climate change in Asia. The Climate Works Foundation works in nations and economic sectors with the highest greenhouse gas emissions. This includes transport. It works both with regional foundations and with best practice networks; both ITDP and ICCT have been selected as best practice networks on transport by the Climate Works Foundation.⁵¹

⁵⁰ The Japan Bank for International Cooperation (JBIC) is now part of the Japan International Cooperation Agency (JICA).

⁵¹ See: <http://www.climateworks.org>

Box 6. 7: Sustainable Transport in the Asian Development Bank

In the period 2000-2007 CAI-Asia and ADB conducted several joint studies, built a network of organizations interested in sustainable, low-carbon transport and conducted extensive policy dialogues at the regional, national and local level with policy makers and other stakeholders on the importance and viability of sustainable, low-carbon transport solutions. Hosting the CAI-Asia Secretariat enabled ADB to benefit from the extensive network of contacts of CAI-Asia in the field of sustainable transport.

CAI-Asia and ADB thinking on Transport and environment evolved through a series of studies and projects, including:

- *Policy Guidelines for Reducing Vehicle Emissions in Asia. (2003)*
- *Partnership on Sustainable Urban Transport in Asia (PSUTA) (2004 -2006)*
- *Sustainable Urban Mobility in Asia (SUMA) (2007-2009)*
- *Energy Efficiency and Climate Change Considerations for On Road Transport in Asia (2006)*

The growing attention for climate change as a strategic driver for change in ADB activities and the success in developing an energy and climate change initiative in ADB contributed to the willingness to develop a sustainable transport initiative (STI). This was enabled and supported by changing priorities of the ADB member countries and their willingness to borrow for sustainable transport rather than just for road construction. The Gleneagles G8 meeting in 2005 also provided focus within ADB on transport and climate change. The Gleneagles meeting called on MDBs to collaborate on climate change issues and allocated sectors to certain organizations. ADB was given the responsibility to lead the coordination on transport and climate change.

Through its Sustainable Transport Initiative ADB intends to achieve that 50% of its \$ 6 billion annual transport lending will be sustainable by 2015. Impact on climate change will be an important dimension of the criteria to assess sustainability.

Source: Authors.

313. While universities are very important at the national level in many Asian countries in stimulating research on sustainable urban transport and advising policy makers so far there is not a well developed regional research community on sustainable urban transport or on low carbon transport in Asia. Existing international research groups (WCTR, EAST, VREF) have so far not taken a lead role in developing a research agenda on transport and climate in Asia. Because of the lack of coordinated Asia specific research on transport and climate change policy discussions have made more use of research in developed countries which has contributed to an emphasis on technological approaches in policy discussions to lower the carbon intensity of the transport sector.⁵²

6.3.4 Global level Institutions

314. Transport is an integral part of the United Nations Framework Convention on Climate Change and the various Assessment Reports issued by the Intergovernmental Panel on Climate Change have addressed the importance of transport as a contributor to Climate Change and the

⁵² While the transport sector in Europe can be considered as mature, the vehicle fleet in Asia is still growing very rapidly. This offers the opportunity to undertake measures to avoid or reduce the need for additional transport through land-use planning and by shifting transport to the most efficient mode of transport.

mitigation potential of the transport sector. Yet, both the head on UNFCCC and IPCC have made statements recently (see box 6.8) that not enough is being done to tackle emissions from the transport sector.

315. The absence of a well articulated focus on transport in the global climate community and in climate change mitigation modalities can be partly blamed for the relatively slow development of a supportive global network of NGOs, research organizations and international conferences on low carbon transport compared to e.g. forestry, bio-fuels, or renewable energy where a much

Box 6.8: UNFCCC Executive Secretary and Chairman IPCC on Transport and Climate Change

“Given the role that transport plays in causing greenhouse gas emissions, any serious action on climate change will zoom in on the transport sector”.

Yvo de Boer, Executive Secretary UNFCCC, Tokyo, January 2009

“Existing approaches have not worked and we should considering the use of a sectoral approach to Transport to overcome the relative neglect of the sector”

Rajendra Pachauri, Chairman IPCC, Poznan, December 2008

stronger international institutional network exists. This is a chicken-and-the-egg situation. Would there have been a stronger global network of NGOs, research organizations and international conferences on low carbon transport then it is plausible that transport would have by now a higher profile in the global climate discussions.

316. The weak position of transport in the international climate instruments is well illustrated by the limited number of approved transport methodologies and registered transport projects under the Clean Development Mechanism as described in chapter 2. This weakness has had a number of linked consequences: (a) limited experience has been gained with the piloting of technological approaches which can be scaled up; (b) difficulties to undertake transport under CDM: because of issues related to base-line, project boundaries, leakage, and additionality; (c) an emphasis in discussions among specialized transport and climate change organizations on what does not work rather than what can work. There is a danger that the negative experiences faced by various organizations in developing transport projects under CDM will carry on under a new global agreement to be reached at COP 15 in Copenhagen in December 2009. It is now widely expected that the follow-up to the current Kyoto Protocol will include a more broad based approach to CDM, including possible sectoral and programmatic CDM, and that through the adoption of a key element of the Bali Action Plan; Nationally Appropriate Mitigation Actions (NAMAs), developing countries will be encouraged to (further) develop and implement policies and actions to reduce greenhouse gas emissions. In the case of NAMAs, such reductions would be reported directly to the UNFCCC through the MRV mechanism and not to generate emission reductions for sale under CDM to Annex 1 countries to offset their emissions.⁵³

317. The absence of a well coordinated international network on transport and climate change, combined with the limited success under the current commitment period of CDM, might mean that transport is again not well covered in the future even though because of the need to

⁵³ Details on how NAMA's would be structured are still being worked out. It might still be possible to sell some of the emission reductions realized under a NAMA as part of CDM, in such a case these CERs would have to be deducted from the reductions reported to UNFCCC by the country.

achieve more ambitious reduction targets a future climate regime might be more conducive to transport being integrated.

318. The international transport community is still getting organized in its efforts to make climate change an integral part of its activities. ADB was also assigned the lead multilateral development bank on transport and climate change in the G8 meeting in Gleneagles, Scotland in 2005 which was one of the first G8 meetings where climate change was an important agenda point. Following this ADB in 2006 addressed Transport and Climate Change through a workshop and report: "Energy Efficiency and Climate Change Considerations for On-road Transport in Asia".

319. At the global level, the International Transport Forum made climate change the main theme of its 2008 Meeting. The Transport Research Board in the United States did likewise in 2009 by making climate change the overall theme of its 2009 annual meeting. TRB also set up a working group to study how TRB should engage with climate change in the future. The World Conference on Transport Research is planning a special workshop on Transport and Climate Change in September of 2009. These initiatives suffer from the same problem as some of the regional policy meetings in Asia described above; the meetings are overlapping and repetitive and there is not enough attention for follow-up.

320. Recently there have been some important initiatives to develop a more concerted global approach to transport and climate change. This includes the setting up of the Climate Works Foundation, with transport as one of the main priority sectors, which has substantially increased funding for international NGOs working in transport and climate change. Another new group is the Bridging the Gap initiative created by GTZ, International Association for Public Transport, International Railway Association, the Transport Research Laboratory, and Veolia Transport.⁵⁴ This initiative undertakes activities to bridge the gap between the transport and the climate community with the intention to influence the outcome of the Copenhagen climate talks. The organizations represented in the Bridging the Gap Initiative also participate in a series of events organized by a loose coalition of organizations spearheaded by the Asian Development Bank and the CAI-Asia Center. An important milestone in this process was the recent May 2009 meeting in Bellagio, Italy which resulted in the adoption of the Bellagio Declaration on Transport and Climate Change and a Common Policy Framework on Transport and Climate Change (see box 6.9). The organizations represented at the Bellagio meeting also agreed to consolidate their coordination by developing a partnership on sustainable, low carbon transport.

⁵⁴ See www.sutp.org/bridging_the_gap

Box 6.9: Bellagio Declaration

Twenty one representatives from eighteen different organizations working on transport and climate change in developing countries met 12 -16 May, 2009 in Bellagio, in a meeting to build a consensus on the required policy response to the growing CO₂ emissions from transport in the developing world. The meeting resulted in the Bellagio Declaration on Transportation and Climate Change. This Declaration calls on organizations and individuals to support urgent action to change the trajectory of future GHG emissions from transport and to make transport in developing countries more sustainable. It appeals to all participants in the climate negotiations leading up to COP 15 to provide strong support for the following 3 key-principles

- Principle 1: Effective Climate Action Is Incomplete Without Addressing the Overall System Performance of the Transport Sector.
- Principle 2: Climate action in the transport sector should recognize co-benefits
- Principle 3: Carbon finance mechanisms and associated procedures should catalyze sustainable transport policies, programs and projects

The meeting also formulated a Common Policy Framework on Sustainable, Low Carbon Transport, which elaborates the vision underpinning the Bellagio Declaration on Transportation and Climate Change.

Source: www.sutp.org/bellagio-declaration

DRAFT

6.4 Directions for Strengthening Institutional Capacity for Transport and Climate Change

6.4.1 Introduction

321. Institutional development for low carbon sustainable transport is an open ended process of which the final shape and direction of which is still being determined by a range of international and local processes (see Box 6.10). For example the outcome of the climate negotiations at COP 15 in Copenhagen and decision making on the future arrangements on mitigation (e.g. Mitigation Fund and Board, NAMAs) will strongly affect the future arrangements for institutional arrangements in the transport sector.

322. At the same time institutional development in the transport sector needs to be seen as part of the larger context of institutional development in Asia. Asian countries are struggling to put in place institutions to respond to the ongoing rapid urbanization and associated process of motorization as well as the need for economic and social development. So far this has resulted in different, and frequently, conflicting priorities. Careful thought needs to be given to how to structure the institutional change process. Development agencies and other international organizations have often underestimated or misunderstood the complexity of institutional development and the role of local ownership for the institutional change process (see Box 6.10).

323. Institutional development to make a low carbon transport system possible is also still an area of concern in the Annex 1 or developed countries. While transport institutions are typically stronger in most of these countries they are also still in process to reorient their institutions in the transport sector to help ensure achieving CO₂ emission reduction goals.

Box 6.10: Understanding institutional change processes

Three specific types of institutional change processes can distinguished:

- 1st order change. This concerns improvement of existing organizations within their present mandate, basic structures and processes;
- 2nd order change. This involves changes in the role of organisations, possible creation of new organisations, whereby direction of change is clear and agreed upon;
- nth order change. This relates to an overall change of institutional context, whereby future role of organisations, (mandate, structures, etc.) are not clear at the beginning of the change process)

Institutional development to promote low-carbon transport in Asia is an “nth. order change process”. This means that countries, cities and international organizations need to embark on a joint process whereby the final outcome is not fully defined. This makes it important that organizations give enough attention to “learning” to ensure that the institutional development process stays on track. Learning is required in order to arrive at improvements in the management of institutional development projects.

C. Huizenga and D. Kramer (1996)

6.4.2 Institutional Development at the local, the subnational and the national level

6.4.2.1 New versus existing organizations

324. A first question that needs to be asked is whether Asian countries need to create new institutions to make transport more climate friendly? The answer is a qualified “No”. Climate change mitigation does however need to be integrated and mainstreamed in development policies and as such ministries responsible for economic planning as well as well as the transport ministries will need to adjust their mandates to better integrate transport and climate change mitigation.

325. Coordinating, e.g. urban development or environment ministries need to ensure that transport is an integral part of their emerging climate change policies and the transport ministries need to make climate change mitigation one of the key drivers of transport policies. Both coordinating and transport ministries need to embrace the “Avoid-shift-improve” approach as the cornerstone for future policies.

326. The cross cutting nature of the ““Avoid-shift-improve” approach which integrates land-use, transport and environmental planning, calls for the creation or strengthening of horizontal linkages between government departments and in some cases national task forces that were created in several Asian countries to coordinate climate change policy. There is however no one-size fits all approach in strengthening national level coordination to promote low-carbon sustainable transport systems. In India the Ministry of Urban Development plays a central role, while in China the National Development and Reform Commission plays a key role in coordinating climate policy, urban development, and large scale investments in transport infrastructure. However, transport departments should maintain primacy in transport policy. It helps if transport departments are unified like the case of Ministry of Land Infrastructure and Transport in Japan and have a broad, rather than a narrow mandate.⁵⁵

327. While there is generally no need for new national level institutions there is an urgent need to improve data availability and quality, organizational capacity, and budgets within concerned governmental departments. This underscores the need to take on a structural approach in institutional development rather than an ad-hoc approach. (See box 6.11).

⁵⁵ The splitting of responsibilities for transport between the Ministry of Communication and the Ministry of Construction which was the case until recently was considered a main barrier for improving urban transport in China.

Box 6.11: Approaches to Institutional Development

What characterizes institutions are its mandate, functions, leadership, incentive structure, planning systems, budgeting processes as well as its type and scale of activities. Characteristics of effective organizations (also in the transport sector) are responsiveness, transparency and accountability. When talking about institutional development it is important to differentiate between ad-hoc versus structural change. In an ad-hoc change strategy specific activities are added to an organization while the overall organization continues to function as usual. In the case of structural change a change of paradigm works its way through the organization and results usually in changes in its mandate, functions, leadership, incentive structure, planning systems, and budgeting processes. The origin of change can be bottom-up or top-down. Paradigm shifts towards low carbon transport so far comes mostly from the global level. International organizations multilaterals, development banks and international NGOs and foundations can play an important role in initiating, facilitating and catalyzing institutional changes, yet, the awareness and willingness to strengthen capacities ultimately needs to be locally owned, either at city, or province/state or the national level.

Local champions or visionary leaders are important. However, if local champions do not promote structural institutionalization local champions can become counter productive. If one successful leader can “push through” change, the next generation of leaders can reverse decisions.

The effectiveness of institutional change is determined by the ability of local institutions to manage political support for such changes. Revised Mandates and increased core budgets are dependent on such external support within the country.

328. Several of the Asian countries have started, or are considering, strengthening the provincial or state level as part of an administrative devolution process which also includes the city level. For Provinces or States to be able to take on such a role will require considerable institutional development. For these intermediate level organizations to be able to advance the “Avoid-Shift-Improve” approach there is a need to clarify their mandates vis-à-vis the national as well vis-à-vis the local city level. This clarification of mandates will help to decide what their role will be in applying various types of policy instruments. Generally, it is expected that most of the regulatory instruments related to vehicle and fuel quality will be in the domain of national level institutions. Provincial or State level institutions can however play an important role in developing planning guidelines for urban development, institutional structuring of the transport sector and passing on national level funds for low carbon transport investments to the city level. Care should be taken to avoid duplication of functions, and reduced speed of implementation through imposing an additional layer of bureaucracy.

329. It is at the local level that there is the largest need for institutional development, especially in the secondary and tertiary level cities where institutions are very weak and in many cases need to be established almost from scratch. Before such institutions can start to address the issue of transport and climate change they often first need to develop capacities to exercise their basic functions. Limited institutional capacity in these cities often goes hand in hand with a weak financial basis which prevents the cities from making broad based long term efforts to improve the transport infrastructure without substantial support from the national or provincial/state governments. These smaller cities often also lack a formal public transport system which makes planning for its strengthening more difficult. In the developed world, to overcome the limited capacity for transport planning in smaller cities responsibilities have been shifted to the next higher administrative level or in some cases a programmatic approach has been adopted where several smaller cities worked together.

330. New organizations will in certain cases be required at the local level to help transform the public transport sector. This can consist of setting up a transport commission or other form of overseeing authority. This can be helpful in bringing informal paratransit operators in the formal sector as part of a modernization and reorganization of the transport sector (e.g. as part of the introduction of a BRT program) or to support the delegation of functions from the government to the private sector. Different models are being tested at the moment, careful monitoring is required to determine what works best under what circumstances.

331. The development of local level institutions is usually a slow process which takes many years. When it comes to reversing the Business as Usual scenarios for the development of transport sector and associated CO₂ emissions it is doubtful whether local level institutions in Asia have the time to develop gradually. If cities continue to build their institutional capacity as they have done till now, they are likely to be overtaken by events of the Business as Usual motorization scenarios. Ideally, the scale of the challenge should drive the speed of the capacity development.

332. Having access to adequate financing will greatly help Asian cities to develop their transport institutions. Asian countries should therefore carefully review the experiences of those countries which have implemented either general administrative devolution combined with financial transfer to lower administrative levels or which have established dedicated funds such as the Jawahl Urban Renewal Mission in India or the Special Road Users Fund in the Philippines which are now providing local governments with dedicated funds to promote sustainable and low-carbon transport solutions. Internalizing environmental and other costs in the pricing of transport (as recommended in the Financial think-piece) is the best structural solution to provide the thousands of cities in Asia with the financial resources to make transport more climate friendly. In many cases however such additional funds will be collected by national level government and until a working mechanism is put in place to transfer funds to the local city level it will be difficult for cities to take a lead role in making their transport sector more climate-friendly. Interim solutions do exist which can be implemented immediately – e.g. parking charges, and these can be collected directly by the local governments

6.4.2.2 Private sector and Civil Society

333. The private sector has a large potential role in helping Asian governments to implement the “Avoid-Shift-Improve” approach in the transport sector. A large part of the public transport sector is operated by the private sector and controlled and uncontrolled land development by the private sector shape the future of transport systems. Almost all vehicles are produced and marketed by the private sector. It is important that governments at the national and local level develop transparent, accountable and predictable policies and regulations which can guide private sector involvement. This should include sending the right pricing signals to give proper incentives to galvanize the private sector to take action at the scale required to accomplish required reductions in the growth of emissions.

334. Equally important is the existence of a vibrant civil society which can exercise pressure on the government to quicken the development, adoption and implementation of policies to reduce CO₂ emissions in the transport sector and to monitor their implementation afterwards. International organizations can help the strengthening of a local transport oriented civil society in Asian countries by adopting a more targeted strategy to build and support local organizations. Rather than only making use of civil societies for implementation of specific projects international organizations should assist local civil society organizations to develop their overall strategic capacity. Asian governments should welcome the contributions of civil society

organizations and give them a clear role in the policy process. After stronger national and local civil society organizations come up it might be that there will also be stronger regional civil society organizations with the capacity to lobby regional policies with organizations such as ASEAN, AD and World Bank, or UN-related organizations such as ESCAP, UNEP and UNDP.⁵⁶

335. Strengthening, or in some cases the development, of regulatory frameworks for private sector and civil society engagement in sustainable transport is a joint responsibility of national and local governments, international development organizations and international NGOs.

6.4.2.3 Impact of International Climate Change and Transport Policy Discussions on National and Local Level Institutional Capacity Building Efforts

336. It is widely expected that a new climate agreement to be reached at COP 15 in Copenhagen will have a much stronger focus on mitigation measures in non-Annex 1 countries in line the substantial deviation below baseline scenarios as called for the in Bali Action Plan. Such intensified mitigation efforts can lead to the establishment of a global mitigation fund and board. At the national and local level it is expected to lead to sector oriented NAMAs as well as programmatic or sectoral CDM. Transport institutions will only be able to benefit if transport is acknowledged as specific sector in the new climate agreement.⁵⁷ The shift to more programmatic and sectoral carbon financing modalities as currently discussed in the context of the post 2012 climate regime and a better integration of the transport sector should lead to a change in capacity building approaches. This should be greatly helped by increased financial flows from developed to developing countries as well as technology transfer and capacity building all of which were added as conditions in the Bali Action Plan by developing countries to agree to undertake NAMAs in the post 2012 period and which are included in the draft negotiation text for COP 15.

337. The chapter on co-benefits described how GHG reductions in the transport sector in many cases will be accomplished as co-benefits of other interventions aimed at e.g. reducing congestion or improving air quality. This implies that the institutional responsibility for creating climate gains will rest with institutions or organizations whose primary mandate or responsibility is not climate change mitigation. They, thereby, become the target of institutional development efforts. The dependence on the co-benefits approach to make headway in mitigating emissions from the transport sector distinguishes developing countries from several developed countries where organizations or ministries are created whose exclusive mandate is climate change mitigation.

⁵⁶ In Europe Transport and Environment (T&E) is a good example of a regional umbrella organization lobbying for strengthening environmental sustainability at the regional, European, level. T&E has now 49 members from 23 countries. See www.transportenvironment.org

⁵⁷ So far transport has been dealt with more as a sub-sector of the energy sector than as a sector in its own right. This has contributed to an overemphasizing of the technological approach to reduce CO₂ emissions from the transport sector.

6.4.3 Directions for Institutional Development on Transport and Climate Change at the Regional – Global Level

6.4.3.1 Importance of regional Asian based and owned institutions

338. A stronger regional consultation process in Asia can provide the region with more leverage towards the Annex 1 countries to increase financial and capacity building support and technology transfer related to the transport sector. It can also help build a stronger political momentum to put low carbon transport on the national and local policy agendas in Asia. Recent COP meetings have shown that developing Asian countries increasingly operate as a regional block, but one that is integrated in the “G77+China”. So far discussions in the context of G 77+China have had limited sectoral focus with the exception of forestry issues which have been discussed intensively in the context of Land use, land-use change and forestry (LULUCF) sector.

339. Regional cooperation can also help directly in better coordinating the development of climate and transport policies and its implementation. Currently China is the only country in developing Asia which has fuel economy standards in place while India is discussing the development of fuel economy standards. If the discussion on fuel economy standards can be expanded to a regional discussion this would benefit all those countries which have not yet started such a discussion. Similarly the debate on bio-fuels would be well served by a regional discussion. Of similar importance may be the upward harmonization of fuel taxes. It is encouraging that on fuel economy and bio-fuels regional discussions are now being initiated.

340. There are different options that Asian countries could pursue in developing and strengthen regional processes on transport and climate change. First, within the scope of the ongoing climate negotiations the G77/China role in COP could be expanded with more intensive activities in between COPs. This would however require the creation of Secretariat capacity. Also, such a process would be more political in nature and not necessarily focus on the transport sector.

341. Another more Asia and transport specific solution, largely outside the scope of the climate negotiations would be to build on existing, emerging regional policy forums which specifically target transport, environment and climate change in Asia. The emphasis here would be strengthening the integration of climate considerations in transport policies. Possible candidates to accomplish such include:

- (i) Ministerial Meeting on Global Environment, Energy and Transport (MEET) which includes the G8 countries and almost all Asian countries. This could facilitate discussions on dedicated financial, technology and capacity building assistance between developed and developing countries. It might be however that the leading role played by Japan would make it difficult for Asian developing countries to fully accept it as a common initiative;
- (ii) EST Forum which includes most developing Asian countries as well as Japan and Korea, although less high ranking than MEET the EST forum has been in place for 4 years and it has made a good start with integrating transport and environment ministries and to reach out to city level (see Figure 6.3). The EST Forum has also initiated the development of country level national EST strategies which could be considered as a first step in developing low-carbon transport

- policies which can guide future policy and investment frameworks in the transport sector.⁵⁸
- (iii) ESCAP is a regional body and has a well established capacity to work on transport section and it is now in process to set up an Asian Transport Ministers Forum. ESCAP also has a well established environment section which together with the transport section could mobilize a substantial follow-up capacity to work with Asian countries to develop and implement low carbon transport solutions;
 - (iv) If a sub-regional level forum is to be pursued ASEAN would be a good starting point. ASEAN over the last years has intensified its efforts to address the sustainability of the transport sector and has supported international claims for intensified climate change mitigation efforts. This would also enable South East Asian countries to develop their own profile and map out their own strategies and policies, coordinate with but independently from China and India.⁵⁹

342. In the further development of these individual policy forums, each of which has its own strengths and weaknesses it is not only important to assess how each of them can be strengthened in their own right it is also important to consider how these different policy processes can be integrated whereby each of the forums would have its own discrete functions. In such a future structure (see Figure 6.3) MEET could be used to reach an overall policy consensus between Asian and developed G8 countries on the environmental dimension of transport policy and support to be provided by G8 countries to Asian countries to implement an environmental policy consensus for the transport sector. The combined EST Forum and Asian Transport Ministers Forum would focus on developing internal policy consensus which could also serve as an input for MEET, or as follow up, and to exchange experiences between Asian countries. The ASEAN Transport Senior Officials meeting could be one of more sub-regional meetings in Asia among countries with common interests and emerging integrated economic structures to discuss in more detail how to move forward in strengthening sustainable transport. Subregional bodies would have to have the largest capacity to assist their member countries in implementation of low carbon transport policies and programs.

6.4.3.2 Engaging the vehicle industry in Asia

2. The vehicle industry in Asia is currently the fastest growing in the world, fuelled by income growth and increased affordability both for 4 wheeled vehicles as well as motorized 2-3 wheelers. Asian countries are also gaining in importance as exporters of vehicles. China is by far the largest producer of electric bicycles and scooters. In several countries the vehicle industry is deemed to be a strategic industry for development of the national economy and it receives either direct or indirect incentives from the government. The approach to promote low-carbon transport suggested in these think pieces calls for restraint in the use of private cars, to ensure that cars and fuels are as efficient as possible, make better use of public transport and reduce the need for travel through better city planning.

⁵⁸ The EST strategies can be an important sectoral contribution to what ADB calls Climate Change Investment Plans and the EU calls Low Carbon Development Strategies.

⁵⁹ The motorization rate and vehicle fleet size for the combined ASEAN countries is currently higher than that of India and is expected to remain so in the coming years. ,

Figure 6.3: Possible Hierarchy of Transport Policy Forums in Asia



343. This makes the vehicle industry an important stakeholder in the discussion on the future of mobility in Asia. Yet, there appear to be few ongoing national or regional dialogues with the vehicle industry on its environmental sustainability and future development. Asia could take the lead from the European Union which in 2006 convened a high level working group: CARS21, consisting of European Commission officials, members state representatives, vehicle industry representatives and civil society representatives to “review major policy areas which impact the competitiveness of the European automotive industry and to agree on a number of recommendations which aim to enhance the industry’s global competitiveness and employment while sustaining further progress in safety and environmental performance at a price affordable to the consumer discuss the future of the European vehicle industry”.⁶⁰

344. An important new development for the vehicle industry in Asia is the recently established Global Fuel Economy Initiative (see box 6.12). This initiative aims to strengthen fuel economy regulations and expand the number of developing countries that have fuel economy measures in place. Of the developing countries in Asia only China has so far fuel economy standards while India is discussing the adoption of fuel economy standards.

345. A particular topic of discussion with the private vehicle industry in Asia needs to be the production of busses. The demand for high quality busses is going up much quicker than the production. This hampers the development of BRT systems and maintaining or expanding the public transport mode share by bus.

⁶⁰ While this initiative was criticized by some in Europe as being too car friendly it would be a substantial move forward in the case of developing Asia. Available: <http://ec.europa.eu/enterprise/automotive/pagesbackground/competitiveness/cars21finalreport.pdf>.

Box 6.12: Global Fuel Economy Initiative

The Global Fuel Economy Initiative, launched in early 2009 by FIA Foundation, IEA, ITF, and UNEP, aims to improve the understanding of the fuel economy potential and cost of cars built and sold around the world, and to provide guidance and support on the development of policies to promote fuel efficient vehicles. Its activities will include the following:

- Development of improved data and analysis on fuel economy around the world;
- Work with governments and regional bodies to develop policies to encourage fuel economy improvement for vehicles produced or sold in their countries and regions;
- Work with stakeholders including auto makers to better understand the potential for fuel economy improvement;
- Support regional awareness initiatives to provide consumers and decision makers with the information they need to make informed choices.

“Making Cars 50% More Fuel Efficient by 2050 Worldwide” 50by50 Global Fuel Economy Initiative, www.50by50campaign.org

6.4.3.3 Role of International Organizations, Multilateral and Bilateral Donor Organizations, International NGOs and Foundations in Building Institutions and Institutional capacity

346. International organizations will continue to play an important role in enabling developing countries in Asia to reduce CO₂ emissions from transport through setting overall climate and transport policies; gathering and managing knowledge; building capacities; and providing funding. It is estimated that there are about 75 organizations that play a significant role in this respect. (see box 6.13). To be successful in making transport more climate friendly in developing countries these 75 organizations will have to ensure that their commitments towards lowering greenhouse gases from the transport sector results in short term actions while developing more comprehensive medium and long term strategies.

3. Over the last year several of the organizations listed in box 12 have started to coordinate their activities on transport and climate Change. This resulted in a number of coordinated side events at COP 14 in December 2008 and follow-up activities at the Transport Research Board (TRB) meeting in January 2009.⁶¹

347. Following the Bellagio meeting described above work is now ongoing on the establishment of an informal Partnership on Sustainable, Low Carbon Transport. The Partnership will provide regional and global stakeholders on Transport and Climate Change in developing countries with a coordinated framework for assistance which can complement their own individual activities on Transport and Climate Change and thereby increase their impact and reduce the transaction costs.

348. The Partnership which is expected to have an initial three year running time will focus on land transport in developing countries. Geographically the Action Plan will focus primarily on Asia and Latin America. The proposed Partnership will have four working groups:

⁶¹ The joint activities are documented at http://www.sutp.org/bridging_the_gap

Box 6.13: International and Regional Stakeholders on Transport and Climate Change in Asia

Intergovernmental organizations: Global Environmental Facility, International Energy Agency, International Civil Aviation Organization, Intergovernmental Panel on Climate Change, International Maritime Organization, International Transport Forum, United Nations Center for Regional Development, United Nations Development Program, United Nations Environment Program, United Nations Department for Economic and Social Affairs, United Nations Framework Convention on Climate Change.

Development Banks: African Development Bank, Asian Development Bank, Inter American Development Bank, Japan Bank for International Cooperation, KfW Bankengruppen, and the World Bank.

Regional Economic Commissions: Economic Commission for Africa, Economic Commission for Latin America, and Economic and Social Commission for Asia Pacific

Partnerships: C40 Cities Climate Leadership Group, Cities Development Initiative for Asia, Clean Air Initiatives for Asia and Latin America, Global Alliance for Eco-mobility, Global Fuel Economy Initiative, global Transport Knowledge Partnership, Partnership for Clean Fuels and Vehicles, World Economic Forum – Future of Mobility Council, UNCRD-Environmentally Sustainable Transport Forum, UN-Economic Commission Europe/Working Party.29.

Bilateral Development Agencies: Department for International Development Cooperation, German Agency for Technical Cooperation, Japan International Cooperation Agency, Swedish International Development Cooperation Agency

Transport Research Bodies: Eastern Asia Society for Transportation Studies, Japan Automotive Research Institute, Japan Transport Energy Research Center, Transport Research Board, Transport Research Laboratory, World Conference on Transport Research

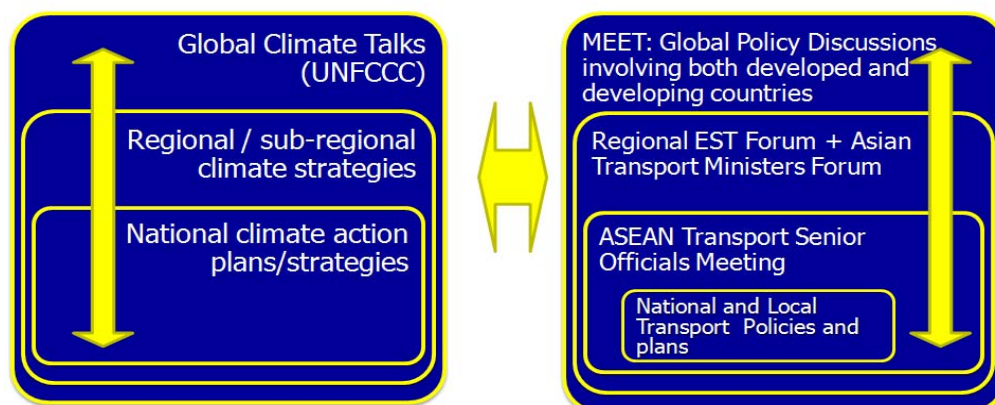
NGOs: Interface for Cycling Expertise, International Council for Clean Transport, Institute for Global Environmental Studies, Institute for Transport Development and Policy, EMBARQ/World Resources Institute, Transport and Environment,

Foundations: Climate Works, Clinton Foundation, Energy Foundation, FIA Foundation, William and Flora Hewlett Foundation, Shell Foundation, Volvo Research and Education Foundation.

Transport operators branch organizations: International Association of Public Transport, International Union of Railways

- (a) Transport Data, Indicators and GHG assessment methodologies.
- (b) Application of Post 2012 Climate instruments such as CDM, Sectoral Crediting and NAMAs for the transport sector.
- (c) Financing.
- (d) Outreach and policy dialogue

349. The Partnership can play an important role in the further integration of transport into climate change and in integrating climate into transport policies. To accomplish this it is important to strengthen the coordination and cooperation between the transport and the climate change community. At the same time this will also require that coordination within the climate and transport community improves and that global policies and agreements result in national and local level policies. Different members in the Partnership can, based on their mandate and activities, help to realize this “horizontal” and “vertical” coordination. See Fig. 6.4.

Figure 6.4: Climate Change and Transport Policy processes

6.5 Conclusions and Recommendations

350. The following conclusions can be drawn:

- The absence of strong transport institutions in developing Asia makes it difficult to put in place what are seemingly obvious and logical sustainable transport policies and programs based on the “avoid-shift-improve” approach which is increasingly seen as the way forward to make a reduction of CO₂ emissions in the transport sector in Asia
- Without major changes in the institutional performance of the transport sector in Asia it is unlikely that the nascent policy commitment towards sustainable transport in Asia will result in a significant lowering of greenhouse gases from the transport sector;
- In almost all the policy areas relevant for strengthening the sustainability of urban transport systems and thereby also making them less carbon intensive there are examples of institutions at regional, national or local level which have been able to demonstrate that it is feasible in the context of developing Asia to be effective as an organization with respect to urban transport;
- The trend towards more emphasis on mitigation in international climate agreements is expected to result in new instruments, such as NAMAs, a scaling up of carbon financing mechanisms and more attention for data gathering and assessment through the MRV mechanism. All of these bode well for institutional development in non-Annex 1 countries. The transport sector should be able to benefit from this provided that transport is considered as a sector in its own right in the climate negotiations.
- Notwithstanding a recent increase interest among regional organizations such as ASEAN, ESCAP, UNCRD and Japan (in its capacity as G8 chair and regional leader), regional intergovernmental organizations and the UN have so far not been able to demonstrate leadership which has been able to trigger significant action to promote low carbon sustainable urban transport in developing Asian countries and cities.

351. The following recommendations are made:

- A clear signal by key stakeholders in the global climate negotiations on the importance to fully integrate transport in climate change mitigation modalities will have a positive

impact on the development and strengthening of institutions with a focus on urban transport in developing countries;

- Institutional development in support of the newly emerging policy consensus on low carbon sustainable urban transport needs to take account of the scale required. To serve the needs of the 2500 cities in Asia with a population of over 100,000 inhabitants' capacity needs to be created at the regional, national and the local level in the 2500 cities. A critical mass of well equipped institutions is needed to enable structural changes in policies;
- Institutional development in support of low carbon urban transport in Asia will require: (a) clarification of institutional mandates at all geographical levels (local, sub-national, national, regional and global, (ii) strengthening of institutional capacities within all sectors (government, civil society, academe and private sector, (c) improved coordination and cooperation between different sectors at, and between, different geographical levels;
- Developing institutional capacity to strengthen low carbon sustainable transport at the local level will in most Asian countries require changes in policies at the national level to enable changes in mandates for cities to plan, finance and manage urban transport;
- Medium term urban development and integrated transportation plans will need to be accompanied by institutional development plans which define: roles and mandates, organizational capacity building schemes, core financing, and reporting requirements.
- The development community is challenged to increasingly mainstream climate change in their ODA. Considering its importance in lending volume by MDBs this applies very much to the transport sector. There is at the same time a need to coordinate ODA and special Climate Funds which are also being used to support the transport sector. Once financing in support for the implementation of NAMAs comes on stream there is an additional need to position ODA vis-à-vis this new flow of funding which will be less under the control of traditional development organizations;
- Once Asian countries and cities start to intensify low carbon transport policies and programs there will be an increased need for effective and transparent consultation mechanisms to give concerned and affected sectors in society a chance to give their views. The absence of effective and transparent public consultation mechanisms will ultimately slow down decision making and its implementation and might reduce the rate in which changes in behavior are adopted. Therefore it is important to develop such mechanisms in a timely manner.
- Private sector participation in the provision of low-carbon transport products and services needs to be encouraged as the private sector is better at mobilizing investments required to support the implementation of low carbon transport policies. To facilitate this appropriate regulatory frameworks need to be developed and put in place;
- Development Banks, bilateral development organizations and international foundations in their efforts to promote low carbon transport systems in Asia should couple their support for individual projects increasingly to support for policy dialogues, institutional reform and capacity building, and the development of indigenous financing for low carbon policies, programs and projects with the aim to achieve a step change in the speed of development of policies and policy instruments and the coverage of Asian cities with locally owned, funded and implemented low carbon transport projects.

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