“Shaping the role of climate finance for sustainable transport – What are the levers and how to make them work?”

Draft, 23 January 2015

General remarks which we already discussed with Adnan:
- The case study summaries need to be readable as stand-alone text without having to refer back to the full case studies: Actors need to be introduced, data shouldn’t be mentioned in the conclusions for the first time
- Case study summaries need to include how CF could best be used in this measure
- Conclusions should be reworked somehow (see comments in the text)

Background Information on the TRANSfer Project

The TRANSfer project is run by GIZ and funded by the International Climate Initiative of the German Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB). Its objective is to support developing countries to develop and implement climate change mitigation strategies in the transport sector as „Nationally Appropriate Mitigation Actions“ (NAMAs). The project follows a multi-level approach:

- At country level, TRANSfer supports selected partner countries in developing and implementing NAMAs in the transport sector. The NAMAs supported by the project cover a broad variety of approaches in the partner countries Indonesia, South Africa, Peru and Colombia.
- At international level and closely linked to the UNFCCC process, the project helps accelerate the learning process on transport NAMAs with a comprehensive set of measures (events, trainings, facilitation of expert groups, documents with guidance and lessons learned such as the transport NAMA handbook and a database, which is an interactive wiki-based portal that provides access to transport NAMAs).

Activities at country and international level are closely linked and designed in a mutually beneficial way. While specific country experience is brought to the international stage (bottom-up) to facilitate appropriate consideration of transport sector specifics in the climate change regime, recent developments in the climate change discussions are fed into the work in the partner countries (top-down).

For more information see: http://www.transferproject.org
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<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
</tr>
<tr>
<td>AEP</td>
<td>Autoridad del Espacio Público</td>
</tr>
<tr>
<td>BOL</td>
<td>Bank of Lanzhou</td>
</tr>
<tr>
<td>BRT</td>
<td>Bus rapid transit</td>
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<tr>
<td>CAF</td>
<td>Andean Development Corporation</td>
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<tr>
<td>CCF</td>
<td>Climate Change Fund</td>
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<tr>
<td>CDM</td>
<td>Clean Development Mechanism</td>
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<tr>
<td>CER</td>
<td>Certified emission reductions</td>
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<tr>
<td>CMI</td>
<td>Carbon Market Initiative</td>
</tr>
<tr>
<td>CMMCh</td>
<td>Centro Mario Molina Chile</td>
</tr>
<tr>
<td>CO</td>
<td>Carbon monoxide</td>
</tr>
<tr>
<td>CO₂</td>
<td>Carbon dioxide</td>
</tr>
<tr>
<td>CO₂eq</td>
<td>Carbon dioxide equivalents</td>
</tr>
<tr>
<td>COP</td>
<td>Conference of Parties</td>
</tr>
<tr>
<td>CTF</td>
<td>Clean Technology Fund</td>
</tr>
<tr>
<td>DOE</td>
<td>Department of Energy</td>
</tr>
<tr>
<td>DOF</td>
<td>Department of Finance</td>
</tr>
<tr>
<td>DOT</td>
<td>Department of Transport</td>
</tr>
<tr>
<td>EIRR</td>
<td>Economic internal rate of return</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FIRR</td>
<td>Financial internal rate of return</td>
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<td>g</td>
<td>Gram</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>GCCA</td>
<td>Global Climate Change Alliance</td>
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<td>GCF</td>
<td>Green Climate Fund</td>
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<td>GEF</td>
<td>Global Environment Facility</td>
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<td>GFEI</td>
<td>Global Fuel Economy Initiative</td>
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<tr>
<td>GHG</td>
<td>Greenhouse gas</td>
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<tr>
<td>GIZ</td>
<td>Deutsche Gesellschaft für Internationale Zusammenarbeit</td>
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<tr>
<td>HC</td>
<td>Hydrocarbons</td>
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<tr>
<td>ICI</td>
<td>International Climate Initiative</td>
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<tr>
<td>IDB</td>
<td>Inter-American Development Bank</td>
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<td>IEA</td>
<td>International Energy Agency</td>
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<tr>
<td>IMTS</td>
<td>Integrated Mass Transit Systems</td>
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<tr>
<td>ITDP</td>
<td>Institute for Transportation and Development Policy</td>
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<tr>
<td>ITS</td>
<td>Intelligent Transportation Systems</td>
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<tr>
<td>JCM</td>
<td>Joint Crediting Mechanism</td>
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<tr>
<td>JI</td>
<td>Joint Implementation</td>
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<tr>
<td>km</td>
<td>Kilometer</td>
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<tr>
<td>KwH</td>
<td>Kilowatt-hour</td>
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<td>L</td>
<td>Liter</td>
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<tr>
<td>LBP</td>
<td>Land Bank of the Philippines</td>
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<tr>
<td>LDC</td>
<td>Least Developed Countries</td>
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<tr>
<td>LGU</td>
<td>Local government unit</td>
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<tr>
<td>LIBOR</td>
<td>London interbank offered rate</td>
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<tr>
<td>LPTG</td>
<td>Lanzhou Public Transport Group</td>
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<tr>
<td>MDB</td>
<td>Multilateral development bank</td>
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<tr>
<td>MRV</td>
<td>Monitoring, reporting, and verification</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>NAMA</td>
<td>Nationally Appropriate Mitigation Action</td>
</tr>
<tr>
<td>NDF</td>
<td>Nordic Development Fund</td>
</tr>
<tr>
<td>NGO</td>
<td>Nongovernmental organization</td>
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<tr>
<td>NMT</td>
<td>Non-motorized transport</td>
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<tr>
<td>NOx</td>
<td>Oxides of nitrogen</td>
</tr>
<tr>
<td>NUTP</td>
<td>National Urban Transport Program</td>
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<tr>
<td>O&amp;M</td>
<td>Operations and maintenance</td>
</tr>
<tr>
<td>ODA</td>
<td>Official Development Assistance</td>
</tr>
<tr>
<td>OEB</td>
<td>Operadora de Estacionamientos Bicentenario</td>
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<tr>
<td>OECD</td>
<td>Organization for Economic Cooperation and Development</td>
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<tr>
<td>P3</td>
<td>Public-private partnership</td>
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<tr>
<td>PCU</td>
<td>Project Coordination Unit</td>
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<tr>
<td>PLG</td>
<td>Project Leading Group</td>
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<tr>
<td>PMO</td>
<td>Project Management Office</td>
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<tr>
<td>PMR</td>
<td>Partnership for Market Readiness</td>
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<tr>
<td>PRC</td>
<td>People's Republic of China</td>
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<tr>
<td>ROI</td>
<td>Return on investment</td>
</tr>
<tr>
<td>SECCI</td>
<td>Sustainable Energy and Climate Change Initiative</td>
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<tr>
<td>SLoCAT</td>
<td>Partnership for Sustainable Low Carbon Transport</td>
</tr>
<tr>
<td>SO₂</td>
<td>Sulfur dioxide</td>
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<tr>
<td>SPTS</td>
<td>Strategic Public Transport Systems</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>UN/ECE</td>
<td>Economic Commission for Europe of the United Nations</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nations Environmental Program</td>
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<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>USD</td>
<td>United States dollars</td>
</tr>
<tr>
<td>VOC</td>
<td>Vehicle operating costs</td>
</tr>
</tbody>
</table>
Executive Summary

Report Objective
This report, developed for the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), explores the potential role of climate finance in stimulating the development of sustainable modes of transport. It does so by elaborating six case studies and drawing recommendations from the case studies. The study supports GIZ’s TRANSfer project, the aim of which is to support developing countries to develop and implement climate change mitigation strategies in the transport sector through Nationally Appropriate Mitigation Actions (NAMA). The report is especially intended for decision makers, policy makers, and those working on climate and transport finance, including staff and executives at national and multilateral aid institutions which provide loans and grants to support sustainable transport projects in developing countries, as well as transport planners and decision makers in developing countries.

The particular issue addressed in this report is how climate finance can be used to leverage sustainable transport and to realize the large greenhouse gas (GHG) emission reduction potential in the sector. Climate finance represents just a small proportion of total national and international finance available for the transportation sector. The challenge is therefore to use climate funds to leverage other, non-climate funding sources towards supporting more sustainable transport.

Case Studies
The report includes six case studies of sustainable transport projects and programs; two focused on infrastructure, two on vehicle technology, and two on policy measures. The six case studies are:

- Lanzhou Sustainable Urban Transport Project – Bus rapid transit (BRT), nonmotorized, and road improvements;
- National Urban Transport Program in Colombia – funding for local public transportation infrastructure & capacity building;
- Electric tricycles in Manila, Philippines;
- Green Trucks project in Guangdong Province, China;
- EcoParg on-street parking management project in Mexico City;
- National fuel economy policies in Chile.

The case studies examine the components of each project: the financing mechanisms, revenue sources, GHG reduction, and other benefits. Findings are drawn with respect to success factors, risks, the suitability of the type of project or program for climate finance, and other lessons learned. Key findings and recommendations are provided below.

Recommendations for Climate Finance

- Grants and loans should be made contingent upon local adoption and implementation of sustainable policies and program directions. This should be true for all international transport finance, not just for climate finance sources. Leveraging local money with climate funds alone will have much less impact – all agencies’ different programs should be working towards the same objectives.

- Currently the availability of climate finance is predicated on agreeing to meet certain requirements for the evaluation and monitoring of GHG benefits. These requirements, however, are so onerous that they deter project sponsors from using these funds. Simple criteria based on easily measurable...
factors such as project characteristics and ridership/usage may be preferable to rigorous evaluation requirements.

- Co-benefits, such as mobility, safety, and air quality, of low-carbon transport projects should be considered in cost-benefit analysis of projects and in directing finance for sustainable transport.
- Capacity-building is essential for project analysis, development, implementation, and monitoring. Planners must understand the benefits of their choices in order to make good decisions.
- Successful pilot projects can help to spur interest in similar projects elsewhere. After a pilot is completed, the funding agency should assess the potential for replication, including self-financing.

Conclusions are also made for the different types of projects or programs – infrastructure, technology, and policy.

- For infrastructure projects and programs, loans with favorable terms can assist local governments in financing if payback can be arranged through user fees and general revenues. However, project costs and scale cannot exceed the local funding capacity (accounting for reasonable economic growth projections) and subsidies will quickly use up international funds on a small number of projects.
- For clean technology projects, cost-effective technologies should be able to pay for themselves over time, with loans being needed only to overcome up-front cost barriers. Pilot (demonstration) projects can help introduce new technology.
- Support for policy development can yield some of the most cost-effective projects in terms of GHG reductions per international dollar invested. However, recipients must be committed to policy implementation as well as monitoring and enforcement to ensure the policy continues to be carried out.

A proposed approach to achieve maximum leverage of climate finance for sustainable transport is shown in Figure ES-1. This focus includes five key strategies: capacity-building, enabling policy environments, removing barriers to investment, catalyzing investments, and facilitating demonstration projects. Note that it does not include routine financing of projects – which would overwhelm the capacity of available climate finance and divert from the other activities which have much greater leveraging power.

**Figure ES-1: A Proposed Focus For Climate Finance**

1. Building capacity and technical assistance
2. Building enabling policy environments
3. Removing barriers to investment
4. Catalysing investments
5. Facilitating and financing demonstration/pilot projects

In addition to leveraging existing sources of capital, financiers should consider how to increase the capital available for sustainable transport, including leveraging private sources. Such strategies may include...
increasing the role for private investors; innovative financing schemes such as land value capture; and better preparation of projects to attract institutional investors.

Kommentiert [LW13]: Would leave this out if no reference to the analysis can be generated.
1 Introduction

1.1.1 Objective

This report, developed for the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), explores the potential role of climate finance in stimulating the development of sustainable transport modes. It does so by elaborating six case studies and drawing recommendations from the case studies. The study supports GIZ’s TRANSfer project, the aim of which is to support developing countries to develop and implement climate change mitigation strategies in the transport sector through Nationally Appropriate Mitigation Actions (NAMA). The report is especially intended for decision makers on climate and transport finance, including staff and executives at national and multilateral aid institutions which provide loans and grants to support sustainable transport projects in developing countries, as well as transport planners and decisionmakers in developing countries.

The particular issue to be addressed in this report is how climate finance can be used to leverage sustainable transport and to realize the large greenhouse gas (GHG) emission reduction potential in the sector. For the context of this report, climate finance refers to international public funds with a specific objective to mitigate GHG emissions. Climate finance represents just a small proportion of total national and international finance for the transportation sector. As such, the direct impact of climate finance on achieving emission reductions may be limited. Furthermore, its impact may be overwhelmed if other transport funding is working at cross purposes.

The challenge is therefore to use climate funds to leverage other, non-climate funding sources towards supporting more sustainable transport. This can take a two-tiered approach:

- Using climate finance to shift traditional transport finance to low-emission, sustainable transport;
- Using climate finance to leverage additional financing for sustainable transport.

1.1.2 Scope

This report begins by providing a broad overview of transport finance approaches. It then documents six case studies of sustainable transport projects. For each case study, it examines their finance mechanisms to understand how climate finance can be used to leverage transport funding to more broadly achieve sustainability objectives. The case studies cover different types of projects including investment in advanced vehicles and fuels, investment in transport infrastructure, and supportive policies. Lessons learned are identified for how climate finance can leverage other funding to achieve sustainable transport. Conclusions are drawn as to how different types of finance mechanisms may be suitable for different types of projects.

Throughout this report, the term “project” in the broad sense to include transport policies and programs as well as specific projects (construction and/or operation of transportation infrastructure and services). For example, development of a nonmotorized transport plan, or development and

---

1 More broadly, “climate finance” is defined as all financial flows whose expected effect is to reduce greenhouse gas emissions and/or to enhance resilience to the impacts of climate change in accordance with the definition of IPCC (2014). This covers private and public funds, domestic and international flows, expenditures for mitigation and adaptation, and the full value of the financial flows rather than only the share associated with the climate change benefit. International Climate Finance, the key subject of interest in this report, is flows from developed to developing countries, public climate finance including climate relevant ODA and specific bilateral and multilateral climate funds. Examples of climate finance mechanisms include programs such as the Global Environment Facility (GEF), Clean Technology Fund (CTF), the Inter-American Development Bank’s (IDB) Sustainable Energy and Climate Change Initiative, the Green Climate Fund, bilateral programs such as Germany’s International Climate Initiative.
implementation of fuel economy standards or parking regulations, would be considered a “project” in this broad sense.

1.1.3 Methodology

The report was prepared with inputs from an Expert Group comprised of climate finance experts from multilateral development banks, the private sector, and academic institutions, as well as the Partnership for Sustainable Low Carbon Transport (SLoCaT). This Expert Group also separately prepared a policy brief on the topic of climate finance. The members of the Expert Group are listed in Annex 1.

An initial, and longer, list of case studies was reviewed with GIZ, SLoCaT, and the Expert Group, and narrowed down for further investigation. After determining the availability of information, a final list of case studies was developed. For each case study, published resources such as loan documents and project descriptions were reviewed, and funding agency and local agency project managers were consulted for further information. Preliminary findings from one case study were presented at a meeting of the Expert Group at the Asian Development Bank (ADB) Transport Forum in Manila, Philippines in September 2014, with preliminary findings from the remaining case studies presented at a workshop at the Conference of Parties (COP) 20 in Lima, Peru in December 2014.

In the workplan for this project, and through subsequent discussion with the Expert Group, a number of criteria were identified for selecting case studies. These criteria included:

1. Status of the project – We looked for projects that were either complete, or far enough underway so that sufficient information was available about the finance mechanisms and project benefits.
2. Funding source(s) – We looked for a mix of projects that included funding from climate funds, other sustainable transport funding from development banks, and/or domestic government sources.
3. Replicability – We looked for projects with potential for replication in other cities around the world.
4. Availability of data – We looked for projects with publicly available data on finances and benefits, and also whether the data were available in a language that was accessible for the project team.
5. Willingness to cooperate – We considered whether those involved in the project were willing to cooperate and provide the project team with additional information compared to what was publicly available.
6. Geographic dispersion – We did not want all the case studies to come from one country, or one part of the world.
7. Diversity of project types – We looked for a cross-section of project types across the “avoid – shift – improve” spectrum.
8. “Transformational potential” of the project – We considered whether the project has potential to support broader transformation in the transport sector for greater sustainability.

2 Partnership for Sustainable Low Carbon Transport. “Climate Finance as the Engine for More Low-Carbon Transport: Recommendations to Policy Makers on Transport and Climate Change.”
The final list of case studies is shown in Table 1.1. The list includes a diverse mix of primarily infrastructure projects (bus rapid transit and associated improvements in Lanzhou and Colombia), vehicle technology programs (e-trikes in Manila and clean trucks in Guangdong), and policies (parking management in Mexico City and fuel economy regulation in Chile). The case studies include projects in both Asia and Latin America.

<table>
<thead>
<tr>
<th>Project</th>
<th>Location</th>
<th>Project Status¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lanzhou Sustainable Urban Transport Project</td>
<td>China (Lanzhou)</td>
<td>Implementation completed</td>
</tr>
<tr>
<td>– BRT, nonmotorized, and road improvements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Urban Transport Program – Colombia</td>
<td>Colombia</td>
<td>Ongoing</td>
</tr>
<tr>
<td>– funding for local public transportation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>infrastructure &amp; capacity building</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitigation of Climate Change through</td>
<td>Philippines (Manila)</td>
<td>Pilot e-trikes tested;</td>
</tr>
<tr>
<td>Increased Energy Efficiency and the Use of</td>
<td></td>
<td>procurement issued for</td>
</tr>
<tr>
<td>Clean Energy – E-Trikes</td>
<td></td>
<td>additional e-trikes</td>
</tr>
<tr>
<td>Guangdong Green Trucks Project</td>
<td>China (Guangdong</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td>Province)</td>
<td></td>
</tr>
<tr>
<td>EcoParq On-street Parking Management Project</td>
<td>Mexico (Mexico City)</td>
<td>In operation since 2012</td>
</tr>
<tr>
<td>Fuel Economy Policies</td>
<td>Chile</td>
<td>Fuel economy labeling</td>
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<td></td>
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<td>complete; development</td>
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<td></td>
<td></td>
<td>of feebate system in</td>
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<tr>
<td></td>
<td></td>
<td>progress</td>
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</table>

¹Status of funded project at the time of case study development
2 Overview of Transport and Climate Finance

2.1 Introduction

Transport finance includes two key elements:

- **Funding programs or revenue sources** that provide either short-term (e.g., one-time) or long-term (e.g., annual) cash streams; and
- **Finance mechanisms** such as public or commercial debt, equity and loan programs, which leverage funding/revenue into the cash needed upfront for capital investment.

For sustainable transport projects, funds and finance mechanisms under the umbrella of climate finance may provide opportunities to leverage existing funds available from transport. This chapter briefly summarizes different types of transport funding and finance mechanisms available to sustainable transport projects, and provides a list of potential climate finance opportunities. Lefevre et al. (2014) estimate global capital expenditures in the transport sector ranging between 1.4 and 2.1 trillion USD annually. Climate funding could support investment in sustainable transport, but given the huge investments that are needed and the limited sums of climate finance, climate funding can only provide some leverage to existing transport funding options.

In general, delivery of transport projects requires leveraging available funding sources and financing mechanisms, which may include financial resources from multiple levels of government (national, regional, and local), bilateral and/or multilateral organizations, and the private sector. Most transport projects require some sort of a commercial and/or economic feasibility assessment that requires estimation of revenues, costs, benefits and risks of the project. This assessment forms the basis for a financial plan that combines revenues, grants, loans, and/or debt financing. Some of the challenges (with or without climate financing) faced by project sponsors and developers while assembling a financial plan for a project include:

- Ensuring that sufficient funding or revenue sources are available to ensure financing of the project.
- Identifying and understanding the criteria governing eligibility for grant and loan programs, mapping the project or specific elements to these criteria, and developing the case for discretionary/competitive programs.
- Identifying and securing dedicated revenues or funding sources that are pledged to repay loans and debt, and/or to support annual operating and maintenance expenses.
- Understanding institutional, governance and technical capacity barriers that may affect private sector engagement in transport infrastructure financing.

Additional challenges faced when climate finance is provided include:

- Climate finance must be directed specifically at projects or programs that reduce (or limit the increase in) greenhouse gas emissions. This imposes monitoring, evaluation, and verification requirements to demonstrate that GHG reductions are being achieved, the stringency of which varies by funding agency.
- Adding climate finance as one off the funding sources for a project therefore increases the technical capacity needed to manage the project and these grants/loans/technical assistance under the rules and regulations set forth by multilateral and bilateral organizations sponsoring these mechanisms.
- Climate finance often adds its own set of administrative requirements, and funding and
2.2 | Transport Finance

2.2.1 Funding Programs (Revenue Sources)

In general, funding/revenue programs for transport projects can be characterized within the following categories: user fees (direct and indirect), dedicated taxes, value capture, and grant programs from government and other organizations.

User fees refer to direct and indirect revenue sources that are levied through the use of transport infrastructure and services. Direct revenues include tolls, passenger fares, mileage-based user fees, cordon and congestion pricing charges, and parking fees. Indirect revenues, such as motor fuel taxes, vehicle-related and driver license fees, while not directly related to a specific trip, are collected on items that facilitate transport. It should be noted, however, that indirect fees are not always dedicated to transport, and that this varies by country.

Dedicated taxes refer to any form of taxation that is dedicated to pay for transport infrastructure, operations, and maintenance (which may include user fees as well as other sources). Some examples include the use of sales taxes by local governments in the U.S. to pay for transport investments, and employer taxes in France for public transport services. Some countries do not allow dedicated earmarking of taxes.

Value capture attempts to capture some portion of the value resulting from infrastructure improvements. A beneficiary-based revenue source levies fees or taxes on a defined and generally localized group(s) of beneficiaries that are expected to receive a benefit from a particular transport facility or resource. Better access and mobility through improved transport infrastructure may result in increased property values and economic growth that would have not occurred without the transport project. In that case, new property assessments or the increase in property value can be dedicated to finance the transport project. In other cases, developers would pay impact fees or pay for specific infrastructure improvements as part of the permitting process to develop land.

Grant programs from government and other organizations refer to any type of funding that would be available to project sponsors to deliver, operate and/or maintain transport infrastructure. These programs are typically provided from a higher level of government to a lower level of government and/or to project sponsors. The scope of the program may vary from single project funding to annual funding apportionments. These grant programs might be competitive in nature or distributed based on specified formula or criteria. At the government level, the grants could be funded through either dedicated taxes and fees (e.g., motor fuel taxes), or through general tax revenues (e.g., value-added taxes, personal income or business/corporate taxes). Bilateral and multilateral organizations, such as multilateral development banks may also provide grant funding from moneys provided by member countries. Transport finance varies by country, and the availability and feasibility of applying different types of funding and finance mechanisms depends on laws and policies across different levels of government where the project is located.

2.2.2 Finance Mechanisms

Financing tools do not generate new revenue, but allow leveraging of existing resources to accelerate the construction of projects. Debt must be repaid over time, and the total cost of an investment increases by the discounted value of interest payments. As noted earlier, one of the key challenges is to identify a sustainable or feasible repayment source. The benefits of financing a transport project as opposed to “pay-as-you-go” (i.e., undertaking the project as revenues are taken in) include public and economic benefits (e.g., travel-time savings; reduced crashes; GHG reduction for sustainable projects; accessibility to jobs, suppliers, customers, and intermodal terminals; job creation; expanded tax base) realized by having the
asset in place earlier. The use of these tools also recognizes the fact that the cost is being paid by future users over the life of the project. These benefits may be weighed against the higher costs of paying interest on the debt through a net present value analysis.

Financing mechanisms include bond financing, loan programs, and financing packages through public-private partnerships (P3s) which include private equity. Public-private partnerships allow transport investments with financing packages that combine public and private debt, equity, and public funding.

**Bond financing** refers to a borrowing instrument in which the government or a private corporation issues bonds that are purchased by investors. The issuer receives an immediate influx of cash that can be used to pay for a project. The investors are repaid over time through principal plus interest payments from the revenue source(s) pledged to support debt service.

**Loan and credit enhancement programs** are another form of borrowing. In this case, a government or a multilateral development bank lends the money to a project sponsor. In some instances, the terms to borrow money from the government or multilateral development banks may lower the cost of borrowing compared to accessing funds through the private capital markets or provide certain terms (e.g., deferred repayment, free of interest) that reduce the cost of capital. Credit enhancement tools come in various forms (e.g., lines of credit, loan guarantees), but basically they help reduce the risk to investors, allowing project sponsors to borrow at lower interest rates.

**Public-private partnerships** are contractual agreements between a public agency and a private entity, which allows greater private sector participation in the delivery and operation of transport projects and facilities. P3s involve a sharing of responsibilities, risks, and rewards between public sector owners of transport facilities and a private sector partner(s), but the public partner usually retains full ownership of the facility. There are several models of P3s, but some include private financing. In that case, in addition to providing funding through corporate bonds, private investors may provide equity in exchange for a return on the investment (ROI) through the repayment source (e.g., user fees, public subsidies and payments, dedicated taxes, etc.). Revenue-generating projects are most suitable for project finance, although some P3 arrangements with private financing include availability payments, where the private sector receives milestone and/or annual payments from the project sponsor based on performance. Some projects may require additional public subsidies (e.g., grants, public debt) to be financially feasible. In addition, since sustainable transport projects are usually under public sector ownership, there is a need to develop the technical capacity to manage and provide oversight of P3 projects, in addition to setting up the institutional, legal and regulatory frameworks necessary to attract private investment.
Table 2.1 provides a list of potential opportunities in sustainable transport projects for private finance by measure. Measures are grouped by the “avoid-shift-improve” framework commonly used in sustainable transport policy development (avoid the need for travel; shift travel to more efficient modes; and improve the efficiency of existing modes). Note that not all measures have the potential for equity/debt repayment from measure-related revenues, and therefore must be publicly funded. Even the sources listed may not always be sufficient to repay the full costs of the project or program.
### Table 2.1 Potential Opportunities for Private Finance

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Measure</th>
<th>Suitable for Private Finance*</th>
<th>Equity/Debt Repayment Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid</td>
<td>Land use planning</td>
<td>N</td>
<td>Land value capture</td>
</tr>
<tr>
<td></td>
<td>Travel demand management</td>
<td>N</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Parking management</td>
<td>Y</td>
<td>Parking facility revenues/ use charges</td>
</tr>
<tr>
<td></td>
<td>Urban distribution centers</td>
<td>Y</td>
<td>Freight operator user fees</td>
</tr>
<tr>
<td>Shift</td>
<td>Urban transit –BRT, mass rapid transit</td>
<td>Y</td>
<td>Fares, property value capture</td>
</tr>
<tr>
<td></td>
<td>Bicycle and pedestrian infrastructure and programs</td>
<td>N</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Freight rail infrastructure and intermodal improvements</td>
<td>Y</td>
<td>Shipping/usage fees</td>
</tr>
<tr>
<td>Improve</td>
<td>Clean vehicles and fuels (e.g., public bus fleets, EV/alt fuel refueling infrastructure)</td>
<td>Y</td>
<td>Fuel purchases (motor fuel taxes)</td>
</tr>
<tr>
<td></td>
<td>Traffic system operations/flow improvements/ ITS</td>
<td>N</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Managed lanes</td>
<td>Y</td>
<td>Toll revenue</td>
</tr>
<tr>
<td></td>
<td>Clean trucks infrastructure &amp; incentives (natural gas, electric, anti-idle technology)</td>
<td>Y</td>
<td>Vehicle and fuel purchases (excise taxes)</td>
</tr>
<tr>
<td></td>
<td>Eco-driving</td>
<td>N</td>
<td>--</td>
</tr>
<tr>
<td>All Effects</td>
<td>Pricing (fuel, carbon, parking, tolling, congestion, road use charge)</td>
<td>Y</td>
<td>Toll/fee revenue</td>
</tr>
<tr>
<td></td>
<td>Systemwide and corridor sustainable transport plans, including integrated transportation and land use plans</td>
<td>N</td>
<td>--</td>
</tr>
</tbody>
</table>

*If yes, in many cases private finance alone will not be sufficient and public funding will also be required.

### 2.3 Climate Finance

As discussed in more detail in Section 1.1.1, “climate / mitigation finance” is broadly defined as financial means whose expected effect is to mitigate to climate change (including the full finance flow, not just the share associated with the climate change benefit). For the purpose of this study, international climate finance provided by international public sources, is the key subject of interest, i.e. developed to developing country, public climate finance especially from specific bilateral and multilateral climate funds. In this context, climate finance can be used in combination with other transport funding and financing mechanisms to deliver sustainable transport projects. The total value provided by climate finance is small compared to traditional transport finance. In a world of limited funding to advance transport investments, however, climate financing can help leverage those limited resources and advance much needed transport investments, that not only enhance and address mobility and accessibility needs, but also achieve GHG mitigation goals.

The climate funds presented here are available through multilateral and bilateral organizations, and include grants, loan programs and technical assistance.

**Kommentiert [sb48]:** The measures also need to be unambiguous and easy to understand. How have the measures been selected? Might be useful to add a column indicating if measures require capital investments or not.

**Kommentiert [sb49]:** Maybe need to be more specific as there are many measures (most of which don’t require finance).

**Kommentiert [sb50]:** That might depend on the measure.

**Hat formatiert:** Schriftart: 11 Pt., Nicht Fett, Schriftfarbe: Automatisch.
Table 2.2

Table 2.2 provides a list of available resources with information on international climate financing sources for sustainable transport projects. Table 2.3 (Table 2.3) summarizes some of the climate funding opportunities listed in these reports, which are briefly described in this section. Potential climate funding opportunities for sustainable transport at national and local government levels are not listed here. To be eligible for climate finance, a project or program must typically show a demonstrated link to GHG mitigation. The specific evaluation and reporting requirements vary from program to program. Some programs have detailed quantitative evaluation requirements, while others have less rigorous or more qualitative standards.

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binsted, Anne</td>
<td>Accessing Climate Finance for Sustainable Transport: A Practical</td>
<td><a href="http://www.climatefinanceoptions.org/cfo/node/224">http://www.climatefinanceoptions.org/cfo/node/224</a></td>
</tr>
<tr>
<td>Bongardi, Daniel</td>
<td>Overview (Technical Document #5)</td>
<td></td>
</tr>
<tr>
<td>Dalkmann, Holger</td>
<td><em>Sustainable Urban Transport</em> (Module 1f)</td>
<td><a href="http://www.sutp.org/en-dr-th1">http://www.sutp.org/en-dr-th1</a></td>
</tr>
<tr>
<td></td>
<td>Implementation of Nationally Appropriate Mitigation Actions (NAMAs)</td>
<td></td>
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<tr>
<td></td>
<td>in the Transport Sector</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Climate Finance in the Transport Sector</td>
<td>new-giz-btg-transport-readiness-for-climate-finance</td>
</tr>
<tr>
<td>Lefevre, Benoit</td>
<td><em>Sustainable Transport: A Practical Overview</em></td>
<td></td>
</tr>
<tr>
<td>Leipziger, David</td>
<td>*Sustainable Transport: A Framework to Access Climate Finance in the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transport Sector</td>
<td></td>
</tr>
</tbody>
</table>

Note: Last accessed on August 1, 2014

Table 2.3 Overview of Selected Potential Climate Funds for Sustainable Transport

<table>
<thead>
<tr>
<th>Sources of Climate Finance</th>
<th>Nature of Support</th>
<th>World Regions Covered</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grants</td>
<td>Loans</td>
</tr>
<tr>
<td>ADB Climate Change Fund</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Clean Technology Fund</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Global Climate Change Alliance (EU)</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Global Environment Facility</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Green Climate Fund</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>IDB Sustainable Energy and Climate Change Initiative</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>IDB Infrastructure Fund</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>International Climate Initiative (Germany)</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
### Sources of Climate Finance

<table>
<thead>
<tr>
<th>Source</th>
<th>Nature of Support</th>
<th>World Regions Covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAMA Facility (Germany-UK)</td>
<td>Grants, Loans, Technical Assistance</td>
<td>International</td>
</tr>
<tr>
<td>Nordic Development Fund</td>
<td>Loans</td>
<td>Eligible countries in Africa, Asia and Latin America</td>
</tr>
<tr>
<td>Partnership for Market Readiness</td>
<td>Loans</td>
<td>International</td>
</tr>
</tbody>
</table>

**Source:** Adapted from Binsted et al. (2010 and 2013), Lefevre (2014)

- **Asian Development Bank (ADB) Climate Change Fund (CCF)** – the CCF was created to support adaptation and mitigation projects in Asian countries, and focuses in three areas:
  - Clean energy, sustainable transport and low-carbon urban development;
  - Reduced emissions from deforestation and degradation and improved land use management;
  - Adaptation.

- **Clean Technology Fund (CTF)** – the World Bank’s CTF is administered under the Climate Investment Funds program, and supported by six multilateral development banks. In the transport field, eligible investments include energy efficiency and modal shift projects.

- **Global Climate Change Alliance (GCCA)** – the European Union (EU) nations provide grant funding and technical assistance through the GCCA to developing countries vulnerable to climate change effects, targeting Least Developed Countries (LDCs) and Small Island Developing States (SIDS). It covers five priority areas, including: mainstreaming climate change into poverty reduction and development strategies; adaptation, building on the National Adaptation Programmes of Action (NAPAs) and other national plans; reducing emissions from deforestation and forest degradation (REDD); enhancing participation in the Clean Development Mechanism (CDM); and disaster risk reduction (DRR). The program does not include a focus on transport although it does not appear to explicitly exclude transport-related projects.

- **Global Environment Facility (GEF)** – the GEF is a partnership for international cooperation to address global environmental issues, administered by the United Nations Framework Convention on Climate Change (UNFCCC). Funding through GEF goes beyond climate financing, but sustainable transport is an emerging focus of its interventions. GEF has funded numerous transport projects.

- **Green Climate Fund (GCF)** – The GCF, based on South Korea, is an operating entity of the UNFCCC and was established in 2010 at COP 16 to contribute to the achievement of the ultimate objective of the UNFCCC. The fund channels public and private financial resources to developing countries for projects to address both mitigation and adaptation.

- **Inter-American Bank Sustainable Energy and Climate Change Initiative (SECCI)** – the SECCI focuses investment in four areas: renewable energy and energy efficiency; sustainable biofuel development; access to carbon markets; and adaptation to climate change. Potential sustainable transport investment that could be funded through this program include energy efficiency and biofuel projects.
- **IDB Infrastructure Fund (InfraFund)** – the InfraFund was created to fill the funding gap to support planning and development efforts associated with infrastructure projects prior to project implementation.

- **International Climate Initiative (ICI)** – Germany’s ICI provides grants and technical assistance for biodiversity and climate (mitigation/adaptation) projects in developing and newly industrializing countries and countries in transition.

- **NAMA Facility** – The NAMA Facility is a joint program of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety and the UK Department of Energy and Climate Change. It conducts competitive calls and selects the most ambitious and promising NAMA support projects for funding.

- **Nordic Development Fund (NDF)** – the NDF provides funding to low-income countries for climate change investments. The NDF partners with multilateral and bilateral organizations to provide co-financing of climate change adaptation and mitigation activities, primarily for technical assistance. There are 27 eligible countries that can receive NDF funding in Africa, Asia and Latin America. Other low-income countries can apply, and funding may be awarded on a case-by-case basis.

- **Partnership for Market Readiness (PMR)** – Established by the World Bank, the PMR is a capacity-building trust fund providing grants for development of carbon-market based instruments. The PMR builds capacity in setting GHG baselines; of monitoring, reporting and verification (MRV), data management, and registries; policy mapping; and carbon offset standards and programs. PMR activities cover all sectors including transport.

Carbon markets are not covered by the definition of Climate Finance as international public financial flows which is used for this document. However, some of the case studies analysed in the report have received carbon credits, which are traded in the carbon markets. Examples of carbon market mechanisms include the Clean Development Mechanism (CDM), joint implementation and voluntary carbon markets. Revenues from selling carbon credits are used to finance investment projects.

- **The Clean Development Mechanism** was introduced under the Kyoto Protocol, where certified carbon credits from projects in developing countries are sold in the carbon market and the revenues generated are used to finance those projects. According to data from the Centre of Energy, Climate and Sustainable Development, there are a total of 32 CDM transport projects in nine countries, out of over 8,700 projects in the pipeline. Of these 32 projects, 28 are registered and four are at the validation stage; carbon credits have been issued for nine projects. Most registered projects are BRT and modal shift (road to rail). Lefevre et.al. reported that the low number of transport projects in the pipeline is due to stringent requirement of monitoring, reporting and verification of emission reductions.

- **Joint implementation** (JI) is similar to CDM, but for carbon trading in countries with GHG reduction/limit targets under the Kyoto protocol. According to data from the Centre of Energy, Climate and Sustainable Development, there are four JI transport projects (all from Ukraine) out of 761 projects.

- **The Joint Crediting Mechanism** (JCM) is an initiative of the government of Japan. Its purpose

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3 [http://www.cdmpipeline.org](http://www.cdmpipeline.org) (last accessed on August 12, 2014).

4 Asia (China, India and Malaysia), Latin America (Colombia, Ecuador, Guatemala, Mexico, and Paraguay), and Africa (Tunisia)

5 Annex I countries including Australia, the European Union, Belarus, Iceland, Kazakhstan, Liechtenstein, Norway, Switzerland, and Ukraine.
is to facilitate diffusion of low carbon technologies, products, systems, services, and infrastructure as well as implementation of mitigation actions, and contributing to sustainable development of developing countries. Japan enters into agreements with host countries for technology transfer and implementation of mitigation actions, and a governing board determines how to assign credits among country governments. JCM credits are not tradeable.

- The voluntary carbon market is similar to CDM, but it allows organizations, individuals, and governments to buy carbon credits related to emission reduction activities on a voluntary basis. For example, businesses may set their own emission reduction commitments, and purchase carbon credits from projects participating in the voluntary carbon market. Credits originated from the voluntary market are called Voluntary Emissions Reductions (VER). There are various quality assurance providers that issue credits on this market, such as the Verified Carbon Standard (VCS), Climate, Community, and Biodiversity Standard (CCB), the Gold Standard, BMV Standard, and Chicago Climate Exchange (CCS).

3 Case Study Summaries

This section provides summary of each case study, including a description of the project, finance and funding, and key findings with respect to the role of climate finance. The complete case studies are presented in the Annex to this report.

3.1 Sustainable Urban Transport Project, Lanzhou, China

3.1.1 Project Description

The Lanzhou Sustainable Urban Transport Project is a high capacity bus rapid transit (BRT) project in Lanzhou, which is the capital of Gansu province in northwest People’s Republic of China. It is ADB’s first project supporting BRT in the PRC, which is guided by the Bank’s Sustainable Transport Initiative. By providing policy guidance and dialogue with the Lanzhou municipal government (LMG) in redesigning its master plan to establish a sustainable urban transport system in the city, ADB supported the development of the BRT system, which is an integral element of the LMG master plan.

The project includes four components:

- Construction and reconstruction of 33.8 km of urban roads including BRT and non-motorized transport (NMT) facilities [Figure 3.1];
- Advanced traffic management including an advanced traffic signal control system, travel demand management strategy, and NMT development plan;
- Environmental monitoring system, including air quality sensors; and
- Capacity building to support project implementation including BRT operations and management.

The Lanzhou Public Transport Group (LPTG), a consolidated public transport operator created by the Lanzhou municipal government, is responsible for operating public buses. Since 2012, 9 km of the BRT have been operational.

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3.1.2 Project Funding and Finance
A loan from ADB makes up around 31 percent of the total project cost of USD 480.3 million, with Bank of Lanzhou (BOL) providing a loan of USD 100 million and Lanzhou Municipal Government providing about USD 230.3 million. The ADB loan has a very favorable 25-year term which includes a grace period of five years, low initial installment payments, and a low interest rate of 2.53 percent. The Bank of Lanzhou loan is a commercial loan with a payback period of five years at a rate of 6.6 percent per annum. The source of Lanzhou Municipal Government’s contribution is not specified.

The ADB loan primarily funded new and reconstructed roads (total costs of USD 152 million, with USD 119 million from ADB); BRT stations and equipment (USD 11 million), and an advanced traffic control system (USD 18 million). ADB’s funding was contingent on inclusion of BRT as a sustainable transport component in the Lanzhou master plan. Costs for road improvements to support BRT are not distinguished from general road-related costs in the available project information.

The available finance and funding data are limited. In particular, annual operating costs or fare revenues for the BRT are not available from LMG and cannot be directly compared with pre-BRT bus operating costs. It is also not clear how LMG manages revenue and cost flows or whether or how revenue streams from this project pay for the operating and maintenance costs. However, fare revenue can be estimated based on ridership and fare levels. The most recent ridership estimates suggest annual fare revenues of USD 13 to 15 million over the 2013-2020 time period (the seven-year period measured for CDM evaluation), or 97 million cumulatively over this period. The projected fare revenues appear to compare...
favorably with the magnitude of the initial investment, reflecting strong ridership. However, LMG noted that the revenue of BRT cannot cover the operation cost due to the very low fare and discounted fares for various age groups including elderly and students.

Land value capture was not considered as one of the project components, but occurred as the BRT project progressed. Value was captured through the lease or sale of land in the project vicinity, including for the development of underground shopping malls. This has provided another source of revenue to LMG.

ADB’s Carbon Market Initiative (CMI) supported this project for preparing an application for CDM registration. Initially, the project was estimated to receive 5,000 certified emission reductions (CERs) annually. At a conservative estimate of $10 per CER, the fund was expected to pay $0.5 million over 10 years towards meeting part of BRT’s operating and maintenance expenses. At that time the local operator was not interested in participating due to the high cost of monitoring compared to the value of the carbon credits. However, ADB convinced the stakeholders to proceed to the CDM monitoring stage.

3.1.3 Greenhouse Gas Benefits

The project is the first ADB transport project to support preparation of an application for certification under the Clean Development Mechanism. CDM GHG reduction estimates, adjusted for observed ridership, show a benefit of about 91,000 tonnes over a seven-year period from 2013 to 2019.

3.1.4 Conclusions

Implementation of the Lanzhou Sustainable Urban Transport Project relied on sustainable transport funding to a significant extent. This project received financial flexibility and advisory services, which played an important role in its successful execution. The project would most likely not have had BRT and NMT components without funding by ADB. Land value capture was not among the project’s components when it was conceived, but occurred as the BRT project progressed. Ridership is exceeding forecast levels and development has occurred along the corridor, suggesting that the project has been beneficial. On the other hand, the small value of carbon credits was of limited attractiveness to the project operator.

3.2 National Public Transport Program, Colombia

3.2.1 Project Description

This case study explores the implications of international financing for domestic sustainable transportation projects in Colombia. Following a series of reforms and significant improvements in national governance in the late 1990s and early 2000s, the Republic of Colombia has emerged as a much favored country for receiving multilateral and bilateral Official Development Assistance (ODA) to finance public sector projects. Colombia’s strategic policy efforts to support sustainable urban transport projects have created a clear framework for attracting and guiding international financing of these important assets.

To address concerns about growing motor vehicle use and associated air pollution and health problems and to prioritize sustainable transportation modes, the Colombian National Council of Economic and Social Policy developed the National Urban Transport Program (NUTP). The NUTP followed the success of investments in sustainable transport in the nation’s capital, Bogota. It was developed to provide competitive, efficient, affordable, safe, and environmentally sustainable mobility options for Colombia’s urban population.

To ensure that transportation resources are spread equitably and effectively amongst Colombia’s diverse cities, the NUTP has relied on two main techniques: Integrated Mass Transit Systems (IMTS) for large cities (population over 600,000); and Strategic Public Transport Systems (SPTS) for medium-size cities.
The World Bank and other ODA institutions have been active in supporting national projects that are part of a comprehensive framework for planning, implementing, and coordinating municipal scale transport projects. The extended legal framework of the NUTP mandates capacity building, coordination, and knowledge transfer among municipalities. Municipalities and local bodies have a high degree of authority, and receive support for technical project preparation by national authorities. This process and strong national direction set the stage for using funds effectively.

### 3.2.2 Project Funding and Finance

The Colombian government has provided national co-financing or in-kind support for 40 to 70 percent of the total costs for implementation of NUTP projects if local authorities agree to meet a set of key conditions. A minimum local match is not required to receive national assistance. Local governments are responsible for the remaining costs. Public-private partnerships play a critical role in implementing Colombia’s NUTP. Since 2002, the World Bank and other ODA institutions have been active in supporting NUTP city improvements through loans to the Government of Colombia.

The total cost of capacity building and IMTS implemented to date for the NUTP (per 2013 estimates) has been USD 1,941 million. Of this amount, the Government of Colombia has contributed USD 554.7 million and Colombian municipalities have contributed USD 629 million. Since 2004, the World Bank has supported Colombia’s NUTP progress through three loans totaling USD 757 million. Thus, the World Bank’s USD 757 million in loans has leveraged a national and local investment in GHG reducing infrastructure of 150 percent of the loan amount.

The latest World Bank loan totalling USD 292 million is directed at capacity building, IMTS projects in two large cities, and SPTS projects in two medium-size cities. This loan (Project ID: P117947) is provided directly to the Columbian Ministry of Transport, which disburses resources to local authorities. Payment on the the loan is due by February 2026 and it is issued at an interest rate of 1.46 percent. Per the Bank’s loan agreement, the total project cost was USD 407 million of which USD 58 million was cancelled. Thus, the Colombian Ministry of Transport or the local municipality, must supply the remaining USD 57.73 million to meet the project objectives and loan fees.

### 3.2.3 Greenhouse Gas Benefits

The NUTP/IMTS has brought an estimated countrywide emissions reduction of close to 1 million tons of CO₂ per year. An evaluation of Bucaramanga’s BRT system estimated a GHG emission reduction of 55,800 tonnes CO₂eq/year. In Medellin the NUTP’s BRT system is estimated to result in a GHG reduction of 123,500 tonnes CO₂eq/year. While specific GHG reduction data are not available for the medium sized cities of Valledupar and Sincelejo, the Clean Technology Fund expects that SPTS projects in the four cities of Armenia, Pasto, Popayan and Santa Marta will reduce emissions by 86,000 tonnes of CO₂eq/year, primarily through bus substitution, but also through modal shift. It is possible that SPTS projects in Valledupar and Sincelejo could together yield GHG reductions of at least 40,000 tonnes CO₂eq/year if similar benefits per city are realized.

### 3.2.4 Conclusions

The Colombian government has earmarked USD 4.4 billion towards transport sector projects that are focused on sustainability. In the context of climate finance, the estimated total of USD 1.644 billion from ODA loans has leveraged 2.67 times that amount in national spending on projects with significant social and environmental enhancements, including GHG reductions. Early successes in Colombia’s capital created a positive public opinion of the value of sustainable transport projects and a demand for similar services in cities across the country. Colombia built on this success to develop a comprehensive national policy framework for planning for, implementing, and coordinating municipal scale transport projects.
Not all of the expected benefits of the NUTP have been realized, with institutional weakness and governance failures as key reasons for the NUTP's incomplete performance. Nevertheless, the NUTP has played an important role in the development of Columbian cities' transport infrastructure.

### 3.3 E-Trikes, Manila, Philippines

#### 3.3.1 Project Description

This project proposes a market transformation of the Philippines tricycle industry by introducing electric tricycles (e-trikes) to increase energy efficiency, reduce reliance on imported fuels and GHG emissions, minimize environmental impact of current inefficient polluting vehicles, and increase driver income, while generating new employment in the manufacturing of parts for these vehicles. A traditional gasoline-powered tricycle is typically a motorcycle-sidecar combination, where the sidecar is closed and accommodates passengers (Figure 3.2). This project is an undertaking to introduce 100,000 e-trikes. The project is scheduled to be implemented over 60 months from January 2013 to December 2017, in two phases:

- An industry development phase when 20,000 e-trikes will be procured and distributed;
- A scale-up phase when the remaining 80,000 units will be procured and distributed.

![E-Trikes](image)

Source: Asian Development Bank

The Philippines Department of Energy (DOE) is the executing agency in charge of procurement, implementation and technical supervision of this project. An e-trike group of DOE staff and consultants has been established by the DOE to supervise and manage project implementation. ADB and the Clean Technology Fund are funding partners who are providing loans and grant for this project. DOE has been holding stakeholder outreach with several players including local government units (LGU), private stakeholders, environmental stakeholders, and others. As of November 2014, DOE has bid supply and distribution of 3,000 units of e-trikes, and has expanded the program to participants beyond LGUs, many of which did not meet loan requirements.

The pilot phase of this project also included demonstration of renewable energy for charging the vehicle batteries, with four solar charging stations installed by ADB for 20 vehicles. The target for this phase of project implementation is to have 500 locally assembled public charging stations by December 2015.
3.3.2 Project Funding and Finance

The project is estimated to cost USD 504 million, of which ADB’s loan makes up around 59 percent or USD 300 million, and the CTF is cofinancing a grant of USD 5 million and a loan of USD 100 million (20 percent of the total project cost). The government of the Philippines is financing the remaining USD 99 million, although this includes only taxes and contingency costs. Of the CTF grant of USD 5 million, USD 1 million is to be spent for capacity building and USD 4 million for the solar charging pilot. Each charging station costs about USD 23,000.

The e-trikes were initially estimated to cost USD 4,800, compared to USD 2,400 for a gasoline tricycle; this cost later increased to USD 6,500. A government financial institution such as the Land Bank of the Philippines (LBP) will establish a loan facility with the LGUs to cover the cost of the e-trikes. A single digit interest rate for the driver and no credit risk for the Department of Finance (with the LGU’s assuming the driver’s credit risk) are the two key guiding principles for this project design. An e-trike office at a given LGU can involve a private agency or a nongovernmental organization (NGO) to collect a daily “boundary” payment from the drivers and use the collected fund to repay the loan. The e-trike office also establishes penalties and undertakes remote immobilization procedures in case of default. DOE will procure the e-trikes directly from suppliers and ADB will directly pay the supplier on receiving confirmation from the DOE for units delivered. There are two ways the funds flow arrangements work:

- LGU as borrower from LBP and as lender or lessor to drivers;
- Bank conduits as borrower from LBP and as lender/lessor to drivers.

Typically the distribution of e-trikes will be executed in three steps:

- ADB pays selected suppliers based on DOE’s request;
- Supplier delivers e-trikes to LGUs;
- LGUs e-trike office supplies e-trikes to drivers.

The loans have favorable terms. ADB’s loan has a 20-year term, including a grace period of five years. The CTF loan (administered by ADB) has a 40-year term, including a grace period of 10 years. Both loans have a very low interest rate compared to any commercial loan.

ADB undertook a detailed financial analysis based on data from the pilot study. By switching to an e-trike, the driver saves about USD 5.00 per day in fuel costs. To pay for the vehicles, LGUs or government financial institutions (GFI) will charge the drivers a “single-digit interest rate” which the drivers will repay through daily payments similar to what they currently pay under the existing leasing system over a period of five years. Even after these payments, the net increase in daily cash flow per driver is estimated to be over USD 3.00.

3.3.3 Greenhouse Gas Emission Reduction Benefits

The Clean Development Mechanism component project activities document estimates emission reductions for distribution and operation of e-trikes under the local government of Quezon City. Considering a total of 2,000 e-trikes, the CDM reductions estimation over a crediting period of 10 years (with an anticipated start date in 2015) is estimated to be 11,100 tons per year or 111,000 tons over this period. This estimate assumes an 80 km daily activity and a baseline vehicle emission of 146.93 gCO₂e/km, with a typical e-trike reducing about 3.8 tons of CO₂eq annually, or about 54 percent per vehicle. The total revenue from CERs would be about USD 20 million (at a rate of USD 10 per CER) for 100,000 e-trike units over a seven-year renewable crediting period.
3.3.4 Conclusions

The project initially ran into some delays due to higher-than-expected vehicle costs, and experience to date is based on a very limited pilot implementation. Issues such as reliability and technical support have not been fully tested. However, even with the higher vehicle costs the project appears to have favorable economics. Vehicle operators will save money and the cost of the vehicles can be paid back in five years, considerably shorter than the 20 to 40 year loan periods offered by ADB and CTF. The project is attractive from a climate mitigation perspective, although the per-vehicle benefits will greatly depend upon the local electricity generating mix. Local air pollutant emissions are also eliminated, which should benefit public health.

The economics of this project suggest that similar projects should be replicable in other cities and countries. Loans are needed to offset capital costs, but otherwise the project should be self-financing. Payback periods will depend upon the relative cost of petroleum fuel vs. electricity, but vehicle costs should decline as production scales up and technology advances. In the case of Manila, the model of leasing vehicles used in the tricycle transport industry provides an obvious mechanism to recoup costs through lease fees. Initial investment is also needed to demonstrate unproven technology and build a local network of suppliers and service agents. For example, the solar charging station component, for which CTF grant support was requested, demonstrates technological viability and helps set the stage for more e-trike charging with renewable energy.

Sources suggest that the project would likely have been undertaken at a reduced scale without the use of climate finance, including the CTF loan and grant constituting about 21 percent of the total project funding; as well as ADB’s loan which accounts for 60 percent of the total funding.

3.4 Green Trucks Project, Guangdong, China

3.4.1 Project Description

The Guangdong Green Freight Demonstration Project is an energy efficiency technology demonstration project designed to demonstrate the global and local environmental benefits of the application of energy efficient vehicle technologies and operating techniques and support the development of sustainable measures for improving energy efficiency in the on-road freight transport sector. The project, funded through a GEF grant, is located in Guangdong Province of the People’s Republic of China.

The project includes four components:

- **Green Truck Technology Demonstration**: Incentive payments (government rebates) for installing energy efficient technology on trucks, as well as a green freight trade fair (Figure 3.3) and vehicle monitoring systems and evaluation reporting.

- **Green Freight Logistics Demonstration**: Conducting market studies for “drop and hook logistics methods and a proposed provincial logistics brokerage platform.”

- **Capacity Building**: Providing technical advisory services for policy research and training of officials and private stakeholders and dissemination support via Guangdong green freight websites.

- **Project Implementation Support**: Providing technical advisory services for project implementation, stakeholder consultations, project results evaluation and dissemination, and project management.

The Phase I technology demonstration component introduced six technologies that improve the fuel efficiency of operating vehicles. In a pilot phase, three of these – low resistance tires, roof fairings, and energy efficient driving systems – were found to have significant benefits. For Phase II, 11 companies with 1,284 trucks have been chosen to apply these technologies as well as two new technologies, lightweighted aluminum alloy semi-trailers and liquified natural gas (LNG) trucks. Participating drivers are...
given special training courses on energy efficient driving skills and best practices, to enhance the fuel efficiency of each technology package.

Figure 3.3: Guangdong Green Freight Trade Fair

Source: Global Environment Facility, Flickr Album, https://www.flickr.com/photos/thefgef/

The Guangdong Provincial Government’s Department of Finance (DoF) is the recipient of the GEF grant and responsible for the grant disbursement. DoF in turn designated the Department of Transport (DoT) as the leading agency for implementation of the project, which constituted a Project Management Office (PMO), in turn overseen by a Project Leading Group (PLG) comprising of senior officials from various provincial government departments. Along with the government, trucking companies, vehicle dealers, technology suppliers played vital roles in project implementation. The project was also peer reviewed by staff from the U.S. Environmental Protection Agency (EPA) Smartway Program and Clean Air Asia.

3.4.2 Project Funding and Finance

The total project cost is about USD 14 million, of which the GEF grant financed 30 percent or USD 4.2 million, while the government co-financed 17 percent of project cost (USD 2.4 million). The remaining share of 53 percent (USD 7.4 million) is enterprise co-finance, in the form of funds from participating companies.

The largest component of costs is for incentive payments, which total USD 9.3 million (2 million from GEF and 7.3 million from enterprise co-finance). The two logistics demonstration projects cost USD 1.9 million in total. The remaining costs, including various outreach, capacity-building, and management activities, are almost fully paid through GEF and local government co-finance. GEF grants go towards enterprise co-financing in two ways: Green Freight technology rebates, which lower up-front costs for new technologies; and performance-based payments, which provide incentives to participating companies to properly operate these technologies and monitor fuel savings. The enterprise co-financing is considered to be the private owner/operator investment in the new technology.

3.4.3 Greenhouse Gas Benefits

The GHG benefits of this project are potentially substantial, with per-vehicle benefits of 7 to 26 percent estimated from efficient technology and 10 percent from improved logistics efficiency. The question is how much the benefits scale up. Initially, 1,200 vehicles were projected to participate in the technology demonstration, saving 27,000 tons of GHG annually. However, the most recent report indicates 240 participating vehicles to-date and 5-6% efficiency gains due to technologies. GEF estimated that a 10 percent improvement in efficiency for 60 percent of trucks registered in the province would reduce GHG emissions by 1.2 million tons annually, but the basis for assuming such an extensive scale-up of the technology from this demonstration project is not clear.
3.4.4 Conclusions
Overall, more information is needed to evaluate the actual impacts of the project in terms of technology adoption before the effectiveness of this particular climate finance grant can be evaluated. If wider adoption of the technologies can be demonstrated through the incentives and outreach funded here, the grant seems like a very cost-effective use of climate finance. If not, the relative impact is small.

3.5 EcoParq On-street Parking Management Project, Mexico City, Mexico

3.5.1 Project Description
This case study examines the EcoParq parking meter system, which was proposed in Plan Verde, Mexico City’s sustainable development plan. EcoParq was conceived as a parking management response to Mexico City’s congestion issues by regulating parking spaces and improving the overall management of the city’s public space. Until this program came into existence, Mexico City’s parking was either free and unregulated or controlled informally by independent operators called “franeleros.” This practice, compounded with irregular parking, poor enforcement and parking behavior like parking on sidewalks and blocking driveways meant increased wait times and cruising times looking for parking.

This project was introduced in the year 2012 in Mexico City’s Polanco district, by introducing 426 multi-space meters (Figure 3.4) where parking was previously unregulated and free-of-cost. A private parking management company, Operadora de Estacionamientos Bicentenario (OEB), is contracted to implement, operate, and maintain the meter technology, as well as install signage and wayfinding. Enforcement of regulations by the local traffic authority is an important aspect of the project.

Figure 3.4: EcoParq Elements


3.5.2 Project Funding and Finance
The project is completely funded by private operators. Capital costs are around USD 9 million, with annual operation costs about USD 4.5 million. OEB is responsible for purchasing the meters, installing them, setting up signaling and wayfinding, and operating the system.

Currently, OEB keeps 70 percent of the funds raised by ecoParq, while 30 percent are directed to the Autoridad del Espacio Público (AEP), which is responsible for the recovery of public space in the neighborhood. The use of these funds is determined by the Committee on Transparency and Accountability comprised of neighborhood associations, the Miguel Hidalgo District, and AEP. Based on data published by EcoParq, USD 3.3 million was collected in 2012, of which USD 1 million was transferred to the AEP.
3.5.3 Greenhouse Gas Benefits

Greenhouse gas emission reductions from ecoPaq implementation were quantified for reduced cruising time spent looking for parking. An evaluation by the Institute for Transportation and Development Policy (ITDP) estimated that average cruising time per vehicle was reduced by nearly 10 minutes, for 15,000 vehicles per day, resulting in a savings of 7.7 million liters of gasoline and a reduction in GHG emissions of 18,000 tons. The estimate did not account for any changes in travel time, fuel and GHG emissions that might arise from other effects, such as changes in modal use if people avoid driving because of the parking charge, changes in destinations related to either higher parking costs or increased parking availability, or increased turnover rates.

3.5.4 Conclusions

The major benefit of ecoPaq has been in regularization of parking in Polanco, due to which there was greater availability of parking spaces for residents and visitors. Occupancy rates, which used to be 30 percent above capacity before ecoPaq implementation, were reduced dramatically. Surveys have estimated that average cruising time per vehicle has also been reduced substantially, resulting in reductions in fuel use and GHG emissions.

The project potentially appears replicable in other districts and cities, where parking demand exceeds supply. The primary barriers appear political – notably, gaining local support to implement and enforce the parking management approach – rather than financial or technical. While this project was undertaken without climate finance, it is possible that climate finance could play a role in funding start-up and demonstration costs in cities that have not tried this approach, or guaranteeing a revenue stream for private operators should revenue intake fall short of what is needed to cover operating costs.

3.6 Fuel Economy Policies, Chile

3.6.1 Project Description

The case study examines Chile’s Automotive Fuel Economy policy. Commencing in 2010, a number of international organizations, with support from the GEF and other international funds and organizations, launched a new global initiative – the Global Fuel Economy Initiative (GFEI). This initiative combined expertise and resources from all four partners for a comprehensive program to improve global automotive fuel economy.

Chile was chosen as one of the four developing countries where GFEI would support the preparation of national-level strategies and plans for improved auto fuel efficiency for the first phase of this effort. Starting in 2010, GFEI analyzed Chile’s existing and future vehicle fleet, and initiated a multi-stakeholder dialogue with governments and other relevant groups to develop and implement fuel economy policies. Next, GFEI’s key institutional partner in Chile, the Centro Mario Molina Chile (CMMCh), designed and proposed a set of policies, including a fiscally-neutral “feebate” system that would impose a fee on less fuel efficient vehicles and a rebate on more fuel-efficient vehicles in proportion to fuel economy.

With the incentive proposal in mind, in 2013 the Chilean Government prepared a fuel economy policy and launched the first light-duty vehicle fuel economy labeling system in Latin America and the Caribbean region. The mandatory labels provide information on CO₂ emissions, fuel economy (highway, city, and combined), model, and manufacturer (Figure ).
In September 2014, the Government of Chile implemented a tax on new, light and medium duty vehicles based on urban fuel economy performance (km/L) and emissions of nitrogen oxides (g NOx/km). This tax was included as part of a large tax reform package. Ministry sources estimate that the GFEI/CMMCh proposals and market data greatly shaped the new vehicle tax. However, the feebate measure has not been adopted at the time of this writing. Ministry sources suggest that feebate proposals were not included in recent tax reforms because they included a relatively complicated fee mechanism that could not be easily integrated into a much larger legislation.

### 3.6.2 Project Funding and Finance

All policy work related to fuel economy has been completed by Centro Mario Molina Chile, which has been supported by GFEI through GEF grants. The total budget of the Phase I GFEI project was USD 3.1 million. This was funded by a GEF contribution of USD 980,000 and USD 2,140,000 by non-GEF resources in the form of co-financing. Project co-financing came from a variety of sources, both financial and in-kind. The United Nations Environmental Program (UNEP), the U.S. Environmental Protection Agency (EPA), the FIA Foundation, and various contributions from the private sector comprised the bulk of the cash and in-kind contributions. In addition, countries were required to contribute to project implementation through the provision of staff, facilities, and financial contributions.

For specific work in Chile, GEF budget records indicate a sub-contract component for “Chile: GFEI pilot, national activities” of USD 80,000 to be funded by the GEF trust fund, and of USD 100,000 to be funded through co-financing. This total (USD 180,000) represents approximately 6 percent of the total Phase I budget.
3.6.3 Greenhouse Gas Benefits

In Chile, it was previously estimated that the labeling and feebate policy measures (including both the labeling system and feebate) would yield a 5 percent reduction of CO₂ emissions from the total national vehicle fleet in 2014. The proposed benchmark for Chile’s feebate system is 175 grams of CO₂ per kilometer. This would result in a total CO₂ reduction of 2.15 million tons over the five years after adoption. However, the feebate will likely not be adopted, and no data are available to verify whether any emission reductions have been achieved from the labeling policy or the new vehicle taxes.

3.6.4 Conclusions

Fuel economy policies can be extremely cost-effective when comparing the funds requested and the potential benefits in terms of GHG emission reductions. Chile’s recent strategies of new vehicle labels and taxes based on urban fuel efficiency and NOₓ emissions are a step towards sending clear signals to consumers.

At this time, the GFEI/CMMCh feebate proposals have not been adopted, in part because of political challenges due to their complexity. The impacts of the adopted labeling system or tax system alone have not been estimated. Even if the benefits projected from the feebate system are not realized, the costs associated with setting the adopted fuel economy labeling and tax policies [under USD 1 million] are extremely modest compared to the costs of infrastructure investment or financial incentives for adopting new technology. The ongoing implementation costs are also minimal, relying on existing government program resources for testing and vehicle importers and retailers for labeling.

From experience in Chile and other countries, GFEI has identified a number of factors leading to success in setting fuel economy policy. These include the involvement of partners with technical expertise in setting a baseline and developing the policy requirements; collaboration with key government ministries to support implementation, as well as vehicle manufacturer associations and fuel companies to gather political support; and a focus on capacity building and knowledge sharing. This collaborative approach appears to set the stage for successful replication elsewhere, potentially leveraging a modest amount of international climate funding for significant GHG reductions. However, the ability to implement fuel economy policies in any given country will depend upon the willingness of the country’s leadership to undertake such an effort.

Kommentiert [sb92]: What does this refer to? $ 180,000 or other costs? Maybe be more specific
4 Summary of Case Study Findings

Table 4.1 summarizes the six case studies, including the strategy type (avoid, shift, and/or improve), type of project or program (infrastructure, vehicle technology, or policy), total cost of the project, amount contributed by international finance sources and whether this was a loan or grant, revenue sources to pay back loans, GHG reduction benefits, and other benefits. The figures in the table are not entirely comparable, due to sometimes large differences in methods and assumptions. However, the objective is to place the relative costs and benefits of the various projects in rough perspective. Some conclusions on the various project types are then discussed below.

4.1 Infrastructure Projects

Infrastructure projects typically require large capital investment. “Sustainable” infrastructure projects often include BRT, mass rapid transit, nonmotorized travel, rail freight infrastructure, and other projects designed to achieve modal shift and/or reduce the growth in automobile travel. These projects may also include vehicle technology improvements (such as clean buses) to improve energy efficiency. Transit projects also have significant operating costs, although these may be at least partially recouped through fare revenues.

The infrastructure case studies examined here had the following characteristics:

- The international finance contribution was almost entirely in the form of loans. Covering a substantial portion of infrastructure project costs through grants from international institutions would not be feasible or sustainable.
- The loans were provided on attractive terms, with below-market interest rates and extended payback periods. This can make the public sector loan more attractive than a private sector loan even if additional conditions are attached.
- The loans must be paid back through local financing. Operating revenues (including transit fares and possibly land value capture) appear to cover some, but not all, of the loan requirements. Information to fully assess cost recovery was unavailable in the case studies.
- A supportive local policy framework is critical to success from a sustainability perspective. The project sponsor must be receptive to integrating sustainability components. In the case of Columbia, this policy direction already existed and flowed from the national level. In the case of Lanzhou, the terms of the ADB loan helped to leverage this policy direction.
- GHG reductions are modest at a project level but potentially significant when scaled up to a country level. GHG reductions can be difficult to estimate accurately. However, significant other user benefits are typically realized, such as mobility, safety, and air quality. These are generally proportionate to ridership or usage levels which can easily be measured.
- Capacity-building has been an important component of projects, but even so, existing efforts are often inadequate. Issues with local staff management and technical capacity were noted as barriers to achieving greater success in Columbia’s NUTP.
- Carbon finance (such as CDM) may not be an attractive option. The revenue that can be generated is relatively small and appears to be outweighed by the effort involved in monitoring GHG reductions, at least at current carbon prices.
| Project/Program Name                        | Strategy (Avoid, Shift, Improve) | Project/Program Type | Total Cost (USD millions) | International Finance (USD millions) | Revenue Sources                       | GHG Reductions (tonnes CO₂e/year)

1 | GHG Methods/Assumptions | Other Benefits² |
<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Lanzhou, Sustainable Urban Transport Project</td>
<td>S, I</td>
<td>Infrastructure</td>
<td>480²</td>
<td>150 (loan)</td>
<td>Fares, land value capture, other?</td>
<td>14,000</td>
</tr>
<tr>
<td>Colombia, National Public Transport Program¹</td>
<td>S, I</td>
<td>Infrastructure</td>
<td>349 (+ 30-60% local)</td>
<td>292 (loan) 0.7 (grant)</td>
<td>Fuel taxes, fares, other local and national government</td>
<td>220,000</td>
</tr>
<tr>
<td>Manila, E-Trikes</td>
<td>I</td>
<td>Vehicle Technology</td>
<td>504</td>
<td>400 (loan) 5 (grant)</td>
<td>Payback on vehicle lease</td>
<td>11,100</td>
</tr>
<tr>
<td>Guangdong, Green Trucks Project</td>
<td>S, I</td>
<td>Vehicle Technology</td>
<td>14</td>
<td>4.2 (grant)</td>
<td>Vehicle owner/ operator payments, local government funds</td>
<td>₩6,800</td>
</tr>
<tr>
<td>Mexico City, EcoParq On-street Parking Management Project</td>
<td>A, S, I</td>
<td>Policy</td>
<td>9 (capital) + 4.5 (annual operating)</td>
<td>0</td>
<td>Parking fees</td>
<td>18,000</td>
</tr>
<tr>
<td>Chile - Fuel Economy Labeling and Feebate</td>
<td>I</td>
<td>Policy</td>
<td>0.18 (int'l only)</td>
<td>0.18 (grant)</td>
<td>National government funds</td>
<td>430,000</td>
</tr>
</tbody>
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¹Round figure based on 2015 or nearest available year.
²Only documented benefits are listed. Other benefits may have been realized but not documented.
³Includes roadway reconstruction as well as BRT and NMT components.
⁴2013 World Bank loan only, servicing projects in four cities.
4.1.2 Vehicle Technology Projects

Vehicle technology projects include loans and/or grants to assist in covering the additional costs of more fuel-efficient vehicles and technology components. Advanced fuel and emissions saving technology typically costs more than standard technology, but the costs can be partially or fully paid back through fuel cost savings. Technologies with a reasonably short payback period are good candidates for loans, if some form of cost recoupment from vehicle users can be arranged. For longer payback periods, or if cost recoupment cannot be arranged, some grant funding may be required. Grants may also be used for outreach and education to help introduce users to new technologies (as in the case of the Guangdong Green Freight Fair) or for training of drivers.

The two technology project case studies focused on electric vehicles and efficient truck technologies. Findings include:

- The e-trikes project in Manila appeared to have a favorable payback period for the vehicle operators, and payback could be arranged because the vehicles are leased. The project appears to be achieving its objectives of using a loan to overcome up-front cost barriers and demonstrate and scale-up a new, unproven technology.

- The Manila project encountered some challenges due to higher-than-expected vehicle costs, but in the end still appears to work from a financial perspective. Since costs of electric vehicles will only come down over time this bodes well for the success of future, similar projects.

- The Guangdong project is still in the relatively early stages; it is too early to say whether the technologies and finance terms are attractive enough to vehicle owners and operators and therefore whether actual impacts will meet projections. However, if target levels of implementation can be achieved, GHG benefits of nearly 27,000 tonnes CO$_2$e per year from truck technology would compare favorably with estimates from the Manila and Lanzhou projects, compared with the international grant amount of just over USD 4 million. Much larger benefits could be achieved if the project leverages more widespread technology penetration.

- Technology is facilitating monitoring and evaluation, potentially making projects viable by reassuring funders that benefits are being achieved and avoiding fraud. For example, in Guangdong, GPS coupled with on-board computer information is making it possible to monitor driving patterns and fuel consumption. In Manila, e-trikes can be immobilized remotely, helping to prevent theft.

- Clean vehicle technology projects can also provide important air quality benefits if designed properly since many of the deployed technologies also reduce pollutant emissions. However, the projects are not expected to realize large mobility or safety benefits similar to infrastructure projects and services.

4.1.3 Policy Projects

Policy projects typically have modest costs, primarily associated with policy and program design, implementation, and monitoring. Two very different policy projects were evaluated here – nationwide fuel economy initiative, and a pilot neighborhood-based parking pricing and management project. The fuel economy initiative has the potential to save consumers money in the long run, but does not have a direct cost recovery mechanism, and is therefore an obvious candidate for grant funding. The parking management project is recovering costs through direct user fees (parking charges). Findings of these case studies include:

- A supportive policy environment and willingness to act are clearly needed. For example, the impacts of fuel economy standards to vehicle manufacturers and the public are potentially quite large, both negative (vehicle requirements and costs) and positive (fuel savings, GHG reductions). Offering a grant and/or technical assistance with program design can help encourage countries with limited budgets and expertise, but – as demonstrated in Chile – policymakers must be willing to adopt the
program or policy and live with any negative opinions or sufficiently educate stakeholders about the benefits of the policy.

- Similarly, the parking management project in Mexico City has been self-financing through a private operator and did not require any international assistance. This suggests it has potential for broad-scale application if policymakers are willing – but parking pricing can be a politically challenging subject at the municipal level. It is possible that modest international grants, loans, and/or technical assistance could encourage implementation in more places.

- Other types of policies – not evaluated here – may have similar potential to achieve GHG reductions with modest investment, but may not have a revenue-generating/self-financing mechanism. (Refer to Table 2.1 for an overview of financing potential by strategy.) International grants or loans may be more important in such cases to help achieve local policy change.

- National or municipal governments must also be willing to allocate budget – even if a very modest amount – on an ongoing basis to support implementation and enforcement of the policy. Enforcement has been critical to the success of the parking management project in Mexico City; in this case, program revenues could cover the costs, but this will not be true in every situation.
5 Recommendations for Climate Finance

The findings from the case studies enumerated here suggest some general lessons for how climate financiers and other providers of international transport finance can design programs and direct funding to leverage other funding sources and achieve sustainability objectives.

5.1 Program Designs

- Grants and loans should be made contingent upon local adoption and implementation of sustainable policies and program directions. This should be true for all international transport finance, not just climate finance sources. It will be a lot easier to leverage local funds if international transport funds are broadly used. Leveraging local money with climate funds alone will have much less impact – agencies’ different programs should be working towards the same objectives.

- Climate finance by definition needs assurances that the project will lead to GHG reductions. However the requirements for estimation, monitoring, and evaluation should not be so onerous as to deter project sponsors from using these funds. Simple criteria based on easily measurable factors such as project characteristics and ridership/usage may be preferable to rigorous evaluation requirements.

- Co-benefits, such as mobility, safety, and air quality, of low-carbon transport projects should be considered in cost-benefit analysis of projects and in directing finance for sustainable transport. The dollar value of these co-benefits often far outweighs the value of GHG reductions. Projects that look only modestly attractive when measured in terms of GHG cost-effectiveness may be extremely attractive when considering the full range of transport benefits.

- Capacity-building is essential for project analysis, development, implementation, and monitoring. Planners must understand the benefits of their choices in order to make good decisions. Since local agencies typically want to direct limited funds to actual projects, international funding can play an especially critical role in developing tools for data collection, planning and analysis, and monitoring methods, as well as staff capacity.

- Successful pilot projects can help to spur interest in similar projects elsewhere. After a pilot is completed, the funding agency should assess the potential for replication, including self-financing, and consider how funds might best be directed on these types of projects in the future.

5.2 Different Types of Projects

- For infrastructure projects, loans with favorable terms can assist local governments in financing if payback can be arranged through user fees and general revenues. However project costs and scale cannot exceed the local funding capacity (accounting for reasonable economic growth projections) and subsidies will quickly use up international funds on a small number of projects.

- For clean technology projects, cost-effective technologies should be able to pay for themselves over time, with only loans needed to overcome up-front cost barriers. Pilots can help introduce new technology. Attention should be paid in program design to sharing cost savings between vehicle owners/operators and the funding agency. Policy frameworks need to support, not inhibit, the adoption of low-carbon technologies.

- Support for policy development can yield some of the most cost-effective projects in terms of GHG reductions per international dollar invested. However, recipients must be committed to policy implementation as well as monitoring and enforcement to ensure the policy continues to be carried out.
5.3 Recommendations for Sustainable Transport Finance

Through the case studies, the following barriers were identified to financing sustainable transport projects:

- Commercial feasibility – Often projects that are successful in reducing GHG emissions are financed using special funding sources, or are subsidised. Once the special sources of funding dry up, or the subsidies are exhausted, it becomes difficult to replicate the project in market settings. It becomes difficult to replicate the project because it is not commercially attractive, i.e., it does not provide rates of return that are commensurate with needed investments. The lack of a return on investment on can come from many different sources, an insufficient large market, high risky, uncertainty about the performance, or a price tag that the market cannot bear;

- Unproven technologies – A new technology is often seen as providing uncertain benefits, as being too risky, unreliable, costly, or simply unproven. Individuals, companies and businesses, and government are often unwilling to adopt such new “unproven” technologies;

- Inadequate capacity for preparing and structuring projects amongst local and national government agency staff – Properly preparing projects so that they are attractive to public and private sector investors requires considerable level of technical and financial expertise. This expertise is often simply not available where it is needed;

- Lack of an enabling policy/regulatory framework at a national or municipal level – All investors typically look at two things when making an investment; rate of return and risk. The national policy/regulatory framework that is relevant for investments in sustainable transport projects has to make it possible for investors to be able to earn a sufficient return on their investments, while bearing a reasonable level of risk.

- Financial obstacles to private investment – In many countries around the world, there are significant barriers to private, foreign investors investing in the country. Many times the investors cannot own a majority stake in the object of their investment, or it is difficult for investors to repatriate their profits out of the country.

- Weak governance structures, whether the government cannot (or does not want to) take a lead role (for example, land use planning to support transit) – In many countries, the jurisdictions and responsibilities of agencies are overlapping, unclear, and not always anchored in laws, and the agencies are poorly financed. As a result, the agencies are often even capable of engaging in the needed planning, or the enforcement of planning requirements. As a consequence, public lands and goods are often, illegally, expropriated for private use and profit making;

- Small project sizes where costs of monitoring and evaluation of climate benefits may be infeasible – When the total investment required in a project is relatively small, the costs of monitoring and evaluation can be a significant portion of the project costs.

A proposed focus for climate finance to overcome these barriers is shown in Figure 5.1. This focus includes five key strategies: capacity-building, enabling policy environments, removing barriers to investment, catalyzing investments, and facilitating demonstration projects. Note that it does not include financing projects – which would overwhelm the capacity of available climate finance and divert from the other activities which have much greater leveraging power.

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7 Every project has several risk components; policy risk, political risk, market risk, technology risk, etc. Private investors typically are willing to bear risks that they have some measure of control over, and are relatively well understood and known. Thus, they are willing to bear risks associated with markets, operations, etc., and invest in proven technologies and, but are much less willing to invest in countries where the policy/regulatory framework is not clear, prejudicial against private investors, or in places where the political climate is uncertain.
In addition to leveraging existing sources of capital, financers should consider how to increase the capital available for sustainable transport, including leveraging private sources. Strategies may include:

- Increasing the role for private investors through guarantees (export & loan guarantees, subordinate debt, exchange rate), profit repatriation, bonds, P3 arrangements, and viability gap funding;
- Innovative financing schemes, including land value capture, real estate development, and taxes and fiscal incentives;
- Attracting institutional investors with:
  - Properly prepared projects;
  - An enabling macro-economic and regulatory environment;
  - Indexing to inflation;
  - Ring-fencing project revenue streams;
  - Removing or mitigating legal and regulatory requirements (Basel III and ALM) for certain types of investments.
6 References/Bibliography


Annex 1: Detailed Case Studies

The objective of these case studies is to develop more generalizable lessons learned about how climate finance can be used to stimulate sustainable/low-carbon transport by shifting investment in such projects from “high-carbon” transport projects, and how it can be used to increase the total volume of private investments in sustainable/low-carbon transport projects. Each case study includes the following components:

1. A description of the project;
2. An overview of the financing structure, including financing partners, cost components, description of finance sources, types of finance, and the process of how the financial structure was developed;
3. Financial data, including investment costs, operation and maintenance costs, and expected revenues;
4. Quantitative information on greenhouse gas emission reductions and other benefits as available;
5. Conclusions on the (potential) role of climate finance in making the project happen or enhancing the sustainability/GHG reduction aspects of the project.

Each case study was informed by a review of published documents as well as interviews with project stakeholders conducted by email, telephone, or in-person. Questions were asked regarding the following topics:

- How the lending agency determined the amount of the loan that was required for the project;
- Whether the project could have been financed without the lending agency’s assistance, either fully or at a reduced scale;
- Details of the financing provided;
- Whether the possibility of private finance was considered;
- The revenue sources to pay back the project loans;
- Success factors and lessons learned.

Clarifying questions were also asked on other project details as necessary, such as assumptions in estimating GHG reductions.
6.1 Lanzhou Sustainable Urban Transport Project

6.1.1 Introduction

The case study was developed by reviewing project documents available from the ADB and other sources, including the following key documents:


Additional information was gathered by corresponding with experts involved with project development, including:

- Ki-Joon Kim, Senior Transport Specialist, ADB Transport Division, East Asia Department – team leader of Lanzhou Sustainable Urban Transport System project;
- Wang Youping, Officer at the Lanzhou Municipal Government Project Management Office.

6.1.2 Project Description

6.1.2.1 Overview

The Lanzhou Sustainable Urban Transport Project is a high capacity bus rapid transit project in Lanzhou, which is the capital of Gansu province in northwest People’s Republic of China (PRC). It is ADB’s first project supporting a BRT in the PRC,8 which is guided by the Bank’s Sustainable Transport Initiative. By providing policy guidance and dialogue with the Lanzhou municipal government (LMG) in redesigning its master plan to establish a sustainable urban transport system in the city, ADB supported the development of the BRT system, which is an integral element of the LMG master plan.

The project includes the following four components:

- Construction and reconstruction of 33.8 km of urban roads including BRT and non-motorized transport (NMT) facilities;
- Advanced traffic management including an advanced traffic signal control system, travel demand management strategy, and NMT development plan;
- Environmental monitoring system, including air quality sensors;
- Capacity building to support project implementation including BRT operations and management.

Out of the 33.8 km of road construction, 12.4 km include dedicated bus rapid transit lanes with 22 stations. Since 2012, 9 km of the BRT have been operational.9 Figure 1 shows the project location and BRT route alignment and station locations. The non-motorized component of the project provides bicycle access lanes between sidewalks and carriageways and parking facilities at the stations. Pedestrian walkways were constructed along with underground passageways to encourage walking access to the BRT stations.


Kommentiert [LW113]: This information is not stated for all other case studies. Could you add that to the other cases pls?

Kommentiert [LW114]: Does the Sustainable Urban Transport project includes the construction of the urban roads?

Kommentiert [LW115]: Unclear if it is the first BRT project or the first BRT project guided by the STD.
Table 6.1 provides some of the operating parameters of the Lanzhou BRT. The initial stage of the BRT system has 15 fully closed stations and 70 BRT buses are operating in the corridor.

Table 6.1: Lanzhou BRT Operating Parameters

<table>
<thead>
<tr>
<th>Operating Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily System-wide Passenger Trips</td>
<td>290,000 trips</td>
</tr>
<tr>
<td>Fares</td>
<td></td>
</tr>
<tr>
<td>Median Cash Fare</td>
<td>1 Yuan (USD 0.14)</td>
</tr>
<tr>
<td>Median Smart Card Fare</td>
<td>0.85 Yuan (USD 0.12)</td>
</tr>
<tr>
<td>Fleet of BRT Buses</td>
<td>70 (fifty 12-meter and twenty 18-meter buses)</td>
</tr>
<tr>
<td>Average Bus Occupancy</td>
<td>75%</td>
</tr>
<tr>
<td>Seats in 12-meter buses</td>
<td>30</td>
</tr>
<tr>
<td>Seats in 18-meter buses</td>
<td>42</td>
</tr>
<tr>
<td>BRT Vehicle Fuel</td>
<td>CNG</td>
</tr>
</tbody>
</table>


6.1.2.2 Stakeholders

The Lanzhou Municipal Government is the executing agency for the project. It established a project steering committee for overseeing project implementation and a project management office to co-ordinate project management and supervise work procurement, including goods and services. The Project Management Office (PMO) also monitors the utilization of the ADB loan, Bank of Lanzhou funding, and government funding.

The Lanzhou Public Transport Group (LPTG) is responsible for operating public buses. LPTG owned 2,089 buses in the year 2009 and operated along 92 routes. There were also about 99 minibuses, which individual operators run with no fixed bus stops. The Lanzhou municipal government acquired the individual bus companies and consolidated them into LPTG. This eliminated a common challenge of financing transit projects, namely, other services that compete for passengers and revenue. The Institute for Transportation and Development Policy worked closely with the Guangzhou Municipal Engineering Design and Research Institute in developing the detailed engineering design for the project. Figure 6.1.1 shows a map of the project and Figure 6.1.2 illustrates project elements.

Kommentiert [LW116]: Not clear what the timing was in these facts. Were the 99 minibus operators eliminated before the ADB project started?

---

10 Average daily ridership 24-28 September 2013, not including transfers
Figure 6.1.1: Lanzhou Sustainable Urban Transport Project Map

Source: ADB (2009)
6.1.3 Project Financing and Funding

6.1.3.1 Project Financing Structure

According to the ADB loan agreement documents and interviews conducted with project experts, ADB’s loan of USD 150 million makes up around 31 percent of the total project cost of USD 480.3 million, with Bank of Lanzhou (BOL) providing a loan of USD 100 million and Lanzhou Municipal Government providing about USD 230.3 million (as shown in Figure 6.1.3). ADB’s loan has a 25-year term which includes a grace period of five years; the interest rate (2.53 percent) is determined in accordance with ADB’s London interbank offered rate (LIBOR)-based lending facility. ADB’s loan also includes a commitment charge of 0.15 percent per annum. The Bank of Lanzhou loan is a commercial loan with a payback period of five years at an rate of 6.6 percent per annum. The source of Lanzhou Municipal Government’s contribution is not specified. A flow chart showing the financing partners and financial flows indicating the project implementation and organization structure is shown in Figure 6.1.4.

11 According to the ADB team leader, Bank of China did not end up financing the project and the Bank of Lanzhou provided funding instead. Loan documents on ADB’s website still refer to Bank of China as being the financier and have not been updated with this development.
Figure 6.1.3: Project Funding Sources (millions of USD)

- $230.27 (47.9%)
- $150.00 (31.2%)
- $100.00 (20.8%)

Source: ADB (2010)

Figure 6.1.4: Project Financial Flow Chart

- Asian Development Bank (loan)
- Bank of Lanzhou (loan)
- Lanzhou Municipal Government (unspecified)

Asian Development Bank

USD 150 M

Bank of Lanzhou

USD 100 M

Loans

Lanzhou Municipal Government (LMG)

USD 230.27 M

Project Execution

BRT Operations & Fleet

Lanzhou Project Management Office

Lanzhou Public Transport Group (LPTG)
6.1.3.2 Description of Financial Sources

ADB’s loan accounted for a considerable share of project funding (31 percent of total), especially for BRT construction, equipment, and consulting services (as seen from Table 6.1.2). Elements including new road construction and BRT equipment were wholly financed by ADB’s loan. This funding was contingent on inclusion of BRT as a sustainable transport component in the Lanzhou master plan. The Bank of Lanzhou and LMG financed land acquisition and resettlement costs and a share of new road construction of the project, among other components, with a USD 100 million loan (20.8 percent share of total project funding). LMG provided the remaining funds (47.9 percent of total project funding) for project execution, which will pay for project components including resettlement costs, financing, and commitment charges during project implementation.

Table 6.1.2: Cost Estimates by Financier (millions of US dollars)

<table>
<thead>
<tr>
<th></th>
<th>Total Cost</th>
<th>Financing Plan</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ADB</td>
<td>BOL</td>
<td>LMG</td>
<td>ADB</td>
<td>BOL</td>
</tr>
<tr>
<td>A. Base Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Civil Works Components</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. New Roads</td>
<td>96.44</td>
<td>63.38</td>
<td>65.7</td>
<td>26.17</td>
<td>27.2</td>
<td>6.89</td>
</tr>
<tr>
<td>b. Reconstructed Roads</td>
<td>55.22</td>
<td>55.22</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2. Equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. BRT Station and Onboard Equipment</td>
<td>11.1</td>
<td>11.1</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>b. Advanced Traffic Control System</td>
<td>18.18</td>
<td>18.18</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>c. Environment monitoring system</td>
<td>0.74</td>
<td>0.74</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>d. Utility equipment</td>
<td>28.25</td>
<td>0</td>
<td>0</td>
<td>28.25</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>3. Consulting Services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Design supervision and monitoring</td>
<td>12.93</td>
<td>0</td>
<td>0</td>
<td>9.83</td>
<td>76</td>
<td>3.1</td>
</tr>
<tr>
<td>b. Technical Advisory Services</td>
<td>1</td>
<td>1</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4. Capacity Building</td>
<td>0.5</td>
<td>0.38</td>
<td>76</td>
<td>0</td>
<td>0</td>
<td>0.12</td>
</tr>
<tr>
<td>5. Taxes and Duties</td>
<td>21.42</td>
<td>0</td>
<td>0</td>
<td>16.76</td>
<td>78.2</td>
<td>4.66</td>
</tr>
<tr>
<td>6. Resettlement and Compensation</td>
<td>138.32</td>
<td>0</td>
<td>0</td>
<td>121.93</td>
<td>88.2</td>
<td>16.39</td>
</tr>
<tr>
<td>7. Project Administration</td>
<td>0.47</td>
<td>0</td>
<td>0</td>
<td>0.47</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Subtotal (A)</td>
<td>384.57</td>
<td>150</td>
<td>39</td>
<td>195.99</td>
<td>51</td>
<td>38.58</td>
</tr>
<tr>
<td>B. Contingencies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Physical Contingency</td>
<td>34.82</td>
<td>0</td>
<td>0</td>
<td>34.82</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>2. Price Contingency</td>
<td>11.44</td>
<td>0</td>
<td>0</td>
<td>9.5</td>
<td>83</td>
<td>1.94</td>
</tr>
<tr>
<td>Subtotal (B)</td>
<td>46.26</td>
<td>0</td>
<td>0</td>
<td>44.32</td>
<td>95.8</td>
<td>1.94</td>
</tr>
</tbody>
</table>

Source: ADB (2009)
6.1.3.3 Loan Repayment Terms

ADB’s loan can be repaid over 20 years plus a five year grace period. Installment shares start low: 0.83 percent for the first payment cycle in the year 2015, gradually ramping up to 5.5 percent in the year 2034, as seen in Figure 6.1.5. This is a favorable manner of structuring payment installations for infrastructure projects, which considers the expectation that revenue will increase over time. In the case of a BRT, for example, phased construction and installment of feeder/supporting transit systems means that ridership typically takes some time to reach its full potential. On the other hand, Bank of Lanzhou’s commercial loan has a payback period of five years after completion of the project and initiation of operations.

Figure 6.1.5: Loan Repayment Schedule – ADB and BOL

ADB’s interest rate of 2.53 percent was much lower than Bank of Lanzhou’s interest rate of 6.6 percent. This loan has been made available to the People’s Republic of China, which will extend it to the Gansu provincial government on the same conditions as those of the ADB loan. It has then been extended to LMG on the same terms as the ADB loan, with LMG bearing interest rate and foreign exchange variation risks of the loan amount. As seen in Figure 6, due to the high share of principal and interest rate of Bank of Lanzhou share of the loan, loan payments are higher in the initial years of repayment.¹²

ADB Installment Share | BOL Installment Share
---|---
2015 | 0.83%
2016 | 0.83%
2017 | 0.83%
2018 | 0.83%
2019 | 0.83%
2020 | 0.83%
2021 | 0.83%
2022 | 0.83%
2023 | 0.83%
2024 | 0.83%
2025 | 0.83%
2026 | 0.83%
2027 | 0.83%
2028 | 0.83%
2029 | 0.83%
2030 | 0.83%
2031 | 0.83%
2032 | 0.83%
2033 | 0.83%
2034 | 0.83%

Source: ADB (2010)

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¹² Interest payments starting from 2015 post construction completion were considered. No clear information is available on interest payments for BOC during construction phases.
Interest charges accumulated by the end of the loan repayment period were compared for two scenarios. The first scenario is the existing share of loan arrangements between ADB and BOL; in the second scenario, the project is completely funded by BOL in absence of an ADB loan. If the loan were to be totally financed by BOL, a marginal increase of USD 2.2 million in interest payments would have been incurred by LMG, as shown in Figure 6.1. Along with the advantage of a favorable interest rate, the ADB loan provides LMG with greater flexibility by virtue of its structuring to be paid over a longer period of time. However, interest on the ADB loan needs to be paid every six months.

Interest Payments – ADB and BOL

![Interest Payments Chart]

Figure 6.1.7: Interest Payment Scenarios

![Interest Scenarios Chart]

Scenario 1 (Existing - ADB+BOL)  Scenario 2 (BOL Alone)
6.1.3.4 Capital, Operating, and Maintenance Costs

ADB undertook a service quality and financial assessment of LPTG and audited its financial statements from 2004-2008. It determined that LPTG’s BRT operations are expected to offset the losses of its other divisions post 2013 (ADB, 2009). ADB’s financial and project analysis reports assumed that this project will not earn any direct revenue. While loan repayments are to be paid through the LMG annual budget, funds to cover the project operations and maintenance (O&M) costs are sourced from the LMG annual operating budget. It is not clear how LMG manages revenue and cost flows or whether or how revenue streams from this project pay for the O&M costs. A periodic roadway maintenance cycle of seven years is assumed. Annual maintenance costs range from $2.5 million in 2014 to $2.7 million in 2019, of which the majority are for the roadway not on the BRT route. LPTG is responsible for operating BRT buses for this project, and a breakdown of operating expense details of LPTG has not been located.

Table 6.1.3 shows capital, annual operating and maintenance, and periodic maintenance costs. Annual costs include operations as well as the maintenance of BRT and other traffic management equipment.

Table 6.1.3: Project Capital, Operating, and Maintenance Costs (millions of U.S. dollars)

<table>
<thead>
<tr>
<th>Year</th>
<th>Capital Costs</th>
<th>Periodic Maintenance Costs</th>
<th>Annual Costs</th>
<th>Total Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>17.4</td>
<td>0.0</td>
<td>2.6</td>
<td>20.0</td>
</tr>
<tr>
<td>2010</td>
<td>112.1</td>
<td>0.0</td>
<td>15.5</td>
<td>127.6</td>
</tr>
<tr>
<td>2011</td>
<td>105.2</td>
<td>0.0</td>
<td>23.3</td>
<td>128.5</td>
</tr>
<tr>
<td>2012</td>
<td>67.8</td>
<td>0.0</td>
<td>28.4</td>
<td>96.2</td>
</tr>
<tr>
<td>2013</td>
<td>30.9</td>
<td>0.0</td>
<td>29.6</td>
<td>60.5</td>
</tr>
<tr>
<td>2014</td>
<td>12.0</td>
<td>0.0</td>
<td>32.7</td>
<td>44.7</td>
</tr>
<tr>
<td>2015</td>
<td>0.0</td>
<td>0.0</td>
<td>34.1</td>
<td>34.1</td>
</tr>
<tr>
<td>2016</td>
<td>0.0</td>
<td>0.0</td>
<td>35.5</td>
<td>35.5</td>
</tr>
<tr>
<td>2017</td>
<td>0.0</td>
<td>0.0</td>
<td>36.9</td>
<td>36.9</td>
</tr>
<tr>
<td>2018</td>
<td>0.0</td>
<td>0.0</td>
<td>38.5</td>
<td>38.5</td>
</tr>
<tr>
<td>2019</td>
<td>0.0</td>
<td>0.0</td>
<td>40.1</td>
<td>40.1</td>
</tr>
<tr>
<td>2020</td>
<td>0.0</td>
<td>54.5</td>
<td>41.8</td>
<td>96.3</td>
</tr>
<tr>
<td>2021</td>
<td>0.0</td>
<td>0.0</td>
<td>43.5</td>
<td>43.5</td>
</tr>
<tr>
<td>2022</td>
<td>0.0</td>
<td>0.0</td>
<td>45.3</td>
<td>45.3</td>
</tr>
<tr>
<td>2023</td>
<td>0.0</td>
<td>0.0</td>
<td>47.2</td>
<td>47.2</td>
</tr>
<tr>
<td>2024</td>
<td>0.0</td>
<td>0.0</td>
<td>49.2</td>
<td>49.2</td>
</tr>
<tr>
<td>2025</td>
<td>0.0</td>
<td>0.0</td>
<td>51.3</td>
<td>51.3</td>
</tr>
<tr>
<td>2026</td>
<td>0.0</td>
<td>0.0</td>
<td>53.4</td>
<td>53.4</td>
</tr>
<tr>
<td>2027</td>
<td>0.0</td>
<td>54.5</td>
<td>55.7</td>
<td>110.2</td>
</tr>
<tr>
<td>2028</td>
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<td>2030</td>
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<td>63.0</td>
<td>63.0</td>
</tr>
<tr>
<td>2031</td>
<td>0.0</td>
<td>0.0</td>
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<td>65.7</td>
</tr>
<tr>
<td>2032</td>
<td>0.0</td>
<td>0.0</td>
<td>68.5</td>
<td>68.5</td>
</tr>
<tr>
<td>2033</td>
<td>0.0</td>
<td>-115.2</td>
<td>71.4</td>
<td>-43.8</td>
</tr>
</tbody>
</table>
Note: Costs are in 2009 USD. Negative values in year 2033 are not explained in the source document.

6.1.3.5 Estimated Fare Revenue

Fare revenue estimates based on ex-ante ridership add up to over $80 million over a seven-year period. Actual ridership data from 2013 indicates a significant increase over ex-ante estimates, providing additional fare revenue of $16.6 million over the first seven-year period, compared to an initial estimate of $80 million over this period, as shown in Table 6.1. Ridership has increased considerably from 110,000 passengers a day in January 2013 to 290,000 by September 2013, and studies on pedestrian volume and peak hour passenger volume surveys conducted at various stations also show a steady increase.

Table 6.1: Revised Ridership and Revenue Estimations

<table>
<thead>
<tr>
<th>Year</th>
<th>Ex-ante Estimate</th>
<th>Revised Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BRT Passengers</td>
<td>Ex-ante Fare Revenue Estimate</td>
</tr>
<tr>
<td>2013</td>
<td>65,517,500</td>
<td>$9,827,625</td>
</tr>
<tr>
<td>2014</td>
<td>67,452,000</td>
<td>$10,117,800</td>
</tr>
<tr>
<td>2015</td>
<td>72,014,500</td>
<td>$10,802,175</td>
</tr>
<tr>
<td>2016</td>
<td>76,540,500</td>
<td>$11,481,075</td>
</tr>
<tr>
<td>2017</td>
<td>80,665,000</td>
<td>$12,099,750</td>
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<tr>
<td>2018</td>
<td>84,789,500</td>
<td>$12,718,425</td>
</tr>
<tr>
<td>2019</td>
<td>88,914,000</td>
<td>$13,337,100</td>
</tr>
<tr>
<td>7-year Total</td>
<td>535,893,000</td>
<td>$80,383,950</td>
</tr>
</tbody>
</table>


LMG staff noted that the revenue of BRT cannot cover the operation cost due to the very low fare and discounted fares for various age groups including elderly and students.

6.1.3.6 Land Development and Value Capture

There are several techniques for capturing revenue from land value increases related to a transport investment such as BRT. Typical financial instruments used for value capture include benefit capitalization, developer exactions (covenants and impact fees), and land management and sales. In the case of Lanzhou, value capture was undertaken through lease or sale of land in the project vicinity, the value of which has been enhanced due to the BRT infrastructure investment. Literature shows that in the case of new transit facilities, property value premiums can be as high as 167 percent. A case study of Beijing’s Southern Axis BRT line 1 reports a 66.7 percent increase in property values in the catchment areas (immediate vicinity of the BRT stations up to about 500 meters) between the construction period of the BRT project and four years after full BRT operation.

Six underground shopping malls were constructed in the Lanzhou BRT corridor as part of a public-private partnership financing arrangement and implemented by the government through the Lanzhou-ADB

PMO. LMG allotted 90Mu (6.0 hectares or 14.8 acres) of land along the BRT corridor and 450mu (30.0 hectares or 74.1 acres) of land near the end of BRT corridor to the PMO for development. Value capture occurred as ADB’s BRT project progressed, but was not considered as one of the project components when the project was initiated. Revenue from these sources could be used towards paying back project loan and interest payments, which are to be paid through the LMG annual budget (data on value capture revenue were not available).

6.1.4 Other Benefits
The project improves the energy efficiency of public transport and reduces private vehicle travel activity, thereby reducing greenhouse gas emissions. Other benefits include reduced private vehicle operating costs, benefits of diverted and generated traffic, time savings, air quality, and safety. These benefits were monetized in an economic analysis conducted by ADB.

6.1.4.1 Greenhouse Gas Emission Reductions
The project is the first ADB transport project to support preparation of an application for certification under the Clean Development Mechanism (CDM) of the Kyoto Protocol. However, after CDM registration, ADB’s CDM related unit contacted the Lanzhou Bus Company, but they were not interested in getting in to the monitoring stage even though they agreed to do so earlier. Among the reasons for lack of interest were the fact that documentation requirements were too onerous and monitoring costs outweigh the value of carbon credits. ADB since convinced the stakeholders to proceed to the CDM monitoring stage. An advance payment for fulfilling documentation requirements for obtaining CDM funds was arranged. In light of revised ridership data being available, Table 6.1.5 shows a marginal increase in emission reductions of 2,741 tons of carbon dioxide (CO₂) compared to initial estimates. Reductions are shown for a seven-year period, which is the CDM crediting period (renewable).

15 2014 Sustainable Transport Award Finalist: Lanzhou, China, ITDP.
16 ADB’s Carbon Market Initiative (CMI) supported this project for preparing an application for CDM registration. Initially, this project was estimated to receive 5,000 certified emission reductions (CERs) annually. At a conservative estimate of $10 per CER, the fund was expected to pay $0.5 million over 10 years towards meeting part of BRT’s operating and maintenance expenses.

Kommentiert [LW127]: I thought the advance payment was for setting up the monitoring system?
Table 6.1.5: Project Emission Reductions (Tonnes of CO\(_2\))

<table>
<thead>
<tr>
<th>Year</th>
<th>Ex-ante Estimate</th>
<th>Revised Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>11,804</td>
<td>15,675</td>
</tr>
<tr>
<td>2014</td>
<td>11,487</td>
<td>14,884</td>
</tr>
<tr>
<td>2015</td>
<td>12,273</td>
<td>14,038</td>
</tr>
<tr>
<td>2016</td>
<td>12,923</td>
<td>13,134</td>
</tr>
<tr>
<td>2017</td>
<td>13,149</td>
<td>12,170</td>
</tr>
<tr>
<td>2018</td>
<td>13,312</td>
<td>11,141</td>
</tr>
<tr>
<td>2019</td>
<td>13,396</td>
<td>10,044</td>
</tr>
<tr>
<td>7-year Total</td>
<td><strong>88,345</strong></td>
<td><strong>91,086</strong></td>
</tr>
</tbody>
</table>


6.1.4.2 Monetized Benefits

Project benefits were quantified and monetized by ADB in an economic evaluation of the project. The monetized benefits include:

- Vehicle operating costs (VOC) – reduced vehicle repair and fuel costs due to road reconstruction and reduced congestion;
- Diverted traffic benefits – reduced VOC due to a shift from private and smaller transit vehicles to larger transit vehicles;
- Generated traffic benefits – estimated at one-half the VOC savings per mile compared to normal and diverted traffic;
- Travel time benefits - due to improved travel time reliability and reduced congestion;
- Avoided costs and other benefits – including safety (avoided accident costs) and carbon emission reductions, valued at USD 10 per ton of CO\(_2\). Air pollution benefits were noted but not quantified.

The value of these benefits is shown by year and compared with project costs in Table 6.1.6. Benefits from VOC savings are the major economic benefit (47.9 percent), followed by diverted traffic benefits (22.4 percent), time savings benefits (18.8 percent), generated traffic benefits (5.6 percent), and other benefits (5.3 percent). The economic internal rate of return used to measure the social profitability of this project under the most likely traffic growth scenario is 17.02 percent with the net present value at the annual discount rate of 12 percent. Sensitivity analysis indicated that the net present value was positive within the plausible range of variability. ADB’s conclusion was that it was unlikely that the risk associated with either cost overruns or reduced project benefits would make the project unfeasible (ADB, 2009).
Table 6.1.6: Total Costs vs. Monetized Benefits of Project

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Costs</th>
<th>Vehicle Operating Cost Savings</th>
<th>Diverted Traffic Benefits</th>
<th>Generated Traffic Benefits</th>
<th>Time Savings Benefits</th>
<th>Other Benefits</th>
<th>Total Benefits</th>
<th>Net Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>20.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>-19.95</td>
</tr>
<tr>
<td>2010</td>
<td>127.6</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>-127.65</td>
</tr>
<tr>
<td>2011</td>
<td>128.5</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>-128.51</td>
</tr>
<tr>
<td>2012</td>
<td>96.2</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>-96.23</td>
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<tr>
<td>2013</td>
<td>60.5</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>-60.48</td>
</tr>
<tr>
<td>2014</td>
<td>44.7</td>
<td>31.93</td>
<td>2.49</td>
<td>1.35</td>
<td>5.13</td>
<td>11.26</td>
<td>52.16</td>
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<td>2015</td>
<td>34.1</td>
<td>44.69</td>
<td>4.98</td>
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<td>6.60</td>
<td>6.21</td>
<td>65.86</td>
<td>31.81</td>
</tr>
<tr>
<td>2016</td>
<td>35.5</td>
<td>54.82</td>
<td>10.42</td>
<td>5.86</td>
<td>8.06</td>
<td>6.48</td>
<td>85.64</td>
<td>50.17</td>
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<tr>
<td>2017</td>
<td>36.9</td>
<td>64.96</td>
<td>15.87</td>
<td>8.86</td>
<td>11.28</td>
<td>7.14</td>
<td>108.10</td>
<td>71.15</td>
</tr>
<tr>
<td>2018</td>
<td>38.5</td>
<td>75.09</td>
<td>21.32</td>
<td>9.90</td>
<td>14.49</td>
<td>7.80</td>
<td>128.60</td>
<td>90.11</td>
</tr>
<tr>
<td>2019</td>
<td>40.1</td>
<td>85.22</td>
<td>26.76</td>
<td>10.94</td>
<td>17.70</td>
<td>8.47</td>
<td>149.10</td>
<td>109.01</td>
</tr>
<tr>
<td>2020</td>
<td>96.3</td>
<td>95.36</td>
<td>32.21</td>
<td>11.99</td>
<td>20.92</td>
<td>9.13</td>
<td>169.60</td>
<td>73.33</td>
</tr>
<tr>
<td>2021</td>
<td>43.5</td>
<td>99.76</td>
<td>40.15</td>
<td>12.43</td>
<td>24.13</td>
<td>9.80</td>
<td>186.26</td>
<td>142.74</td>
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<tr>
<td>2022</td>
<td>45.3</td>
<td>104.16</td>
<td>48.08</td>
<td>12.86</td>
<td>32.60</td>
<td>10.05</td>
<td>207.77</td>
<td>162.43</td>
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<td>2023</td>
<td>47.2</td>
<td>108.57</td>
<td>56.02</td>
<td>13.30</td>
<td>41.08</td>
<td>10.30</td>
<td>229.27</td>
<td>182.03</td>
</tr>
<tr>
<td>2024</td>
<td>49.2</td>
<td>112.97</td>
<td>63.96</td>
<td>13.74</td>
<td>49.55</td>
<td>10.56</td>
<td>250.78</td>
<td>201.56</td>
</tr>
<tr>
<td>2025</td>
<td>51.3</td>
<td>117.38</td>
<td>71.90</td>
<td>14.18</td>
<td>58.02</td>
<td>10.81</td>
<td>272.29</td>
<td>221.00</td>
</tr>
<tr>
<td>2026</td>
<td>53.4</td>
<td>121.95</td>
<td>80.28</td>
<td>14.63</td>
<td>66.50</td>
<td>11.06</td>
<td>294.42</td>
<td>240.98</td>
</tr>
<tr>
<td>2027</td>
<td>110.2</td>
<td>126.70</td>
<td>89.13</td>
<td>15.10</td>
<td>76.21</td>
<td>11.31</td>
<td>318.45</td>
<td>208.25</td>
</tr>
<tr>
<td>2028</td>
<td>58.0</td>
<td>131.63</td>
<td>98.46</td>
<td>15.58</td>
<td>87.34</td>
<td>11.56</td>
<td>344.57</td>
<td>286.53</td>
</tr>
<tr>
<td>2029</td>
<td>60.5</td>
<td>136.76</td>
<td>108.29</td>
<td>16.08</td>
<td>100.09</td>
<td>11.80</td>
<td>373.02</td>
<td>312.54</td>
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<td>2030</td>
<td>63.0</td>
<td>142.08</td>
<td>118.66</td>
<td>16.60</td>
<td>114.71</td>
<td>12.03</td>
<td>404.09</td>
<td>341.05</td>
</tr>
<tr>
<td>2031</td>
<td>65.7</td>
<td>147.61</td>
<td>125.58</td>
<td>17.14</td>
<td>123.46</td>
<td>12.27</td>
<td>438.06</td>
<td>372.36</td>
</tr>
<tr>
<td>2032</td>
<td>68.5</td>
<td>153.35</td>
<td>141.09</td>
<td>17.70</td>
<td>150.66</td>
<td>12.50</td>
<td>475.30</td>
<td>406.82</td>
</tr>
<tr>
<td>2033</td>
<td>43.8</td>
<td>159.31</td>
<td>153.20</td>
<td>18.27</td>
<td>172.66</td>
<td>12.74</td>
<td>516.19</td>
<td>560.00</td>
</tr>
</tbody>
</table>

Note: Benefits expressed in 2009 US dollars

6.1.5 Conclusions
6.1.5.1 Overall Conclusions
Implementation of the Lanzhou Sustainable Urban Transport Project relied on sustainable transport funding to a significant extent. This project received financial flexibility and advisory services, which played an important role in its successful execution. The project would most likely not have had BRT and NMT components without funding by ADB. Land value capture was not among the project’s components when it was conceived, but occurred as the BRT project progressed. Ridership is exceeding forecast levels and development has occurred along the corridor, suggesting that the project has been beneficial.

ADB’s economic evaluation of the project concluded that the project is expected to earn net social benefits starting in the year 2014, and that any risks related to project execution are relatively minimal and
would not make the project unfeasible. However, this evaluation considered only social benefits and not revenues. As net fare-based revenues are not reported, no financial internal rate of return has been calculated that includes operational costs and revenues.

6.1.5.2 Success Factors

Among the various factors that made the project feasible are the partnership with ADB, which led to the inclusion of a sustainable transport component in the Lanzhou master plan, and various BRT design elements and operational characteristics.

Sustainable transport and BRT component - It is evident from the project execution documents and the interviews with project execution staff that ADB’s support to this project by having a policy dialogue on sustainable urban transport and incorporating BRT into the project has been a major enabling factor for inclusion of the BRT component into LMG’s master plan.

BRT system design elements – Several elements of the project, including a strong non-motorized component to support alternative means of transport and access to the BRT system, proved to be critical in the project’s success. Promoting safety for non-motorized traffic has increased the number of bicyclists and pedestrians using the BRT system.17 Also, flexible operations management including real-time tracking of buses, response to changes in passenger demand, and signal prioritization have led to better reliability of the BRT system. The Lanzhou BRT received a “Silver Standard” from the BRT Standard Technical Committee and “will likely achieve a gold standard when a planned integrated bike sharing system opens.”18 The project was also one of the four finalists for the ITDP 2014 Sustainable Transport Award.

6.1.5.3 Project Risk Management

ADB identified risks that could affect the implementation or economic viability of the project, which can affect the ability to realize benefits. They also identified actions that can mitigate these risks. Table 7 juxtaposes risks and their corresponding mitigation measures as identified by ADB (ADB, 2009). These measures are in addition to standard assurances that LMG and ADB have agreed to as part of the project undertaking.

<table>
<thead>
<tr>
<th>Risks</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequately designed BRT that fails to improve the efficiency of public transport or attract people to use it to the extent projected</td>
<td>Provision of consulting services to supervise BRT design</td>
</tr>
<tr>
<td>Lacking capacity for BRT operation and management</td>
<td>Provision to LMG and the PMO of institutional capacity building for BRT operation and management planning</td>
</tr>
<tr>
<td>Lacking cooperation for BRT from bus operators and other authorities</td>
<td>Development of manuals for BRT operation and management and implementation of training</td>
</tr>
<tr>
<td>BRT ridership taken by light rail transit (LRT)</td>
<td>Well-coordinated design and development of the LRT</td>
</tr>
<tr>
<td>Delay in the provision of counterpart funding</td>
<td>Covenanted assurances on the provision of counterpart funding</td>
</tr>
<tr>
<td>Failure to provide adequate assistance to people affected by</td>
<td>Management of resettlement to include favorable compensation, relocation, and social security policies of LMG; livelihood training; semiannual resettlement</td>
</tr>
</tbody>
</table>

17 Lanzhou’s Bus Rapid Transit System Brings Quick Relief to Busy City, ADB Knowledge Showcases, Issue 55, May 2014.
18 Lanzhou Bus Rapid Transit, ITDP
6.1.5.4 Suitability for Climate Finance

For a typical BRT project, GHG mitigation potential is realized through mode shift from private automobiles to transit and more efficient transit operation. Emission reductions may be realized due to congestion relief, more efficient or lower-carbon transit vehicles, displaced private vehicle travel activity, and corresponding secondary impacts on land use and travel.

The single most important criterion that determines whether a BRT project is mitigating emissions is the ridership it is able to realize. A sound operational plan and integration of support systems, including local and feeder buses and provisions for walking and bicycling, affect ridership potential of the BRT system. Actual ridership data shows that the Lanzhou BRT is exceeding its initially forecast impacts on travel.

In this particular case, sustainable transport finance added a significant value to the project during its preparation and implementation phases by providing the local government with an incentive to include BRT and other improvements addressing non-motorized travel and safety, rather than just roadway improvements. On the other hand, the potential value of carbon credits is quite small compared to the cost of the project, suggesting that the project could not be justified based on its climate benefits alone.

6.2 Colombia’s National Urban Transport Program

6.2.1 Introduction

The following case study looks at Colombia’s National Urban Transport Program (NUTP), and explores the ways that transport policy provided a national framework to support climate finance across the country. The case study focuses primarily on the latest World Bank loan provided in 2013, but also provides background on the overall finance structure for the NUTP and the role of international co-finance.

The case study was developed by reviewing project documents available from the Colombian Government, the World Bank, the Partnership for Market Readiness, the Center for Clean Air Policy and the World Resources Institute (EMBARQ), and by corresponding with experts involved with transportation development in Colombia. Experts contacted included:

- Carlos Felipe Pardo, Despacio;
- Claudia Díaz, Low Carbon Resilient Development Program.

6.2.2 Description

6.2.2.1 Background

Following a series of reforms and significant improvements in national governance in the late 1990s and early 2000s, the Republic of Colombia has emerged as a much favored country for receiving multilateral development bank financing for public sector projects. The World Bank, the Inter-American Development Bank and the Andean Development Corporation (CAF) have been quick to negotiate and approve loans to finance technical assistance and infrastructure construction across the country.

In Latin America and the Caribbean, sustainable transport infrastructure has not been a priority for national and international funding streams. However, Colombia’s strategic policy efforts to nationally fund sustainable transport projects and create a hospitable climate for international financing of these important assets have proven a model to imitate amongst developing countries. Since 2003 the Colombian National Council of Economic and Social Policy has been developing a National Urban Transport
Program, also referred to as the “National Policy for Urban Mobility and Transport.” The Council is chaired by the President and supported by the National Planning Department (DNP).

Following the success of investments in sustainable transport in the nation’s capital, Bogota, the national policy was designed to provide competitive, efficient, affordable, safe, and environmentally sustainable mobility options for rest of Colombia’s urban population. The NUTP has the following goals:

- Improve the efficiency and safety of public urban transport services;
- Provide reliable transport accessibility for the poor;
- Enhance private sector involvement in service provision;
- Reduce air pollution and greenhouse gas emissions;
- Foster comprehensive and sustainable urban development processes;
- Promote inter-municipal coordination within the metropolitan areas, interagency coordination within the municipalities, and knowledge sharing between the national and local governments.

6.2.2.2 Overview of the National Urban Transport Program

Since 2004, the World Bank has supported Colombia’s NUTP progress through a series three loans totalling USD 757 million. The NUTP has also been supported by other multilateral banks. The most recent World Bank loan was issued in 2013.

The NUTP policy seeks to encourage environmental, operational and financial sustainable mobility solutions. At the same time it promotes proper land use planning linked to sustainable transport. To accomplish these goals, the NUTP provides institutional support, training and assistance in traffic and transit planning, management and control. The NUTP also provides money or in-kind support for 40-70 percent of the total project cost to be used for construction of infrastructure.

To ensure that government resources are spread equitably among Colombia’s diverse cities, the NUTP calls for two main techniques: Integrated Mass Transit Systems (IMTS or SITM) and Strategic Public Transport Systems (SPTS).

- **IMTS** are prioritized in large cities (population at least 600,000; 40 percent of the national population). IMTS aim to improve mobility along strategic corridors via high-quality BRT systems, increase transport accessibility for the urban poor, develop integrated transport policies, and improve urban transport planning and traffic management.

- **SPTS** are favored for medium-size cities (population between 250,000 and 600,000; 10 percent of the national population). SPTS aim to generate city-center urban renewal, upgrade public spaces, implement dedicated infrastructure for public transport, reduce oversupply of public transport (typical to unregulated, informal sector public transport provision), modernize legacy fleets of inefficient/high emission buses, optimize route planning and operations, and support nonmotorized and less carbon-intensive modes.

The NUTP also specifies techniques for cities with less than 250,000 residents.

6.2.2.3 NUTP Financing

Funding for the NUTP comes in the form of national co-finance. If local authorities meet a set of key conditions, the Colombian government will provide money or in-kind support for 40 to 70 percent of the total project cost for construction of infrastructure. To receive the funding, municipalities must create transport authorities and special purpose agencies to manage new public transport systems. Funding is
also contingent on projects that are harmonized with land use plans and that meet strict socio-economic and technical criteria.

Most capital infrastructure costs (including public transit right-of-ways and stations) are funded and provided by the public sector. Through the implementing entities, the public sector also plans and manages transit operations. This is achieved through a combination of national and local funding, and via loans from multilateral and bilateral Official Development Assistance (ODA) institutions.

Public-private partnerships play a critical role in implementing Colombia’s NUTP. Per the national policy, private sector investments must be maximized for construction of infrastructure - at least 10 percent of total infrastructure costs must be covered by private investments. Cities typically contract with the private sector to acquire and operate transit vehicles and support infrastructure (such as maintenance yards, fare collection/control systems, operations monitoring equipment, etc.). There is no national funding available for the operation and maintenance of NUTP projects. Thus, in the case of IMTS projects, public transport fare revenue must cover all operating and maintenance costs for the contractors. Beside transit fares, other opportunities for private investment include real estate development, advertisements, and network infrastructure rights.

The national policy requires that the amount left after national funding and private participation must be financed through local resources. Municipal governments can apply revenues from fuel taxes to contribute 30 percent of the total project cost. Originally created as an indirect tax, in order to raise funds for mass transit (under Act 310, 1990), the fuel surcharge was amended so it became a permanent source of funding for municipalities (local level) and departments (regional level). The current fuel surcharge is 25 percent of the reference price for gasoline and 6 percent for diesel. The NUTP also includes authorizations for advancing economic instruments, namely congestion and pollution charges. In addition, a recent tax reform (Ley 1607 de 2012) has included an initiative to advance “green taxes.”

Under the NUTP, commitments for financing must take the form of an allocated flow of annual fiscal transfers that must be sanctioned by the National Fiscal Policy Council (CONFIS). This system formalizes future budget allocations that are required to cover the government’s contributions to the program. Municipalities participate in this arrangement through cofinancing agreements (with the national government) that promise an annual flow of program contributions. Thus, a financial incentive is created for the municipal governments to submit their programs to the NUTP. National support is ensured and the risk of a potential change in transportation policies secondary to changes in the municipal government is eliminated. Disbursements and completed work are clearly linked as government disbursements are only approved as civil works are executed.

6.2.2.4 NUTP Institutional Structure

To implement and manage local transport improvements, the GoC developed an institutional framework as shown in Figure 6.2.1. The framework shows the relationship of national authorities to local authorities, delivery agencies, and fiduciary bodies.
Colombia’s Ministry of Transportation established a Project Coordination Unit (PCU) to supervise the implementation of IMTS projects at the national level. PCUs are staffed by a mix of civil servants and consultants (including transport engineers, economists, accountants, social and environmental specialists, and others). The PCU provides direct support to NUTP participating cities and local implementing entities. This support may consist of technical, operational, environmental, social/resettlement, and procurement aspects. The PCU is crucial for coordinating and managing key technical aspects of the national plan including the following:

- Administration, finance, and accounting;
- Work and acquisitions;
- Social management of resettlement;
- Environmental management;
- Monitoring and evaluations.

In contrast to the PCU’s top-down approach, local authorities and Implementing Entities provide a bottom-up operational, tactile approach. In Colombia, urban transport is a local responsibility, where municipalities are responsible for planning, regulating, and controlling traffic urban public transport. Local public transport services are provided by the private sector.

In the context of the NUTP, local implementing agencies/entities are empowered bodies that include urban transport planning, civil works, environmental, and social professionals. These bodies are tasked with bringing together the public and private sectors into agreed upon contracts. Staff composition, capacity, and performance are essential for implementing NUTP projects. This is especially true for medium-sized cities where governance and institutional capacity challenges are present.
6.2.2.5 NUTP Projects

Following this framework, the Colombia has provided support to planning activities (project preparation and design) and funding for project infrastructure across the country (Figure 6.2.2).

Figure 6.2.2: Colombia Urban Mobility Projects Summary

With NUTP planning and funding, IMTS/BRT systems are in operation or in construction in eight large cities in Colombia: Barranquilla Metropolitan Area, Bogotá – Soacha, Bucaramanga Metropolitan Area, Cartagena, Cúcuta, Pereira-Dosquebradas, Santiago de Cali, and Valle de Aburrá-Medellín. SPTS interventions have been planned for the following 12 medium-sized cities: Armenia, Buenaventura, Ibagué, Manizales, Montería, Neiva, Pasto, Popayán, Santa Marta, Sincelejo, Valledupar and Villavicencio.

The 2013 World Bank loan (Support to the National Urban Transport Program Project) was to enhance the efficiency, affordability, quality, safety, and environmental sustainability of the provision of public transit services in the participating cities. There are two core project components: IMTS - the construction of BRT systems in Bucaramanga, Cartagena, Medellín, and Pereira; and SPTS the rehabilitation of the road network, travel demand management strategies and urban renewal in Valledupar and Sincelejo.

6.2.3 Project Financing and Funding

The total cost of capacity building and IMTS implemented (per 2013 estimates) has been USD 1,940.7 million\(^{18}\), of which 100 percent was financed (Figure 6.2.3). Of this amount, the Government of Colombia has contributed USD 554.7 million and Colombian municipalities have contributed USD 629 million. Since 2004, the World Bank has supported Colombia's NUTP progress through three loans totaling USD

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\(^{18}\) WB Implementation Completion and Results Report (IBRD-72310 IBRD-74570 IBRD-77590), June 2013.
757 million. Thus, the WB’s USD 757 million in loans has leveraged a national and local investment in GHG reducing infrastructure of 150 percent of the loan amount.

Figure 6.2.3: Colombia NUTP / IMTS Costs by Component (in USD Million)

The above project costs and financing represent a substantial increase from the time of appraisal. Per the Bank’s Implementation Completion and Results Report, the project scope was widened to include more cities and the physical scale of the sub-projects was significantly increased. This resulted in a total cost increase of approximately 185 percent between the 2003 appraisal estimate of the original loan and the 2013 actual/latest estimate.

Other MDBs have also been active in supporting NUTP city improvements through national loans. They include the following:

- Andean Development Corporation - CAF (USD 45 million for IMTS in Bogotá - Avenida Suba);
- IDB (USD 200 million for the IMTS in Cali);
- IDB & CTF (USD 320 million for SPTS in Armenia, Pasto, Popayan, and Santa Maria);
- IDB (USD 30 million for IMTS in Bogotá - Battery-Electric Public Transit Vehicles);

Thus, between 2002 and 2013 the national transport policy has attracted approximately USD 1.352 billion in transport development financing from MDBs.

The World Bank loans have been aimed at implementing IMTS projects, through yearly fiscal transfers to cities participating in the NUTP. Of the eight “large cities” targeted by the NUTP for IMTS, the Bank has financed projects in Barranquilla, Bogotá, Bucaramanga, Cartagena, Medellín-Valle de Aburrá, and Pereira.

On 28 June 2013, Colombia and the Bank entered into a loan agreement (Project ID: P117947, Support to the National Urban Transport Program Project) for USD 292 million plus a USD 0.73 million front end fee to assist in the financing of NUTP capacity building, and the partial financing of the program's IMTS and SPTS projects (Figure 6.2.4).
The objective of this loan was to enhance the efficiency, affordability, quality, safety, and environmental sustainability of the provision of public transit services in the participating cities. There are two core project components:

1. **IMTS** - This component includes the augmentation of bus rapid transit systems in Bucaramanga (Metrolinea) and Medellin – Valle de Aburra (Metroplus) with terminals and feeder routes.
   - In Bucaramanga: BRT ridership levels are increasing. A second phase is set to open in 2014 that is anticipated to approximately triple the system’s daily trips.
   - In Medellin: BRT system operated by Medellin Metro continues to expand to Southern satellite communities. Ridership demand has exceeded estimates.

2. **SPTS** - The second component is the strategic public transit systems. This component entails the rehabilitation of the road network, travel demand management strategies, and urban renewal in Valledupar and Sincelejo.
   - In Sincelejo: Transport demand is being measured and analyzed. New transport service and routes will be designed to meet the demand as identified.
   - In Valledupar: Restructuring public transport network and integrate informal modes (rickshaws, motorcycles, etc.) as feeder routes. Other efforts include road network improvements and pedestrian space rehabilitation.
Payment on the loan is due by February 2026 and it is issued at an interest rate of 1.46 percent.\textsuperscript{20} Per the World Bank loan agreement, the total project cost was USD 407 million\textsuperscript{21} of which USD 58 million was cancelled. Thus, the Colombian Ministry of Transport or the local municipality, must supply the remaining USD 57.73 million to meet the project objectives and loan fees.

6.2.4 Other Benefits

6.2.4.1 Greenhouse Gas Benefits

BRT systems can improve the quality of public transport, lead to a modal shift from private to public transport, reduce congestion and travel times, and support the rationalization and renovation of urban bus fleets. Per Colombia’s Second National Communication to the UNFCCC, BRTs may contribute to the reduction of 0.8 million tons of CO\textsubscript{2}eq per year.\textsuperscript{22} The NUTP/IMTS program has brought an estimated emission reduction of close to 1 million tons of CO\textsubscript{2} per year from transportation.\textsuperscript{23} An evaluation of Bucaramanga’s BRT system estimated a GHG emission reduction of 55,800 tonnes CO\textsubscript{2}eq/year.\textsuperscript{24} In Medellin the NUTP’s BRT system is estimated to result in a GHG reductions at 123,500 tonnes CO\textsubscript{2}eq/year.

While specific GHG reduction data are not available for the medium sized cities of Valledupar and Sincelejo, the Clean Technology Fund estimates that SPTS projects recommended per the NUTP will have significant GHG reductions. These reductions will be secondary to implementing dedicated public transportation infrastructure, reducing excess supply of public transit, replacing obsolete buses with lower-pollution technologies, optimizing and coordinating route planning and operations, and supporting non-motorized modes and a shift toward less carbon-intensive modes. The CTF expects that SPTS projects in the four cities of Armenia, Pasto, Popayán and Santa Marta will reduce emissions by 86,000 tons of CO\textsubscript{2}eq/year. This figure represents the following:

- Direct effect (conservative assessment) of the substitution of the old bus systems by the SPTS (78,000 tons CO\textsubscript{2}eq/year);
- The expected following modal shift (8,000 tons CO\textsubscript{2}eq/year).

Based on the estimates for four Colombian cities of similar size to the cities funded in the 2013 World Bank loan, it is possible that SPTS projects in Valledupar and Sincelejo could together yield GHG reductions of at least 40,000 tons CO\textsubscript{2}eq/year.

6.2.4.2 Safety, Mobility, and Air Quality

In Colombia, the main beneficiaries of the NUTP have been public transit users in participating cities that have implemented IMTS; however, as NUTP has enabled SPTS development, all citizens have benefited from greater access to safe, high-quality, and effective transport services.

NUTP projects have especially benefited the urban poor, in facilitating improved access to services and economic opportunities and reducing their generalized transportation costs. The urban population at large

\textsuperscript{20} P117947: Support to the National Urban Transit Program Project - Financials
\textsuperscript{21} Project: Support to the National Urban Transit Program Project http://www.worldbank.org/projects/P117947/support-national-urban-transit-program-project/lang=en&tab=overview
\textsuperscript{23} Ibid.
\textsuperscript{24} IGES CDM Project Database 2014 http://pub.iges.or.jp/modules/envir/db/view.php?docid=968
have experienced better overall urban mobility and environmental conditions through the relief of traffic congestion and reduction in road crashes and air pollution. Through the project, cities have incorporated new, low-emission high capacity buses, reduced over-supply, and introduced cleaner fuel types. Prior to BRT implementations in cities like Bogota, buses for urban transport systems consumed diesel fuel of more than 4,500 parts per million (ppm) of sulfur. As diesel fuels emit much higher PM volumes than the fixed national standard, the health of city dwellers was significantly affected. Significant annual reductions in SO$_2$, NO, and particulate matter are also estimated. For example, post BRT implementation, Bogotá reported the following reductions in air pollution: SO$_2$ declined by 43 percent, NO, by 18 percent, and particulate matter by 12 percent.

### 6.2.5 Conclusions

#### 6.2.5.1 Overall Conclusions

The Colombian government has earmarked USD 4.4 billion towards transport sector projects that are focused on reducing the need to travel, increasing the mode shares of more environmentally sustainable modes of transport, and improving the energy efficiency of all transport modes and vehicles. In the context of climate finance, the estimated total of USD 1.644 billion from ODA loans, including the most recent World Bank loan of USD 757 million, has leveraged 2.67 times that amount in national spending on projects with significant social and environmental enhancements, including GHG reductions.

#### 6.2.5.2 Success Factors

Colombia’s NUTP provided consistent funding allocations for infrastructure by the national and local governments. Colombia represents a rare example where a national policy actively promotes value capture through negotiated investments and public-private partnerships. The NUTP also creates opportunities for municipalities to support transport investments via creative funding from land use and demand management measures (congestion pricing and parking management).

The extensive legal framework of the NUTP mandates capacity building, coordination, and knowledge transfer among municipalities. Municipalities and local bodies have a high degree of authority, and receive support for technical project preparation by national authorities.

#### 6.2.5.3 Project Risk Management

NUTP transportation projects have transformed Colombia’s cities for the better, but many potential benefits as envisioned by the policy have not been realized. The National Planning Department points to institutional weakness and governance failures as key reasons for the NUTP’s incomplete performance. Columbia has experienced the following challenges implementing the SPTS and IMTS projects as specified by the NUTP:

- Transport demand expectations in many NUTP cities have been wrong. Public transit ridership estimates are often too high. This is based on two factors:
  - The competition of other modes, including impact of semi-formal and informal public transit modes, and the shift to private motor vehicles (e.g., motorcycles) is understated.
  - NUTP policies exclude subsidies for public transit operations to serve a goal of “self-sustainability.” Local authorities often provide poor service (low frequency, high passenger loads, missing urban periphery/off-peak services, etc.) to meet revenue expectations, which further

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21 Diesel fuel quality in Bogotá and Medellín is now 50 ppm and this was set countrywide by January 1st 2013 by law.
hurts ridership. Poorly estimated demand creates financial stress, which results in poor service delivery, which erodes the demand base.

- There is not enough support, or policy instruments for harnessing travel demand management to create disincentives for private motor vehicle use (such as congestion pricing and parking management).

- Coordination, while clearly mandated in the NUTP, is not effective on the ground. There are few regional institutions, unclear responsibilities, and little accountability between regional transport agencies/authorities.

- NUTP is missing service quality standards, consistent performance metrics, and monitoring and evaluation control mechanisms.

- There is insufficient funding available for fully meeting mobility needs. Non-motorized transport is neither adequately prioritized nor integrated into public transport system projects.

- NUTP does not provide guidance or subsidies for assisting people who have low incomes in benefiting from transport improvements. Public transit providers focused on self-sufficiency often develop fare structures that effectively price out the poor that the NUTP claims to serve.

- Capacity building requirements are clearly stated in NUTP; however, in practice these efforts are lacking:
  - The NUTP legal framework is comprehensive but is also complex and often contradictory. Implementing entities are unable to leverage all of the NUTP’s policy instruments.
  - There is low priority for capacity building efforts in operations, management, customer service.
  - There is a lack of continuity in local management and staff results in gaps in technical capacity.

6.2.5.4 Suitability for Climate Finance

Colombia has a comprehensive national policy framework for planning for, implementing and coordinating municipal scale transport projects. This process and strong national direction can set the stage for using funds effectively.

The initial set of sustainable mobility improvements in Colombia’s capital, including the successful Transmilenio BRT system, has created a positive public opinion of the value of these projects and a demand for similar services in cities across the country. Early success and a history of transport innovation has created a critical mass of planners, engineers, and transportation professionals who are well-versed in these techniques.

In the context of climate finance, Colombia has well-developed institutions, national governance capacity, and a successful track record for harnessing ODA loans to fund infrastructure. The country’s development needs, history of political stability, and modern finance experiences make it a prime candidate to manage and attract additional ODA loans.

6.3.1 Introduction
This case study examines the introduction of electric tricycles (e-trikes) as a low emission and energy efficient alternative to replace traditional gasoline-powered tricycles. The case study was developed by reviewing project documents available from the ADB and other sources, including the following key documents and resources:


Additional information was gathered by corresponding with experts involved with project development, including:

- Mr. Sohail Hasnie, Principal Energy Specialist, Southeast Asia Department, ADB – team leader of Market Transformation through Introduction of Energy Efficient Electric Vehicles Project.
- Ms Danielle Guillen, GIZ Philippines.

6.3.2 Project Description

6.3.2.1 Background
According to the Clean Technology Fund Investment Plan for the Philippines, based on a 6 percent rate of growth in motorization, and the projected increase in urban population by 35 million by 2030, road transport emissions, which were estimated at 24 million tonnes CO₂e in 2007, are projected to increase to 37 and 87 million tonnes CO₂e by 2015 and 2030 respectively. With increasing growth in motorization and threats to air quality and energy security, the government made it a strategic priority to a low carbon pathway for the transport sector in the National Framework Strategy on Climate Change.

Though public transport vehicles represent about 15 percent of road transport in the Philippines, they use a disproportionate amount of fuel and cause most of transport related air pollution. Among these vehicles, tricycles account for 67 percent, followed by jeepneys at 23 percent, buses at 6 percent, and cars at 4 percent. The tricycle fleet of the Philippines stood at 3.5 million vehicles in the year 2012, with an estimated 1 million vehicles sold during that year.

26 Department of Energy, Government of the Philippines, Clean Technology Fund Investment Plan
6.3.2.2 Overview

This project proposes a market transformation of the Philippines tricycle industry by introducing electric tricycles (e-trikes) to increase energy efficiency, reduce reliance on imported fuels, minimize environmental impact of current inefficient polluting vehicles, and increase driver income, while generating new employment in the manufacturing of parts for these vehicles.

A traditional gasoline-powered tricycle is typically a motorcycle-sidecar combination, where the sidecar is closed and accommodates passengers (Figure 6.3.1). This project is an undertaking to introduce 100,000 e-trikes to reduce GHG emissions and providing an energy efficient and clean alternative. The project is scheduled to be implemented over 60 months from January 2013 to December 2017. The project is planned for implementation in two phases:

- An industry development phase when 20,000 e-trikes will be procured and distributed;
- A scale-up phase when the remaining 80,000 units will be procured and distributed.

In April 2011, the Asian Development Bank and Philippines Department of Energy (DOE) piloted 20 locally made e-trikes powered by imported lithium-ion batteries in the City of Mandaluyong (see Figure 6.3.2 showing the metro Manila area), which provided for some driver feedback on parameters to design an improved model for a scaled-up program. The project later hit some snags in its implementation due to issues raised between potential suppliers and the local government units (LGUs), which were the beneficiaries, related to higher-than-expected vehicle costs. The award of the first package of units faced extended delays. As of 8 November 2014, DOE rebid supply and distribution of 3,000 units of e-trikes with a deadline of 5 January 2015 and expanded the program to a wider audience beyond the LGUs.

Figure 6.3.1: Traditional Gasoline Tricycle

Photo Credit: Asian Development Bank.

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28 Current project implementation delay will most likely lead to revising these dates to the year 2015 as the start date.

29 ADB-funded e-trike project hits snag due to higher costs


30 DOE Expands e-trike program

Figure 6.3.2: Map of Metro Manila

Source: Metro Manila Website (http://www.philippines.hvu.nl/Luzon4.htm)
The following project output targets have been set by ADB in its project design and implementation:

- **E-trike units**: The project shall deliver 100,000 e-trike units to LGUs to replace gasoline tricycles. This will include a comprehensive warranty on batteries and mechanical parts to ensure technical reliability and after-sales service.

- **Battery supply chain**: The project will initiate creation of a lithium-ion battery supply chain by procuring at least 300 MWh of lithium ion batteries for the 100,000 e-trikes.

- **Charging stations**: The project will pilot five off-grid solar charging stations, 200 kilowatts each, sufficient to meet the demand of 1,000 e-trikes; and establish grid-connected charging stations.

- **Materials recovery**: The project will establish a materials recovery mechanism for collecting and disposing existing passenger sidecars of tricycles and spent lithium-ion batteries.

- **Outreach, social mobilization, and technology transfer**: Educating stakeholders about the project’s benefits, technical parameters, costs, and market potential of e-trikes. This will include training the drivers on maintenance and use of e-trikes and support for development of human resources for capacity building in the local industry.

Figure 6.3.3 shows a typical gasoline tricycle next to an e-trike, e-trike charging equipment, and model e-trikes. The pilot phase of this project includes demonstration of renewable energy for charging, with four solar charging stations installed by ADB serving 20 vehicles. The target for this phase of project implementation is to have 500 locally assembled public charging stations by December 2015. Each charging station costs about USD 23,000.

### 6.3.2.3 Stakeholders

The Philippines DOE is the executing agency in charge of procurement, implementation and technical supervision of this project. An e-trike group of DOE staff and consultants has been established by the DOE to supervise and manage project implementation. ADB and the CTF are funding partners who are providing loans and grant for this project. DOE has been holding stakeholder outreach with several players including LGUs, private stakeholders (battery manufacturers, logistics suppliers, and electricity transport organizations), environmental stakeholders (other government departments including the Department of Interior and Department of Environment and Natural Resources, National Solid Waste Management Commission, Land Transportation Office, Department of Science and Technology, and other stakeholders).

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Figure 6.3.3: E-Trikes

Source: Asian Development Bank

Top: E-Trike and Traditional Gasoline Trike (motorcycle with a passenger sidecar), Middle: Lithium-ion battery charging station, Bottom: Model E-Trikes at ADB.
6.3.3 Project Financing and Funding

6.3.3.1 Project Financial Structure

The project is estimated to cost USD 504 million, of which ADB’s loan makes up around 59 percent or USD 300 million, and the CTF is cofinancing a grant of USD 5 million and a loan of USD 100 million (20 percent of the total project cost). The government of Philippines is financing the remaining USD 99 million, although this includes only taxes and contingency costs. A breakdown of costs by source is shown in Figure 6.3.4.

Of the CTF grant of USD 5 million, USD 1 million is to be spent for capacity building and USD 4 million for a solar charging pilot. ADB’s implementation and supervision services of USD 240,000 are also paid through this grant.

![Figure 6.3.4: Project Funding Sources (millions of USD)](image)

Source: ADB, Report and Recommendation of the President to the Board of Directors (2012)

A government financial institution such as the Land Bank of the Philippines (LBP) will establish a loan facility with the LGUs to cover the cost of the e-trikes. The LGUs assume the driver’s credit risk. Legal instruments such as lease to own agreements and contracts of maintenance are drawn up between the driver and the LGU e-trike office and the vehicle can be immobilized remotely. DOE will procure the e-trikes directly from suppliers and ADB will directly pay the supplier on receiving confirmation from the DOE for units delivered. There are two ways the funds flow arrangements work:

- LGU as borrower from LBP and as lender or lessor to drivers;
- Bank conduits as borrower from LBP and as lender/lessor to drivers.

Typically the distribution of e-trikes will be executed in three steps:

Kommentiert [LW142]: Cofinancing with whom? ADB?

Kommentiert [LW143]: See comment above in the summary of the case study. From the flowchart below, I understand that the bank is LBP.
• ADB pays selected suppliers based on DOE’s request;
• Supplier delivers e-trikes to LGUs;
• LGUs e-trike office supplies e-trikes to drivers.

Two flow charts showing these funding flows and agreements are shown in Figures 6.3.5 and 6.3.6.

Figure 6.3.5: LGU as Borrower from LBP and as Lender or Lessor to Drivers


Note: Acronyms in the funding flow diagrams not defined elsewhere in this document are as follows: BTr = Bureau of Treasury, DBM = Department of Budget and Management, DOF = Department of Finance, IEC = information, education and communication, SARO = special allotment and release order.
The ADB and CTF loans and the CTF grant account for 80 percent of the total project funding, while the government of Philippines covers the remaining 20 percent. The majority of funding by the government of Philippines goes towards contingencies and taxes. ADB’s policy on financial management and analysis of projects stipulates inclusion of contingencies in the total project cost. Contingencies are two types – physical and price contingencies. Physical contingencies are increases in base costs due to changes in the quantity, period and method of implementation of the project. These contingencies are typically calculated in both foreign and local costs. Price contingencies account for any projected increase in project base costs and physical costs due to changes in unit costs. These are typically due to cost escalations due to inflation and thus calculated using the differential between the international inflation rate and the inflation rate on local currency costs. Contingencies of 11.6 percent in foreign costs and 12.6 percent in base costs were calculated in this case. The other significant element of the government’s contribution is in the form of exemption on taxes and duties to suppliers of e-trikes. This is part of an electric vehicle policy that will exempt imports of all electric vehicles from taxes for nine years.

Table 6.3.1 shows funding by source and by project component. Figure 6.3.7 provides the breakdown of total costs by project components.

### Table 6.3.1: Cost Estimates by Funding Source and Project Component (millions of US dollars)

<table>
<thead>
<tr>
<th>Item</th>
<th>ADB</th>
<th>% of Cost Category</th>
<th>CTF Loan</th>
<th>% of Cost Category</th>
<th>CTF Grant</th>
<th>% of Cost Category</th>
<th>GOP</th>
<th>% of Cost Category</th>
<th>Total Cost</th>
<th>Taxes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Base Cost</strong></td>
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<tr>
<td>1. E-trike Components</td>
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</tr>
<tr>
<td>a. Lithium Ion Battery</td>
<td>18.80</td>
<td>16%</td>
<td>100.00</td>
<td>84%</td>
<td>-</td>
<td>-</td>
<td>118.80</td>
<td>16.20</td>
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</tr>
<tr>
<td>b. Body and Other Parts</td>
<td>211.20</td>
<td>100%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>211.20</td>
<td>28.80</td>
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<td></td>
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<tr>
<td>c. Motors</td>
<td>37.84</td>
<td>100%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>37.84</td>
<td>5.16</td>
<td></td>
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<tr>
<td>2. Supporting Infrastructure</td>
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<tr>
<td>a. Charging Stations</td>
<td>0.48</td>
<td>100%</td>
<td>-</td>
<td>0%</td>
<td>-</td>
<td>0%</td>
<td>-</td>
<td>0.48</td>
<td>0.07</td>
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</tr>
<tr>
<td>b. Battery Recycling</td>
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<td>100%</td>
<td>-</td>
<td>0%</td>
<td>-</td>
<td>0%</td>
<td>-</td>
<td>2.30</td>
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<td>c. Materials Recovery</td>
<td>2.64</td>
<td>100%</td>
<td>-</td>
<td>0%</td>
<td>-</td>
<td>0%</td>
<td>-</td>
<td>2.64</td>
<td>0.36</td>
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<tr>
<td>d. Communication, Social Mobilization and Admin Support</td>
<td>0.87</td>
<td>100%</td>
<td>-</td>
<td>0%</td>
<td>-</td>
<td>0%</td>
<td>-</td>
<td>0.87</td>
<td>0.12</td>
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<tr>
<td>e. Solar Charging Station Pilot</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4.00</td>
<td>100%</td>
<td>4.00</td>
<td></td>
<td></td>
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<tr>
<td>3. Consulting Support</td>
<td></td>
<td></td>
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<tr>
<td>a. Technology Transfer and Local Industry Support</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.87</td>
<td>100%</td>
<td>-</td>
<td>0.87</td>
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<td>b. Implementation Consultant</td>
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<td>85%</td>
<td>-</td>
<td>0%</td>
<td>0.13</td>
<td>15%</td>
<td>-</td>
<td>0.86</td>
<td>0.12</td>
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<td><strong>Sub-Total (A)</strong></td>
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<td>72%</td>
<td>100.00</td>
<td>26%</td>
<td>5.00</td>
<td>1%</td>
<td>-</td>
<td>379.86</td>
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<td><strong>B. Contingencies</strong></td>
<td></td>
<td></td>
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<tr>
<td>1. Physical</td>
<td>2.07</td>
<td>5%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>42.31</td>
<td>95%</td>
<td>44.38</td>
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</tr>
<tr>
<td>2. Price</td>
<td>8.63</td>
<td>61%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5.44</td>
<td>39%</td>
<td>14.07</td>
<td></td>
</tr>
<tr>
<td><strong>Sub-Total (B)</strong></td>
<td>10.70</td>
<td>18%</td>
<td>-</td>
<td>-</td>
<td>47.75</td>
<td>82%</td>
<td>58.45</td>
<td></td>
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</tr>
<tr>
<td><strong>C. Taxes</strong></td>
<td>-</td>
<td>0%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>51.25</td>
<td>100%</td>
<td>51.25</td>
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<tr>
<td><strong>D. Financial Charges During Construction</strong></td>
<td>14.44</td>
<td>100%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>14.44</td>
<td></td>
</tr>
<tr>
<td><strong>Total (A+B+C)</strong></td>
<td>300.00</td>
<td>60%</td>
<td>100.00</td>
<td>20%</td>
<td>5.00</td>
<td>1%</td>
<td>99.00</td>
<td>20%</td>
<td>504.00</td>
<td></td>
</tr>
</tbody>
</table>
6.3.3.2 Loan Repayment Terms

ADB’s loan has a 20-year term, including a grace period of five years, and the interest rate is determined in accordance with ADB’s London interbank offered rate (LIBOR)-based lending facility. It also has a commitment charge of 0.15 percent per annum. The CTF loan has a 40-year term, including a grace period of 10 years, a management fee of 0.18 percent and an interest charge of 0.25 percent. Principal payments are structured so that the government can pay 2 percent of the principal each year from the years 11 to 20 and 4 percent for the years 21 to 40. The CTF loan is administered by ADB. Both loans have a very low interest rate compared to any commercial loan. The CTF loan has similar concessional terms to the International Development Association (IDA) charges. These loans have little interest and repayments are stretched over 25 to 30 years, including a five or 10-year grace period.

6.3.3.3 Financial and Economic Analysis

ADB undertook a detailed financial analysis based on data from the pilot study. From a driver's perspective, a typical gasoline tricycle driver uses about USD 6.50 for a total daily trip distance of 80 kilometers, which needs 5.5 liters of gas. By switching to an e-trike, which consumes 6 kilowatt-hour of power at a cost of about USD 1.50 per day, the driver saves about USD 5.00 per day. The financial internal rate of return (FIRR) for the driver is over 47 percent, which is considered desirably high.

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33 Proposed financing products, terms and conditions for public sector operation of the Clean Technology Fund

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ADB's sensitivity testing, under extremely adverse scenario of the driver facing a daily lease payment increase of an additional 10 percent, the FIRR decreases to 16.5 percent, which is still above the ADB’s acceptable requirement standard of over 12 percent.

ADB also conducted an economic analysis of the effect of this project by comparing two scenarios with and without the project implementation. The economic analysis included a cost benefit analysis of the project with the benefits mainly coming from reduced fuel use. ADB reports that the economic internal rate of return (EIRR) is 23.7 percent and indicates that the project is economically viable. This economic analysis considers effects such as sensitivity to gasoline prices and includes benefits of employment created by the e-trike industry. EIRR drops to 17.5 percent in case of a drop of gasoline price by 20 percent according to the sensitivity testing. ADB estimated that the project could create about 10,000 jobs by the year 2015.

6.3.3.4 Payback Arrangements and Monetized Benefits

As mentioned earlier in the funding flows section of this document, a GFI such as the Land Bank of the Philippines will establish a loan facility with the LGUs to cover the cost of e-trikes. Based on the disbursement arrangement, LGUs or GFIs will charge the drivers a “single-digit interest rate” (assumed to be 9.5 percent in Table 6.3.2), which the drivers will repay through daily payments similar to what they currently pay under the existing “boundary system” over a period of five years. Table 5 shows that under the originally estimated cost of an e-trike of USD 4,800, drivers increase daily cash flow from 7.1 to 10.2 USD due to fuel savings. Even with a more expensive vehicle cost, drivers still see an increase in cash flow compared to the gasoline tricycle.

Table 6.3.2: Estimated Cash Inflow and Outflow for Drivers

<table>
<thead>
<tr>
<th></th>
<th>Gasoline Tricycle</th>
<th>E-Trike</th>
<th>E-Trike (Higher Cost)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Cost of Tricycle (USD)</td>
<td>2,400</td>
<td>4,800</td>
<td>6,500</td>
</tr>
<tr>
<td>Daily Range (KM)</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Daily Energy Consumption</td>
<td>5 liters</td>
<td>6 KwH</td>
<td>6 KwH</td>
</tr>
<tr>
<td>Daily Cost of Fuel/Energy (USD)</td>
<td>6.6</td>
<td>1.9</td>
<td>1.9</td>
</tr>
<tr>
<td>Boundary Fee (USD)</td>
<td>3.6</td>
<td>5.1</td>
<td>7.6</td>
</tr>
<tr>
<td>Daily Cash Outflow in USD</td>
<td>10.2</td>
<td>7.1</td>
<td>9.6</td>
</tr>
<tr>
<td>Daily Cash Inflow in USD</td>
<td>17.3</td>
<td>17.3</td>
<td>17.3</td>
</tr>
<tr>
<td>Daily Net Cash Flow on Average (USD)</td>
<td>7.1</td>
<td>10.2</td>
<td>7.6</td>
</tr>
</tbody>
</table>


Note: Data from multiple sources including news articles used for estimating cost of e-trikes. Boundary fee and cash flow estimates assume a loan rate of 9.5 percent.

15 Due diligence, Market Transformation through Introduction of Energy-Efficient Electric Vehicles Project, Report and Recommendation of the President to the Board of Directors, ADB

16 Creating 10,000 jobs in the e-trike industry by 2015 might not be possible given the delay in project implementation; however there is no revised information to make any adjustments to reflect current conditions of the project.

17 Boundary system is a vehicle leasing system where the driver pays a daily fee to the owner or financier of the tricycles.

6.3.4 Other Benefits

The project improves the energy efficiency of a section of the largest public transport fleet in the country and reduces greenhouse gas emissions. Other developmental benefits are improved health of drivers, skill development due to an emerging employment sector for e-trikes manufacturing, job creation, and supporting industries. The project has also devoted emphasis to gender needs, especially for women, in the design of e-trikes and set a target of at least 30 percent charging station jobs for women during day-shifts.

The Clean Development Mechanism component project activities document estimates emission reductions for distribution and operation of e-trikes under the local government of Quezon City. For this estimation purpose, a total of 2,000 e-trikes, which are scheduled to be implemented by Quezon City, have been considered. Table 6.3.3 shows the CDM reductions estimation over a crediting period of 10 years from 2013 to 2022 (which will be adjusted to likely start in 2015 due to the delay in project implementation). Assuming an 80 km daily distance per vehicle and a baseline vehicle emission of 146.9 gCO₂/km, a typical e-trike reduces about 3.8 tons of CO₂eq annually, or about 54 percent per vehicle.39 If applied in other locations, the GHG benefits would depend upon the local electricity generating mix.40

Table 6.3.3: Project Emission Reductions

<table>
<thead>
<tr>
<th>Year</th>
<th>Baseline emissions (tonnes CO₂eq)</th>
<th>Project emissions (tonnes CO₂eq)</th>
<th>Emission reductions (tonnes CO₂eq)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>13,163</td>
<td>2,052</td>
<td>11,111</td>
</tr>
<tr>
<td>2014</td>
<td>13,163</td>
<td>2,052</td>
<td>11,111</td>
</tr>
<tr>
<td>2015</td>
<td>13,163</td>
<td>2,052</td>
<td>11,111</td>
</tr>
<tr>
<td>2016</td>
<td>13,163</td>
<td>2,052</td>
<td>11,111</td>
</tr>
<tr>
<td>2017</td>
<td>13,163</td>
<td>2,052</td>
<td>11,111</td>
</tr>
<tr>
<td>2018</td>
<td>13,163</td>
<td>2,052</td>
<td>11,111</td>
</tr>
<tr>
<td>2019</td>
<td>13,163</td>
<td>2,052</td>
<td>11,111</td>
</tr>
<tr>
<td>2020</td>
<td>13,163</td>
<td>2,052</td>
<td>11,111</td>
</tr>
<tr>
<td>2021</td>
<td>13,163</td>
<td>2,052</td>
<td>11,111</td>
</tr>
<tr>
<td>2022</td>
<td>13,163</td>
<td>2,052</td>
<td>11,111</td>
</tr>
<tr>
<td>Total</td>
<td>131,630</td>
<td>20,520</td>
<td>111,122</td>
</tr>
</tbody>
</table>

Source: Philippine Electric Vehicle Project, CDM Emission Reduction Calculation, http://cdm.unfccc.int/ProgrammeOfActivities/Validation/DB/H1J0SGF4SESWSDAFMY9ZL2GRG1RS9/view.html

Note: Emission calculation in CDM for 2,000 e-trikes in Quezon City in Metro Manila.

39 Cost benefits analysis of technology and replacement options for 2-stroke three wheelers in the Philippines, Clean Air Initiatives for Asian Cities, Manila, July 2011

40 The base case assumed in the CTF and CDM calculations was 34 percent coal, 10 percent oil, 29 percent natural gas, and 27 percent hydro and geothermal; see CTF “Philippines CTF IP Update,” Appendix 1, December 2011.
6.3.5 Conclusions

6.3.5.1 Overall Conclusions

The Manila e-trikes project initially ran into some delays due to higher-than-expected vehicle costs, and experience to date is based on a very limited pilot implementation. Issues such as reliability and technical support have not been fully tested. However, even with the higher vehicle costs the project appears to have favorable economics. Vehicle operators will save money and the cost of the vehicles can be paid back in five years, considerably shorter than the 20 to 40 year loan periods offered by ADB and CTF. The project is attractive from a climate mitigation perspective as the shift from gasoline to electric tricycles is estimated to reduce GHG emissions per vehicle significantly. Local air pollutant emissions are also eliminated, which should benefit public health. Employment generation potential of the project and the possibility of this project developing the region into a manufacturing hub are sustaining the negotiations towards smooth implementation.

6.3.5.2 Success Factors

The project was piloted with 20 e-trikes in different configurations including battery sizes and charging options. It could be deduced from the pilot that:

- Lithium-ion batteries are an environmentally sustainable battery choice;
- E-trike designs are capable of meeting the variable range, speed, and terrain specifications as demanded during operation in the country;
- Fuel savings are enough to sustain a lease-to-own e-trike scheme for the drivers.

However, due to the limited quantity of pilot vehicles and batteries, the drivers and LGUs were not able to address the risks of faulty equipment and batteries. Limited availability of spares and lack of technical support was also encountered during the pilot implementation. Mitigation measures like ensuring warranty and manufacturer compensation with easy access to repair services, and other forms of capacity building have been incorporated.

The higher-than-anticipated price of the vehicles after bidding caused delays in the project. To address concerns about high costs, the Electric Vehicle Association of the Philippines is reducing the average cost of an e-trike from USD 6,500 by 20 percent by downscaling specifications.

Many LGUs did not meet the loan requirements laid out by the Department of Finance (DOF), so the DOE revised its approach to offer e-trikes to a wider audience of educational institutions, tourism growth areas, commercial entities and other interested parties beyond the initially identified LGUs. It is expected that the total number of e-trikes that will be introduced as part of this project is estimated based on the participation and eligibility of LGUs who facilitate funding flows. However, the lack of qualified LGUs meant that there are fewer off-takers, which led to the DOE re-bidding the contracts for the first 3,000 e-trikes to roll-out during the first year of the project.

6.3.5.3 Project Risk Management

The following risks and their respective mitigation measures have been identified in the ADB assessment and risk mitigation plan. However, it is not clear what measures have been identified in scaling up from the pilot stage of the project to its first year of the first phase of roll-out. Also, risks like failure of finding enough off-takers and price escalation risk mitigation are not addressed in Table 6.3.4.

Kommentiert [LW151]: Incorporated where?

Kommentiert [LW152]: This is mentioned here for the first time. Not appropriate in a conclusion.

Kommentiert [LW153]: Same as above. This should not be part of the conclusion.

Kommentiert [LW154]: Factual information taken from ADB documents. Should not be part of the conclusion.
6.3.4 Risks and Mitigation Measures

<table>
<thead>
<tr>
<th>Risks</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor-quality of manufactured e-trikes and batteries undermine technology credibility</td>
<td>Prequalified bidders, professional design with international safety standards, and at least 3-years warranty. Staggered payment to suppliers will ensure quality batteries are delivered and warranties are honored by suppliers.</td>
</tr>
<tr>
<td>Low demand for e-trikes discourages new investment</td>
<td>A mid-term review will assess overall performance after distributing the first 20,000 e-trikes after Phase 1 and before distributing the remaining 80,000 e-trikes.</td>
</tr>
<tr>
<td>Inadequate capacity of local industry to meet demand</td>
<td>Procurement will be phased to ensure sufficient time and supply capacity, new investments and technology transfer</td>
</tr>
<tr>
<td>Multiple layers of govt. and insufficient LGU management capacity to support the project</td>
<td>Leadership, competency, and credit worthiness with GFFs coupled with strong support from drivers for the e-trike program will be the key criteria for selecting the cities for the first 20,000 e-trikes.</td>
</tr>
<tr>
<td>Efficient supporting industry will not be set-up to supply quality spare parts</td>
<td>The draft bidding documents identifies a range of associated services that a potential bidder will be required to deliver (including inventory of spare parts), which will encourage wider participation of local industry.</td>
</tr>
<tr>
<td>Non-payment by e-trike drivers</td>
<td>Payment defaults by the driver will be dealt with by the tricycle association. E-trikes will be equipped with a remote immobilization tool to stop a defaulting driver from using the e-trike. The pilot program had no defaults.</td>
</tr>
</tbody>
</table>

6.3.5.4 Suitability for Climate Finance

Improving energy efficiency of the omnipresent tricycles (and auto-rickshaws) in Asia and the developing world is potentially a very effective strategy to reduce GHG emissions from the transport sector, as well as air pollution. In cases where it can be demonstrated that the economic and financial rates of return on investment are high, this strategy is a win-win for financing entities and end-use drivers. In the case of electric vehicles, emissions are due to the grid electricity that the vehicles consume for battery charging. This shift from traditional gasoline tricycles to e-trikes leads to an estimated 54 percent reduction in GHG emissions, given the Philippines’ mix of fossil fuel and renewable energy electricity generation sources.

Sources suggest that the project would likely have been undertaken at a reduced scale without the use of climate finance, including the CTF loan and grant constituting about 21 percent of the total project funding; as well as ADB’s loan which accounts for 60 percent of the total funding.

This project is replicable across wide range of countries conceptually, due to the prevalence of inefficient public utility vehicles combined with the economic viability of such transformation provided through a customized financing mechanism to the end-users. The project is almost entirely financed by loans, not grants; the vehicle costs are being recovered in five years from drivers through fuel savings; and the drivers see a net benefit to daily cashflow. It has also been observed in this project that there is an acknowledgement of risk while setting loan qualification requirements for local governments, which has to be addressed by national or provincial governments, which might be able to provide some guarantees to facilitate higher levels of participation. In the case of Manila, the model of leasing vehicles used in the tricycle transport industry provides an obvious mechanism to recoup costs through lease fees, which may not be replicable when vehicles are owned rather than leased. Initial investment is also needed to demonstrate unproven technology and build a local network of suppliers and service agents.

A successful implementation of these types of projects could have a cascading effect on the clean vehicle technology industry, as manufacturing and creation of an export base and supplies for e-trikes take hold, and costs decline.
6.4 Guangdong Green Freight Demonstration Project

6.4.1 Introduction

The case study examines the Guangdong Green Freight Demonstration Project, which was financed in part by the Global Environment Facility. The case study was developed by reviewing project documents available from the World Bank, GEF and other sources, including the following key documents:


Additional information was gathered by corresponding with Shomik Mehndiratta, Senior Transport Specialist, the World Bank, and Ke Fang of the World Bank, both project experts involved in implementation.

6.4.2 Project Description

6.4.2.1 Background

Between 2000 and 2008, total freight, tonnage in Guangdong Province moved by truck increased by more than 125 percent (Figure 6.4.1). Over the same period, the extent of Guangdong’s highway network grew at an average rate of 11 percent annually, while the number of registered trucks grew by 56 percent (Figure 6.4.2). On-road freight accounted for 70 percent of transported goods by total tonnage in 2008. The energy efficiency of trucks in China was 30 percent lower than in advanced Organization for Economic Cooperation and Development (OECD) countries. Truck operations also needed streamlining to reduce the empty back-haul vehicle travel activity, which was estimated to be more than 30 percent of all truck vehicle kilometers traveled.

Figure 6.4.1: Total Freight Ton-Kilometers Transported by Road in Guangdong Province

![Figure 6.4.1: Total Freight Ton-Kilometers Transported by Road in Guangdong Province](image)

6.4.2 Overview

The Guangdong Green Freight Demonstration Project is an energy efficiency technology demonstration project designed to demonstrate the global and local environmental benefits of the application of energy efficient vehicle technologies and operating techniques and support the development of sustainable measures for improving energy efficiency in the on-road freight transport sector. The project is located in Guangdong Province of the People’s Republic of China (Figure 6.4.3).

Under this project, freight companies can take advantage of government rebates for installing energy efficient technologies on their trucks. The project also provides incentives to operators for operating the installed technological features and for providing the project team with monitoring and evaluation reports. This project has been a follow-up to a smaller pilot project undertaken in Guangzhou municipality, 44 and is an initial step toward establishment of a Green Freight Program for China and the formation of a Green Freight Network.

The project includes the following four components:

- **Green Truck Technology Demonstration**: Incentive payments (government rebates) for installing energy efficient technology on trucks, as well as a green freight trade fair and vehicle monitoring systems and evaluation reporting;
- **Green Freight Logistics Demonstration**: Conducting market studies for “drop and hook” logistics methods and a proposed provincial logistics brokerage platform;
- **Capacity Building**: Providing technical advisory services for policy research and training of officials and private stakeholders and dissemination support via Guangdong green freight websites; and
- **Project Implementation Support**: Providing technical advisory services for project implementation, stakeholder consultations, project results evaluation and dissemination, and project management.

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44 Green Trucks Pilot Project in Guangzhou, http://cleanairinitiative.org/portal/project/GreenTrucksPilot
The technology demonstration component introduced six technologies that can improve the fuel efficiency of operating vehicles. The following technologies approved by the U.S. Environmental Protection Agency (EPA) Smartway program were considered eligible for this demonstration:

- Low resistance tires;
- Tire pressure gauges;
- Side skirts;
- Wind shield/gap fairing;
- Nose cones;
- Driver behavior diagnostic system.

Participating drivers were given special training courses on energy efficient driving skills and best practices, to enhance the fuel efficiency of each technology package. This component also included a Green Freight Fair (Figure 6.4.4) to introduce operators to new technologies.
6.4.4 Guangdong Green Freight Demonstration Project Photos

Source: Global Environment Facility, Flickr Album, [https://www.flickr.com/photos/thegef/](https://www.flickr.com/photos/thegef/)

Clockwise from top left: Project members at technology installation; Green Freight technology installation in trucks; Guangdong International Green Freight Fair & Guangdong Green Freight Demonstration Project

A total of 10 trucking companies participated in the pilot Phase I technology demonstration, involving 145 trucks. An evaluation, carried out in April 2014, concluded that there were energy efficiency outcomes from three of these technologies: low resistance tires, roof fairings, and energy efficient driving systems.

For Phase II, 11 companies with 1,284 trucks have been chosen to apply the three proven technologies. In addition, two new technologies, light-weighted aluminum alloy semi-trailers and liquified natural gas (LNG) trucks, will be piloted during Phase II to assess their energy efficiency impacts.

### 6.4.2.3 Stakeholders

The Guangdong Provincial Government’s Department of Finance (DoF) is the recipient of the GEF grant and responsible for the grant disbursement. DoF in turn designated the Department of Transport (DoT) as the leading agency for implementation of the project, which constituted a Project Management Office (PMO), in turn overseen by a Project Leading Group (PLG) comprising of senior officials from various provincial government departments. Along with the government, trucking companies, vehicle dealers, technology suppliers played vital roles in project implementation. The project was also peer reviewed by staff from the U.S. EPA Smartway program and Clean Air Asia.

### 6.4.3 Project Financing and Funding

#### 6.4.3.1 Project Financing Structure

According to the GEF grant and project documents, the total project cost is USD 13.97 million, of which the GEF grant financed 30 percent or USD 4.2 million, while the government co-financed 17 percent of
The remaining share of 53 percent (USD 7.405 million) is enterprise co-finance, in the form of funds from participating companies. A breakdown of funding by financier is shown in Figure 6.4.5. A flow chart showing the financing partners and financial flows indicating the project implementation and organization structure is shown in Figure 6.4.6.

![Figure 6.4.5: Project Funding Sources (millions of USD)](image)

6.4.3.2 Description of Financial Sources

Figure 6.4.7 shows funding by major project component, while Table 6.4.1 shows a detailed cost estimate by financier by component. The majority of the funding (67 percent) is allocated to incentive payments, which are paid in the form of rebates and performance payments to the participating trucking companies. A large portion of Guangdong provincial government’s funding goes toward Green Freight study demonstration and outreach in the form of the project website and promotion.

GEF grants support enterprise co-financing in two ways:

- **Green Freight technology rebates**, which lower up-front costs for new technologies; and
- **Performance-based payments**, which provide incentives to participating companies to properly operate these technologies and monitor fuel saving results.

Typically, GEF funds have paid for down payments on purchase of new trucks or retrofits and principal payments towards capital costs. The “enterprise co-financing” is considered to be the private owner/operator investment in the new technology.
The project did not require the World Bank procurement process to be followed, which led to the grant money being directly paid out in reimbursement to participating companies upon provision of proof and documentation of technology investment. On average, GEF funding paid for 40 to 60 percent of total green freight technology costs for a typical truck.

*Figure 6.4.7: Uses of Project Funding (millions of USD)*

### Table 6.4.1: Cost Estimates by Financier (millions of US dollars)

<table>
<thead>
<tr>
<th>Component</th>
<th>Total Cost (USD)</th>
<th>GEF Co-finance (USD)</th>
<th>Government Co-finance (USD)</th>
<th>Enterprise Co-finance (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade Fair</td>
<td>150,000</td>
<td>150,000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Incentive payments</td>
<td>9,377,000</td>
<td>1,965,000</td>
<td>0</td>
<td>7,372,000</td>
</tr>
<tr>
<td>Driver training</td>
<td>70,000</td>
<td>70,000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Vehicle monitoring equipment</td>
<td>148,000</td>
<td>115,000</td>
<td>0</td>
<td>33,000</td>
</tr>
<tr>
<td>Vehicle monitoring and evaluation</td>
<td>100,000</td>
<td>100,000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Sub-Total</strong></td>
<td><strong>9,805,000</strong></td>
<td><strong>2,400,000</strong></td>
<td>0</td>
<td><strong>7,405,000</strong></td>
</tr>
<tr>
<td>Logistics brokerage study and demonstration</td>
<td>540,000</td>
<td>540,000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Drop and Hook operation study and demonstration</td>
<td>1,360,000</td>
<td>460,000</td>
<td>1,000,000</td>
<td>0</td>
</tr>
<tr>
<td><strong>Sub-Total</strong></td>
<td><strong>1,900,000</strong></td>
<td><strong>900,000</strong></td>
<td><strong>1,000,000</strong></td>
<td>0</td>
</tr>
<tr>
<td>Government and enterprise management training</td>
<td>250,000</td>
<td>250,000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Project website</td>
<td>1,155,000</td>
<td>100,000</td>
<td>1,055,000</td>
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</tr>
<tr>
<td>Project promotion</td>
<td>150,000</td>
<td>110,000</td>
<td>40,000</td>
<td>0</td>
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<tr>
<td><strong>Sub-Total</strong></td>
<td><strong>1,645,000</strong></td>
<td><strong>550,000</strong></td>
<td><strong>1,095,000</strong></td>
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<tr>
<td>Technical advisory and quality Assurance</td>
<td>100,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Technical assistance for implementation of Green Truck technology component</td>
<td>60,000</td>
<td>60,000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Procurement agent</td>
<td>50,000</td>
<td>50,000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Project completion report</td>
<td>10,000</td>
<td>10,000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Evaluation and dissemination workshops</td>
<td>50,000</td>
<td>50,000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>PMO incremental operating cost</td>
<td>290,000</td>
<td>20,000</td>
<td>270,000</td>
<td>0</td>
</tr>
<tr>
<td><strong>Sub-Total</strong></td>
<td><strong>560,000</strong></td>
<td><strong>290,000</strong></td>
<td><strong>270,000</strong></td>
<td>0</td>
</tr>
<tr>
<td>Total Baseline</td>
<td>13,910,000</td>
<td>4,140,000</td>
<td>2,365,000</td>
<td>7,405,000</td>
</tr>
<tr>
<td>Contingency</td>
<td>60,000</td>
<td>60,000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL COST</strong></td>
<td><strong>13,970,000</strong></td>
<td><strong>4,200,000</strong></td>
<td><strong>2,365,000</strong></td>
<td><strong>7,405,000</strong></td>
</tr>
</tbody>
</table>


Kommentiert [sb163]: Excellent table

Kommentiert [sb164]: So basically the companies paid for their own incentives, right?
A follow-on project has been funded by World Bank loans to energy service companies (ESCOs) to finance improvements on trucks for operators using the ESCO’s services. The original concept was for GEF to do this but it was too complicated given GEF rules.

6.4.3.3 Project Component Costs

GEF’s funding of USD 1.6 million was used to leverage USD 2.1 million in the form of private enterprise funding under the Green Truck technology demonstration component as shown in Table 6.4.2.

<table>
<thead>
<tr>
<th>Component 1 Cost Description</th>
<th>Total Cost in USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Down Payment / Rebate Value</td>
<td>596,040</td>
</tr>
<tr>
<td>Interest Payment / Performance-Based Subsidy</td>
<td>234,347</td>
</tr>
<tr>
<td>Monitoring Equipment Cost (funded by GEF)</td>
<td>831,600</td>
</tr>
<tr>
<td>GEF Subsidy (Subsidies + Equipment)</td>
<td>1,661,987</td>
</tr>
<tr>
<td>Trucking Company Contribution</td>
<td>2,149,813</td>
</tr>
<tr>
<td>Total Package Cost</td>
<td>2,980,200</td>
</tr>
</tbody>
</table>

Source: GEF Project Appraisal Document, Incremental Cost Reasoning and GEF Role

6.4.4 Other Benefits

Potential beneficiaries of this project include the more than one-half million registered trucking companies in Guangdong province, residents of the province, manufacturers and suppliers of energy efficient technologies, and shippers. Based on U.S. EPA Smartway verifications and the results of the pilot testing in Guangzhou, an early estimate put the potential efficiency gains of the technology packages introduced, along with driver training, in the range of 7 to 26 percent. However, the Phase I demonstration showed that the fuel savings and emission reductions were not as high as anticipated based on Smartway results. This is due to several factors that differ between the U.S. and China including driver behavior, travel speeds, and driving conditions. Analysis of fuel savings data provided as part of the monitoring program showed an average 5 to 6 percent savings were realized.

The project team also tracked other indicators including total private sector investment leveraged through the project, including number of drivers trained, establishment and maintenance of the project website, and the number of government officials and enterprise representatives trained among other outcomes. Table 6.4.3 shows the latest implementation results status report with these indicators measured against their targets.

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43 Project Appraisal Document, GEF, Annex 7, GEF Incremental Cost Analysis. Year?
44 Ke Feng, Project Lead, Communication, January 16, 2015
Table 6.4.3: Project Development Results Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Current</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total private sector investment leveraged through the project (million USD)</td>
<td>0</td>
<td>0.3</td>
</tr>
<tr>
<td>Number of existing or newly purchased trucks installing Green Truck technologies</td>
<td>240</td>
<td>435</td>
</tr>
<tr>
<td>Number of drivers participating in the project training program</td>
<td>120</td>
<td>600</td>
</tr>
<tr>
<td>Establishment of a project website</td>
<td>Complete</td>
<td>Complete</td>
</tr>
<tr>
<td>Number of government officials and enterprise representative trained through the project</td>
<td>85</td>
<td>25</td>
</tr>
<tr>
<td>Organization and implementation of the Green Freight trade fair</td>
<td>Complete</td>
<td>Complete</td>
</tr>
</tbody>
</table>

Emission reduction estimates have been computed based on anticipated increases in fuel efficiency by technology installation and improved operations due to driver training. For a target 1,200 vehicles participating under the Green Truck Technology Demonstration component a total of 26,760 tons of GHG emissions will be reduced due to fuel saved. The Green Freight Logistics Demonstration (Component 2) is estimated to potentially provide a fleet-wide 10 percent increase in fuel efficiency across 60 percent of registered trucks in Guangdong province. This level of implementation would result in a total reduction of 1.2 million tons of CO₂e annually (Table 6.4.4). Over an average life span of eight years for a truck in China, the program is estimated to reduce total emissions by 9.6 million tons if these projected effectiveness levels are achieved. However, the projected levels of implementation have not yet been achieved; the latest report cites 240 trucks that have installed the Green Truck technologies, and information has not been provided on observed benefits of the logistics demonstration projects.

Table 6.4.4: GHG Emission Reductions due to Energy Efficiency Improvement

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>No. of Registered Vehicles</th>
<th>Average Annual Distance Traveled per truck (km)</th>
<th>Average Fuel Efficiency (L/100km)</th>
<th>Average Annual Fuel Consumption (L)</th>
<th>CO₂e Emissions per L Combusted (kg)</th>
<th>Annual CO₂e per Vehicle (tons)</th>
<th>Total CO₂e for Registered Fleet in 2009 (tons)</th>
<th>10% efficiency improvement on 60% Registered Fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy Duty</td>
<td>149,522</td>
<td>63,451</td>
<td>32</td>
<td>20,235</td>
<td>2.77</td>
<td>56</td>
<td>8,380,698</td>
<td>502,842</td>
</tr>
<tr>
<td>Medium</td>
<td>46,836</td>
<td>64,953</td>
<td>25</td>
<td>16,550</td>
<td>2.77</td>
<td>46</td>
<td>2,147,117</td>
<td>128,827</td>
</tr>
<tr>
<td>Light</td>
<td>598,023</td>
<td>40,947</td>
<td>13</td>
<td>5,524</td>
<td>2.77</td>
<td>15</td>
<td>9,150,205</td>
<td>549,012</td>
</tr>
</tbody>
</table>

Source: GEF Project Appraisal Document, Project Benefits

6.4.5 Conclusions

6.4.5.1 Overall Conclusions

The Green Freight project is consistent with the GEF climate change focal area, specifically climate change mitigation. It furthers GEF’s policy to “promote the demonstration, deployment and transfer of innovative low carbon technologies,” and “financing clean energy and sustainable urban transport.” The

Kommentiert [sb180]: [In which period of time? I assume these are not annual savings. And what is this based on? 5-6% efficiency gain?]

Kommentiert [sb181]: [Yes, but what about the GF Logistics Demonstration: what has been the level of implementation?]

Kommentiert [sb177]: [Year?]

Kommentiert [sb178]: [Year?]
This project has so far had some success in demonstrating Green Freight technologies and their impact and potential for adoption in China. Some lessons have been learned on institutional hurdles and the policy measures that need to be undertaken for a seamless adoption of such technologies. For example, project implementation team had to secure special permissions for installing external nose cones for improving aerodynamics of trucks. The project has also identified the technologies that would produce benefits under conditions seen in China. World Bank staff indicated that the drop and hook demonstration has been a success and they are able to use this demonstration project to streamline those operations.

Against the target of a 10 percent fuel efficiency target for 60 percent of registered trucks in Guangdong province, the project seems to have a long way to go to realize its objective. Even by the project cost-benefit analysis estimation of 1,200 trucks participating in the program, the demonstration has not yet reached that mark, with the latest report citing 240 trucks that have installed the Green Truck technologies.

6.4.5.2 Success Factors

The pilot project in Guangzhou was instrumental in demonstrating what technologies would be most beneficial. While the original project concept came from U.S. experience, some technologies were less applicable to China. For example, side skirts are only effective at higher speeds on the highways where aerodynamic benefits outweigh the additional weight. At the slower speeds traveled by Chinese trucks, this technology did not provide benefits. Low rolling resistance tyres and gap fairings turned out to be more beneficial.

The international project sponsors also chose to focus on win-win technologies that were accepted by all parties. Technologies that could require extensive regulatory approval were discarded from the project focus. Also, while the international project sponsors were initially interested only in vehicle technology, the project was modified to include logistics strategies to meet the interest of the provincial government.

Inter-departmental coordination has been successful at addressing institutional barriers.

New technology is supporting monitoring and verification of emission reductions. For example, sensors can verify that drivers are not stealing gas or that tires are kept pressurized. Without this type of monitoring technology, it would be much harder to verify the benefits of the program.

6.4.5.3 Suitability for Climate Finance

The project potentially has a high degree of replicability in the developing world due to the scope of increase in energy efficiency in the areas of technology adoption as well as from an operational efficiency for both driver behavior and logistical perspective. Providing rebates and performance-based payments in the form of grants or loans helped leverage private investment from trucking companies and suppliers of technology for this demonstration project. Though the government did not contribute to incentive payments in this particular case, there are instances where this has resulted in leveraging private funds for energy efficient retrofits in on-road freight projects. Performance-based payments provide trucking companies with incentives to report and help in the monitoring of effectiveness of energy efficient improvements and keep track of changes in driver behavior.

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More evidence is needed on scale-up and success of implementation. To-date, only a direct impact of 240 trucks has been documented, whereas the project plans optimistically project a 60 percent province-wide adoption of fuel-saving technology. That said, a number of the technologies appear to have rapid pay-back periods of a few months to a few years. This suggests strong potential for private finance, using public seed money or guarantees. The World Bank funded project to support technology improvements through ESCOs will demonstrate the viability of an approach financed primarily by the private sector.

6.5 EcoParq Parking Management System – Polanco, Mexico City

6.5.1 Introduction

This case study examines the potential role of climate finance in sustainable transport demand management by deploying effective parking management strategies to improve urban mobility. The case study examines the EcoParq parking meter system, which was proposed in Plan Verde, Mexico City’s sustainable development plan.

The case study was developed by reviewing project documents available from and other sources, including the following key resources:

- EcoParq website, general resources, annual revenue reports. [https://www.ecoparq.df.gob.mx/](https://www.ecoparq.df.gob.mx/)
- Impacts of the ecoParq Program on Polanco, ITDP. [https://www.itdp.org/impacts-of-the-ecoparq-program-on-polanco/](https://www.itdp.org/impacts-of-the-ecoparq-program-on-polanco/)

Additional information was gathered by corresponding with experts involved with project development and monitoring, including:

- Andrés Sañudo, ITDP
- Michael Kodransky, ITDP
- Carlosfelipe Pardo, Executive Director, Despacio

6.5.2 Project Description

6.5.2.1 Overview

EcoParq was conceived as a parking management response to Mexico City’s congestion issues by regulating parking spaces and improving the overall management of the city’s public space. Until this program came into existence, Mexico City’s parking was either free and unregulated or controlled informally by independent operators called “franeleros,” who made anywhere between USD 578 and 2,311 per month, widely acknowledged as a thriving enterprise. This practice, compounded with irregular parking, poor enforcement and parking behavior like parking on sidewalks and blocking driveways meant increased wait times and cruising times looking for parking.

This project was introduced in the year 2012, in Mexico City’s Polanco district (Figure 6.5.1), by introducing 426 multi-space meters (Figure 6.5.2), where parking was previously unregulated and free-of-cost. Parking rates were set based on historic parking prices in the city where parking meters have existed for years, despite lax enforcement. In interviews with experts, the general opinion expressed was that a variable pricing would have been a desirable alternative. Presently, ecoParq operates from 8 a.m. to 8 p.m.

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51 Overview of EcoParq, ADB Case Studies, [https://go.itdp.org/display/ADBdemo/ecoParq](https://go.itdp.org/display/ADBdemo/ecoParq)
on weekdays and charges a flat rate of USD $0.15 per 15 minutes. There is a three hour time limit for parking in Polanco. EcoParq was implemented incrementally in the following neighborhoods:

- Polanco: January 2012
- Lomas: Julio 2012
- Anzures: January 2013
- Roma-Condesa: March 2013

For the purposes of this study, the first phase of this project in Polanco has been considered, owing to baseline data availability along with post-implementation data for estimating benefits and other returns.

Figure 6.5.1: Map of EcoParq Zones


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12 Some areas with restaurants and high demand during evening and non-peak hours have hours of operation from 8:00 a.m. extending until 1:00 a.m.
6.5.2.2 Stakeholders

The proposal for ecoParq was included in Plan Verde, Mexico City’s sustainable development plan written under Mayor Ebrard, which was continued and extended by the next Mayor Miguel Mancera. The following stakeholders from national to local government agencies and private operator were involved in executing the project from planning and programming, signaling, enforcement, outreach, and project execution:

- Autoridad del Espacio Público (AEP) - (Public Space Authority);
- SEDUVI (Urban Development and Housing Department);
- SETRAVI (Transportation Department);
- SSP (Public Safety Department);
- Delegaciones (Local Governments);
- Operadora de Estacionamientos Bicentenario (OEB) - (Private Parking Management Company).
Along with the stakeholders mentioned above, ITDP advised the city from the onset on baseline data collection, contracting, branding, and enforcement. A grant from the British Embassy in Mexico was provided as part of the “Strategies to reduce car use in Mexican Cities.” Using Polanco as a case for demonstrating the utility of collecting baseline information and estimating the program’s benefits, ITDP has persuaded the local governments to instruct parking operators to collect baseline and post-implementation data to perform assessments.

6.5.3 Project Financing and Funding

6.5.3.1 Project Financing Structure

The project is completely funded by private operators. The favorable revenue sharing formula and making resources available for enforcement of illegal parking and violations have been used as leverage by the Federal District in attracting a 100 percent private investment for project implementation. Capital costs are around USD 9 million, with annual operation costs about USD 4.5 million. OEB is responsible for purchasing the meters, installing them, setting up signaling and wayfinding, and operating the system. The cost of purchasing and installing a parking meter is approximately USD 10,000 to 12,000.

Currently, OEB gets 70 percent of the meter generated revenue from ecoParq, of which 20 percent would go to the Secretariat of Public Safety for enforcement, for 10 years, in exchange for investment, installation, operation, and maintenance of the parking management system. The remaining 30 percent of the metered income is directed to the AEP, which is responsible for the recovery of public space in the neighborhood. The use of these funds is determined by the Committee on Transparency and Accountability comprised of neighborhood associations, the Miguel Hidalgo District, and AEP. The funding flow is shown in Figure 6.5.3.

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13 Andres Sanudo, Interviewed November 26th 2014.
6.5.3.2 Revenue

Based on data published by EcoParq, USD 3.3 million was collected in 2012, of which USD 1 million was transferred to the Public Space Authority of Mexico City, Federal District (AEP) as funds for the renewal of the neighborhood’s public spaces. Figure 6.5.4 shows revenue earned by OEB and earmarked funds for public space restoration transferred to AEP each month in the year 2012. This appears to have increased on track to exceed 5 million in 2014. However, it is not yet clear from the available data that the operating revenues are sufficient to both cover operating costs and pay back the capital costs.
Revenue from enforcement, in the form of tickets for violation, has also proved to be a significant revenue generator for the Federal District. At an average of $530 per immobilization or towing, ticketing revenue is estimated to have generated USD 1.33 million in Polanco for the year 2012.

6.5.4 Other Benefits
The major benefit of ecoParq has been in regularization of parking in Polanco, due to which there was greater availability of parking spaces for residents and visitors. Some of the benefits of ecoParq implementation, including travel time, fuel, and GHG savings as a result of reduced cruising to search for parking, are shown in Table 6.5.1.

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Before EcoParq Metering</th>
<th>After EcoParq Metering</th>
<th>Savings (USD)</th>
<th>Benefit (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Cruising Time per Vehicle (min)</td>
<td>13 min 26 sec</td>
<td>3 min 04 sec</td>
<td>67,300,000</td>
<td>11,678,205</td>
</tr>
<tr>
<td>Annual Cruising Time (hours)</td>
<td>8,720,000</td>
<td>1,990,000</td>
<td>68,800,000</td>
<td>28,000,000</td>
</tr>
<tr>
<td>Annual Cruising Distance (km)</td>
<td>104,700,000</td>
<td>23,900,000</td>
<td>80,800,000</td>
<td>9,900,000</td>
</tr>
<tr>
<td>Annual Gasoline Spent Cruising (liters)</td>
<td>9,900,000</td>
<td>2,200,000</td>
<td>7,700,000</td>
<td>81,861,000</td>
</tr>
<tr>
<td>Annual GHG Emissions Spent Cruising (tons)</td>
<td>23,000</td>
<td>5,000</td>
<td>18,000</td>
<td>7,000,000</td>
</tr>
</tbody>
</table>

Source: Impacts of the EcoParq Program on Polanco, ITDP

Occupancy rates, which used to be 30 percent above capacity before ecoParq implementation, were reduced dramatically. Among regular parking spaces (excluding illegally parked spaces and blocked
entrances), occupancy rates fell from 93 percent to 55 percent. Figures 6.5.5 and 6.5.6 show daily average occupancy in Polanco before and after ecoParq implementation.

Figure 6.5.5: Daily Average On-Street Occupancy, Polanco Before Project Implementation (April 2011)

Figure 6.5.6: Daily Average On-Street Occupancy, Polanco After Project Implementation (May-Oct 2012)

Source: ITDP Data from EcoParq

14 Parking spaces occupancy, Impacts of the ecoParq program on Polanco, ITDP
EcoParq's implementation also had a considerable impact on parking turnover rates. On average, on-street parking spaces showed a turnover rate of 3.5 times per day before implementation, increasing to 4.5 to 5.5 times per day after implementation. This was primarily due to increased chances of finding available spaces, in event of the need to move and re-park during the course of a day. This is a measure of efficient use compared to the earlier practice of parking for an extended period of six hours on average, before ecoParq was implemented.

ITDP estimated the GHG reduction benefits of reduced cruising time spent looking for parking by making the following assumptions:

- 15,000 car trips are involved cruising for on-street parking on a daily basis;
- Estimated value of travel time was USD 1.73 (based on average hourly wage in the Greater Mexico City area);
- An annualization factor of 260 days was used reflecting the annual days of operation of ecoParq;
- Cruising speed was estimated at 12 km/h;
- A value of 10.5 km/l was used as the average fuel efficiency of cars;
- The price per ton of carbon was assumed to be USD 30.

Based on the above assumptions, ecoParq Polanco is estimated to reduce emissions by 18,000 tons per year. The estimate did not account for any changes in travel time, fuel and GHG emissions that might arise from other effects, such as changes in modal use or destinations related to either higher parking costs or increased parking availability, or increased turnover rates. These secondary effects would be more difficult to estimate than the primary impact of reduced cruising time.

The analysis of cruising times was done based on the Polanco Parking Meter Implementation Baseline Study. Parking locations used to evaluate cruising for the baseline study were mapped to determine the average occupancy of parking in those areas (shown in Figures 5 and 6). Based on the occupancy of a given area, three slabs of cruising times were assigned conservatively. If the occupancy was less than 50 percent, cruising time was set at 1 minute; if occupancy was between 50-80 percent, a 3-minute cruising time was assigned; for occupancy over 80 percent, a 6-minute cruising time was assigned.

6.5.5 Conclusions

6.5.5.1 Overall Conclusions

The project appears to have been successful in achieving its objectives of managing parking and reducing traffic and emissions related to parking searches. Expansion of the project to other districts suggests that it is replicable. ITDP's baseline study and its report on the “Impacts of the ecoParq program on Polanco” recommends “implementing mechanisms for public-private investment to enable expeditious improvements in public space.” This will expand the project reach, which is presently occurring in small incremental steps due to reliance on revenue from the metering system. Interviewees confirmed that the project has so far been attractive for private investors and has been successful in achieving its objectives. There was also a consensus among those contacted that the project has a high level of replicability elsewhere.

55 Implementación de parquímetros en Polanco. Estudio de Línea Base. México: Instituto de Políticas para el Transporte y el Desarrollo, Andres Sanudo
There is also scope for greater collaboration between project stakeholders to maximize project benefits. It was agreed that there is still some irregular parking prevalent in the area despite enforcement and requirement for a zero tolerance policy to address it.

6.5.5.2 Success Factors

Potential for Private Revenue – Demand for parking in the project neighborhoods relative to supply is great enough that significant revenues can be generated through pricing. The revenue stream appears to be sufficient over a multi-year period to make the project attractive for a private operator even after the costs of the equipment and other associated activities (such as signage/wayfinding) are included.

Reinvestment in Public Space Recovery - Reinvesting 30 percent of the revenues in public space recovery ensures that the project scope increases steadily as the project implementation takes hold. This is partly instrumental in expanding the project beyond Polanco to other municipalities.

Ticketing and Enforcement – A strong zero-tolerance policy supported by local agency enforcement is key for providing conducive environment for attracting private sector investment into parking management projects. For example, over 42,000 vehicles were immobilized and nearly 1,200 were towed in Polanco in the year 2012. The cost of enforcement appears to be more than covered through ticketing revenue, which is returned to the Federal District.

6.5.5.3 Suitability for Climate Finance

The ecoParq project appears to be providing measurable GHG reductions and other public benefits without the need for public investment. Revenue sharing and favorable guarantees and policy instruments were used to leverage a 100 percent private investment for the implementation of this project. The primary role of the public sector has been to set the policy framework to allow a private operator to manage parking within clearly defined parameters, and also to enforce parking infringements so that the operator can realize revenue. The steady scope of expansion of the ecoParq program with increased revenues and the increased involvement of investors and operators in new neighborhoods where the program has been expanding since 2012 is a clear indication of a successful program.

The project potentially appears replicable in other districts and cities, where parking demand exceeds supply. The primary barriers appear political – notably, gaining local support to implement and enforce the parking management approach – rather than financial or technical. It is possible that climate finance could play a role in funding start-up and demonstration costs in cities that have not tried this approach, or guaranteeing a revenue stream for private operators should revenue intake fall short of what is needed to cover operating costs.

A more complete evaluation of the travel and GHG impacts of parking management would be useful in helping to fully assess the benefits of the approach and potential for climate finance. For example, secondary effects such as changes in mode, trip destination, and trip frequency were not for the ecoParq project. These can be difficult to measure and research on this topic would be a logical use for climate finance. However, the demonstrated benefits of parking management in terms of parking availability, turnover, and reduced cruising clearly stand on their own merit.

6.6 Fuel Economy Labeling and Standards, Chile

6.6.1 Introduction

The case study examines Chile’s Automotive Fuel Economy policy, which was provided much technical support by Centro Mario Molina Chile (CMMCh), and the Global Fuel Economy Initiative (GFEI) which is a partnership led by the United Nations Environment Programme (UNEP), the FIA Foundation, International Energy Agency, International Transport Forum, and others. The GFEI is funded through the Global Environment Facility.

The case study was developed by reviewing project documents available from the GFEI, GEF, and the Government of Chile, and by corresponding with experts involved with project development. Experts contacted included:

- Cristina Victoriano, Fuel Efficiency Specialist, Energy Efficiency Division, Ministry of Energy, Government of Chile;
- Xiamei Tan, Climate Change Specialist, Climate Change and Chemicals, Global Environment Facility.

6.6.2 Description

6.6.2.1 Background

Growing importance of light-duty vehicle GHG emissions. Chile is the only member of the OECD in South America. It is the fifth-largest consumer of energy on the continent, but unlike most other large economies in the region, it is only a minor producer of fossil fuels. Therefore, Chile is heavily dependent on energy imports. As is the case in most developing countries, transportation is the largest source of Chile’s energy-related CO2 emissions which are projected to double by 2020 in the absence of mitigation measures. The transportation sector is growing even faster than the rest of the economy, and accounts for about 28 percent of GHG emissions, of which two-thirds is from the passenger sector. Chile’s motorization rate over the last 20 years has increased dramatically from 78 vehicles per 1,000 inhabitants to 180, with the segment of larger vehicles increasing significantly.

Chile has a history of supporting international accords to protect the environment and reduce greenhouse gas emissions. Chile ratified the UNFCCC in 1995 and the Kyoto Protocol in 2002. The country has developed policies to slow the rate of emissions growth or mandate specific energy efficiency measures; however, the Chilean government had previously noted that measures to address climate change will not impede economic growth.

The role of fuel economy standards. Facing the oil crisis of the 1970s, the United States was the first country to establish fuel economy standards for passenger vehicles. While other countries have continued to innovate and move forward on fuel economy requirements, most standards have remained largely unchanged for nearly a quarter century. However, the recent threat of climate change and potential oil shortages has spurred efforts to improve vehicle standards globally. Many countries are developing their

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58 “Transportation in Developing Countries: Greenhouse Gas Scenarios for Chile” Pew Center on Global Climate Change (2002)
59 “Developing Chile’s Automotive Fuel Economy Policy” (2011)
own fuel economy or GHG emission standards, and more are expected to initiate similar measures in the coming years to address concerns of fuel security and support sustainable transport (Figure 6.6.1).

Figure 6.6.1: Fuel Economy Framework – Global Fuel Economy Initiative

For example, in 2013 Mexico implemented a new fuel efficiency standard for LDVs. This new standard requires each automaker to achieve a fleet average of 14.9 km/L by 2016. It is estimated that the new standard will reduce CO₂ emissions by 170 megatons, and will save consumers USD 2,700 each in fuel costs over the life of a regulated vehicle.

Global Fuel Economy Initiative. Commencing in 2010, the UNEP, the International Energy Agency, the International Transport Forum, and the FIA Foundation, with support from the GEF and other international funds and organizations, launched a new global initiative – the GFEI (www.50by50campaign.org), which combined expertise and resources from all four partners for a comprehensive program to improve global automotive fuel economy within the next few decades.

The GFEI partnership led a three-phased, international effort to drive fuel economy standards around the world (Figure 6.6.2). The initiative’s objective is to “Promote further research, discussion and action to improve fuel economy worldwide.” GFEI estimates that cutting global average automotive fuel consumption (L/100 km) by 30 percent would reduce emissions of CO₂ by over 1 gigaton (Gt) a year by 2025 and over 2 Gt by 2050.

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60 Automobile GHG emission standards are typically measured in grams per kilometer (gCO₂/km) or grams per mile (gCO₂/mile).

61 GFEI Initiative – http://www.globalfueleconomy.org/about/Pages/AboutHome.aspx
6.6.2.2 Overview

GFEI in Chile. Chile was chosen as one of the four developing countries where GFEI would prepare national-level strategies and plans for improved auto fuel efficiency for Phase I. Starting in 2010, GFEI analyzed Chile’s existing and future vehicle fleet, and initiated a multi-stakeholder dialogue with governments and other relevant groups to develop and implement fuel economy policies.

In December 2011, the GFEI’s key institutional partner in Chile, the Centro Mario Molina Chile (CMMCh), prepared an action plan to address Chile’s vehicular fleet growth trends. CMMCh proposed two options as part of the Phase I pilot:

- Update national vehicle emission standards to EURO VI;
- Develop a set of incentive policies to improve vehicle fuel economy and increase the purchase of low emissions vehicles.

To support an incentive system, GFEI and CMMCh completed a study of vehicle models and average CO₂ emissions. The impacts on the national automotive market were also estimated as Chile has no industry publications that would document annual demand for automobiles. GFEI’s pilot country project enabled Chile to establish their baseline and compare it to other countries (Figure 6.6.3). With the results of the baseline analysis, Chile prepared a fuel economy policy that was submitted to congress for approval 2012.
Vehicle Fuel Economy Testing and Labeling. On the 1st of February 2013 GFEI and CMMCh's efforts yielded fruit when the Chilean Government launched the first LDV fuel economy labeling system in Latin America and the Caribbean region. This was a joint initiative developed between the Ministries of Transport, Energy and Environment. In Chile, air pollution regulation including a vehicle testing program had begun in the early 1990s by the Transport Ministry, so no additional government resources were required. The vehicle labelling tasks required of the new program were supported entirely by vehicle importers and retailers.

The mandatory labels provide information on CO$_2$ emissions, fuel economy (highway, city, and combined), model, and manufacturer (Figure 6.6.4). Chile is the only country to display emission standards on the label. Per Chile’s policy, the energy label must be provided by manufacturers, operators, retailers, distributors and importers of vehicles with official performance data provided by the Center for Vehicle Control and Certification and the Ministry of Transport. Official numerical values of performance listed in the energy label will include the emissions of hydrocarbons (HC), carbon monoxide (CO) and CO$_2$.

Vehicle fuel efficiency is calculated through laboratory tests conducted under certain driving conditions (urban, highway, and combined). The methodology is tied to the provisions of Annex 6 to Regulation No. 101 of the Economic Commission for Europe of the United Nations (UN/ECE). As this program is designed to send a clear signal to consumers, guidance is given for the consistent display of the energy consumption tag on the windshield of vehicles in automotive showrooms.
Feebate Proposal. In July 2011, CMMCh with specific assistance from the GFEI and the International Council on Clean Transportation (ICCT), designed and proposed a “feebate.” Feebates are fiscal policies for encouraging car buyers to prefer more efficient, lower emission vehicles and manufacturers to design them.

The proposed feebate system has the advantage of being fiscally neutral and it produces a change towards cleaner vehicles in all segments of the vehicle fleet. This type of incentive/disincentive program has been successfully utilized in France (the bonus/malus system), Denmark, and the U.S. In contrast to incentives for specific vehicle technologies, it is estimated that feebates have a greater impact spread across the vehicle fleet. These targeted government subsidies have proven to be useful in facilitating the adoption of vehicle technologies and cleaner fuels. They can help new, clean technologies quickly emerge and reach economies of scale.

As of November 2014 a feebate system to encourage fuel efficiency and discourage GHG emissions has not yet been adopted. Ministry sources suggest that feebate proposals were not included in recent tax reforms because they included a relatively complicated fee mechanism that could not be easily integrated into a much larger legislation.

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63 Feebate = FEEs on inefficient vehicles + ReBATEs on efficient vehicles.
64 GFEI http://www.unep.org/transport/gfei/autotool/approaches/economic_instruments/fee_bate.asp
6.6.2.3 Fuel Efficiency and NO\textsubscript{x} Emission Based Taxes

The Government of Chile implemented a tax on new, light and medium duty vehicles based on urban fuel economy performance (km/L) and emissions of nitrogen oxides (g NO\textsubscript{x}/km). This tax was included as part of a large tax reform package (Article 3 & Article 10 from Act 20780, September 2014).\textsuperscript{65} Article 3 of the Act defines the additional tax using the following calculation:

\[
\text{Tax}_\text{UTM} = \left[ \frac{35}{\text{urban fuel efficiency (km/L)}} + (120 \times \text{g/km NO\textsubscript{x}}) \right] \times (0.00000006 \text{ sales price})
\]

During the first 12 months of validity of the tax, the Ministry of Transport and Telecommunications will assign specific values for urban fuel efficiency performance and NO\textsubscript{x} emissions per the following sources:

- Certification from other countries where European standard applies to determine performance;
- Technical information from independent or government agencies in other countries; or
- Technical calculations of the Secretariat of Transport based on size, weight, engine size, or other technical specifications for each vehicle model.

Ministry sources suggest that while the GFEI/CMMCh feebate proposals were not adopted, they greatly shaped the new vehicle tax.

6.6.3 Project Financing and Funding

6.6.3.1 Project Financing Structure

All policy work related to fuel economy has been completed by Centro Mario Molina Chile, which has been supported by GFEI through GEF grants (Figure 6.6.5).

The total budget of the Phase I GFEI project was USD 3,120,000. This was funded by a GEF contribution of USD 980,000 and USD 2,140,000 by non-GEF resources in the form of co-financing. Project co-financing came from a variety of sources, both financial and in-kind. UNEP, the U.S. EPA, the FIA Foundation, and various contributions from the private sector comprised the bulk of the cash and in-kind contributions. In addition, countries were required to contribute to project implementation through the provision of staff, facilities, and financial contributions.

For specific work in Chile, GEF budget records indicate a sub-contract component for “Chile: GFEI pilot, national activities” of USD 80,000 to be funded by the GEF trust fund, and of USD 100,000 to be funded through co-financing. This total (USD 180,000) represents approximately 6 percent of the total Phase I budget.

All GFEI resources provided were not expected to be paid back. The co-financing was also in the form of cash or in-kind contributions that did not require repayment.

\textsuperscript{65} Tax Reform to Amend the System of Taxation of Income and Introduce Different Settings in the Tax System (Act 20780) - http://www.leychile.cl/Navegar?idNorma=1067194
6.6.3.2 Project Funding

The costs of Chile’s vehicle labeling program were covered by the private sector (automobile importers and retailers). The tax on new light and medium duty vehicles based on their urban fuel efficiency and NOx emissions will be paid by consumers. Regarding ongoing and implementation costs for Chile’s vehicle labeling program, the Chilean Transport Ministry has supported a vehicle testing program since the early 1990s. Therefore minimal additional government resources were required to implement the vehicle labeling requirements. The labeling and associated tasks were passed on to the vehicle import and retail industry.

6.6.4 Other Benefits

Fuel economy standards can be extremely cost effective when comparing the funds requested and the potential benefits in terms of GHG emissions reductions. In the transport sector, off-the-shelf
technologies and fuel-related GHG reduction measures have very low implementation costs and offer the potential for significant consumer cost savings as well as large emission reductions.

In Chile, it was estimated that the labeling and feebate policy measures (including both the labeling system and feebate) would yield a 5 percent reduction of CO₂ emissions from the total national vehicle fleet in 2014. The proposed benchmark for Chile’s feebate system is 175 grams of CO₂ per kilometer. This would result in a total CO₂ reduction of 2.15 million tons over the five years after adoption. However, the feebate will likely not be adopted, and no data are available to verify whether any emission reductions have been achieved from the labeling policy or the new vehicle taxes.

6.6.5 Conclusions

6.6.5.1 Overall Conclusions

In Chile, GFEI pilot tasks have been completed with the outcomes of establishing a national stakeholder group, developing a national light duty fuel economy baseline, requiring labeling of new vehicles, and developing a fiscal instrument (feebate) to incentivize car buyers to choose more efficient, lower emission vehicles and manufacturers to design them. While the feebate has not yet adopted, it has led to a tax on new, light and medium duty vehicles based on fuel efficiency and NOₓ emissions as part of a larger tax reform bill. The policy that mandates vehicle testing and labeling of fuel efficiency and GHG impacts is currently the only one of its kind in Latin America and the Caribbean.

The feebate is projected to yield a five percent reduction of CO₂ emissions from the total national vehicle fleet, yielding an initial annual average benefit of over 0.4 million tons nationwide over the first five years. In addition, CMMCh and the Ministry of Energy are now in the process of developing Chile’s first fuel economy standards to which all light duty vehicles will be subject, which would greatly increase the long-term CO₂ reduction benefits. [These policies are being accomplished at a modest investment of much less than USD 1 million from the international community.]

6.6.5.2 Success Factors

In general GFEI found that the project yielded the following key lessons:

• GFEI partners with technical expertise and extensive experience in developing the fuel economy policies were especially important to develop a baseline setting.

• To facilitate vehicle fuel efficiency policies and standards, local ownership of the project was essential.
  - Multi-stakeholder groups led by government and supported by NGOs, academic institutions, and the private sector are strongly encouraged.
  - The policy development process must include collaboration with key government ministries (finance, energy, and transportation) to support policy implementation.
  - Vehicle manufacturer associations and fuel companies (international, domestic, state-owned) must also be brought to the table early to generate support (and reduce opposition) for cleaner fuels and efficient vehicle policies and legislation.

• To foster the development of fuel economy measures in developing countries where standard setting and using economic instruments are not mainstreamed, it is critical to balance policy development with extensive capacity building and knowledge sharing activities.

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64 UNEP - [https://www.unep.org/climatechange/ClimateChangeConferences/COPI8/Booklet/CLEANERCARSWITHTHEGLOBALFUELECONOMYINITIATI.aspx](https://www.unep.org/climatechange/ClimateChangeConferences/COPI8/Booklet/CLEANERCARSWITHTHEGLOBALFUELECONOMYINITIATI.aspx)
6.6.5.3 Suitability for Climate Finance

Fuel economy policies can be extremely cost-effective when comparing the funds requested and the potential benefits in terms of GHG emission reductions. Even if the projected level of benefits from the feebate are not realized, the costs associated with setting the fuel economy policy are extremely modest compared to the costs of infrastructure investment or financial incentives for adopting new technology. The ongoing implementation costs are also minimal, relying on existing government program resources for testing and vehicle importers and retailers for labeling.

The collaborative approach taken through the GFEI appears to set the stage for successful replication elsewhere, potentially leveraging a modest amount of international climate funding for significant GHG reductions. However, the ability to implement fuel economy policies in any given country will depend upon the willingness of the country’s leadership to undertake such an effort.