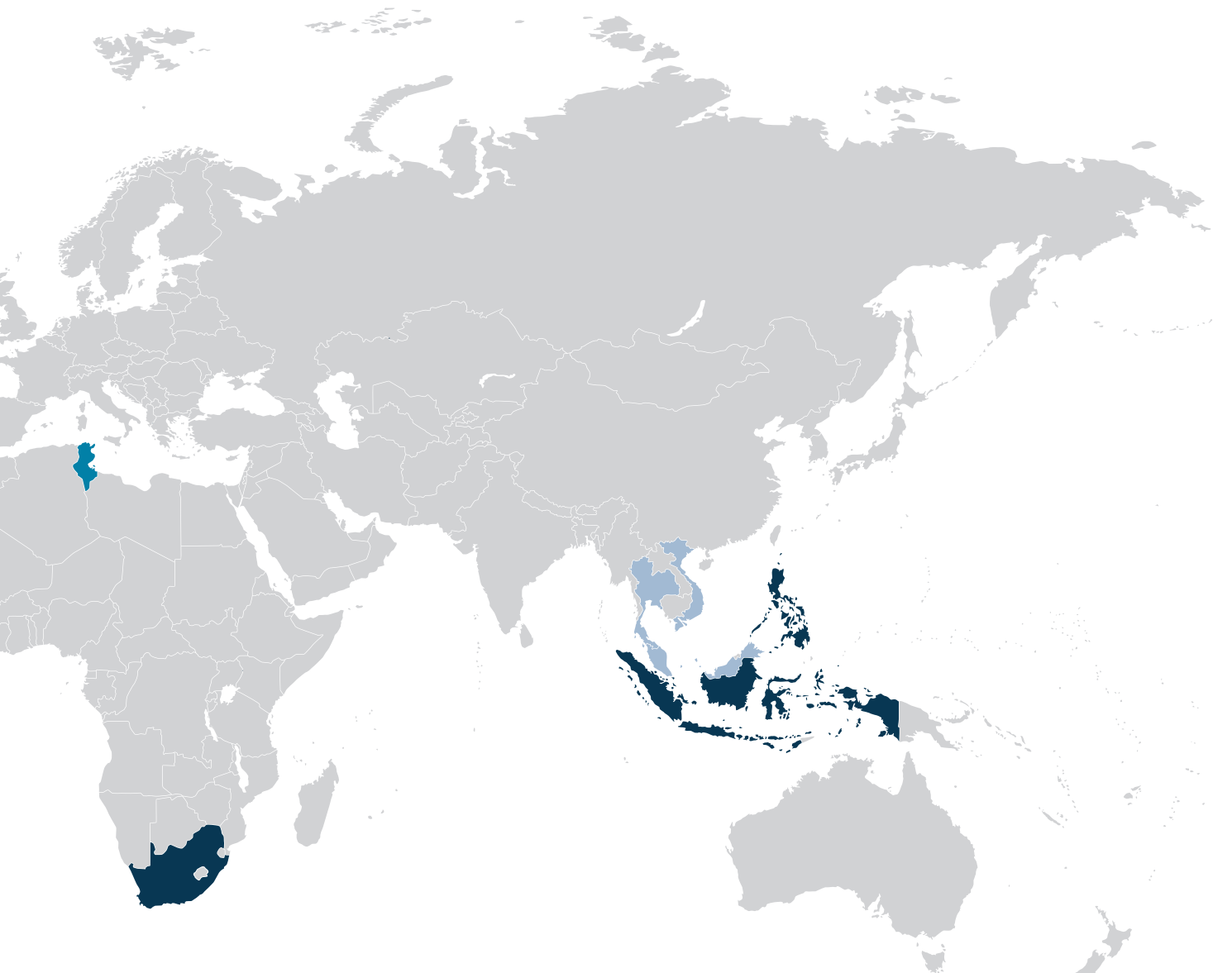




Shaping the role of climate finance for sustainable transport: What are the levers and how to make them work? Final Report

On behalf of:





The Project Context

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, the Philippines, South Africa, Peru and Colombia.
- At international level and closely linked to the UN-FCCC process, the project helps accelerate the learning process on transport NAMAs with a compre-

hensive set of measures (events, trainings, facilitation of expert groups, documents with guidance and lessons learned).

To encourage NAMA development worldwide, TRANSfer has set out to develop a first set of so-called MRV blueprints for transport NAMAs – a description of the MRV methodology and calculation of emission reductions for different NAMA types in the transport sector.

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: www.transport-namas.org



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Glossary

ADB	Asian Development Bank
AEP	Autoridad del Espacio Público
BOL	Bank of Lanzhou
BRT	Bus rapid transit
CAF	Andean Development Corporation
CCF	Climate Change Fund
CDM	Clean Development Mechanism
CER	Certified emission reductions
CMI	Carbon Market Initiative
CMMCh	Centro Mario Molina Chile
CO	Carbon monoxide
CO ₂	Carbon dioxide
CO ₂ eq	Carbon dioxide equivalents
COP	Conference of the Parties
CTF	Clean Technology Fund
DOE	Department of Energy
DOF	Department of Finance
DOT	Department of Transport
EIRR	Economic internal rate of return
EPA	Environmental Protection Agency
EU	European Union
FIRR	Financial internal rate of return
g	Gram

GCCA	Global Climate Change Alliance
GCF	Green Climate Fund
GEF	Global Environment Facility
GFEI	Global Fuel Economy Initiative
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HC	Hydrocarbons
ICI	International Climate Initiative
IDB	Inter-American Development Bank
IEA	International Energy Agency
IMTS	Integrated Mass Transit Systems
ITDP	Institute for Transportation and Development Policy
ITS	Intelligent Transportation Systems
JCM	Joint Crediting Mechanism
JI	Joint Implementation
km	Kilometre
kWh	Kilowatt-hour
L	Litre
LBP	Land Bank of the Philippines
LDC	Least Developed Countries
LGU	Local government unit
LIBOR	London interbank offered rate
LPTG	Lanzhou Public Transport Group
MDB	Multilateral development bank
MRV	Measurement, reporting, and verification

NAMA	Nationally Appropriate Mitigation Action
NDF	Nordic Development Fund
NGO	Nongovernmental organisation
NMT	Non-motorised transport
NO _x	Oxides of nitrogen
NUTP	National Urban Transport Programme
O&M	Operations and maintenance
ODA	Official Development Assistance
OEB	Operadora de Estacionamientos Bicentenario
OECD	Organization for Economic Cooperation and Development
P3	Public-private partnership
PCU	Project Coordination Unit
PLG	Project Leading Group
PMO	Project Management Office
PMR	Partnership for Market Readiness
PRC	People's Republic of China
ROI	Return on investment
SECCI	Sustainable Energy and Climate Change Initiative
SLoCAT	Partnership for Sustainable Low Carbon Transport
SO ₂	Sulphur dioxide
SPTS	Strategic Public Transport Systems
UK	United Kingdom
UN/ECE	Economic Commission for Europe of the United Nations
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change

USD	United States dollars
VOC	Vehicle operating costs

Executive Summary

Report Objective

This report 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 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 realise 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 transport 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 programmes; 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), non-motorised, and road improvements;
- National Urban Transport Programme in Colombia – funding for local public transportation infrastructure and capacity building;
- Electric tricycles in Manila, Philippines;
- Green Trucks project in Guangdong Province, China;
- EcoParq on-street parking management project in Mexico City;
- National fuel economy policies in Chile.

The case studies describe the project and its financing mechanisms and revenue sources, and provide evidence on GHG reduction and other benefits. For each case study, findings are drawn with respect to the suitability of the type of project or programme for climate finance, including success factors, risks, and other lessons learned. Overall recommendations are then drawn on the role climate finance can play to shift funding from conventional, unsustainable towards low-carbon sustainable transport for different types of sustainable transport measures. Key findings and recommendations are provided below.

Recommendations for Climate Finance

- Grants and loans can be made contingent upon **local adoption and implementation of sustainable policies and programme 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 programmes 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, traffic volume, and ridership or usage may be preferable to rigorous evaluation requirements.

- **Co-benefits**, such as mobility, accessibility, 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 implications 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 programmes – infrastructure, technology, and policy and planning.

- For **infrastructure projects and programmes**, climate finance sources can provide loans with favourable terms to 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 (rather than loans) will quickly use up international climate 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. Climate finance sources can fund pilot (demonstration) projects to help introduce new technology, but sustained subsidies will again quickly use up available resources.
- Climate finance support for **policy and plan development** can yield some of the most cost-effective actions in terms of GHG reductions per international dollar invested. However, recipients must be committed to policy and plan implementation as well as monitoring and enforcement to ensure the policy or plan 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, for example, training practitioners on sustainable transport planning methods;
- Enabling policy environments – researching, creating, and adopting policies and regulations that favour reducing GHG emissions;
- Removing barriers to investment in sustainable transport projects and clean technologies;
- Catalyzing investments (public and/or private) in sustainable transport projects and clean technologies;
- Facilitating demonstration projects to prove the viability of sustainable infrastructure and technology.

If sufficient lending capacity is developed in the transport climate finance sector, this approach could be expanded to include loans for more routine projects (with proven effectiveness at reducing GHG emissions) on favourable terms. However, it is unlikely to include large-scale grants or subsidies. Such grants or subsidies would overwhelm the capacity of available climate finance and divert from the other activities which have much greater leveraging power.

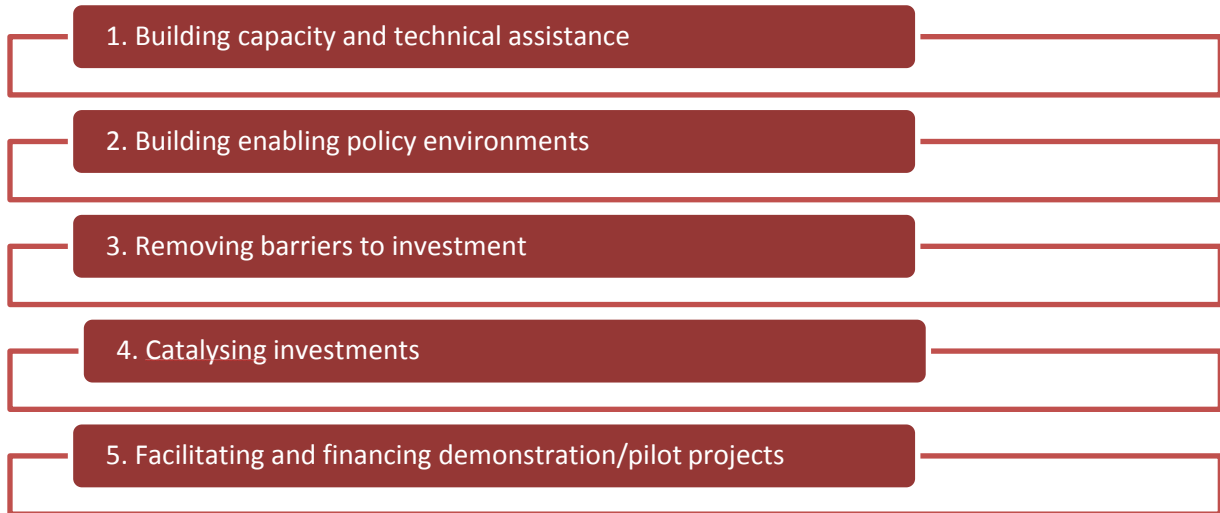


Figure ES-1: A proposed focus for climate finance

1 Introduction

1.1 Objective

This report 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 promote sustainable transport in developing countries; as well as transport planners and decision makers in developing countries.

The issue addressed in this report is how climate finance can be best used to promote sustainable transport and to realise the large greenhouse gas (GHG) emission reduction potential of the transport sector. In this report, climate finance refers to funds from public sources with the specific objective of mitigating GHG emissions.¹ The total volume of funds that can fall under the definition of climate finance is a small proportion of the total funds (from national and international sources) available to the transportation sector. Given these limited funds, the direct impact of climate finance on achieving emission reductions may be limited. Furthermore, given that funds provided to the transport sector from other sources do not always have the goal of promoting sustainable transport, the effects of climate finance to promote sustainable transport may be swamped by the effects of the funding from other sources.

Thus, one of the challenges facing policy makers is how to use climate funds to leverage other, non-climate funding sources to promote sustainable transport. This can be done in two ways:

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

1.2 Scope

This report begins by providing an overview of financing in the transport sector. It then documents six case studies of sustainable transport projects. For each case study, it examines the source of funds and type of financing to understand how climate finance can be used to leverage transport funding to more achieve the objective of sustainable transport. The case studies cover projects, policies, and programmes to promote sustainable transport. The cases studies include investment in advanced vehicles and fuels, investment in transport infrastructure, and supportive policies. The case studies are used to draw some “lessons learned” for how climate finance can be used to leverage funding from other sources to promote

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 programmes 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 programmes such as Germany's International Climate Initiative.

sustainable transport. Finally, conclusions are presented on how different types of financing mechanisms may be more or less suitable for different types of interventions to promote sustainable transport.

1.3 Selecting the Case Studies

The case studies were selected by reviewing publicly available information on the financing of interventions to promote sustainable transport, as well as considering input from experts.

An Expert Group² that included climate finance experts from multilateral development banks, the private sector, academic institutions, and the Partnership for Sustainable Low Carbon Transport (SLoCAT) provided input for identifying and selecting the case studies. This Expert Group also separately prepared a policy brief on the topic of climate finance.³ The members of this Expert Group are listed in Annex 2.

An initial list of case studies was prepared and reviewed with GIZ, SLoCAT, and the Expert Group. For each case study on this list, published resources such as loan documents and project descriptions were reviewed, and funding agency and local agency project managers were consulted about the availability of additional information.

After determining the availability of information, this list of case studies was presented to the Expert Group in Manila, Philippines in September 2014 to gather input on criteria to use in selecting the final six case studies. During this same meeting, the preliminary findings from one case study was presented to the Expert Group as an example of the focus of the case studies and the information that would be included for each case study. The findings from the remaining case studies were presented at a workshop held in Lima, Peru during the Conference of Parties (COP) in December 2014.

The criteria used for selecting the case studies included:

- Status of the case – We looked for cases that were either complete, or far enough underway so that sufficient information was available about the finance mechanisms and the benefits;
- Funding source(s) – We looked for a mix of cases that included funding from climate funds, other sustainable transport funding from development banks, and/or domestic government sources;
- Replicability – We looked for cases with the potential for replication in locations around the world;
- Availability of data – We looked for cases with publicly available data on finances and benefits, and also whether the data were available in a language that was accessible for the team that was working on preparing this report;
- Willingness to cooperate – We considered whether those involved in the case were willing to cooperate and provide us with additional information compared to what was publicly available;
- Geographic dispersion – We did not want all the case studies to come from one country, or one part of the world;
- Diversity of project types – We looked for different types of cases across the “avoid – shift – improve” spectrum and tried to include cases to cover both passenger and freight transport;
- “Transformational potential” of the case – We considered whether the case had the potential to support broader transformation towards greater sustainability in the transport sector.

² <http://transport-namas.org/expertgroup/expert-group-on-climate-finance-for-sustainable-transport/>

³ 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.”, see <http://transport-namas.org/resources/publications/>

The final list of case studies is shown in Table 1.1. The list includes a mix of cases covering infrastructure projects (bus rapid transit and associated improvements in Lanzhou and Colombia), vehicle technology programmes (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 Asia and Latin America.

Table 1.1 Case Studies

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

¹Status at the time that the six case studies were presented in Lima, Peru (December, 2014)

2 Overview of Transport and Climate Finance

Finance for the development of transport infrastructure and other measures has two elements:

- **Funding** – revenue sources (project-generated or subsidies) providing either short-term (e.g., one-time) or long-term (e.g., annual) cash streams;
- **Finance** – Loans from public or private sources providing cash needed for the capital investment needs for a project, which must be repaid from the income from a funding source.

Climate finance may provide opportunities to shift funding from less sustainable to more sustainable transport infrastructure projects, as well as to invest in clean technologies and more sustainable policies. Key roles for climate finance include technical assistance and capacity building, support for good policy development, building of sustainable transport project pipelines, and the unlocking of private investments (Sayeg et al., 2015). This chapter provides an overview of how transport infrastructure projects and other programmes are funded and financed and identifies opportunities for using climate finance to supplement traditional funding and financing mechanisms. It focuses primarily on transport infrastructure, but also draws conclusions for financing clean technologies and for policy and plan development.

2.1 Financing Transport Infrastructure Projects

Lefevre et al. (2014) estimate that the annual total global investment in the development of transport infrastructure is somewhere between USD 1.4 and 2.1 trillion. Given this huge investment, it bears keeping in mind that the current level of funding available under the label of climate finance is, by itself, still too small to bring about significant changes in the kinds of transport infrastructure that is being developed, or is being planned. It is important to use the available funding as effectively as possible, not just to fund individual projects but to leverage broader change, e.g., through capacity-building for planning and through the demonstration of new technology that ultimately may prove attractive without financial support.

2.1.1 Assembling a Funding/Finance Package

The decision to proceed with the development of a transport infrastructure project typically requires an assessment of the project's feasibility. This feasibility assessment includes:

- An estimate of the demand for the new infrastructure;
- Based on this demand, the estimated future revenues;
- Estimated cost of developing (capital investment), operating, and maintaining the new infrastructure;
- Estimated future benefits;
- Risks inherent in developing the infrastructure; e.g., cost overruns because of technical reasons; shortage of equipment, raw materials, or people; withdrawal of political support for the project resulting in cancellation of licences, permit and permissions; changes in the relevant laws, rules, policy framework that adversely affect costs and/or revenues; and over-estimated demand.

This feasibility assessment forms the basis for creating a funding/financing package for implementing the project. Typically, when government funds are involved (i.e., which do not have to be repaid), the benefits from the development of this new transport infrastructure must outweigh the costs for building, operating and maintaining the infrastructure over the “lifecycle” of the project. When the infrastructure project is being financed by private sources (i.e., the money has to be repaid), the “rate of return” from the project must satisfy the investors’ rate of return requirements. The rate of return of a project that investors require from any project (not just transport projects) is linked to their assessment of the risks associated

with the project – the greater the risks, the higher the rate of return will have to be to attract investors to invest in the project, *ceterus paribus*.

The rate of return requirements of investors can vary from investor to investor, and from one project to another. It is not unusual for projects, especially larger projects, to be developed using combined funding and financing from multiple public and private sources, all combined into one single package. Combining funds and financing from different sources makes it possible to develop infrastructure that would otherwise not be developed because the required investments to do so would not be available. Combining different sources of funds and financing is possible because of the different rate of return requirements of different investors.

2.1.2 Funding/Revenue Sources

The money needed for the development of transport infrastructure, also called capital investment requirements, usually comes from a variety of sources, often including both public and private sources combined into a funding/financing package. Public sources may include grants from national, state, or local governments, development banks, and development aid agencies. Private sources can include private banks, or other financial institutions such as pension funds, insurance companies, and sovereign funds.

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

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 localised 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, special rules and/or legislation can be put in place so new, higher property taxes, or the increase in property value resulting from the new infrastructure, can be appropriated for financing the transport infrastructure project. In other cases, those developing would pay “impact fees,” or pay for specific other infrastructure improvements as part of the permitting process to develop land as part of the transport infrastructure project.

Grant programmes from government and other organisations refer to any type of funding that would be available to project sponsors to build, operate and/or maintain transport infrastructure. These programmes are typically provided from a higher level of government to a lower level of government and/or to project sponsors. The scope of the programme may vary from single project funding to annual funding apportionments. These grant programmes 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 organisations, such as multilateral

development banks (MDBs) may fund 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.

2.1.3 Finance Mechanisms

Financing tools do not generate new revenue, but allow leveraging of existing resources to accelerate the construction of projects. Existing resources can be funds, grants, subsidies, and future revenue streams from user fees. The gap between the investment needed for an infrastructure project and the funds available from these sources can, provided the project is attractive enough to investors, be financed using a variety of financing mechanisms. This financing, regardless of what mechanism is used, must be repaid in due course of time. Fully or partially financing the investment needs of an infrastructure project raises the total cost of the project by an amount equal to the discounted value of interest payments. The increased costs associated with financing a project are offset by the larger and longer stream of benefits from the project (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) realised by having the asset in place earlier than what would be possible if no financing was used to meet the project's investment needs. The use of such financing tools also recognises the fact that the cost is being paid by future users over the life of the project.

Financing mechanisms include bonds, loans, and public-private partnerships (P3s) which include private equity. Public-private partnerships allow transport investments with financing packages that combine financing from public and private sources, 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 of the bonds receives an immediate influx of cash that can be used to meet the investment needs of a project. The investors are repaid the money they have invested in purchasing the bonds over time through principal plus interest payments. Typically one or more future revenue sources are used to guarantee these payments; i.e., these future revenues can only be used to repay those who have purchased the bonds.

Loan and credit programmes are another form of borrowing. In this case, a government, an MDB, or a commercial bank lends the money to the party (typical also a government, or a government agency) that is developing the project. Loans and credits from governments and MDBs are an attractive way for financing projects because, in some cases, the terms and conditions (e.g., the interest payments, the time period over which the loan has to be repaid for borrowing money from the government or MDB) may be more favourable than the terms and conditions for borrowing through the private capital markets, thus lowering the cost of borrowing the money. Loans and credits from government or MDBs, because of their favourable terms and conditions, help to reduce the risk associated with the project and make it more attractive (compared to what it would be without the loans and credits from governments and/or multilateral development banks) for other, private investors, allowing for the borrowing at lower interest rates from private investors.

Public-private partnerships are contractual agreements between a public agency and a private entity, which allows for equity participation of private sector investors, allowing them own some part, or all of the project rather than just through purchasing the project's bonds, or by lending money to meet the capital investment needs of the project. P3s involve the sharing of responsibilities, risks, and rewards for the building and operation of a project between the public and private sector. The public partner, however, usually retains full ownership of the infrastructure that is built using P3s. 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 for using private finance (i.e., non-government money or money from MDBs) to promote the development of transport projects that contributing to more sustainable transport. The interventions are grouped using 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 interventions 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 an intervention (the policy, programme, or infrastructure project).

2.1.4 Role of Climate Finance

Climate finance refers to funds from public sources with the specific objective of mitigating GHG emissions. The opportunity for climate finance to influence funding and financing for the development of transport infrastructure that promotes sustainable transport lies in increasing the flow of funds into sustainable transport projects. An increase in funds available for the development of infrastructure that promotes sustainable transport can be beneficial in two ways. First, projects that would not have been financed, because of the lack of funds, can now be financed. And second, an increase in the funding (money that does not need to be repaid) for infrastructure projects will reduce the risks associated with the project, and hence reduce the “rate of return” required to attract investors to the project.

Creating a funding/financing plan is, however, a complicated and difficult exercise at the best of times. The inclusion of climate finance in a funding/financing package for an infrastructure project is only going to increase the complexity and difficulty of putting together an adequate package.

Some of the challenges faced in assembling a funding/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 programmes, mapping the project or specific elements to these criteria;
- 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.

The introduction of climate finance can introduce some additional challenges, for example:

- Climate finance must be directed specifically at infrastructure projects, programmes, or policies that reduce (or limit the increase in) greenhouse gas emissions. This requirement imposes Monitoring, Evaluation, and Verification (MEV) or Measurement, Reporting and Verification (MRV) requirements to demonstrate that the estimated GHG reductions are being achieved, the stringency of which varies by funding agency;
- Adding climate finance as one of the funding sources for a project increases the technical capacity needed to manage the project;

- Climate finance often adds its own set of administrative requirements, and funding and disbursement cycles may be difficult to align with those of other financing mechanisms.

Table 2.1 Examples of Opportunities for Using Private Finance to Promote Sustainable Transport

Strategy	Intervention	Suitable for Private Finance?*	Equity/Debt Repayment Sources
Avoid	Land use planning to promote higher density, clustering of destinations, mixed use activity centers, more accessible development	Y	New taxes on home/business owners Value capture (taxing the increase in land values) Developer exactions (requirements to develop specific infrastructure) or impact/mitigation fees
	Travel demand management, e.g., car/ride sharing services, shuttle services, telecommuting	Y	Operating revenues through user fees
	Parking management (e.g., charging for parking, unbundling costs of parking from rents, providing spaces for high-priority uses and users such as high-occupancy or car-share vehicles, sharing parking among uses)	Y	Parking facility revenues/ use charges Enforcement activities for fining parking violations
	Car free planning (designing neighborhoods/areas of a city in such a way that it minimises car use)	N	
	Urban freight distribution centers	Y	Freight operator user fees
Shift	Urban transit –BRT, mass rapid transit	Y	Fares, property value capture
	Bicycle and pedestrian infrastructure and programmes	N**	--
	Freight rail infrastructure and intermodal improvements	Y	Shipping/usage fees
Improve	Clean vehicles and fuels (e.g., public bus fleets, EV/alternative fuel refueling infrastructure)	Y	Fuel savings (motor fuel taxes) Reduced fuel costs for public fleets
	Traffic system operations/flow improvements/ ITS infrastructure	N	--
	Managed lanes	Y	Toll revenue
	Clean trucks infrastructure & incentives (natural gas, electric, anti-idle technology)	Y	Vehicle and fuel purchases (excise taxes)
	Eco-driving	Y	Fuel savings
All Effects	Pricing (fuel, carbon, parking, tolling, congestion, road use charge)	Y	Toll/fee revenue
	System-wide and corridor sustainable transport plans, including integrated transportation and land use plans	N	--

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

**bike sharing systems and pedestrian access to e.g. malls may be financed by the private sector

Source: Cambridge Systematics, Inc.

2.2 Funding and Financing Other Transport Measures

Other transport measures, including clean vehicle and fuel technology and policy and planning, involve somewhat different financing approaches although many of the challenges are similar.

2.2.1 Clean Vehicle and Fuel Technology

A major difference between infrastructure and clean technology is that private sector companies are usually responsible for vehicle development, sales, and purchase. Furthermore, private parties are also responsible for purchasing and operating vehicles (private vehicles, buses, trucks), although clean technology may also be part of a public infrastructure or transport service project (e.g., clean buses in a publicly-operated system). Unlike many infrastructure projects, there is a natural revenue stream (sales of vehicles and fuel), but this revenue stream must offset the development and manufacturing costs of the technology.

Challenges with introducing clean vehicles and fuels include overcoming higher costs (capital/purchase costs for vehicles, and/or fuel costs for vehicle operations), as well as overcoming other barriers to introducing new technology such as performance (driving range, capacity), lack of refuelling infrastructure, or consumer awareness and acceptance. The role of climate finance may include:

- Loans to offset higher up-front costs, if they can be paid back from lower operating costs over the vehicle's lifetime;
- Grants for demonstration projects to overcome initial hurdles, test and demonstrate the feasibility and utility of new technology⁴, and/or cover incremental costs of vehicles⁵.

The goal is to help bring new technology “to scale,” to the point where vehicle costs and performance are competitive on the private market. The risk is that the technology remains uncompetitive, and requires ongoing subsidies. This is unlikely to be sustainable for the private vehicle market, and can only be justified if the social benefits outweigh the subsidy costs.

2.2.2 Policy and Plan Development

This category of transport measure includes the development of plans for infrastructure and services, as well as regulations on vehicle technology, system operations, and other aspects of the transport system. Compared with capital requirements for transport infrastructure and vehicles, the funding required for policy and plan development is relatively modest. The costs of comprehensive planning for a metropolitan area may be on the order of a few million USD, compared to the tens of millions to billions required for major infrastructure projects. However, there is also not a natural market-generated revenue stream to finance policy development and planning, so policy and plan development is typically government-funded (although in some cases private-sector firms may support development of policies or plans in which they have a particular interest). The government funding may come from transport-specific sources (such as fuel taxes, tolls, or licensing and registration fees), and/or from general revenues such as sales, property, or income taxes.

The role of climate finance in policy and plan development is to make policy and planning possible above and beyond what would have been done anyway by the local government, with additional activities directed at developing a cleaner and more sustainable transportation system. Examples of these activities include:

⁴ For example, in the Clean Development Mechanism, four registered projects are promoting the production and sales of electric motorbikes

⁵ As, for example, proposed in the Vietnam Low-carbon Bus NAMA: <http://www.transport-namadatabase.org/low-carbon-bus-nama-vietnam/>

- Developing and implementing fuel economy or GHG regulations;
- Training planners on sustainable transport policies and measures;
- Developing area-wide plans for sustainable transport infrastructure;
- Improving data collection to support sustainable planning and GHG emissions measurement;
- Developing regulatory and operational measures for the transport system (e.g., parking management);
- Evaluating and enforcing existing policies to reduce emissions.

2.3 Sources of Climate Finance

As discussed in Section 1.1, “climate/mitigation finance” is broadly defined as financial resources that are available for interventions whose expected effect is to mitigate 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 to governments and international public-sector lending institutions is the subject of interest here, 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 finance or fund interventions designed to promote sustainable transport and mitigate climate change. 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 (not limited to those funds that are specifically designed for, or so far that been used for interventions in the transport sector) presented here are available through multilateral and bilateral organizations, and include grants, loan programmes and technical assistance.

Table 2.2 provides a list of available resources with information on international climate financing sources for sustainable transport projects.

Table 2.2 Resources Related to Climate Funding for Transport

Author(s)	Title	Website
SLoCaT	Climate Finance Transport Projects Matrix	http://www.slocat.net/documents
Binsted, Anne Bongardt, Daniel Dalkmann, Holger Sakamoto, Ko	Accessing climate finance for Sustainable Transport: A Practical Overview (Technical Document #5)	http://www.sutp.org/en/news-reader/accessing-climate-finance-for-sustainable-transport-updated.html
Sakamoto, Ko	Financing Sustainable Urban Transport (Module 1f)	http://www.sutp.org/files/contents/documents/resources/A_Sourcebook/SB1_Institutional-and-Policy-Orientation/GIZ_SUTP_SB1f_Financing-Sustainable-Urban-Transport_EN.pdf
GIZ	Navigating Transport NAMAs: Practical Handbook for Design and Implementation of Nationally Appropriate Mitigation Actions (NAMAs) in the Transport Sector	http://transport-namas.org/resources/handbook/
Lefevre, Benoit Leipzig, David	Transport Readiness for climate finance: A Framework to Access climate finance in the Transport	http://www.wrirosscities.org/sites/default/files/Transport-Readiness-for-Climate-Finance-EMBARQ-BtG.pdf

	Sector	
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Note: Last accessed on December 19, 2016

Table 2.3 summarises 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 programme must typically show a demonstrated link to GHG mitigation. The specific evaluation and reporting requirements vary from programme to programme. Some programmes have detailed quantitative evaluation requirements, while others have less rigorous or more qualitative standards.

Table 2.3 Overview of Selected Potential Climate Funds for Sustainable Transport

Sources of climate finance	Nature of Support			World Regions Covered
	Grants	Loans	Technical Assistance	
ADB Climate Change Fund	x	x	x	Asia
Clean Technology Fund	x	x		International
Global Climate Change Alliance (EU)	x		x	International
Global Environment Facility	x		x	International
Green Climate Fund	x	x		International
IDB Sustainable Energy and Climate Change Initiative	x	x	x	Latin America and the Caribbean
IDB Infrastructure Fund	x	x	x	Latin America and the Caribbean
International Climate Initiative (Germany)	x		x	International
NAMA Facility (Germany, UK, Denmark, EU)	x	x	x	International
Nordic Development Fund	x		x	Eligible countries in Africa, Asia and Latin America
Clean Development Mechanism	x			International
Joint Crediting Mechanism	x		x	International
Partnership for Market Readiness	x		x	International

Source: Adapted from Binsted et.al. (2010 and 2013), Lefevre (2014) and SLoCaT (2016)

- **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 programme, and supported by six multilateral development banks. In the

transport field, eligible investments include energy efficiency and modal shift 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 programme 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 industrialising countries and countries in transition.
- **NAMA Facility** – The NAMA Facility is a joint programme of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, the UK Department of Energy and Climate Change, the Danish Ministry of Energy, Utilities and Climate Change and the European Union. 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 organisation 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 MRV, data management, and registries; policy mapping; and carbon offset standards and programmes. PMR activities cover all sectors including transport.
- **Carbon markets** are not covered by the definition of climate finance as part of the 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 fund investment projects and cover incremental costs of deploying cleaner technologies.
- 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 Development⁶, there are a total of 32 CDM transport projects in nine countries⁷, 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 project 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.⁸ 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 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 organisations, 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).

⁶ <http://www.cdmpipeline.org> (last accessed on August 12, 2014).

⁷ Asia (China, India and Malaysia), Latin America (Colombia, Ecuador, Guatemala, Mexico, and Paraguay), and Africa (Tunisia)

⁸ Annex I countries including Australia, the European Union, Belarus, Iceland, Kazakhstan, Liechtenstein, New Zealand, Norway, Russia, Switzerland, and Ukraine.

3 Case Studies

The objective of these case studies is to develop generalisable 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. This section provides a summary description 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 Annex 1 to this report. The case studies include:

- Lanzhou Sustainable Urban Transport Project – BRT, nonmotorised, and road improvements in Lanzhou, China;
- National Urban Transport Programme – Funding for local public transportation infrastructure and capacity building in Colombia;
- E-Trikes – Mitigation of Climate Change through Increased Energy Efficiency and the Use of Clean Energy in Manila, Philippines;
- Guangdong Green Trucks Project in Guangdong Province, China;
- EcoParq On-street Parking Management Project in Mexico City, Mexico;
- Fuel Economy Policies in Chile.

3.1 Sustainable Urban Transport Project, Lanzhou, China

3.1.1 Case Study Description

The Lanzhou Sustainable Urban Transport Project includes roadway, BRT, and non-motorised transport (NMT) improvements for the city of Lanzhou, the capital of Gansu province in the northwest of the People’s Republic of China. It is ADB’s first project supporting BRT in the PRC,⁹ under the ADB’s Sustainable Transport Initiative. By providing policy guidance and entering into a dialogue with the Lanzhou Municipal Government (LMG), the ADB was able to bring about a revision of the city’s master plan for establishing a sustainable urban transport system. One of the major revisions to the plan, which was originally roadway-focused, was the development of a BRT system.

The project included four components:

- Construction and reconstruction of 33.8 km of urban roads, including the BRT system and facilities for NMT (Figure 3.1);
- Installation of advanced traffic management technologies and systems, including an advanced traffic signal control system, travel demand management strategy, and a plan for developing NMT;
- Installation of an environmental monitoring system, including air quality sensors; and
- Capacity building to support project implementation, particularly the management and operation of the BRT system.

The LMG specifically created the Lanzhou Public Transport Group (LPTG), a consolidated public transport operator, for operating the BRT system. Since 2012, 9 km of the BRT have been operational.

⁹ “Bus Rapid Transit Project to Cut Greenhouse Gas Emissions in PRC,” <http://www.adb.org/news/bus-rapid-transit-project-cut-greenhouse-gas-emissions-prc>

3.1.2 Financing and Funding¹⁰

The total project cost was USD 480.3 million. The project was financed by loans from ADB, the Bank of Lanzhou and the LMG - ADB provided a loan for about USD 149 million, the Bank of Lanzhou (BOL) providing a loan of USD 100 million, and the LMG put in about USD 230.3 million.

The ADB loan was provided on very favorable terms and conditions – it has a 25-year repayment term and this includes a grace period of five years, low initial payment installments, and, even for an ADB loan, a low interest rate of 2.53 percent. The ADB loan was provided on the condition that the BRT system would be included in the LMG’s master plan for developing a sustainable urban transport system.

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 money for the LMGs contribution could not be determined.

The ADB loan was used for funding new roads and reconstructing existing roads (USD 119 million); BRT stations and equipment (USD 11 million), and an advanced traffic control system (USD 18 million). The costs of road improvements for the BRT system could not be separated from the total costs of reconstruction of the roads.

The publicly available data on the financing and funding for this project were limited. In particular, the data on annual operating costs and revenues from fare collection for the BRT are not available from LMG sources and cannot be directly compared with pre-BRT bus operating costs. Based on the publicly available information and our discussions with experts, we were not able to clearly establish how the LMG manages revenue and cost flows and whether or how revenue from fare collection contributes to the operating and maintenance costs of the BRT system. We estimated revenues from fare collection based on ridership and fare levels. Using the most recent ridership estimates we calculated annual revenues from fare collection to be between USD 13 to 15 million for the time period 2013-2020 (the seven-year period measured for CDM evaluation), or USD 97 million for the entire seven years (see Annex 1). The revenues from fare collection compare favorably with the size of the initial investment – assuming the entire ADB loan was for the construction of the BRT system, and ignoring operation, maintenance, and interest costs, fare box revenues would equal the initial investment between 10 and 11.5 years. However, the revenues from fare collection cannot be taken to be completely accurate as LMG staff noted that the revenue of BRT cannot cover even the operational costs of the BRT system because of very low fares and the discounted fares for the elderly and students who use the BRT. Thus, it is difficult to reach a definitive conclusion regarding the financial health of the BRT system based on estimates of the fare box revenues.

Interestingly, initially, there was no thought given to capture the increases in land value and use it for financing the BRT system. Thus, this potential source of funding for the BRT system was not included in the original financing package. However, as the BRT system has developed, it has become clear that the price of land in the areas served by the BRT system has increased. Revenues from fare box collections have been supplemented by the sale and lease of land in the BRT system’s catchment area. However, we were unable to determine how much revenues have been raised from the sale and lease of land.

What is also interesting about this project is that ADB’s Carbon Market Initiative (CMI) supported this project for preparing an application for CDM registration – the project description included in the loan agreement between the ADB and government of the People Republic of China specifically states that the project will generate “certified emission reduction.” The loan agreement, however, does not specifically require the project to initiate and complete the CDM process. At the start of the project, the local

¹⁰ Asian Development Bank (2009). Proposed Loan: People’s Republic of China: Lanzhou Sustainable Urban Transport Project. Financial Analysis, Report and Recommendation of the President, to the Board of Directors; Asian Development Bank (2010). Loan Agreement for Lanzhou Sustainable Urban Transport Project between People’s Republic of China and Asian Development Bank Dated 30 March 2010. See <http://www.adb.org/projects/40625-013/main#project-documents>

operator was not interested in using the CDM mechanism because of the stringent MRV requirements and the costs of fulfilling these requirements relative to the value of the certified emission reductions (CERs). ADB, however, has since convinced the local operator to register and proceed to the CDM monitoring stage.

Initially, it was estimated, based on ex-ante ridership estimates and reported in the loan application, that the project would receive about 5,000 certified emission reductions (CERs) annually (ADB, 2009). Using a conservative estimate of \$10 per CER, the fund was expected to pay \$0.5 million over 10 years towards meeting part of operating and maintenance costs of the BRT system. Understandably, the local operator of the BRT system was not interested in participating in the CDM process given the small contribution of the CERs.

3.1.3 Greenhouse Gas Benefits

This project was the first ADB transport project to support preparation of an application for certification under the Clean Development Mechanism. GHG reduction estimates, adjusted for observed ridership, show a benefit of about 107,000 tonnes over a seven-year period from 2013 to 2019. This is significantly higher than the initial estimate of 5,000 annual CERs developed as part of the loan application. However, the initial annual ridership forecast was for 110,000 at the start of the project (January 2013) while the actual ridership by September 2013 (based on peak hour surveys) was closer to 290,000, almost three times as high as the initial forecast.¹¹ Even this figure, however, would result in credit values covering only a small portion of the operating and maintenance costs of the BRT system.

3.1.4 Conclusions

Some clear conclusions can be drawn from this case study regarding the role of climate finance. First, if it had not been for the policy guidance and dialogue initiated by the ADB, the master plan for sustainable urban transport for Lanzhou would not have been revised to include the BRT system. Second, the ADB loan was instrumental in the implementation of the BRT system, as well as the facilities and plans for developing non-motorised transport. Third, without the ADB loan the traffic management technologies and systems and the emission monitoring systems would not have been implemented as part of the master plan. In the case of Lanzhou, climate finance made a project happen, and its accompanying benefits, that would otherwise not have happened.

The funding and financing package put together for the project as whole did not include any revenue streams from sources other than fare collection. The value of the benefits from participating in the CDM mechanism were too small, despite the BRT system being more successful in terms of ridership than what was initially forecast, to make up for the costs and burden of complying with the MRV requirements of the CDM process. In our view the local operator of the BRT system agreed to register and proceed to the monitoring phase of the CDM only because the ADB loan covered the costs of procuring and installing the monitoring equipment, and an advance payment partially covered the costs of operating the monitoring equipment. Without this financial assistance, the large burden of complying with the MRV requirements of the CDM process relative to the value of the benefits received from doing so, would have clearly dissuaded the local operator of the Lanzhou BRT from participating in the CDM process. Thus, if the CDM, or some similar process, is to be effective, it will have to significantly reduce the burden of compliance imposed on participants.

For future projects, this case study suggests that climate finance can be combined with other funding sources with the express provision that the project includes low-carbon strategies. In the case of capital-intensive infrastructure projects, the finance will primarily need to be in the form of loans, not grants. Climate finance should also cover the incremental cost of MRV if needed (through grants).

¹¹ Lanzhou BRT Quantitative Parameters, <http://www.chinabrt.org/en/cities/lanzhou.aspx>, accessed August 2014.

3.2 National Public Transport Programme, Colombia

3.2.1 Case Study Description

This case study explores the implications of international financing for domestic sustainable transportation projects in Colombia, with a focus on a World Bank loan to support the National Urban Transport Programme (NUTP). The international finance in this case is not explicitly climate finance as it is not from sources specifically directed at reducing GHG emissions, but rather provided more broadly to support transportation investment. However, as the funded investments reduce GHG emissions, they could be considered candidates for climate finance.

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 prioritise sustainable transportation modes, the Colombian National Council of Economic and Social Policy developed the National Urban Transport Programme. The NUTP followed the success of investments in sustainable transport in the nation's capital, Bogotá. It was developed to provide competitive, efficient, affordable, safe, and environmentally sustainable mobility options for Colombia's urban population.

Local governments are responsible for planning, regulating and controlling traffic, and providing public transport in Colombia. Public transport in Colombian cities is, for the most part, provided by private operators. The national government supports the local governments by providing co-financing for their initiatives, under the conditions that these initiatives meet the requirements set down by the national government.

Interestingly, it was the success of Bogotá's TransMilenio BRT system that helped to build consensus and support for the need to develop a national plan for providing Integrated Mass Transit Systems (IMTS) that would replicate the example of Bogotá in other parts of Colombia. The country adopted its National Policy for Urban Mobility and Transport (NPUMT) in 2003 to provide guidance to cities for developing solutions to the well known urban traffic problems. The NUTP provides funding and assistance to implement the policy. The NUTP has two primary instruments; the IMTS for cities with a population greater than 600,000; and Strategic Public Transport Systems (SPTS) for cities with fewer than 600,000, but more than 250,000 inhabitants. For cities with a population of less than 250,000 the primary effort is on re-organising public transport and putting traffic management measures in place.

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. The aim of STPS is to bring about urban renewal, improve public spaces, put in place infrastructure that is only for public transport, manage and regulate the public transport sector, initiate fleets modernisation, rationalise route networks, optimise operations, and stimulate NMT and other sustainable transport modes.

3.2.2 Financing and Funding¹²

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

¹² World Bank (2010), Project Information Document (PID) Concept Stage (Report No. AB6086) and Appraisal Stage (AB6409): Support to the National Urban Transport Programme (NUTP); and correspondence with experts (see Annex 1)

conditions. Since 70 percent is the maximum contribution allowed by law from the National Government in these projects, a minimum local match of at least 30 percent is required to develop the project. 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 supported a national and local investment in GHG-reducing infrastructure of 150 percent of the loan amount. Other Development Banks have also issued loans to the Colombian government for the development of mass transit systems.

A 2013 World Bank loan totalling USD 292 million was directed at capacity building, IMTS projects in two large cities, and SPTS projects in two medium-sized cities. This loan (Project ID: P117947) is provided directly to the Colombian Ministry of Transport, which disburses resources to local authorities. Payment on 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 Benefits¹³

The Colombian NUTP has been effective in promoting public transport and BRT systems in Colombia. In the period since 2003, IMTS projects are operational in six cities, with two projects under implementation and one in preparation as of 2014. For medium-sized Colombian cities, the national government has authorised funding for SPTS in seven cities and SPTS are under preparation in another four cities. Thus, clearly the NUTP has had its intended effect of stimulating and providing public transport, BRT systems. The BRT systems carry almost 2.5 million passengers per day.

BRT systems, by improving the quality of public transport, lead to a shift away from private to public transport, reduce congestion, improve travel times, and support the rationalisation and renovation of urban bus fleets. In addition, energy use per passenger-km is often significantly lower than for traditional buses. The NUTP/IMTS programme has brought an estimated emission 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 Medellín the NUTP's BRT system is estimated to result in GHG reductions at 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 estimates that SPTS projects recommended for development under the NUTP will help to significantly reduce GHG emissions from transport. These reductions will be the result of the actions taken under the NUTP such as implementing dedicated public transportation infrastructure, reducing excess supply of public transit, replacing obsolete buses with lower-pollution technologies, optimising and coordinating route planning and operations, and supporting NMT 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 GHG emissions by 86,000 tons of CO₂eq/year, of which 78,000 tons is a direct effect from the replacement of the old bus system and 8,000 tons is an indirect effect resulting from the expected modal shift.

¹³ IGES CDM Project Database 2014 <http://pub.iges.or.jp/modules/envirolib/view.php?docid=968>; Turner et al. (2012) "Case Study: Colombia's Bus Rapid Transit (BRT) Development and Expansion," Center for Clean Air Policy.

Using the above four Colombian cities (which are of similar size to the cities funded in the 2013 World Bank loan), the SPTS projects in Valledupar and Sincelejo could together yield GHG reductions of at least 40,000 tons CO₂eq/year.

3.2.4 Conclusions

The Colombian government has earmarked billion of USD towards transport sector projects that are focused on sustainability. In the context of climate finance, the estimated total of USD 1.644 billion in the form of loans from MDBs has supported 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. 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. This process and strong national direction set the stage for using funds effectively.

What explains the success of the Colombian NUTP? There are many factors that can be given to explain the success of the NUTP (and we go into these below), but if there are two things that stand out they are the long period of time that the Colombian national government has consistently provided funding to the NUTP, and the equal priority given to non-technical elements (capacity building, legal and regulatory context) of implementing the NUTP.

How has the Colombian government managed to provide long-term funding for the NUTP, this despite the change in governments? Three things have contributed to this. First, the NUTP requires that the national and local governments work together with the private sector in terms of financing projects. This mutual dependence creates a coalition that safeguards the funding for an intervention under the NUTP – no one partner can unilaterally withdraw support from a project. Second, the NUTP requires the funding for interventions under the NUTP be approved by the National Fiscal Policy council. Once this funding has been approved by Fiscal Policy Council it cannot be taken away in future years, but becomes part of the budget process in future years. And finally, the national government has provided the local governments, one of the partners providing financing/funding to NUTP project, with the means to provide this funding/financing in the form of revenues collected through a fuel tax.

The second noteworthy feature of the NUTP is along with the technical aspects of IMTS, BRT systems, and other public transport infrastructure, the Colombian government has developed a specific institutional and regulatory infrastructure to support the planning, funding, and implementation of the projects. What has helped to make this capacity building exercise successful is the allocation of concrete and large resources specifically for capacity building; under the NUTP.

Not all of the expected benefits of the NUTP have been realised, 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 Colombian cities' transport infrastructure.

For future projects and programmes, this case study suggests once again that for capital-intensive infrastructure projects, most of the finance (including climate finance) will be in the form of loans. Providing loans on favorable terms can be an important incentive for local governments to meet lending agency objectives, which in the case of climate finance include ensuring that the loans support investment in sustainable transport. Climate finance should also be directed to support planning for capacity-building to ensure that sustainable transport is well-planned and that implementation continues over time. The funds for capacity-building may be in the form of grants due to the much lower cost requirements compared to infrastructure. In addition, climate finance can support the development of a NUTP.

3.3 E-Trikes, Manila, Philippines

3.3.1 Case Study Description

This project, funded by the Asian Development Bank, proposed to transform the market for tricycles in the Philippines by introducing electric tricycles (e-trikes) to increase energy efficiency, reduce reliance on imported fuels, and minimise emissions, while increasing driver income through greater passenger capacity and lower operating costs, and creating new jobs in the manufacturing of parts for these electric tricycles.

The traditional gasoline-powered tricycles are typically a motorcycle-sidecar combination, with a sidecar that is closed for accommodating passengers. This project aims to introduce 100,000 e-trikes over a 60 period months from January 2013 to December 2017.¹⁴ The implementation of the project is planned in two phases:

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

In April 2011, the ADB together with Philippines Department of Energy (DOE) funded a pilot project that bought 20 locally made e-trikes powered by imported lithium-ion batteries in the City of Mandaluyong (part of Metropolitan Manila). The aim of this pilot was to get feedback from tricycle drivers on ways to improve the design of the e-trikes that would be bought in the scaled up programme.

The ADB set the following targets for the project:¹⁵

- **E-trike units:** The project shall deliver 100,000 e-trike units to Local Government Units (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 mobilisation, 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.

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 Phase 1 of the project implementation (the "industry development" phase during which 20,000 e-trikes were to be purchased and distributed) is to have 500 locally assembled public charging stations by December 2015. Each charging station costs about USD 23,000.¹⁶

¹⁴ Current project implementation delay will most likely lead to revising these dates to the year 2015 as the start date.

¹⁵ Project Impact and Outcome, Proposed Loan and Administration of Loan and Grant, Republic of the Philippines: Market Transformation through Introduction of Energy-Efficient Electric Vehicles Project.

¹⁶ A Future for Electric Vehicles Gets a Bit Closer in the Philippines.

<http://blogs.wsj.com/indonesiarealtime/2013/08/02/a-future-for-electric-vehicles-gets-a-bit-closer-in-the-philippines/>

The Philippines DOE is the executing agency in charge of procurement, implementation and technical supervision of this project. An e-trike group made up 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. The DOE has been holding stakeholder outreach with several players including LGUs, private stakeholders (battery manufacturers, logistics suppliers, and electricity transport organisations), and other public agency stakeholders.

Figure 3.2: E-Trikes



Source: Asian Development Bank

3.3.2 Financing and Funding¹⁷

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 provided 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. From the CTF grant of USD 5 million, USD 1 million is to be spent on capacity building and USD 4 million for the solar charging pilot project to develop solar charging stations for the e-trikes.

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 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 organisation (NGO) to collect a daily “boundary” payment (the payment made by the driver of the vehicle to the vehicle owner, from whom the vehicle is rented on a daily basis) from the drivers and use the collected fund to repay the loan. The e-trike office also establishes penalties and undertakes remote immobilisation 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;

¹⁷ Asian Development Bank (2013). Loan Agreement, ADB Clean Technology Fund, Market Transformation through Introduction of Energy Efficient Electric Vehicles Project.

- Since the LBP cannot directly lend to individual e-trike owners, an intermediary bank acts as a conduit for borrowing the money from the LBP and then lending it to the as e-trike owner/ 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 (under this financing arrangement, e-trike drivers will own the e-trikes after 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 Benefits

The project reduces GHG emissions by improving the energy efficiency and converting to a less GHG-intensive fuel for a section of the vehicles making up the single largest part of the public transport fleet in the Philippines. Other benefits include long-term health effects such as better health of drivers, skill development due to the creation of a new e-trike industry, job creation, and ancillary industries that provide spare parts and support needed for the manufacturing and maintenance of e-trikes. The project also pays attention to involving women in in the design of e-trikes and has set a target of employing at least 30 percent women to fill the job of charging station attendants during day shifts.

As part of the preparatory work the project estimated the potential emission reductions from e-trikes. The CDM report estimated that annual emissions would be reduced from 13,200 tonnes CO₂eq to 2,000 tonnes based on 2,000 e-trikes in Quezon City.¹⁸ Assuming that e-trike drivers drive, on average, 80 km and a baseline emissions per vehicle of 147 gCO₂eq/km, a typical e-trike would reduce total annual emissions/vehicle by about 3.8 tons of CO₂eq, or about 54 percent per vehicle.¹⁹ In other locations, the reduction in emissions could be higher or lower, depending on the local electricity generating mix.²⁰

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 favourable 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

¹⁸ Philippine Electric Vehicle Project, CDM Emission Reduction Calculation, <http://cdm.unfccc.int/ProgrammemeOfActivities/Validation/DB/H1J0SGF4SESWDA5FMY9ZLC2GRG1R59/view.html>

¹⁹ 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

²⁰ 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.

the local electricity generating mix. Local air pollutant emissions are also eliminated, which should benefit public health.

The Manila e-trikes project is an interesting case in that it attempts to completely transform the emissions from the small-scale public transport sector by providing incentives for introducing a new, cleaner technology into the sector. The jury is still out on whether the project has worked or not as the project has experienced delays. However, we can still draw some interesting conclusions from the perspective of climate finance.

The chosen intervention attempts to tackle one of the biggest sources of emissions – trikes are a major contributor to GHG emissions from public transport. The mechanism chosen is facilitating the adoption of new technology by providing realistic solutions to problems on the ground through incentives for adopting the new technology. The problem with introducing new e-trikes is the cost of the new e-trikes; they cost almost two and half times what a traditional e-trike costs and the average e-trike driver simply does not have the capital to purchase the e-trike. Thus, focusing on providing capital to potential e-trike drivers to purchase e-trikes on attractive terms is a first step in introducing this new technology into the market. The terms and conditions for e-trike drivers for repaying the loan are also important. In this case, making small payments on a daily basis is important because this is what e-trike drivers in the Philippines are used to (trike drivers rent their trikes and make daily boundary payments to the owners of the trikes).

Equally important, this new technology has to deliver real cost savings and benefits to drivers – reducing GHG emissions is not something that an average e-trike driver cares about, they care about earning a living. Thus, the reduction in daily operating costs is a very real benefit, but it is not enough. The second important characteristic of the e-trike is the ability to carry more passengers than the traditional trike. This means that the daily earning of an e-trike driver can be higher than the driver of a traditional trike. Finally, for the e-trike project to be successful, there has to be the necessary infrastructure to support the operation of the e-trikes. To this end, creating the infrastructure for charging the e-trikes is an important element of the project. Just simply providing the e-trikes would not be enough for this project to succeed; charging an e-trike has to be as simple and easy as filling a traditional trike with gasoline.

For future clean vehicle projects, this case study suggests that climate finance should be directed to demonstrate clean technology where its costs and benefits are not yet proven and/or new to the country, and also to overcome institutional barriers to adopting that technology, such as lack of information, financing needs for small operators, etc. Up-front loans (repaid from fuel savings) can be provided to cover initial capital costs, with grants for items such as training, coordination, policy development, measurement, and enforcement.

3.4 Green Trucks Project, Guangdong, China

3.4.1 Case Study 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, light-weighted aluminium alloy semi-trailers and liquefied 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/thegef/>

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 Programme and Clean Air Asia.

3.4.2 Financing and Funding²¹

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

²¹ World Bank (2011). China - Global Environment Facility (GEF) Guangdong Green Freight Demonstration Project: Project Appraisal Document and Project Information Document.

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 a pre-project report estimating per-vehicle benefits of 7 to 26 percent from efficient technology and 10 percent from improved logistics efficiency.²² One question is how much the benefits of efficient technology are realised in practice and how much they scale up. Initially, 1,200 vehicles were projected to participate in the technology demonstration; this number was exceeded with 1,345 participating trucks as of November 2015. Early evaluations suggested a 5-6 percent efficiency gain due to technologies.²³ Another question is the outcome of the logistics demonstration projects. 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, and post-project results are not yet available.

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 and its funding structure seem like a very cost-effective and appropriate use of climate finance. If adoption is not scaled up, the relative impact will be small.

For future green freight projects, this case study suggests that there may be situations in which elements of the private sector (possibly with support from climate finance loans or small grants to cover perceived risks) are able to finance up-front capital costs of technology, based on repayment from vehicle owners/operators through fuel savings. Logical roles for climate finance grants include education, cooperation on developing institutional arrangements, and evaluation to measure the effectiveness of the technology and track adoption over time.

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

3.5.1 Case Study 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 programme 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,

²² Project Appraisal Document, GEF, Annex 7, GEF Incremental Cost Analysis

²³ Results framework, GEF Guangdong Green Freight Demonstration Project, <http://www.worldbank.org/projects/P119654/gef-guangdong-green-freight-demonstration-project?lang=en>

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



Source: EcoParq Website, <http://www.ecoparq.df.gob.mx/>, Publímetro, <http://www.publimetro.com.mx/>

3.5.2 Financing and Funding and Finance²⁴

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 and improvement of public space in the neighbourhood. The use of these funds is determined by the Committee on Transparency and Accountability comprised of neighbourhood 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. The revenue collection appeared to be on track to exceed USD 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.

3.5.3 Greenhouse Gas Benefits

Greenhouse gas emission reductions from ecoParq 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.

• ²⁴ EcoParq website, including general resources and annual revenue reports. <http://www.ecoparq.df.gob.mx/>; Impacts of the ecoParq Programme on Polanco, ITDP. <https://www.itdp.org/impacts-of-the-ecoparq-programme-on-polanco/>

3.5.4 Conclusions

The major benefit of ecoParq has been in regularisation of parking in Polanco, due to which there was greater availability of parking spaces for residents and visitors. Occupancy rates of parking spaces, which used to be 30 percent above capacity before ecoParq 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 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 realise revenue.

This project is especially noteworthy for not using climate finance, but rather for being entirely self-financed through revenue from user fees and fines. 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.

Although climate finance was not used in this case study, the conclusions still suggest a potential role for climate finance in future city or neighbourhood-based policies such as parking management. For example, climate finance could play a role in funding start-up and demonstration costs in cities that have not tried this approach; guaranteeing a revenue stream for private operators should revenue intake fall short of what is needed to cover operating costs; or expanding the project to neighbourhoods with lower revenue potential. It should be noted that parking management can be part of a larger set of transport demand management and/or a sustainable urban transport plan, in which climate finance can play a role by providing planning support, monitoring and cofinance of measures.

3.6 Fuel Economy Policy, Chile

3.6.1 Case Study Description

This case study examines Chile's automotive fuel economy policy. Commencing in 2010, a number of international organisations, with support from the GEF and other international funds and organisations, launched a new global initiative – the Global Fuel Economy Initiative (GFEI). This initiative combined expertise and resources from all four partners for a comprehensive programme 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 analysed 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 labelling 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 Fehler! Verweisquelle konnte nicht gefunden werden.3.5).



Figure 3.5: National Fuel Economy Label - Chilean Ministry of Energy

Source: <http://www.consumovehicular.cl>

In September 2014, the Government of Chile implemented a tax on new, light and medium duty vehicles based on fuel economy performance (km/L) and emissions of nitrogen oxides (g NO_x/km).²⁵ 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 Financing and Funding²⁶

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 Programme (UNEP), the U.S. Environmental Protection Agency (EPA), the FIA Foundation, and various contributions from the private sector comprised the bulk

²⁵ 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>

²⁶ GEF (2012), Project Identification Form: Stabilizing GHG Emissions from Road Transport Through Doubling of Global Vehicle Fuel Economy: Regional Implementation of the Global Fuel Efficiency Initiative (GFEI); and information obtained from experts contacted (see Annex 1).

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.

The costs of Chile’s vehicle labelling programme 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 NO_x emissions will be paid by consumers. Regarding ongoing and implementation costs for Chile’s vehicle labeling programme, the Chilean Transport Ministry has supported a vehicle testing programme since the early 1990s. Therefore minimal additional government resources were required to implement the vehicle labelling requirements. The labelling and associated tasks were passed on to the vehicle import and retail industry.

3.6.3 Greenhouse Gas Benefits

In Chile, it was previously estimated that the labelling and feebate policy measures 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.²⁷ However, the feebate will likely not be adopted, and no data are available to verify whether any emission reductions have been achieved from the labelling 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 fuel efficiency and NO_x 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 labelling system or tax system alone have not been estimated. Even if the benefits projected from the feebate system are not realised, the costs associated with setting the adopted fuel economy labeling and tax policies (including the GFEI grant of USD 180,000) 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 programme resources for testing and vehicle importers and retailers for labelling.

Policy-setting is potentially a very cost-effective use of climate finance. 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.

²⁷ UNEP - <http://www.unep.org/climatechange/ClimateChangeConferences/COP18/Booklet/CLEANERCARSWITHTHEGLOBALFUELECONOMYINITIATI.aspx>

In addition, fuel economy standards can be part of a broader package of measures to promote more efficient technology. Climate finance can be used to provide loans for vehicles applying cleaner technology (see section 3.2), e.g. through a revolving fund as proposed in Malaysia for electric motorcycles²⁸.

²⁸ <http://www.nrc.gov.my/sites/lecnrc/Documents/Final-Report/App5.1.pdf>

4 Summary of Findings and Implications for Climate Finance

This section provides a summary of the case study findings by type of measure (infrastructure, clean vehicles, and planning/policy), as well as an assessment to barriers to the success of climate finance and success factors observed in the case studies. It concludes with a proposed focus for climate finance to overcome the barriers and build on success factors.

4.1 Findings by Type of Measure

Table 4.1 summarises the six case studies, including the strategy type (avoid, shift, and/or improve), type of project or programme (infrastructure, vehicle technology, or policy), total cost of the project, amount contributed by international finance sources and whether this was a loan or grant, (potential) 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.

4.1.1 Infrastructure Projects

“Sustainable” infrastructure projects often include providing infrastructure for BRT systems, other forms of public transport (metro, light rail, etc.), non-motorised transport, rail and infrastructure for freight distribution. Providing this infrastructure helps stimulate modal shift and/or reduce the growth in automobile travel. Public transport, however, requires substantial capital investments and often have significant operating costs.

The infrastructure case studies examined here, the Lanzhou BRT and the Colombia NUTP (although the scope of the latter is wider than infrastructure), had the following characteristics:

- The international finance contribution (not specifically climate finance) was almost entirely in the form of loans. The loans that were provided cover a large portion of the costs of building the infrastructure. These loans have to be repaid. Simply providing a transfer payment or grant is not an option for covering the capital costs of larger infrastructure project.
- In both the case studies, the loans were provided on attractive terms, with below-market interest rates and extended payback periods. Such attractive terms and conditions make these loans more attractive than loans from the private sector on commercial terms. This is important as it reduces the interest payments that have to be made during the life of the project, increasing the likelihood of success of the project. Thus, providing loans on attractive terms is a good way to get projects off the ground that would otherwise not get off the ground (as was the case with the Lanzhou BRT system). Loans on attractive terms can also help to attract private sector funding by reducing risks, depending on how the project is structured, faced by private sector investors.
- In the case of both the Lanzhou BRT and projects carried out under the Colombian NUTP, the fare revenues have not been sufficient to even fully cover the operating costs of these systems. The loans, even though they are on very attractive terms, must be repaid. In the case of Lanzhou, the difference is covered by the Guansu provincial government. And, to some extent, the operator of the Lanzhou BRT uses land sales and development to cover some of the operating costs. In the case of the Colombian NUTP, the deficit is covered by local governments who receive payments from the national government from revenues collected using a fuel tax. What is also important for the continued and successful operation of infrastructure, once it has been built, is that funding to cover

payments on the capital costs, and the deficit in operational costs, is guaranteed. In the case of the Colombian NUTP, future funding is guaranteed because when the project is approved, these future payments have to be approved by the National Fiscal Policy Council as part of the approval process of a project under the NUTP.

- 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 Colombia, this policy direction existed already 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 realised, such as mobility, safety, and air quality.
- Capacity-building has been an important component of both 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 Colombia's NUTP. In the case of the Lanzhou BRT, without the active involvement of the ADB, the Lanzhou transport master plan would not have been revised to include the BRT and NMT components. The Colombian NUTP is an excellent example of how dedicated efforts to build capacity, at all levels of government and in the private sector, can result in successful infrastructure projects. Given the efforts of the Colombian government to build capacity, the quality of project preparation under the NUTP programme has increased to the point that when the Colombian government approaches MDBs for loans to finance NUTP projects, the loan approval procedure is usually fast tracked.
- Financing using existing carbon finance mechanisms such as the CDM (a subset of the broader range of climate finance options) are not very attractive because the revenue that can be generated is relatively small compared to the cost and effort involved in monitoring, verifying and reporting GHG reductions, something that is required under the CDM. In the case of the Lanzhou BRT, even though the ADB succeeded in convincing the BRT operator to register the Lanzhou BRT as a CDM project, they were unwilling to proceed to the next phase of MRV process. In fact, the only way the operator was persuaded to move to this phase was by arranging a pre-payment that would cover the costs of going through this process.

Table 4.1 Summary of Case Study Project Costs and Benefits

Project/Programme Name	Strategy (Avoid, Shift, Improve)	Project/Programme Type	Total Cost (USD millions)	International Finance (USD millions)	Revenue Sources	GHG Reduction (tCO ₂ e/a) ¹	GHG Methods/ Assumptions	Other Benefits ²	Role of Climate Finance
Lanzhou, Sustainable Urban Transport Project	S, I	Infrastructure	480 ³	150 (loan)	Fares, land value capture, other?	14,000	CDM estimate	Mobility, Air Quality, Safety	Leverage inclusion of sustainable project elements (BRT, NMT)
Colombia, National Public Transport Programme ⁴	S, I	Infrastructure	349 (+ 30-60% local contribution)	292 (loan) 0.7 (grant)	Fuel taxes, fares, other local and national government funds	220,000	CTF-based estimates: 2 project-specific estimates + 2 estimates extrapolated from other cities	Mobility, Air Quality, Safety	Leverage sustainable transport investment (BRT, NMT) across multiple urban areas; capacity-building
Manila, E-Trikes	I	Vehicle Technology	504	400 (loan) 5 (grant)	Payback on vehicle lease	11,100	CDM estimate (2,000 e-trikes)	Air Pollution	Up-front financing and testing and implementation of new technology
Guangdong, Green Trucks Project	S, I	Vehicle Technology	14	4.2 (grant)	Vehicle owner/ operator payments, local government funds	3,800	For projected participation of 1,345 trucks, does not include benefits of broader technology adoption	Air Pollution	Up-front financing and testing and implementation of new technology
Mexico City, EcoParq On-street Parking Management Project	A, S, I	Policy	9 (capital) + 4.5 (annual operating)	0	Parking fees	18,000	ITDP estimate, based on cruising impacts only, does not consider trip changes	Congestion, Air Pollution	None (project done without climate finance)
Chile - Fuel Economy Labelling and Feebate	I	Policy	0.18 (int'l only)	0.18 (grant)	National government funds	430,000	Ex-ante estimate for feebate system, based on target emissions level	N/A	National policy development

¹Round figure based on 2015 or nearest available year. ²Only documented benefits are listed. Other benefits may have been realised 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 Clean Technology Measures

Advanced technologies for improving fuel efficiency of vehicles or reducing emissions are often more expensive than conventional technologies that are already in the market. While over the life of the technology, the investment may more than pay itself back, consumers or manufacturers are still reluctant to invest in these technologies because they lack experience with the performance of these technologies, or may not have the initial capital required to invest in the technologies.

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 demonstration case studies, the Guangdong Green Freight and the Philippines e-Trikes, suggest the following:

- Both case studies introduced new technology into the market, in the case of the Guangdong case study, these were technologies that had already been developed and used elsewhere, such as in the US. In the case of the Philippines e-trikes project, the technology was not new, but its application to power e-trikes was. In both cases, the full scale project was preceded by a pilot programme that provided valuable information. For the Guangdong project, the pilot suggested focusing on a limited number of technologies that were most relevant for conditions found in China. In the case of the e-trikes, they yielded design improvements. These pilots are important for the eventual success of the larger project as it allows a new technology to be tailored to the local conditions in another country and market than where the technology was originally developed and used.
- In both cases, private participation was an important part of the project. In the case of the Guangdong project, the trucking companies invested in the new fuel efficiency improving technologies. The funding was used to make the investment in these new technologies comparable to the investment that would be required in conventional technologies. In the case of the Philippines, the e-trike drivers were given loans, on attractive terms, that would have to be paid back. The incentive for e-trike drivers to participate in this project was the reduction in fuel costs and the larger capacity of the e-trike (compared to the traditional trikes) which allowed them to increase their earnings sufficiently to repay the loan over a five-year period. Thus, one general conclusion that can be put forward is that when climate funds are being used to fund technology demonstration projects, the involvement of the eventual users of the technology in the project is important.
- Technologies can facilitate 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 immobilised remotely, helping to prevent theft.
- Clean vehicle technology projects can provide other important benefits, such as air quality, energy security, and reduced transport costs. However, the projects are not expected to realise large mobility or safety benefits similar to infrastructure projects and services.

4.1.3 Policy and Planning Measures

Typically, policy and planning activities cost less than an infrastructure project, and if they yield successful results can be an attractive way to stimulate/bring about change towards a more sustainable transport

sector. Two very different policy projects were evaluated here – the nationwide fuel economy initiative in Chile, and a pilot parking pricing and management project in Mexico. The fuel economy initiative has the potential to save consumers money, 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 programme design can help encourage countries with limited budgets and expertise, but – as demonstrated in Chile – policymakers must be willing to adopt the programme 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, programme revenues could cover the costs, but this will not be true in every situation.

4.2 Barriers to financing sustainable transport projects

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 dries 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 can come from many different sources: an insufficiently large market, high risk, uncertainty about the performance, or a price tag that the market cannot bear. In the Guangdong Green Freight project, the Colombia BRT system, the e-trikes case, and the ecoParq project the involvement of the private sector was important in the success of the project, suggesting that the willingness of the private sector is one way to judge the commercial viability of a project.
- 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 reasonable²⁹ 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 not 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.

4.3 Success Factors

The case studies suggest the following factors can support programme and project design and implementation:

- Grants and loans can be made contingent upon **local adoption and implementation of sustainable policies and programmes**. 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 programmes should be working towards the same objectives. As suggested by Sayeg et al. (2015), climate finance can also be used to help building high-quality project pipelines.
- 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 can often far outweigh 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

²⁹ 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.

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.

4.4 A Proposed Focus for climate finance

A proposed focus for climate finance to overcome barriers and building on the identified success factors is shown in Figure 4.1. This focus includes five key strategies: capacity-building, enabling policy environments, removing barriers to investment, catalysing investments, and facilitating and financing demonstration projects. Note that it *does not* include fully financing projects – which would overwhelm the capacity of available climate finance and divert from the other activities which have much greater leveraging power.

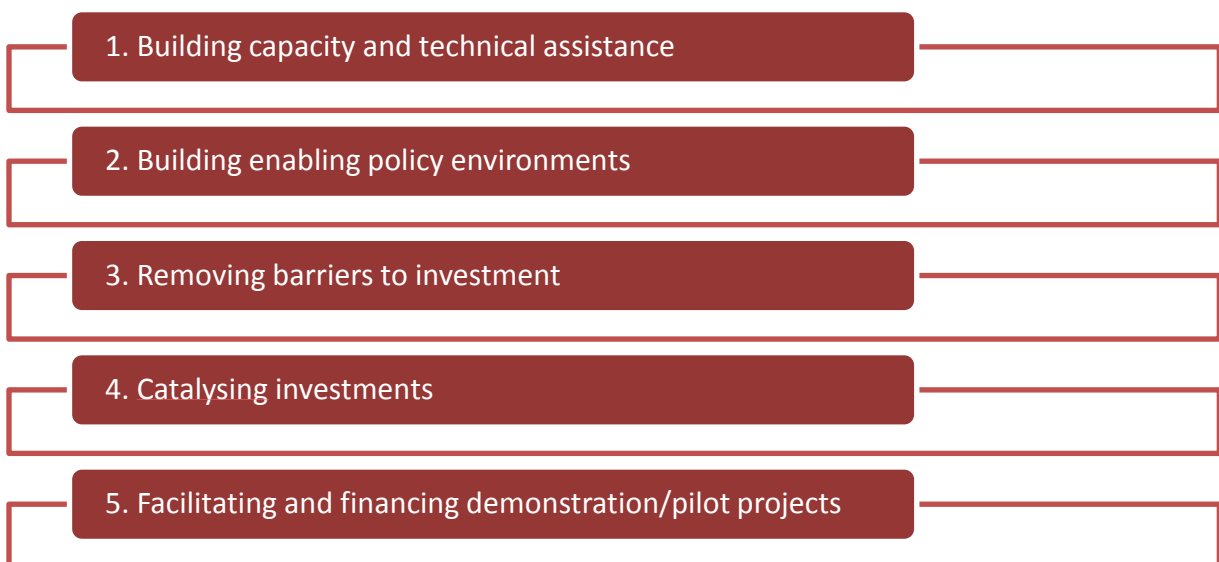


Figure 4.1: A Proposed Focus for climate finance

Considering different types of projects or measures:

- 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 measures**, cost-effective technologies should be able to pay for themselves over time, with primarily loans needed to overcome up-front cost barriers. Grants can cover incremental costs if technologies are not (yet) cost-effective, but the expected cost-effectiveness of the technology should be carefully considered. Pilots can help introduce new technology. Attention should be paid in programme 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 and plan 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 and plan implementation as well as monitoring and enforcement to ensure the policy continues to be carried out.

In addition to leveraging existing sources of capital, financiers 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 for certain types of investments.

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Annex 1: Detailed Case Studies

The objective of these case studies is to develop more generalisable 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.

5.1 Lanzhou Sustainable Urban Transport Project

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

- ADB (2009). Proposed Loan: People's Republic of China: Lanzhou Sustainable Urban Transport Project. Financial Analysis, Report and Recommendation of the President, to the Board of Directors, <http://www.adb.org/sites/default/files/projdocs/2009/40625-PRC-RRP.pdf>.
- ADB (2010). Loan Agreement for Lanzhou Sustainable Urban Transport Project between People's Republic of China and Asian Development Bank Dated 30 March 2010, <http://www.adb.org/sites/default/files/projdocs/2010/40625-PRC-LBJ.pdf>.

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.

5.1.1 Description

5.1.1.1

The Sustainable Urban Transport Project is for Lanzhou, 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,³⁰ and is guided by the ADB's Sustainable Transport Initiative. By providing policy guidance and entering into a dialogue with the Lanzhou municipal government (LMG) for developing its master plan for establishing a sustainable urban transport system in the city, ADB was able to bring about the revision of the master plan to include the development of the BRT system, which is an integral element of the LMG master plan.

This project included:

- Construction and reconstruction of 33.8 km of urban roads including roads for the BRT system, and facilities for NMT;
- Advanced traffic management technologies and systems, including an advanced traffic signal control system, travel demand management strategy, and a plan for the development of NMT;
- An 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 were dedicated bus rapid transit lanes with 22 stations. Since 2012, 9 km of the BRT have been operational³¹. Figure 5.1 shows the project location, BRT route alignment, and location of stations along the route. The NMT 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 safe pedestrian access to the BRT stations. Table 5.1.1 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.

³⁰ "Bus Rapid Transit Project to Cut Greenhouse Gas Emissions in PRC," <http://www.adb.org/news/bus-rapid-transit-project-cut-greenhouse-gas-emissions-prc>

³¹ ADB Knowledge Showcases, "Lanzhou's Bus Rapid Transit System Brings Quick Relief to Busy City," <http://www.adb.org/sites/default/files/pub/2014/lanzhou-bus-rapid-transit-system.pdf>

Table 5.1.1: Lanzhou BRT Operating Parameters

Operating Parameters	Value
Daily System-wide Passenger Trips	290,000 trips ³²
Fares	
Median Cash Fare	1 Yuan (USD 0.14)
Median Smart Card Fare	0.85 Yuan (USD 0.12)
Fleet of BRT Buses	70 (fifty 12-meter and twenty 18- meter buses)
Average Bus Occupancy	75%
Seats in 12-meter buses	30
Seats in 18-meter buses	42
BRT Vehicle Fuel	CNG

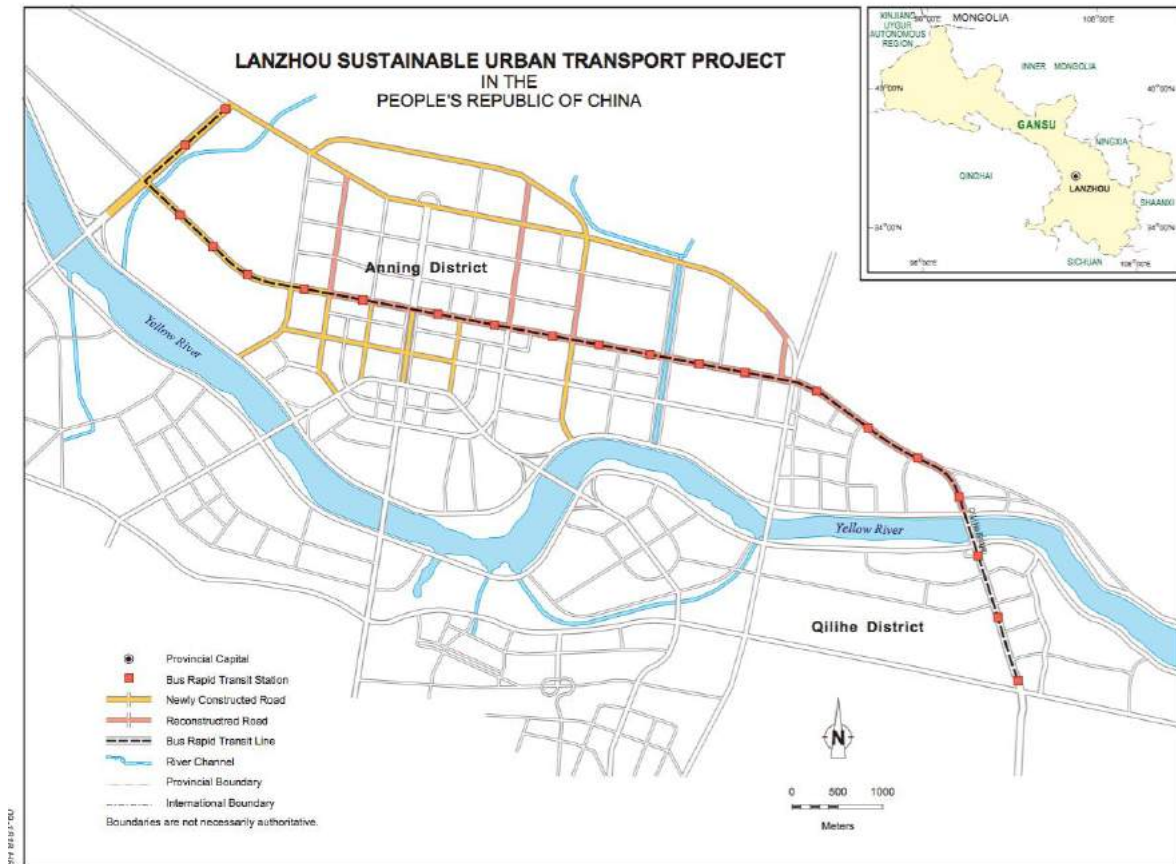
Source: Lanzhou BRT Quantitative Parameters, <http://www.chinabrt.org/en/cities/lanzhou.aspx>

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

The LMG established the Lanzhou Public Transport Group (LPTG) for operating public buses. LPTG owned 2,089 buses in the year 2009 and operated along 92 routes. Prior to the creation of the LPTG, there were also about 99 minibuses run by individual operators without any fixed schedules or fixed stopping points. The LMG acquired the individual bus companies and consolidated them into the LPTG. Doing so eliminated competition for passengers and revenue from competing services and allowed a more rational route network and schedules to be developed. Figure 5.1.1 shows a map of the project and Figure 5.1.2 shows pictures of the BRT corridor, a stations, the underground pedestrian accessways, and the bicycle sharing system.

³² Average daily ridership 24-28 September 2013, not including transfers

Figure 5.1.1: Lanzhou Sustainable Urban Transport Project Map



Source: ADB (2009)

Figure 5.1.2: Images of Lanzhou BRT Elements



Source: ITDP China, <https://www.transportphoto.net/co.aspx?coid=Lanzhou>

Clockwise from top left: Lanzhou West BRT station, aerial view of the BRT corridor, bike sharing station, underground BRT access and signage

5.1.2 Financing and Funding

5.1.2.1 Project Financing Structure

According to the ADB loan agreement documents and interviews conducted with project experts, the total project cost was USD 480.3 million. Originally, the ADB and the Bank of China were going to provide loans to cover the costs of this project. The Bank of China, however, withdrew from the project for reasons that we were not able to determine. The Bank of Lanzhou stepped in to replace the Bank of China in this project and provided a loan USD 100 million, with the LMG providing another USD 230.3 million (as shown in Figure 5.1.3), and the ADB providing the remaining USD 150 million. The Bank of Lanzhou is a loan at commercial rates (6.6 percent) with a five-year payback period. The ADB loan has significantly more favorable conditions; it is a 25-year term and includes a grace period of five years; the interest rate for this loan (2.53 percent) is based on the ADB's London Interbank Offered Rate (LIBOR) – this is the rate at which banks lend money to each other, and it is not realistically possible to borrow money at a lower interest rate than the LIBOR rate. ADB's loan also includes a commitment charge of 0.15 percent per annum.³³ We were unable to determine the terms and conditions for the contribution of

³³ A commitment charge is a fee levied by the lender on a borrower over the unused portion of the loan. The purpose of this commitment fee is for the borrower to express their commitment to using the loan, and in return the lender keeps available the funds at the agreed upon times.

the Lanzhou Municipal Government. A flow chart showing the financing partners and financial flows indicating the project implementation and organisation structure is shown in Figure 5.1.4.

5.1.2.2 Project Risk Management

ADB identified risks that could affect the implementation or economic viability of the project, which can affect the ability to realise benefits. They also identified actions that can mitigate these risks. Table 5.1.2 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 5.1.2: Risks and Mitigation Measures

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

Source: ADB (2009)

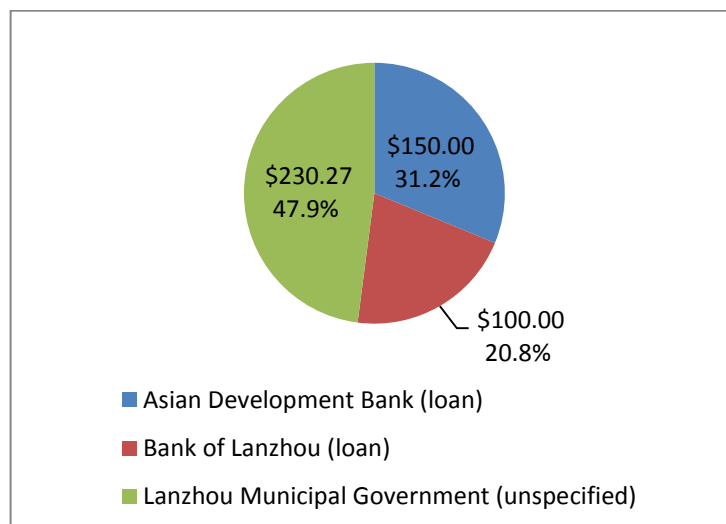


Figure 5.1.3: Project Funding Sources (millions of USD)

Source: ADB (2010)

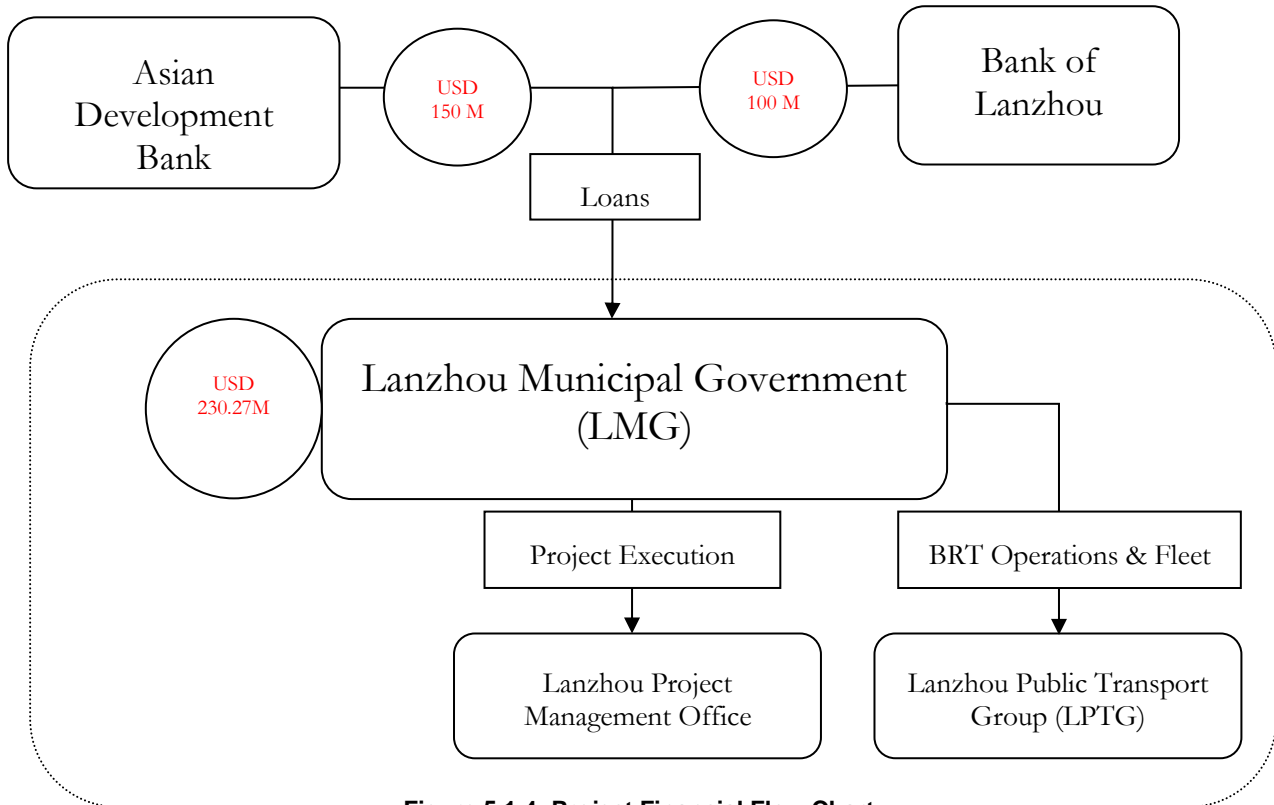


Figure 5.1.4: Project Financial Flow Chart

Source: Authors, based on ADB (2009; 2010)

5.1.2.3 Source of Financing

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 5.1.3). 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 the settlement costs for the loan, the financing (interest payments), and commitment charges during project implementation.

Table 5.1.3: Cost Estimates by Financier (millions of US dollars)

		Total Cost	Financing Plan					
			ADB	%	BOL	%	LMG	%
A.	Base Cost							
1	Civil Works Components	96.44	63.38	65.7	26.17	27.2	6.89	7.1
	a. New Roads							

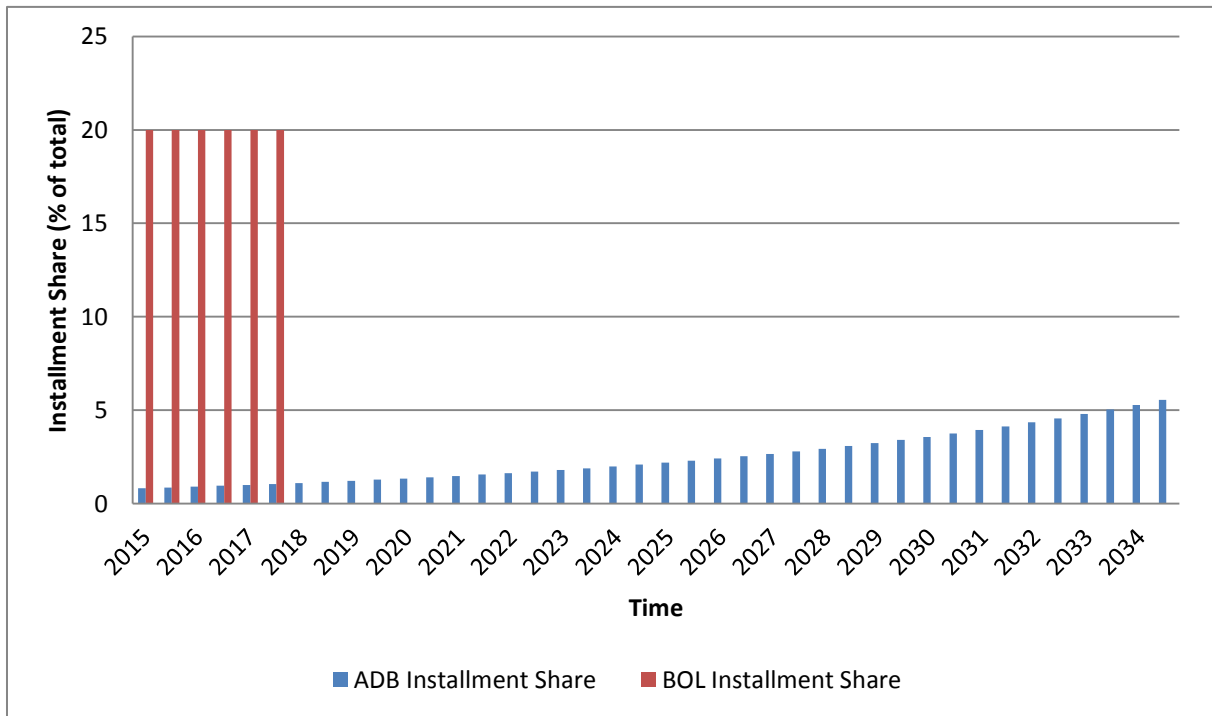
	b. Reconstructed Roads	55.22	55.22	100	0	0	0	0
2	Equipment							
	a. BRT Station and Onboard Equipment	11.1	11.1	100	0	0	0	0
	b. Advanced Traffic Control System	18.18	18.18	100	0	0	0	0
	c. Environment monitoring system	0.74	0.74	100	0	0	0	0
	d. Utility equipment	28.25	0	0	28.25	100	0	0
3	Consulting Services							
	a. Design supervision and monitoring	12.93	0	0	9.83	76	3.1	24
	b. Technical Advisory Services	1	1	100	0	0	0	0
4	Capacity Building	0.5	0.38	76	0	0	0.12	24
5	Taxes and Duties	21.42	0	0	16.76	78.2	4.66	21.8
6	Resettlement and Compensation	138.32	0	0	121.93	88.2	16.39	11.8
7	Project Administration	0.47	0	0	0	0	0.47	100
	Subtotal (A)	384.57	150	39	195.99	51	38.58	10
	B. Contingencies							
	1. Physical Contingency	34.82	0	0	34.82	100	0	0
	2. Price Contingency	11.44	0	0	9.5	83	1.94	16.9
	Subtotal (B)	46.26	0	0	44.32	95.8	1.94	4.2

Source: ADB (2009)

5.1.2.4 Loan Repayment Terms

ADB's loan can be repaid over 20 years plus a five-year grace period. Payment installments 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 5.1.5. This is a favorable manner of structuring the payments for loans made for financing infrastructure projects because the expectation is that revenues will increase over time. In the case of a BRT system with phased construction and installment of feeder/supporting transit systems, it takes some time before ridership reaches its full potential. On the other hand, the Bank of Lanzhou's loan was a commercial loan with a payback period of five years from the completion of the project and initiation of operations.

Figure 5.1.5: Loan Repayment Schedule – ADB and BOL

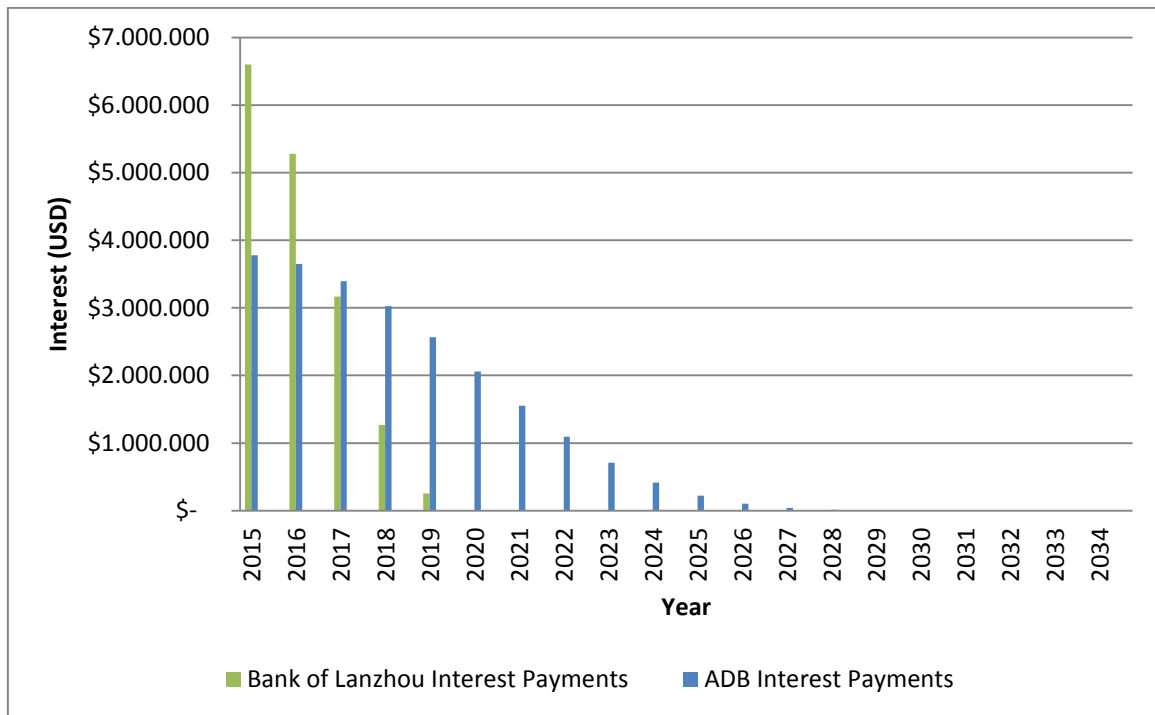


Source: ADB (2010)

The ADB loan for the Lanzhou Sustainable Urban Transport Project was made to the government of the People’s Republic of China with the understanding that the Government of the PRC will provide a loan to the Gansu Provincial Government (GPG) for exactly the same amount as the ADB loan to the government of the PRC, under exactly the same terms and conditions. The ADB made the loan to the Government of the PRC, and not the LMG or the GPG, because in order to make the loan available at such a low interest rate, sovereign guarantees were required, and only the government of the PRC can provide such guarantees. The LMG is responsible for bearing the risks from fluctuations in the interest rate and currency exchange rates. As seen in Figure 5.1.6, due to the large share of principal and interest rate payments on the Bank of Lanzhou share of the loan, total loan payments are higher in the initial years.³⁴

³⁴ Interest payments starting from 2015 post construction completion were considered. No clear information is available on interest payments for BOC during construction phases.

Figure 5.1.6: Interest Payments – ADB and BOL



Source: CS analysis based on data from ADB (2010)

We also compared the total interest charges accumulated at the end of the loan repayment period for two scenarios. In the first scenario, the existing share of loan arrangements between ADB and BOL is included; in the second scenario, the project is completely financed by a BOL loan and there is no ADB loan. In Scenario 2, the only BOL loan scenario, the total interest payments are higher by USD 2.2 million (see Figure 5.1.7). In addition to lower interest payments, the ADB loan also provides LMG with greater flexibility in paying back the loan. This flexibility would be very valuable if, for example, ridership and revenues did not increase as quickly as forecast. The down side, however, of the ADB loan is that interest payments have to be paid every six months instead of annually.

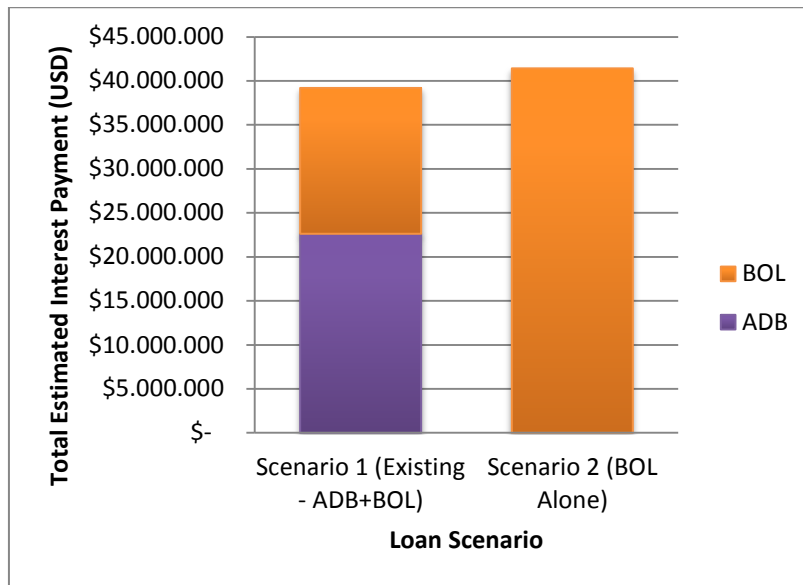


Figure 5.1.7: Interest Payment Scenarios

Source: CS based on data from ADB (2010)

5.1.2.5 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 operating losses of its other divisions post 2013 (ADB, 2009). However, ADB’s financial and project analysis reports (completed prior to the project) had assumed that the entire project (not just the BRT part of the project) for which the loan was made would not not earn any direct revenues. We were also not able to establish whether the conclusions of this audit regarding the revenues from BRT operations offsetting the operating of other LPTG divisions took into consideration the revenues from land sales and leases. The loan repayments were intended to be covered by the annual budget of the LMG, while the resources needed to cover the operational and maintenance (O&M) costs of the project were to be covered by the LMG’s annual operating budget. Based on the information that was available, it is not possible to determine how LMG manages revenue and cost flows, or whether and to what extent revenue streams from this BRT pay for the O&M costs of the BRT network, or for the other roads and facilities making up this project. Thus, it is not possible to say to what extent the revenues (fare box) from the BRT operation cover the operational and maintenance costs of the BRT system.

Assuming a periodic roadway maintenance cycle of seven years, annual maintenance costs increase from \$2.5 million in 2014 to \$2.7 million in 2019. The bulk of these maintenance costs are for the road network and not for the BRT route. We were unable to establish the operating costs for the bus fleet running on the BRT network - LPTG is responsible for operating buses on the BRT corridor, and they were unable to provide a breakdown of operating expense details for only the BRT system.

Table 5.1.4 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 5.1.4: Project Capital, Operating, and Maintenance Costs (millions of U.S. dollars)

Year	Capital Costs	Periodic Maintenance Costs	Annual Operating & Maintenance Costs	Total Costs
2009	17.4	0.0	2.6	20.0

2010	112.1	0.0	15.5	127.6
2011	105.2	0.0	23.3	128.5
2012	67.8	0.0	28.4	96.2
2013	30.9	0.0	29.6	60.5
2014	12.0	0.0	32.7	44.7
2015	0.0	0.0	34.1	34.1
2016	0.0	0.0	35.5	35.5
2017	0.0	0.0	36.9	36.9
2018	0.0	0.0	38.5	38.5
2019	0.0	0.0	40.1	40.1
2020	0.0	54.5	41.8	96.3
2021	0.0	0.0	43.5	43.5
2022	0.0	0.0	45.3	45.3
2023	0.0	0.0	47.2	47.2
2024	0.0	0.0	49.2	49.2
2025	0.0	0.0	51.3	51.3
2026	0.0	0.0	53.4	53.4
2027	0.0	54.5	55.7	110.2
2028	0.0	0.0	58.0	58.0
2029	0.0	0.0	60.5	60.5
2030	0.0	0.0	63.0	63.0
2031	0.0	0.0	65.7	65.7
2032	0.0	0.0	68.5	68.5
2033	0.0	-115.2	71.4	-43.8

Source: ADB (2009). Costs are in 2009 USD. Negative values in year 2033 are not explained in the source document.

5.1.2.6 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. Using the most recent ridership estimates³⁵ we calculated annual revenues from fare collection to be between USD 13 to 15 million for the time period 2013-2020 (the seven-year period measured for CDM evaluation), or USD 97 million for the entire seven years, providing additional fare revenue of USD 16.6 million compared to an initial estimate of USD 80 million over this period, as shown in Table 5.1.5. Studies on pedestrian volume and peak hour passenger volume surveys conducted at various stations also show a steady increase.

³⁵ 290,000 daily riders in September 2013, annualised with a factor of 300.

Table 5.1.5: Revised Ridership and Revenue Estimations

Year	Ex-ante Estimate		Revised Estimate	
	BRT Passengers	Ex-ante Fare Revenue Estimate	BRT Passengers	Revised Fare Revenue Estimate
2013	65,517,500	\$ 9,827,625	87,000,000	\$ 13,050,000
2014	67,452,000	\$ 10,117,800	88,740,000	\$ 13,311,000
2015	72,014,500	\$ 10,802,175	90,514,800	\$ 13,577,220
2016	76,540,500	\$ 11,481,075	92,325,096	\$ 13,848,764
2017	80,665,000	\$ 12,099,750	94,171,598	\$ 14,125,740
2018	84,789,500	\$ 12,718,425	96,055,030	\$ 14,408,254
2019	88,914,000	\$ 13,337,100	97,976,130	\$ 14,696,420
7-year Total	535,893,000	\$ 80,383,950	646,782,654	\$ 97,017,398

Source: Revised estimate developed by Cambridge Systematics based on ex-ante estimate and reported 2013 ridership (Lanzhou BRT quantitative parameters, <http://www.chinabrt.org/en/cities/lanzhou.aspx>). Assumes a nominal 2% increase in ridership annually.

The revenues from fare collection compare favorably with the size of the initial investment – assuming the entire ADB loan was for the construction of the BRT system, and ignoring operation, maintenance, and interest costs, fare box revenues would equal the initial investment between 10 and 11.5 years. However, the revenues from fare collection cannot be taken to be completely accurate as LMG staff noted that the revenue of BRT cannot cover even the operational costs of the BRT system because of very low fares and the discounted fares for the elderly and students who use the BRT. Thus, it is difficult to reach a definitive conclusion regarding the financial health of the BRT system based on estimates of the fare box revenues.

5.1.2.7 Land Development and Value Capture

There are several techniques for capturing revenue from land value increases related to a transport investment such as BRT. In Lanzhou, value capture was undertaken through the lease and 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.³⁶ 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.³⁷

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.³⁸ 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).

³⁶ Capturing the Value of Transit, Report by Reconnecting America’s Center for Transit-Oriented Development, <http://www.reconnectingamerica.org/assets/Uploads/ctodvalcapture110508v2.pdf>

³⁷ The Impact of Bus Rapid Transit on Land Development: A Case Study of Beijing, China, <http://waset.org/publications/14464/the-impact-of-bus-rapid-transit-on-land-development-a-case-study-of-beijing-china>

³⁸ 2014 Sustainable Transport Award Finalist: Lanzhou, China, ITDP.

5.1.3 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 monetised in an economic analysis conducted by ADB.

5.1.3.1 Greenhouse Gas Emission Reductions

The project is the first ADB transport project to support the preparation of an application for certification under the Clean Development Mechanism (CDM) of the Kyoto Protocol. It was estimated in the proposed loan application that the project would generate about 5,000 certified emission reductions (CERs) annually, based on an initial ridership projection of 110,000 daily riders in January 2013. Using a conservative estimate of \$10 per CER, the fund was expected to pay \$0.5 million over 10 years towards meeting part of operating and maintenance costs of the BRT system. Understandably, the local operator of the BRT system was not interested in participating in the CDM process given the small contribution of the CERs.

However, after CDM registration, ADB's CDM related unit contacted the Lanzhou Bus Company, but they were not interested in getting to the monitoring stage even though they had agreed to do so earlier. Among the reasons for lack of interest were the fact that documentation requirements were too onerous and the monitoring costs outweigh the value of carbon credits. However, ADB has since managed to convince the stakeholders to proceed to the CDM monitoring stage.³⁹ This was accomplished by arranging an advance payment for the expected CER credits the project would get. This advance payment was intended to cover the costs of fulfilling the documentation requirements for obtaining CDM funds (the costs of procuring and installing the emission monitoring equipment were covered by the ADB loan).

In light of revised ridership data being available (290,000 daily as of September 2013), Table 5.1.6 shows estimated emission reductions of 107,000 tons of CO₂ over the seven-year CDM crediting period (renewable).

³⁹ 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.

Table 5.1.6: Project Emission Reductions (Tonnes of CO₂)

Year	Estimate based on Ex-Ante Ridership Projections	Revised Estimate based on 2013 Ridership
2013	11,804	15,675
2014	11,487	15,113
2015	12,273	15,425
2016	12,923	15,588
2017	13,149	15,351
2018	13,312	15,081
2019	13,396	14,762
7-year Total	88,345	106,994

Source: Lanzhou Bus Rapid Transit Project, CDM Emission Reduction Calculation and Cambridge Systematics projections based on 2013 ridership.

5.1.3.2 Monetised Benefits

Project benefits were quantified and monetised by ADB in an economic evaluation of the project. The monetised 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 CO₂. Air pollution benefits were noted but not quantified.

The value of these benefits is shown by year and compared with project costs in Table 5.1.7. 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 5.1.7: Total Costs vs. Monetised Benefits of Project

Year	Total Costs	Vehicle Operating Cost Savings	Diverted Traffic Benefits	Generated Traffic Benefits	Time Savings Benefits	Other Benefits	Total Benefits	Net Benefits
2009	20.0	0.00	0.00	0.00	0.00	0.00	0.00	-19.95
2010	127.6	0.00	0.00	0.00	0.00	0.00	0.00	-127.65
2011	128.5	0.00	0.00	0.00	0.00	0.00	0.00	-128.51
2012	96.2	0.00	0.00	0.00	0.00	0.00	0.00	-96.23
2013	60.5	0.00	0.00	0.00	0.00	0.00	0.00	-60.48
2014	44.7	31.93	2.49	1.35	5.13	11.26	52.16	7.43
2015	34.1	44.69	4.98	3.38	6.60	6.21	65.86	31.81
2016	35.5	54.82	10.42	5.86	8.06	6.48	85.64	50.17
2017	36.9	64.96	15.87	8.86	11.28	7.14	108.10	71.15
2018	38.5	75.09	21.32	9.90	14.49	7.80	128.60	90.11
2019	40.1	85.22	26.76	10.94	17.70	8.47	149.10	109.01
2020	96.3	95.36	32.21	11.99	20.92	9.13	169.60	73.33
2021	43.5	99.76	40.15	12.43	24.13	9.80	186.26	142.74
2022	45.3	104.16	48.08	12.86	32.60	10.05	207.77	162.43
2023	47.2	108.57	56.02	13.30	41.08	10.30	229.27	182.03
2024	49.2	112.97	63.96	13.74	49.55	10.56	250.78	201.56
2025	51.3	117.38	71.90	14.18	58.02	10.81	272.29	221.00
2026	53.4	121.95	80.28	14.63	66.50	11.06	294.42	240.98
2027	110.2	126.70	89.13	15.10	76.21	11.31	318.45	208.25
2028	58.0	131.63	98.46	15.58	87.34	11.56	344.57	286.53
2029	60.5	136.76	108.29	16.08	100.09	11.80	373.02	312.54
2030	63.0	142.08	118.66	16.60	114.71	12.03	404.09	341.05
2031	65.7	147.61	129.58	17.14	131.46	12.27	438.06	372.36
2032	68.5	153.35	141.09	17.70	150.66	12.50	475.30	406.82
2033	-43.8	159.31	153.20	18.27	172.66	12.74	516.19	560.00

Source: ADB (2009). Benefits expressed in 2009 US dollars.

5.1.4 Conclusions

5.1.4.1 Overall Conclusions

Some clear conclusions can be drawn from this case study. First, if it had not been for the policy guidance and dialogue initiated by the ADB, the master plan for sustainable urban transport for Lanzhou would not have been revised to include the BRT system. Second, the ADB loan was instrumental in the implementation of the BRT system, as well as the facilities and plans for developing NMT. Third, without the ADB loan, the traffic management technologies and systems and the emission monitoring systems would not have been implemented as part of the master plan. Fourth, the funding and financing package put together for the project as whole did not include any revenue streams from sources other than fare collection. Fifth and finally, the value of the benefits from participating in the CDM mechanism were too

small, despite the BRT system being much more successful in terms of ridership than what was initially forecast, to make up for transaction costs of participating in the CDM process including monitoring.

From the perspective of using climate finance for implementing projects that promote sustainable transport, it is clear that the policy guidance provided by the ADB was instrumental in getting the BRT to see the light of day in Lanzhou. The financing provided by ADB was also crucial for the implementation of the BRT system, infrastructure for walking and cycling, and advanced technologies. Thus, in the case of Lanzhou, climate finance made a project happen, and its accompanying benefits, that would otherwise not have happened.

Finally, in our view the local operator of the BRT system agreed to register and proceed to the monitoring phase of the CDM only because the ADB loan covered the costs of procuring and installing the monitoring equipment, and an advance payment partially covered the costs of operating the monitoring equipment. Without this financial assistance, the costs of complying with the MRV requirements of the CDM process, relative to the value of the benefits received from doing so, would have clearly dissuaded the local operator of the Lanzhou BRT from participating in the CDM process. Thus, if the CDM, or some similar process, is to be effective, it will have to significantly reduce the burden of compliance imposed on participants.

5.1.4.2 Success Factors

The success of the Lanzhou BRT can be attributed to three things:

- **Policy guidance and dialogue with the local government** – Without the policy guidance and discussions that led to the creation of the sustainable urban transport plan for Lanzhou, the BRT system, the advanced traffic management systems and technologies, the facilities and infrastructure for non-motorised transport would not have come into being. It was this that led to the revision of the original master plan and the creation of the Sustainable Urban Transport Project for Lanzhou. It is also clear that the ADB staff have maintained their dialogue with the LMG and LPTG even after the signing of the loan, this is evident from the fact that they were able to convince the LPTG to proceed to the monitoring phase of the CDM process, even after LPTG had shown their unwillingness to do so after the CDM registration.
- **Technical support and capacity building** – ITDP supported the LMG in designing the BRT corridor, stations, and other infrastructure and facilities along this corridor. The excellent technical design of the BRT system (for example, controlled access, protected stations) means that pedestrians can safely and easily access the BRT stations. Several elements of the project, including a strong non-motorised 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 NMT has increased the number of bicyclists and pedestrians using the BRT system.⁴⁰ Also, flexible operations management including real-time tracking of buses, response to changes in passenger demand, and signal prioritisation 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.”⁴¹ The project was also one of the four finalists for the ITDP 2014 Sustainable Transport Award.
- **Attractive financing** - The ADB financing of the BRT component at a very low interests rate (ADB – LIBOR rate) made it relatively easy to include the BRT in the SUTP for Lanzhou. Having this financing also made it easier for the LMG to undertake reforms of public transport sector in the city (for example, the creation of the LPTG, and taking over the mini-buses in the city).

⁴⁰ Lanzhou's Bus Rapid Transit System Brings Quick Relief to Busy City, ADB Knowledge Showcases, Issue 55, May 2014.

⁴¹ Lanzhou Bus Rapid Transit, ITDP

5.1.4.3 Suitability for Climate Finance

It is our view that a BRT system may be well suited to receive climate finance, particularly in the form of loans to cover capital costs as well as grants for data collection and monitoring of emissions. The reasons why we think this is the case are that:

- It is a well defined project, whose contributions to mitigation emissions can be measured;
- The benefits of a BRT system, not just in terms of mitigating emissions, but also in terms of reducing loss of travel times, reducing congestion, improving accessibility, and contributing to economic development are measurable, and may be large;
- There is a tangible revenue stream that can be used to attract commercial financing to make up for any shortfall in financing/funding from government/public sources.

However, the project must be well-designed and its benefits in terms of mobility, safety, environment, etc. should exceed its costs. An assessment of the value of the project should rely upon quality ridership forecasts to measure the expected benefits of the project, and to forecast the expected fare revenue stream to support a robust finance plan.

For future projects, this case study suggests that climate finance can be combined with other funding sources with the express provision that the project includes low-carbon strategies. In the case of capital-intensive infrastructure projects, the finance will primarily need to be in the form of loans, not grants. Climate finance should also cover the incremental cost of MRV if needed (through grants).

5.2 Colombia's National Urban Transport Programme

The following case study looks at Colombia's National Urban Transport Programme (NUTP), and explores the ways that transport policy can provide 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 international finance in this case study is not explicitly climate finance as it is not from sources specifically directed at reducing GHG emissions, but rather provided more broadly to support transportation investment. However, as the funded investments reduce GHG emissions, they could be considered candidates for climate finance. Elements of the NUTP have also received financing from climate-specific sources.⁴²

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. Documents reviewed included:

- World Bank, Project: Support to the National Urban Transit Programme Project <http://www.worldbank.org/projects/P117947/support-national-urban-transport-programme-project?lang=en&tab=overview>;
- World Bank (2010), Project Information Document (PID) Concept Stage (Report No. AB6086) and Appraisal Stage (AB6409): Support to the National Urban Transport Programme (NUTP);
- Inter-American Development Bank. Colombia Strategic Public Transportation Systems Programme (CO-L1091). https://www-cif.climateinvestmentfunds.org/sites/default/files/Colombia%20Strategic_Public_Transportation_Systems__Programme-PID.pdf
- International Bank for Reconstruction and Development (2013), Implementation Completion and Results Report (IBRD-72310 IBRD-74570 IBRD-77390);
- Republic of Colombia and International Bank for Reconstruction and Development (2013), Loan Agreement (Support to the National Urban Transit Programme Project);
- Turner et al. (2012), "Case Study: Colombia's Bus Rapid Transit (BRT) Development and Expansion." Center for Clean Air Policy, <http://www.ccap.org/docs/resources/1080/Colombia-case%20study-final.pdf>.

Experts contacted included:

- Carlosfelipe Pardo, Despacio;
- Claudia Díaz, Low Carbon Resilient Development Programme.

5.2.1 Description

Local governments are responsible for planning, regulating, and controlling traffic, and providing public transport in Colombia. Public transport in Colombian cities is, for the most part, provided by private operators. The national government supports the local governments by providing co-financing for their initiatives, under the conditions that these initiatives meet the requirements set down by the national government.

⁴² Inter-American Development Bank, Colombia Strategic Public Transportation Systems Programme (CO-L1091).

Interestingly, it was the success of Bogotá's TransMilenio BRT system that helped to build consensus and support for the need to develop a national plan for providing Integrated Mass Transit Systems (IMTS) that would replicate the example of Bogota in other parts of Colombia. In 2002, the Government of Colombia adopted the National Urban Transport Programme as a national policy to provide competitive, efficient, affordable, safe, and environmentally sustainable mobility options for the urban population (World Bank, 2010). The NUTP has two primary instruments; the IMTS for cities with a population greater than 600,000; and Strategic Public Transport Systems (SPTS) for cities with fewer than 600,000, but more than 250,000 inhabitants. For cities with a population of less than 250,000 the primary effort is on re-organising public transport and putting traffic management measures in place.

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. The aim of STPS is to bring about urban renewal, improve public spaces, put in place infrastructure that is only for public transport, manage and regulate the public transport sector, initiate fleets modernisation, rationalise route networks, optimise operations, and stimulate nonmotorised and other sustainable transport modes.

The National Policy for Urban Mobility and Transport (NPUMT) came into existence in 2003 through a series of documents prepared by the National Council of Economic and Social Policy (a cabinet level council chaired by the President of Colombia, and supported by the National Planning Department). The NPUMT includes eight specific actions, namely:

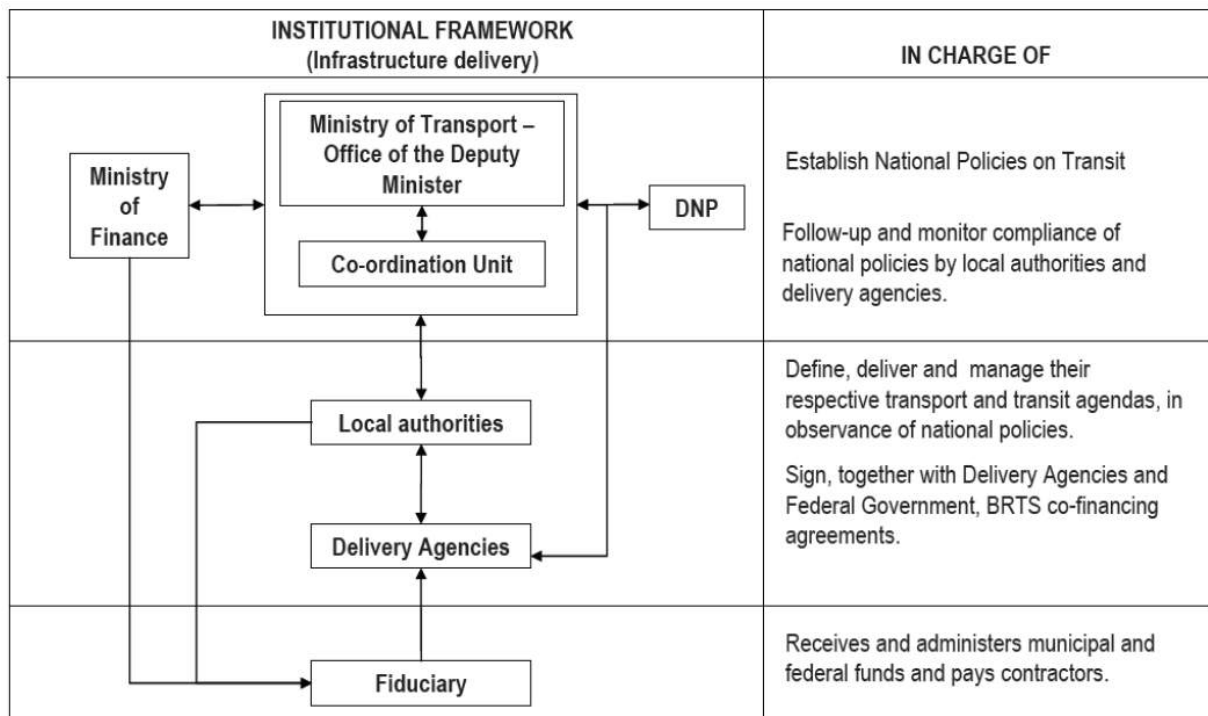
1. Strengthening institutions responsible for planning, managing, regulating and controlling urban mobility.
2. Promoting technically, economic and environmental efficient mobility solutions.
3. Seeking low cost, high impact solutions to urban transport problems.
4. Promoting the principle of efficient use of private vehicles in urban areas, through improvements in public and NMT, seeking safe, comfortable and fast trips.
5. Developing the regulatory framework to enhance private participation and assure sustainability of the mobility systems.
6. Integrating transport services fostering intermodal trips and public transport priority, according to the population and transport demand levels.
7. Developing mechanisms to support territorial and urban development and articulate transport and land use, according to the Territorial Organising Plans (Planes de Ordenamiento Territorial, which are planning instruments defined under Law 338 1997).
8. Adapting services to user needs and giving importance to the user perceptions regarding the transport systems.

Since 2004, the World Bank has supported Colombia's NUTP progress through a series of 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 Corporación Andina de Fomento (CAF) and the Inter-American Development Bank also provide funding for projects falling under the Colombian NUTP. Finally, Public Private Partnerships (PPPs) are an important part of the NUTP.

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 to local governments. 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 (more details are provided in the section on financing and funding).

To implement and manage local transport improvements, the Colombian government has developed an institutional framework just for this purpose (Figure 5.2.1). The framework shows the relationship of national authorities to local authorities, delivery agencies, and fiduciary bodies.

Figure 5.2.1: Institutional Framework for IMTS/BRT Development under NUTP in Colombia



Source: Sistemas Integrados de Transporte Masivo 2002/2010

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:

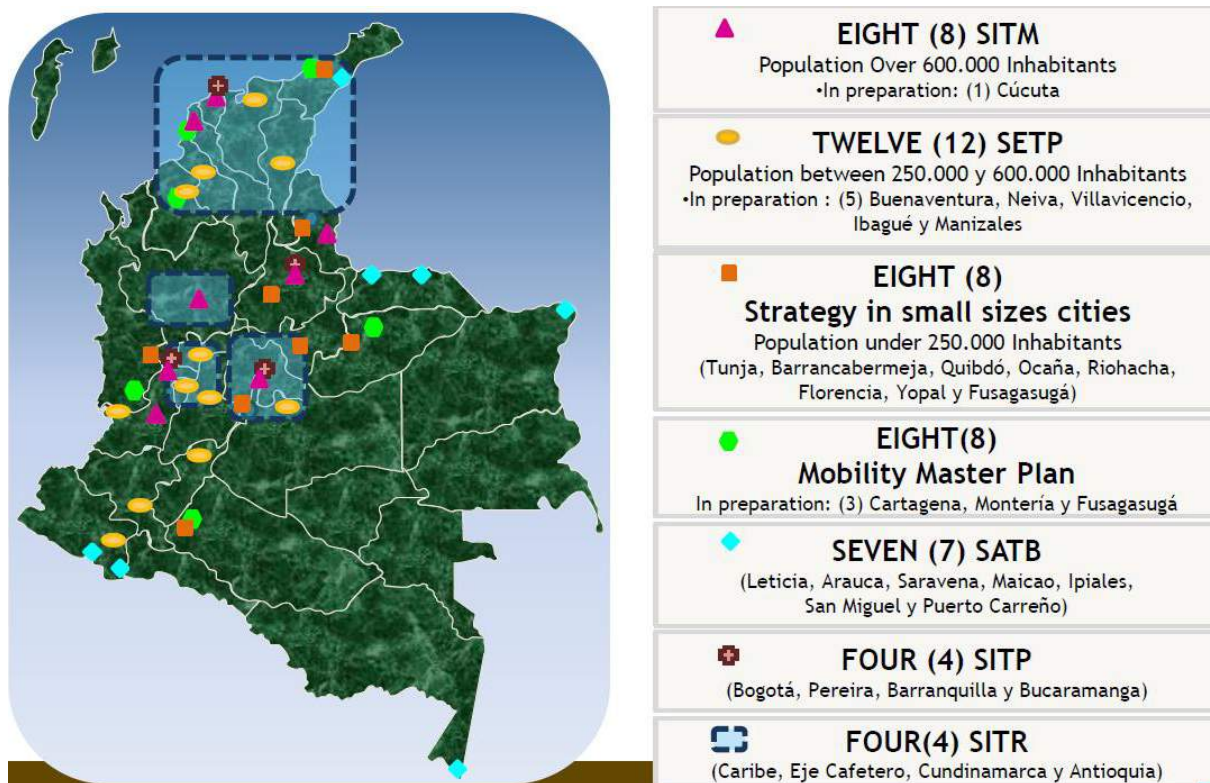
- Administration, finance, and accounting;
- Work and acquisitions;
- Social management of resettlement;
- Environmental management;
- Monitoring and evaluations.

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, and 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.

Using this framework, the Colombia national government has provided support to planning activities (project preparation and design) and funding for project infrastructure across the country (Figure 5.2.2).

Figure 5.2.2: Colombia Urban Mobility Projects Summary



Source: National Planning Department of Colombia, 2013

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 Aburra-Medellín. SPTS interventions have been planned for the following 12 medium-sized cities: Armenia, Buenaventura, Ibagué, Manizales, Montería, Neiva, Pasto, Popayan, Santa Marta, Sincelejo, Valledupar and Villavicencio.

The 2013 World Bank loan (Support to the National Urban Transport Programme 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.

5.2.2 Financing and Funding

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 mass transit systems, the bus fleet, specialised infrastructure for mass transit, and fare collection and control systems. National government co-financing can range from 40 to 70 percent of the total cost of a project. Every project requires a minimum of 10 percent of the cost of the project to come from private sources. The local government is required to provide the remaining financing needed for the project. To receive the funding, municipalities are required to create transport authorities and special purpose agencies to manage new

public transport systems. Funding is also contingent on projects that are harmonised with land use plans and that meet strict socio-economic and technical criteria.

Most capital infrastructure costs (including public transit rights-of-way 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. 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.

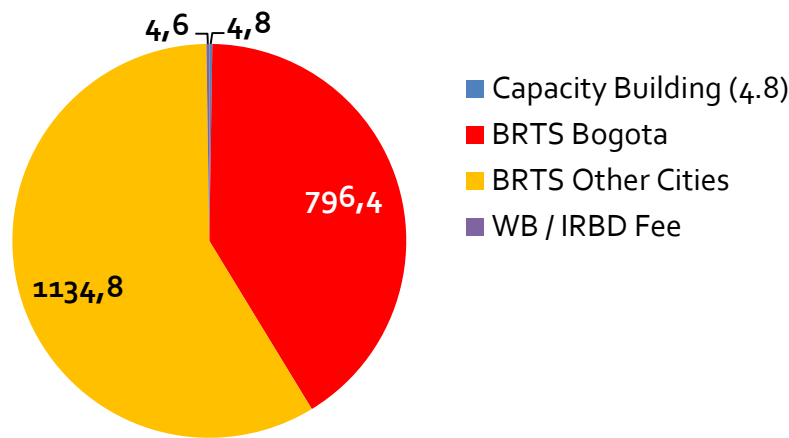
The NUTP requires that the remaining part of the total project cost, after the contribution of the national government and private sector participation, must be financed by the local government. Local governments can use revenues collected from fuel taxes to contribute up to a maximum of 30 percent of the total project cost. Local governments directly receive a 25 percent fuel surcharge that they can use towards their contribution to a project being funded/financed under the NUTP. The NUTP also includes authorisations (providing local governments with the necessary legal and regulatory authority) for developing and using economic instruments, namely congestion and pollution charges. Finally, a recent tax reform (Ley 1607 de 2012) has included an initiative to advance "green taxes."

Under the NUTP, the funding provided by the national government is in the form of a formal commitment to provide financing for an approved project. This commitment is very important as it prevents disruptions in the development/implementation of projects because of lack of funds. To ensure that the funds promised by the national government to the local government will be available in the future, these transfers have to be approved by a separate body - the National Fiscal Policy Council (CONFIS). This system formalises future budget allocations that are required to cover the national government's contributions to the programme. Municipalities participate in this arrangement through cofinancing agreements (with the national government) that promise an annual flow of programme contributions. Thus, a financial incentive is created for the municipal governments to submit their programmes to the NUTP. National support is ensured and the risk that successive governments will stop or abandon projects started by previous governments for political reasons is minimised. This is important in many countries as many projects go through the planning and approval cycles, but never see the light of day because by the time these approvals are completed, the government has changed and the new government has its own, often different ideas and priorities.

The total cost of capacity building and IMTS implemented (per 2013 estimates) has been USD 1,940.7 million⁴³, of which 100 percent was financed (Figure 5.2.3). Of the USD 1.94 billion, the Government of Colombia contributed USD 554.7 million, and Colombian municipalities contributed USD 629 million. Since 2004, the World Bank has supported Colombia's NUTP progress through three loans totaling USD 757 million. Thus, the WB's USD 757 million in loans supported a national and local investment in GHG reducing infrastructure equal to 150 percent of the loan.

⁴³ World Bank Implementation Completion and Results Report (IBRD-72310 IBRD-74570 IBRD-77390), June 2013.

Figure 5.2.3: Colombia NUTP / IMTS Costs by Component (in USD Million)



Source: World Bank (2013), Implementation Completion and Results Report.

Other Multilateral Development Banks have also actively supported the NUTP through loans. They include the following:

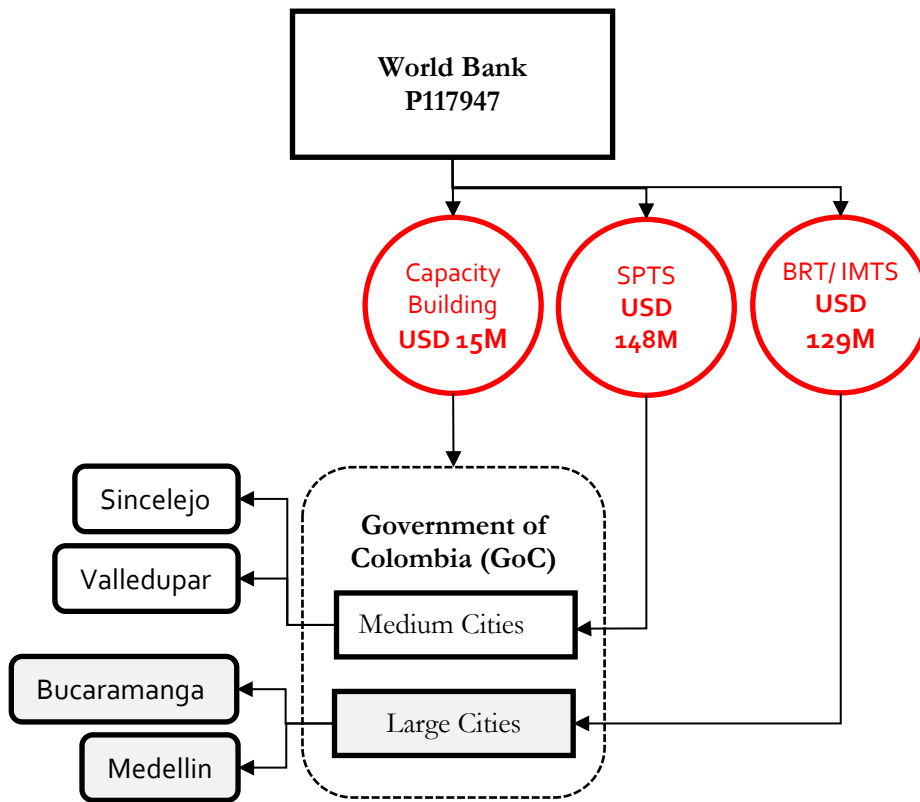
- Andean Development Corporation - CAF (USD 45 million for IMTS in Bogotá - Avenida Suba);
- IDB (USD 200 million for the IMTS in Cali);
- IDB & CTF (USD 320 million for SPTS in Armenia, Pasto, Popayan, and Santa Maria);
- IDB (USD 30 million for IMTS in Bogotá - Battery-Electric Public Transit Vehicles);

Thus, between 2002 and 2013 the NUTP transport policy has attracted approximately USD 1.352 billion in 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, Medellin-Valle de Aburrá, and Pereira.

On 28 June 2013, Colombia and the World Bank entered into a loan agreement (Project ID: P117947, Support to the National Urban Transport Programme 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 programme’s IMTS and SPTS projects (Figure 5.2.4).

Figure 5.2.4: Finance Flows for 2013 World Bank NUTP Loan



Source: CS based on World Bank (2013), Support to the National Urban Transport Programme Project.

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 analysed. 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.⁴⁴ Per the World Bank loan agreement, the total project cost was USD 407 million⁴⁵ 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.

5.2.3 Benefits

The Colombian NUTP has been effective in promoting public transport and BRT systems in Colombia. In the period since 2003, IMTS projects are operational in Bogotá (TransMilenio), Pereira-Central Western Metropolitan Area (Megabús), Cali (Metrocali-MIO), Bucaramanga – Metropolitan Area (Metrolínea), Barranquilla – Metropolitan Area (Transmetro) and Medellín – Metropolitan Area of Aburrá Valley (Metroplús). Two projects are currently under implementation: Cartagena (Transcribe) and Soacha (TransMilenio extension to an adjacent municipality to Bogotá). There is preparatory work for an IMTS project in Cúcuta – Bi-national Metropolitan Area.

For medium sized Colombian cities, the national government has authorised funding for SPTS in seven cities: Santa Marta, Pasto, Armenia, Popayán, Montería, Sincelejo and Valledupar (project infrastructure under construction). SPTS are under preparation in another four cities: Neiva, Villavicencio, Buenaventura and Manizales. Thus, clearly the NUTP has had its intended effect of stimulating and providing public transport, BRT systems.

The BRT systems carry almost 2.5 million passengers per day. For the Metro system in Medellín (27 km of urban railway, three cable-car systems, and a bus corridor) the number of passengers using mass transit is 3.3 million per day (60 percent in Bogotá – TransMilenio; 24 percent in Aburra Valley – Metro de Medellín; 11 percent in Cali – MIO; and 5 percent in other cities).

5.2.3.1 Greenhouse Gas Benefits

BRT systems, by improving the quality of public transport, can lead to a shift away from private to public transport, reduce congestion, improve travel times, and support the rationalisation and renovation of urban bus fleets. According to Colombia's Second National Communication to the UNFCCC, BRTs may contribute to the reduction of 0.8 million tons of CO₂eq per year.⁴⁶

The NUTP/IMTS programme has brought an estimated emission reduction of close to 1 million tons of CO₂ per year from transportation.⁴⁷ An evaluation of Bucaramanga's BRT system estimated a GHG emission reduction of 55,800 tonnes CO₂eq/year.⁴⁸ In Medellín the NUTP's BRT system is estimated to result in GHG reductions at 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 estimates that SPTS projects recommended for development under the NUTP will help to significantly reduce GHG emissions from transport. These reductions will result from the actions taken under the NUTP such as implementing dedicated public transportation infrastructure, reducing excess supply of public transit, replacing obsolete buses with lower-pollution technologies, optimising and coordinating route planning and operations, and supporting non-motorised modes and a

⁴⁴ P117947: Support to the National Urban Transit Programme Project - Financials

<http://www.worldbank.org/projects/P117947/support-national-urban-transport-programme-project?lang=en>

⁴⁵ Project: Support to the National Urban Transit Programme Project <http://www.worldbank.org/projects/P117947/support-national-urban-transport-programme-project?lang=en&tab=overview>

⁴⁶ Turner et al. (2012) "Case Study: Colombia's Bus Rapid Transit (BRT) Development and Expansion," Center for Clean Air Policy, <http://www.ccap.org/docs/resources/1080/Colombia-case%20study-final.pdf>

⁴⁷ Ibid.

⁴⁸ IGES CDM Project Database 2014 <http://pub.iges.or.jp/modules/envirolib/view.php?docid=968>

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 GHG emissions by 86,000 tons of CO₂eq/year, including a direct effect (conservative assessment) resulting from the replacement of the old bus system by the SPTS of 78,000 tons CO₂eq/year, and an indirect effect resulting from the expected following modal shift of 8,000 tons CO₂eq/year.

Using the above four Colombian cities (which are of similar size to the cities funded in the 2013 World Bank loan), the SPTS projects in Valledupar and Sincelejo could together yield GHG reductions of at least 40,000 tons CO₂eq/year.

5.2.3.2 Safety, Mobility, and Air Quality

While the main beneficiaries of the NUTP have been the users of public transport in cities that have taken actions and implemented projects under the NUTP, it is worth noting that even those who do not use public transport have benefited from the improvements in safety, reduced congestion and emissions.

The implementation of the IMTS and SPTS has improved mobility and air quality by reducing traffic congestion, road crashes, air pollution, and access to jobs for the urban poor. Prior to the implementation of the BRT in Bogotá, the buses used diesel fuel with more than 4,500 parts per million (ppm) of sulfur.⁴⁹ Given that there was no alternative means of public transport, these highly polluting buses were allowed to ply the city roads, adversely affecting air quality and the health of Bogotá residents. The introduction of cleaner buses, and the phasing out of these older buses, has led to significant annual reductions in the quantities of SO₂, NO_x and PM - post the implementation of the BRT system, Bogotá reported a decline of 43 percent in SO₂, 18 percent in NO_x, and 12 percent in PM levels (Turner et al., 2012).

5.2.4 Conclusions

Building on the success it has achieved so far with the NUTP, the Colombian government has earmarked USD 4.4 billion for transport sector projects focused on reducing the need to travel, increasing the share of more environmentally sustainable transport modes, and improving the energy efficiency of the transport sector (all transport modes and vehicles). In the context of climate finance, the estimated total of USD 1.644 billion in loans from the World Bank and other MDBs has supported 2.67 times that amount in national spending on projects with significant social and environmental enhancements, including GHG reductions.

Before discussing the success of the NUTP, it is worth pointing out that it was the success of the Bogotá BRT system that led to the development of the NUTP. The Bogotá BRT was the national experiment that created the desire for a national policy for urban transport and public transport. If the Bogotá BRT had not been successful, it is entirely possible that urban transport in Colombia would have developed very differently from how it has developed in the last 12 years. Consider, for example, the failure of the BRT system in Delhi, India, which is often used as an argument for not implementing BRT systems in other Indian cities. The failure of the BRT system in Delhi clearly resulted from the very poor implementation of the BRT system (no controlled access to bus stations, bus stations on centreline with no safe access for users, no grade or physical separation of the bus corridor, etc.). But most policy/decision makers who oppose the BRT do not know these reasons, they only know that the BRT failed in Delhi. By contrast the Metro system in Delhi is seen as a huge success, and now many Indian cities want to implement a metro system. While in some cases there may be sufficient demand for such high-capacity public transport systems, in most cases it is debatable whether the demand for justifying the large investments required by metro systems exists. In many cases, high-capacity BRT systems would be more than adequate, but the failure of the Delhi BRT still works against the implementation of BRT in other Indian cities. The reason

⁴⁹ Diesel fuel quality in Bogotá and Medellín is now 50 ppm and this was set countrywide by January 1st 2013 by law.

for using the example of the failure of the Delhi BRT is to highlight just how important a role the success of the Bogota BRT system was in the creation of the NUTP.

What explains the success of the Colombian NUTP? There are many factors that can be given, but if there are two things that stand out they are the long period of time that the Colombian national government has consistently provided funding to the NUTP, and the equal priority given to non-technical elements (capacity building, legal and regulatory context) of implementing the NUTP.

How has the Colombian government managed to provide long-term funding for the NUTP, this despite the change in governments? Three things have contributed to this. First, the NUTP requires that the national and local governments work together with the private sector in terms of financing projects. This mutual dependence creates a coalition that safeguards the funding for an intervention under the NUTP – no one partner can unilaterally withdraw support from a project. Second, the NUTP requires that funding for interventions under the NUTP be approved by the National Fiscal Policy Council. Once this funding has been approved it becomes part of the budget process and cannot be taken away in future years. And finally, the national government has provided the local governments, one of the partners providing financing/funding to the NUTP with the means to provide this funding/financing, in the form of revenues collected through a fuel tax.

The second noteworthy feature of the NUTP is along with the technical aspects of IMTS, BRT systems, and other public transport infrastructure, the Colombian government has developed a specific institutional and regulatory infrastructure to support the planning, funding, and implementation of the projects. What has helped to make this capacity building exercise successful is the allocation of concrete and large resources specifically for capacity building; under the NUTP close to USD 5 million has been spent on capacity building alone.

While the NUTP has transformed many of Colombia's cities for the better, many of the expected potential benefits have still not been realised. The National Planning Department of the Colombian government has identified several institutional weakness and failures that if properly addressed could still further increase the benefits of the NUTP. In particular:

- Transport demand forecasts have been too high because:
 - The demand forecasts inadequately considered competition from other transport modes, in particular the competition from semi-formal and informal public transport modes, and increasing motorisation (e.g., motorcycles).
 - In the quest to have a self-sustaining mass transit system, no subsidies are provided for the operations of mass transit systems funded/financed under the NUTP. Given the requirement to be self-sustaining, local authorities focus on routes and service schedules that are optimal from a revenue perspective, but not necessarily from the perspective of increasing ridership on the system.
- The NUTP does not pay any attention to managing travel demand. For example, there is nothing in the NUTP on the use of policy instruments such as congestion charging and parking management to manage travel demand or reduce car use.
- While a specific institutional structure has been created for the NUTP, on the ground there is room to improve co-ordination among the various agencies involved in implementing projects under the NUTP. One of the shortcomings of the NUTP is the lack of sufficient regional transport authorities for managing urban transport in an entire region. While a BRT or a metro system are clearly important, it is as important that the agencies responsible for managing and operating these systems do so in a co-ordinated manner, and in discussion with other transport and city/regional agencies responsible for managing, for example, land use, parking, and the provision and use of roads. Thus, there is not yet sufficient coordination between the public transport operators, and other parts of the

transport system in the city or region, and with other city agencies responsible for things like land use that affect the demand for transport and public transport.

- The NUTP does not specify service quality standards, consistent performance metrics, and monitoring and evaluation control mechanisms.
- Non-motorised transport is not properly dealt with in the NUTP. There is no mechanism for adequately planning and funding non-motorised transport (beyond providing access to the BRT stations), and neither is non-motorised transport properly integrated into the public transport system.
- NUTP does not provide guidance on, or subsidies for, assisting people with low incomes so as to enable them to benefit more fully from the improvements in public transport. The operators of the BRT, metro, and other public transport systems that have been developed under the NUTP are required to be self-sustaining. Thus, they are not concerned about the large social and economic development effects of a fare structure that sometimes can put use of the new public transport systems beyond the reach of people in the lower income groups.
- 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, and customer service.
 - There is a lack of continuity in local management and staff which results in gaps in technical capacity.

The example of the NUTP in Colombia amply demonstrates how funding a policy programme can lead to desirable outputs and outcomes. Both the Colombian government and the MDBs have provided significant levels of funding through the NUTP mechanisms for activities such as capacity building for transport planning, procurement. Despite the problems with capacity building mentioned, the availability of funds to build capacity has without doubt led to better planning, better prepared projects, and eventually a higher probability of success once the project has been completed, than what would otherwise have been the case. In fact, one can argue that the money spent on capacity building, designing and implementing the institutional structures to manage and implement the NUTP, and on developing the NUTP itself has yielded handsome dividends in the form of many successful public transport projects that have in many ways changed the face of Colombian cities – more people are using public transport, road congestion has been reduced, and air quality has improved in the cities where NUTP projects have been implemented.

In terms of the suitability of the projects that have been developed under the NUTP, there is little doubt that climate finance – especially low-interest loans and planning and capacity-building grants – can play a constructive and important role in getting projects off the ground that may otherwise not be implemented. As we discussed in this case study, there is a conflict between attracting private capital by providing sufficient returns on investment to make the project an attractive investment, and the need to keep fares affordable for people who are going to be using of the new public transport services once the project has been completed. If the fares are kept low, then unless some subsidy is provided, at least in the early years as ridership on the system matures, the project may turn out to not be feasible at all, or insufficiently attractive to private investors. This, of course, can be different from one project to the next. Thus, while such projects are potentially suitable for receiving climate finance, given the limited volume of climate finance, such decisions should be made on a case by case basis.

For future projects and programmes, this case study suggests that for capital-intensive infrastructure projects, most of the finance (including climate finance) will be in the form of loans. Providing loans on

favourable terms can be an important incentive for local governments to meet lending agency objectives, which in the case of climate finance include ensuring that the loans support investment in sustainable transport. Bus systems, including but not limited to BRT, are key options under such a programme. Climate finance should also be directed to support planning for capacity-building to ensure that sustainable transport is well-planned and that implementation continues over time. The funds for capacity-building may be in the form of grants due to the much lower cost requirements compared to infrastructure. In addition, climate finance can support the development of a NUTP.

5.3 Manila, Philippines – Market Transformation through Introduction of Energy-Efficient Electric Vehicles Project (E-Trikes)

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:

- Asian Development Bank (2013). Loan Agreement, ADB Clean Technology Fund, Market Transformation through Introduction of Energy Efficient Electric Vehicles Project, <http://www.adb.org/sites/default/files/project-document/79021/43207-013-phi-sfj.pdf>.
- Asian Development Bank (2012). Market Transformation Through Introduction of Energy-Efficient Electric Vehicles: Project Administration Manual, <http://www.adb.org/sites/default/files/project-document/74849/43207-013-phi-pam.pdf>.
- Asian Development Bank (2012). Market Transformation Through Introduction of Energy-Efficient Electric Vehicles: Report and Recommendation of the President, <http://www.adb.org/sites/default/files/projdocs/2009/40625-PRC-RRP.pdf>.
- UNFCCC/CCNUCC (2012), Programme of Activities Design Document and Component Project Activities Design Document: Philippine Electric Vehicle Project.

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.

5.3.1 Description

According to the Clean Technology Fund Investment Plan for the Philippines,⁵⁰ road transport emissions are projected to increase from 24 million metric tons CO_{2e} in 2007 to 87 million metric tons CO_{2e} by 2030. This projection is based on an assumed 6 percent annual growth in motorisation, and an increase of 35 million in the urban population by 2030. With increasing motorisation, declining air quality, and concerns about energy security, the government, in its National Framework Strategy on Climate Change,⁵¹ has made the transitioning of transport sector to a low carbon pathway a strategic priority.

⁵⁰ Department of Energy, Government of the Philippines, Clean Technology Fund Investment Plan

⁵¹ Government of the Philippines. 2010. The National Framework Strategy on Climate Change, 2010–2022, Manila.

Although public transport vehicles represent about 15 percent of road transport in the Philippines, they account for much more than 15 percent of the total fuel consumption and are responsible for most of transport related air pollution. Tricycles represent 67 percent, jeepneys 23 percent, buses 6 percent, and cars 4 percent of the fleet of public transport vehicles. There were 3.5 million tricycles in the Philippines with an estimated 1 million vehicles sold in 2012 alone. Given the large share of tricycles in the fleet of public transport vehicles, and their large share of total fuel consumption and emissions, the Philippine Government decided to transform the fuel efficiency of the tricycle fleet by introducing new, more efficient technology.

This project, funded by the ADB, proposed to transform the market for tricycles in the Philippines by introducing electric tricycles (e-trikes) to increase energy efficiency, reduce reliance on imported fuels, and minimise emissions, while increasing driver income. This is possible because the e-trikes can carry more passengers and operating them is less expensive than the traditional tricycles. It would also create new jobs in the manufacturing of parts for these electric tricycles.

The traditional gasoline-powered tricycles are typically a motorcycle-sidecar combination, with a sidecar that is closed for accommodating passengers (Figure 5.3.1). This project aims to introduce 100,000 e-trikes over a 60 month period from January 2013 to December 2017.⁵² The implementation of the project is planned in two phases:

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

In April 2011, the ADB together with Philippines Department of Energy (DOE) funded a pilot project that bought 20 locally made e-trikes powered by imported lithium-ion batteries in the City of Mandaluyong (see Figure 5.3.2 showing the metro Manila area). The aim of this pilot was to get feedback from tricycle drivers on ways to improve the design of the e-trikes that would be bought in the scaled up programme.

<http://climate.gov.ph>

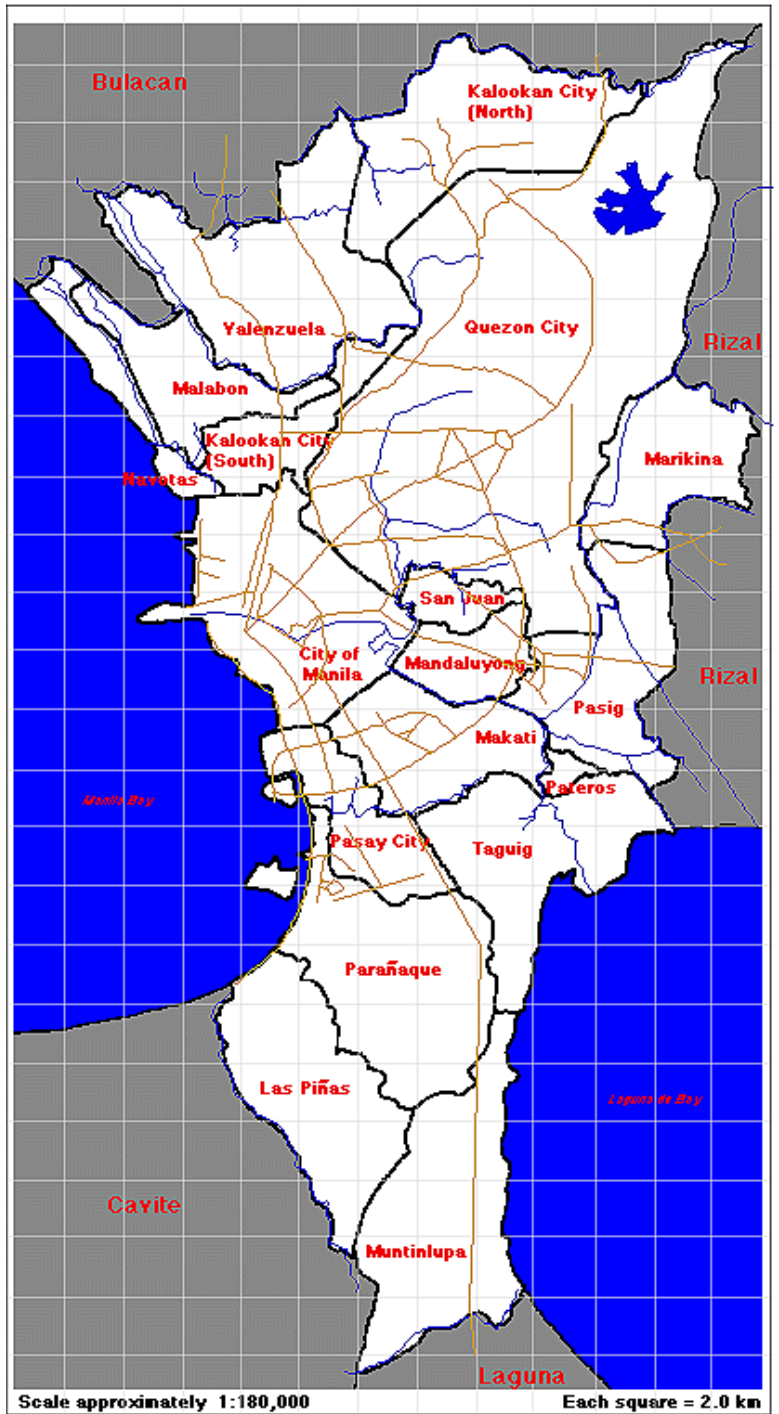
⁵² Current project implementation delay will most likely lead to revising these dates to the year 2015 as the start date.

Figure 5.3.1: Traditional Gasoline Tricycle



Photo Credit: Asian Development Bank.

Figure 5.3.2: Map of Metro Manila



Source: Metro Manila Website (<http://www.philippines.hvu.nl/Luzon4.htm>)

The ADB set the following targets for the project:⁵³

- **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 mobilisation, 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 5.3.3 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 Phase 1 of the project implementation (the “industry development” phase during which 20,000 e-trikes were to be purchased and distributed) is to have 500 locally assembled public charging stations by December 2015. Each charging station costs about USD 23,000.⁵⁴

The Philippines DOE is the executing agency in charge of procurement, implementation and technical supervision of this project. An e-trike group made up 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. The DOE has been holding stakeholder outreach with several players including Local Government Units, private stakeholders (battery manufacturers, logistics suppliers, and electricity transport organisations), environmental stakeholders (Department of Environment and Natural Resources, National Solid Waste Management Commission, Land Transportation Office), Department of Interior, Department of Science and Technology, and other stakeholders.

⁵³ Project Impact and Outcome, Proposed Loan and Administration of Loan and Grant, Republic of the Philippines: Market Transformation through Introduction of Energy-Efficient Electric Vehicles Project.

⁵⁴A Future for Electric Vehicles Gets a Bit Closer in the Philippines.

<http://blogs.wsj.com/indonesiarealtime/2013/08/02/a-future-for-electric-vehicles-gets-a-bit-closer-in-the-philippines/>

Figure 5.3.3: 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.

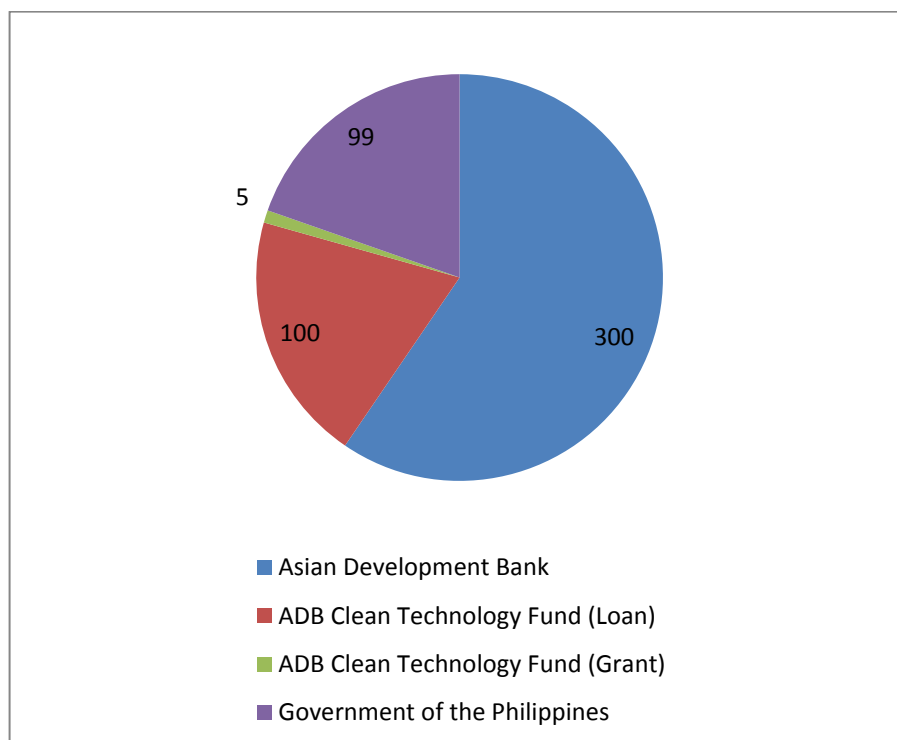
5.3.2 Financing and Funding

5.3.2.1 Sources and Administration

The e-trikes project is estimated to cost USD 504 million, of which ADB’s loan makes up 59 percent or USD 300 million of the total project cost. The CTF is providing 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. A breakdown of the funding by source is shown in Figure 5.3.4.

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 the CTF grant.

Figure 5.3.4: Project Funding Sources (millions of USD)



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

A government financial institution, 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 cover the e-trike driver’s credit risk. The drivers of the e-trikes enter into a lease contract with the LGU e-trike office that also covers maintenance of the e-trike, and the vehicle can be immobilised remotely. The DOE is responsible for buying the e-trikes directly from suppliers and ADB pays the suppliers directly on receiving confirmation from the DOE that the e-trikes have been delivered. There are two ways the funds flow arrangements work:

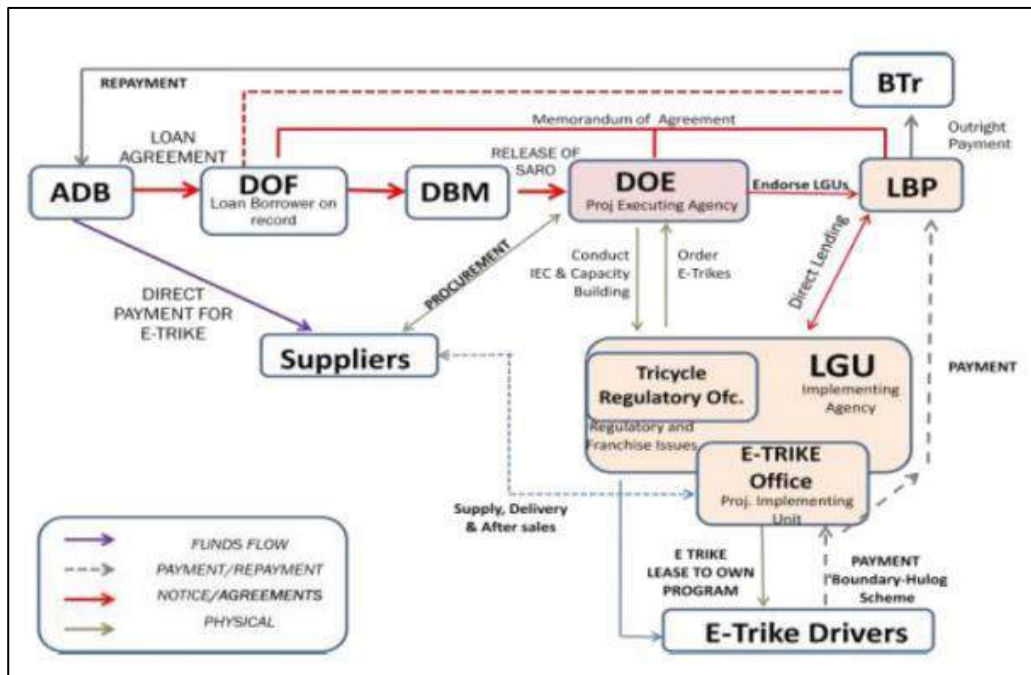
- LGU as borrower from LBP and as lender or lessor to drivers;
- A local bank acts as an intermediary between the LBP and the e-trike drivers. Thus, the LBP gives money to the local bank, and the local bank makes the loan to the e-trike drivers who are buying the e-trike.

The distribution of e-trikes is done in three steps:

- ADB pays selected suppliers of e-trikes 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 5.3.5 and 5.3.6.

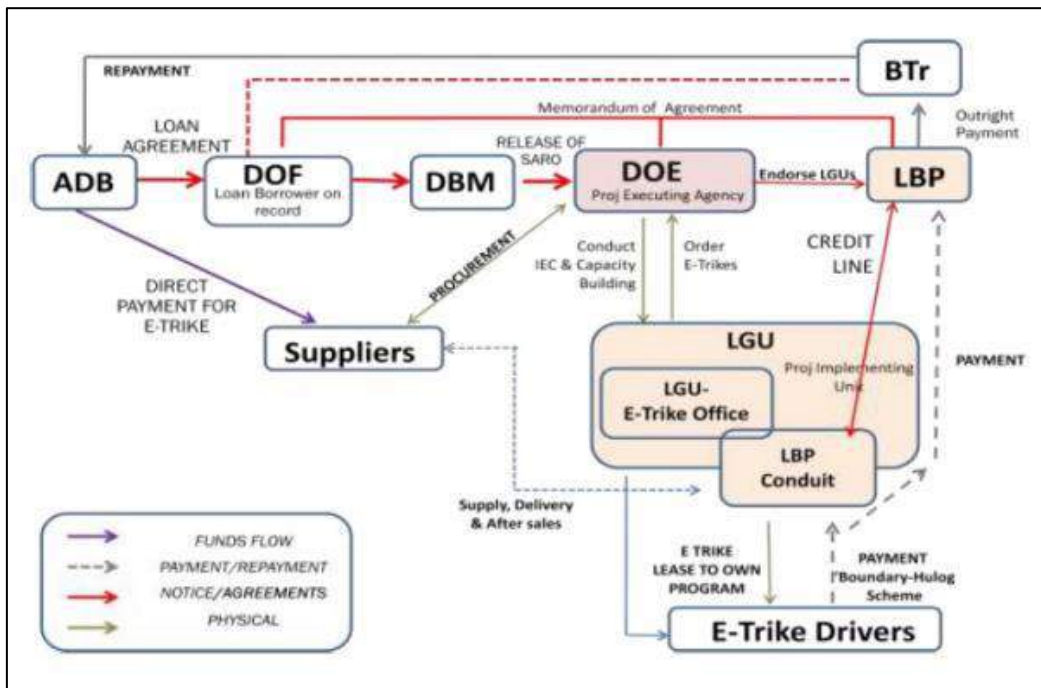
Figure 5.3.5: LGU as Borrower from LBP and as Lender or Lessor to Drivers



Source: ADB Project Administration Manual: Market Transformation through Introduction of Energy-Efficient Electric Vehicles Project, Funds Flow Arrangement, Agreements, and Physical Delivery of E-Trike Units

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.

Figure 5.3.6: Bank Conduits as Borrower from LBP and as Lender/Lessor to Drivers



Source: ADB (2012). Project Administration Manual: Market Transformation through Introduction of Energy-Efficient Electric Vehicles Project.

The majority of funding by the Government of Philippines (about 20 percent of the total project cost) goes towards contingencies and taxes. ADB’s policy on financial management and analysis of projects stipulates inclusion of contingencies in the total project cost.⁵⁵ 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 5.3.1 shows funding by source and by project component. Figure 5.3.7 provides the breakdown of total costs by project components.

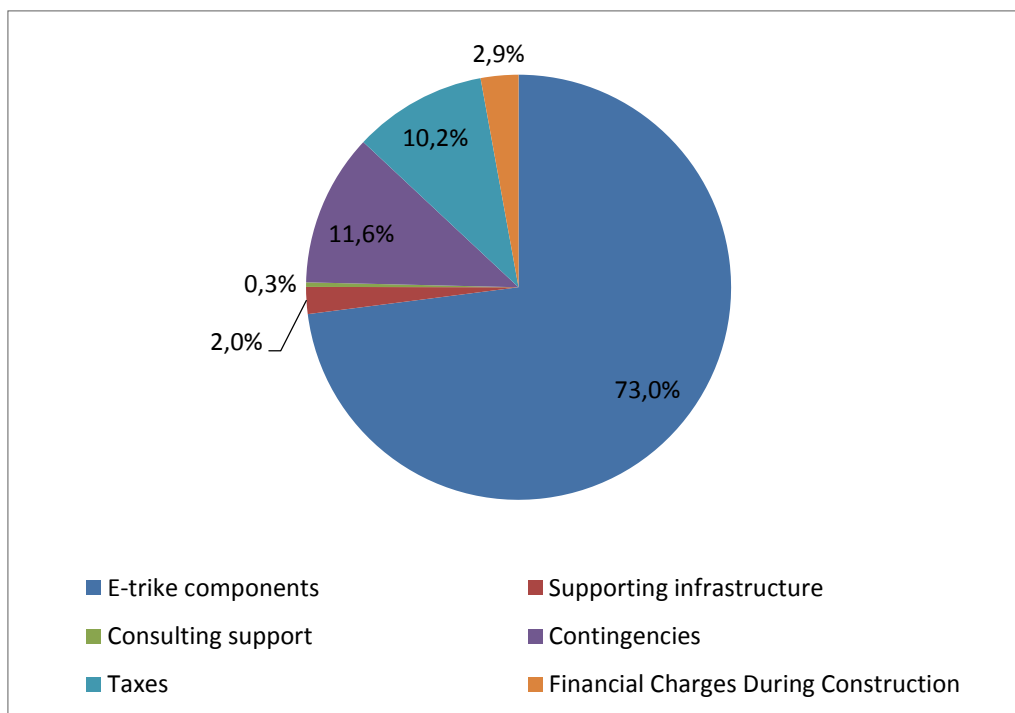
⁵⁵ Handbook for Borrowers on the Financial Management and Analysis of Projects, 2006. <http://www.adb.org/sites/default/files/institutional-document/31337/borrowers-financial.pdf>

Table 5.3.1: Cost Estimates by Funding Source and Project Component (millions of US dollars)

Item	ADB Amount	% of Cost Category	CTF Loan Amount	% of Cost Category	CTF Grant Amount	% of Cost Category	GOP Amount	% of Cost Category	Total Cost	Taxes
A. Base Cost										
1. E-trike Components										
a. Lithium Ion Battery	18.80	16%	100.00	84%	-	-	-	-	118.80	16.20
b. Body and Other Parts	211.20	100%	-	-	-	-	-	-	211.20	28.80
c. Motors	37.84	100%	-	-	-	-	-	-	37.84	5.16
2. Supporting Infrastructure										
a. Charging Stations	0.48	100%	-	0%	-	0%	-	-	0.48	0.07
b. Battery Recycling	2.30	100%	-	0%	-	0%	-	-	2.30	0.31
c. Materials Recovery	2.64	100%	-	0%	-	0%	-	-	2.64	0.36
d. Communication, Social Mobilization and Admin Support	0.87	100%	-	0%	-	0%	-	-	0.87	0.12
									4.00	
e. Solar Charging Station Pilot					4.00	100%			4.00	
3. Consulting Support										
a. Technology Transfer and Local Industry Support	-		-		0.87	100%	-	-	0.87	0.12
b. Implementation Consultant	0.73	85%	-	0%	0.13	15%	-	-	0.86	0.12
Sub-Total (A)	274.86	72%	100.00	26%	5.00	1%	-	-	379.86	
B. Contingencies										
1. Physical	2.07	5%	-		-		42.31	95%	44.38	
2. Price	8.63	61%	-		-		5.44	39%	14.07	
Sub-Total (B)	10.70	18%	-		-		47.75	82%	58.45	
C. Taxes	-	0%	-		-		51.25	100%	51.25	
D. Financial Charges During Construction	14.44	100%	-		-		-		14.44	
Total (A+B+C)	300.00	60%	100.00	20%	5.00	1%	99.00	20%	504.00	

Source: ADB (2012): Project Administration Manual: Market Transformation through Introduction of Energy-Efficient Electric Vehicles Project.

Figure 5.3.7: Funding by Project Component (millions of US dollars)



Source: CS analysis based on ADB, Risk Assessment and Risk Management Plan: Market Transformation through Introduction of Energy-Efficient Electric Vehicles Project.

ADB’s loan for this project 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 repay 2 percent of the principal each year for years 11 to 20, and 4 percent for years 21 to 40. The CTF loan is administered by the ADB. Both loans have very favorable terms (long grace periods) and very low interest rates compared to a commercial loan. The CTF loan has similar concessional terms to the International Development Association (IDA)⁵⁶ charges. These loans have little interest and repayments are stretched over 25 to 30 years, including a five or 10-year grace period.

5.3.2.2 Financial and Economic Analysis

ADB undertook a detailed financial analysis for the project based on the data from the pilot study. A typical gasoline tricycle driver uses about USD 6.50 for a total distance driven in a day, which is about 80 kilometers and requires 5.5 litres of petrol gas. By comparison an e-trike consumes 6 kilowatt-hours of power, costing about USD 1.50, to drive 80 km. Thus, for an average total distance driven of 80 km, an e-trike driver saves USD 5.00 per day in fuel costs. Using these figures, the financial internal rate of return (FIRR) for the driver is over 47 percent, which is considered desirably high. In ADB’s sensitivity testing, under the extremely adverse scenario of the driver facing a daily lease payment (also called the boundary fee) increase of an additional 10 percent, the FIRR decreases to 16.5 percent, which is still above the

⁵⁶ Proposed financing products, terms and conditions for public sector operation of the Clean Technology Fund https://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/proposed_financing_publicsector_ctf_030408.pdf

ADB's acceptable requirement standard of over 12 percent. However, given the higher than projected vehicle cost (see next section) it is possible that this standard is no longer met.

ADB also conducted an economic analysis of the effect of this project by comparing two scenarios, one with and one without the project being implemented. 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.⁵⁷ 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 2015.⁵⁸

5.3.2.3 Payback Arrangements and Monetised Benefits

As mentioned earlier in the funding flows section of this document, an institution such as the Land Bank of the Philippines establishes a loan facility with the LGUs to cover the cost of e-trikes. Based on the disbursement arrangement, LGUs or another bank or financial institution charge the e-trike drivers a "single-digit interest rate" (assumed to be 9.5 percent in Table 5.3.2), which the drivers undertake to repay through daily payments similar to what they currently pay under the existing "boundary system"⁵⁹ over a five year period. Table 5.3.2 shows that under the original estimate of the 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 (from 7.1 to 7.8 USD daily) compared to the gasoline tricycle. The project sponsors have taken steps to try and reduce the costs of this new technology - the Electric Vehicle Association of the Philippines is engaged in efforts to try and reduce the cost of an e-trike by 20 percent from the current USD 6,500 by downscaling the specifications of the e-trike.

Table 5.3.2: Estimated Cash Inflow and Outflow for Drivers⁶⁰

	Gasoline Tricycle	E-Trike	E-Trike (Higher Cost)
Estimated Cost of Tricycle (USD)	2,400	4,800	6,500
Daily Range (km)	80	80	80
Daily Energy Consumption	5 litres	6 kWh	6 kWh
Daily Cost of Fuel/Energy (USD)	6.6	1.9	1.9
Boundary Fee (USD)	3.6	5.1	7.6
Daily Cash Outflow in USD	10.2	7.1	9.6
Daily Cash Inflow in USD	17.3	17.3	17.3
Daily Net Cash Flow on Average (USD)	7.1	10.2	7.8

Source: Department of Energy, The E-trike Project, <http://lmp.org.ph/default/images/LICC/lmp%20-%20e-trike%20project%20presentation%20-%20july%2015%202014.pdf>

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.

⁵⁷ Due diligence, Market Transformation through Introduction of Energy-Efficient Electric Vehicles Project, Report and Recommendation of the President to the Board of Directors, ADB

⁵⁸ 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.

⁵⁹ Boundary system is a vehicle leasing system where the driver pays a daily fee to the owner or financier of the tricycles.

⁶⁰ The E-Trike Project, Daily Cash Flow <http://lmp.org.ph/default/images/LICC/lmp%20-%20e-trike%20project%20presentation%20-%20july%2015%202014.pdf>

5.3.3 Lessons Learned Regarding Finance

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 audience⁶¹ of educational institutions, tourism growth areas, commercial entities, and other interested parties beyond the initially identified LGUs. One of the problems faced by the project has been the lack of LGUs who were able to meet the Department of Finance’s conditions for getting loans to finance the purchase of e-trikes. Thus, the number of people who can purchase e-trikes is also limited. To increase the number of e-trikes getting into the market, the project sponsor expanded the target audience from just drivers of traditional e-trikes to include educational institutions, tourist areas, commercial entities, and essentially any party that was interested in purchasing e-trikes.

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 5.3.4.

Table 5.3.4: Risks and Mitigation Measures

Risks	Mitigation Measures
Poor-quality of manufactured e-trikes and batteries undermine technology credibility	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 honoured by suppliers.
Low demand for e-trikes discourages new investment	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.
Inadequate capacity of local industry to meet demand	Procurement will be phased to ensure sufficient time and supply capacity, new investments and technology transfer.
Multiple layers of govt. and insufficient LGU management capacity to support the project	Leadership, competency, and credit worthiness with GFIs coupled with strong support from drivers for the e-trike programme will be the key criteria for selecting the cities for the first 20,000 e-trikes.
Efficient supporting industry will not be set-up to supply quality spare parts	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.
Non-payment by e-trike drivers	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 programme had no defaults.

Asian Development Bank (2012). Market Transformation Through Introduction of Energy-Efficient Electric Vehicles: Project Administration Manual

5.3.4 Benefits

The project improves the energy efficiency of a section of the vehicles making up the single largest part of the public transport fleet in the Philippines and also reduces greenhouse gas emissions by introducing a lower-carbon intensity fuel. Other benefits include long-term health effects such as better health of drivers, skill development due to the creation of a new e-trike industry, job creation, and ancillary industries that provide spare parts and support needed for the manufacturing and maintenance of e-trikes.

The project also pays attention to involving women in in the design of e-trikes and has set a target of employing at least 30 percent women to fill the job of charging station attendants during day shifts.

As part of the preparatory work the project also estimated the potential emission reductions from e-trikes using the CDM AMS-III.S methodology for introduction of low-emission vehicles/technologies to commercial fleets. The emission reductions were based on around 2,000 e-trikes in Quezon City. Table 5.3.3 shows what the potential emission reductions would be over a 10 year period from 2013 to 2022. Using this methodology, the project is anticipated to reduce emissions approximately 80 percent compared to baseline emissions.

Table 5.3.3: CDM Calculation of Project Emission Reductions

Year	Baseline emissions (tonnes CO₂eq)	Project emissions (tonnes CO₂eq)	Emission reductions (tonnes CO₂eq)
2013	13,163	2,052	11,111
2014	13,163	2,052	11,111
2015	13,163	2,052	11,111
2016	13,163	2,052	11,111
2017	13,163	2,052	11,111
2018	13,163	2,052	11,111
2019	13,163	2,052	11,111
2020	13,163	2,052	11,111
2021	13,163	2,052	11,111
2022	13,163	2,052	11,111
Total	131,630	20,520	111,112

Source: Philippine Electric Vehicle Project, CDM Emission Reduction Calculation, <http://cdm.unfccc.int/ProgrammemeOfActivities/Validation/DB/H1J0SGF4SESWDA5FMY9ZLC2GRG1R59/view.html>

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

A separate report provides a per-vehicle estimate for different technologies. This report suggests that a typical e-trike would reduce total annual emissions per vehicle by about 54 percent compared to a four-stroke carbureted gasoline engine.⁶² This estimate is made with an average of 35 percent renewables in the electricity grid; in other locations, the reduction in emissions could be higher or lower, depending on the local electricity generating mix. Assumptions about the electricity grid, and potentially other assumptions, are likely responsible for the different estimate of percentage benefits using the CDM approach vs. the Clean Air Initiative study.⁶³

⁶² Cost benefit analysis of technology and replacement options for 2-stroke three wheelers in the Philippines, Clean Air Initiative for Asian Cities, Manila, July 2011.

⁶³ 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.

5.3.5 Conclusions

The Manila e-trikes project is an interesting case in that it attempts to completely transform the emissions from a sector (public transport) by providing incentives for introducing a new, cleaner technology into the sector. The jury is still out on whether the project has worked or not as the project has experienced delays. However, we can still draw some interesting conclusions from the perspective of climate finance.

The chosen intervention attempts to tackle one of the biggest sources of emissions – trikes are by far the largest part of the public transport vehicle fleet and a major contributor to GHG emissions from public transport. The mechanism chosen is to facilitate the adoption of new technology by providing realistic solutions to problems on the ground and incentives for adopting the new technology. The problem with introducing new e-trikes is the cost of the new e-trikes; they cost almost two and half times what a traditional e-trike costs and the average e-trike driver simply does not have the capital to purchase the e-trike. Thus, focusing on providing capital to potential e-trike drivers to purchase e-trikes on attractive terms is a first step in introducing this new technology into the market. The terms and conditions for e-trike drivers for repaying the loan are also important. In this case, making small payments on a daily basis is important because this is what e-trike drivers in the Philippines are used to (trike drivers rent their trikes and make daily boundary payments to the owners of the trikes).

Equally important, this new technology has to deliver real cost savings and benefits to drivers. Reducing GHG emissions is not something that an average trike driver cares about; they care about earning a living. In addition to reducing daily operating costs, the second important characteristic of the e-trike is the ability to carry more passengers than the traditional trike. This means that the daily earning of an e-trike driver can be higher than the driver of a traditional trike. Finally, for the e-trike project to be successful, there has to be the necessary infrastructure to support the operation of the e-trikes. To this end, creating the infrastructure for charging the e-trikes is an important element of the project; just simply providing the e-trikes would not be enough for this project to succeed, charging an e-trike has to be as simple and easy as filling a traditional trike with fuel.

One of the important lessons from this project is that before the project was rolled out, a pilot was carried out to identify and solve problems that could be encountered during the project. This pilot provided valuable information that was used to refine the project. For example, the pilot confirmed 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.

Also during the pilot it became clear that simply introducing the e-trikes would not be enough: arrangements had to be made to provide spare parts and personnel capable of addressing problems encountered in the operation of the e-trikes. Information gathered from the pilot formed the basis for incorporating measures like ensuring warranty and manufacturer compensation with easy access to repair services, and other forms of capacity building in the project during the implementation phase.

Another noteworthy feature of the project has been the willingness of the project to shape the project to realistic conditions on the ground. Thus, for example, the project requires drivers who purchase e-trikes to make daily payments to the agency who advanced them the money for their purchase. Also, it is almost impossible to say an untried and untested technology will actually perform in the field, or what it will end up costing. In the case of e-trikes, it turned out that the e-trikes ended up costing significantly more than what was expected when the project was being conceived, although the project sponsors have taken steps to try and reduce the costs of this new technology.

Tricycles, rickshaws, tuk-tuks, two-wheelers and the like form a large and important part of the public transport vehicle fleets in low and middle income countries. These vehicles, often based on old

technology, are polluting and contribute a large part of total emissions from the public transport vehicle fleet. Improving energy efficiency of these vehicles in low and middle income countries is a potentially cost effective strategy for reducing GHG emissions from public transport. 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.

In our research on the e-trike case, we were told that this project would have been undertaken on a much smaller scale without the CTF and ADB funding. Thus, clearly, the CTF and ADB funding made a project possible that would not otherwise been possible on this scale. In the case of introducing new technology to bring about a market transformation, the scale of the project can be important. The reason that it can be important is that economies of scale can be exploited and certain things done that would otherwise be prohibitively expensive and not make economic sense. For example, setting up an electric charging infrastructure is justifiable for 100,000 e-trikes, but to do so for, say, 3,000 e-trikes would not make much sense. The same holds for creating the ancillary industries to provide spare parts for the e-trikes.

Thus, we can draw some important conclusions based on this case study for climate finance:

- Climate funds are a good way to fund technology demonstration – pilot projects that can help to increase the likelihood of the full scale project being successful.
- Climate funds should be used to provide some minimum efficient scale for undertaking a project once a technology has moved beyond the pilot phase.
- Climate funds should be used in ways that exploit market forces and are directed at eliminating barriers to the uptake of new technology. In this case study, the CTF and ADB loans are directed at potential purchasers of e-trikes who do not have the capital to purchase the more expensive e-trike. Interestingly, the organisations that were supposed to be acting as intermediaries between the LBP and the purchasers of the e-trikes have often found it difficult to meet the requirements of the Department of Finance for getting loans. Here, climate funds could be used to provide financial guarantees to overcome what is essentially an administrative hurdle (this is an administrative hurdle as these organisations were just going to be administering the loan; the loan money would be passing through their hands, and thus their risk rating is irrelevant for the loan).
- This project is replicable across a wide range of countries with similar conditions in the public transport sector including numerous energy inefficient vehicles. The financing mechanism is also easily replicated in different countries, though it would probably require some adjustment based on the country.
- 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.

For future clean vehicle projects, this case study suggests that climate finance should be directed to demonstrate clean technology where its costs and benefits are not yet proven and/or new to the country, and also to overcome institutional barriers to adopting that technology, such as lack of information, financing needs for small operators, etc. Up-front loans (repaid from fuel savings) can be provided to cover initial capital costs, with grants for items such as training, coordination, policy development, measurement, and enforcement.

5.4 Guangdong Green Freight Demonstration Project

This case study is on the Guangdong Green Freight Demonstration Project, a project partially financed 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:

- World Bank (2011). China - Global Environment Facility (GEF) Guangdong Green Freight Demonstration Project: Project Appraisal Document. Washington, DC: World Bank. <http://documents.worldbank.org/curated/en/2011/03/13978677/china-guangdong-green-freight-demonstration-project>
- World Bank (2010). China - Global Environment Facility (GEF) Guangdong Green Freight Demonstration Project, Project Information Document. Washington, DC: World Bank. <http://documents.worldbank.org/curated/en/2010/12/13200828/china-global-environment-facility-gef-guangdong-green-freight-demonstration-project>

Additional information was gathered by corresponding with two experts involved in the implementation of the project. The experts were:

- Shomik Mehndiratta, Senior Transport Specialist, the World Bank;
- Ke Fang of the World Bank.

5.4.1 Description

Between 2000 and 2008, the total freight tonnage moved by truck in Guangdong Province increased by more than 125 percent (Figure 5.4.1). Over the same period, the length 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 5.4.2). In 2008, road freight accounted for 70 percent of transported goods by total tonnage.⁶⁴ The energy efficiency of trucks in China is 30 percent lower than that of trucks in advanced Organization for Economic Cooperation and Development (OECD) countries.

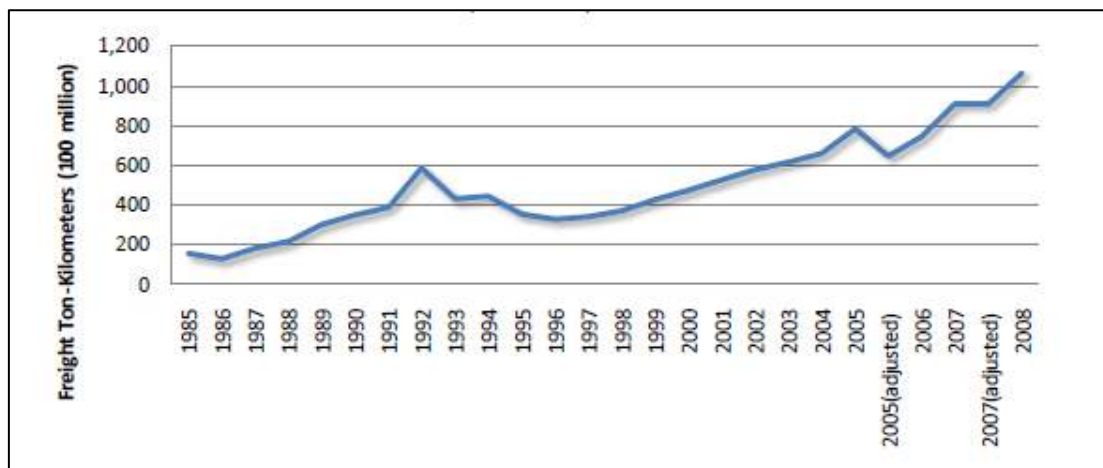


Figure 5.4.1: Total Freight Ton-Kilometers Transported by Road in Guangdong Province

Source: Guangdong Statistical Yearbook. 2009, World Bank Project Appraisal Document, Guangdong Green Freight Demonstration Project.

⁶⁴ Guangdong Statistical Yearbook. 2009, World Bank Project Appraisal Document, Guangdong Green Freight Demonstration Project.

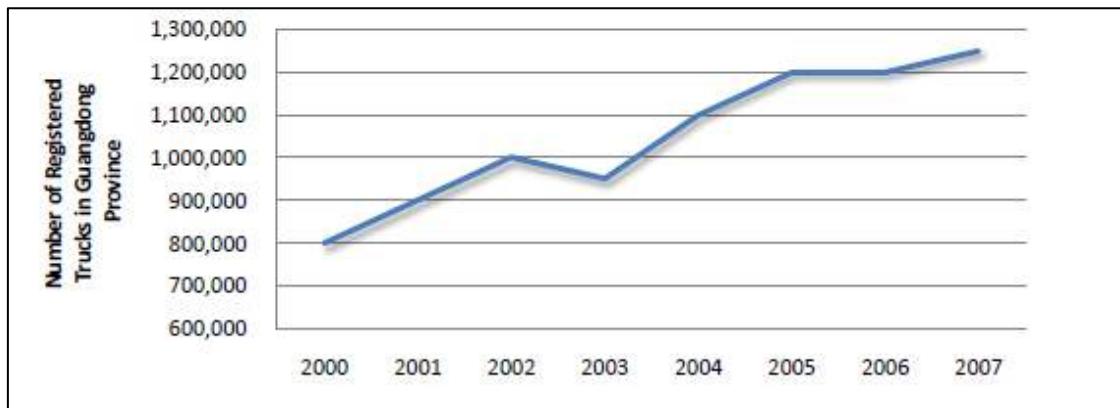


Figure 5.4.2: Number of Trucks Registered in Guangdong Province

Source: Guangdong Statistical Yearbook. 2009, World Bank Project Appraisal Document, Guangdong Green Freight Demonstration Project.

The Guangdong Green Freight Demonstration Project has taken place in Guangdong Province of the People's Republic of China (Figure 5.4.3). The objective of the project is to demonstrate that using technologies to improve energy efficiency of trucks can yield global and local environmental benefits in terms of reducing GHG emissions and improving air quality, and help in “greening” the road freight sector. The project has 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;⁶⁵
- **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.

In the technology demonstration component, the government gives rebates to participating freight companies for installing energy efficient technologies on their trucks. Incentives are provided to operators for installing the technological features and for providing the project team with monitoring and evaluation reports on the performance of these technologies. This project is a follow-up to a smaller pilot project undertaken in Guangzhou municipality,⁶⁶ and is an initial step toward establishment of a Green Freight Programme for China and the formation of a Green Freight Network.

⁶⁵ In the trucking industry, constant drop and hook is a common practice. When a new trailer is hooked up, one challenge is to make sure that the pressure of all the tires on this new trailer is monitored without extra work for the fleet and driver. When tire pressure is too low, fuel efficiency is less than at the correct tire pressure. Thus, a technology that can help to monitor tire pressure without taking more time or involving additional steps can potentially help to increase the fuel efficiency of the logistics operation.

⁶⁶ Green Trucks Pilot Project in Guangzhou, <http://cleanairinitiative.org/portal/projects/GreenTrucksPilot>

Figure 5.4.3: Map of Guangdong Province



Source: Asia Times, Guangdong Travel <http://atimes.com/atimes/Others/guangdong-travel.html>

The technology demonstration component introduced six technologies that can improve the fuel efficiency of operating vehicles. The following technologies, previously approved by the United States Environmental Protection Agency (EPA) Smartway programme, were considered for this demonstration:

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

Truck drivers participating in this project were given special training 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 5.4.4) to introduce truck operators to new technologies for enhancing energy efficiency of trucks.

Figure 5.4.4: Guangdong Green Freight Demonstration Project Photos



Source: Global Environment Facility, Flickr Album, <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 with 145 trucks participated in the pilot Phase I technology demonstration. An evaluation carried out in April 2014 concluded that three of these technologies helped to increase energy efficiency, namely: 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 from Phase I. In addition, two new technologies, light-weighted aluminium alloy semi-trailers and liquefied natural gas (LNG) trucks, will be piloted during Phase II to assess their energy efficiency impacts.

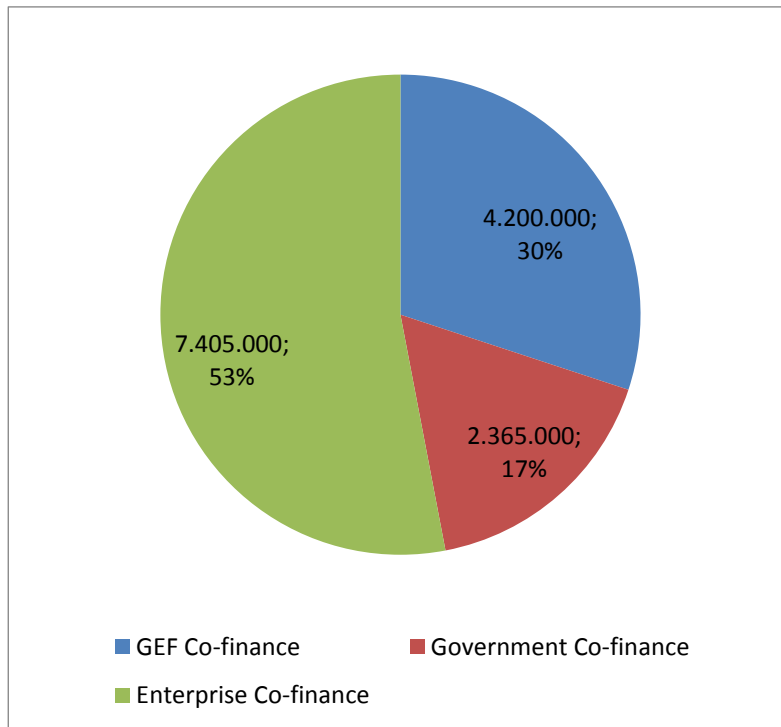
The Guangdong Provincial Government's Department of Finance (DoF) is the recipient of a GEF grant and responsible for the grant disbursement. The DoF designated the Department of Transport (DoT) as the leading agency for implementation of the project. A Project Management Office (PMO), overseen by a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

5.4.2 Financing and Funding

According to the GEF grant and project documents, the total project cost is USD 13.97 million, of which the GEF grant provided 30 percent or USD 4.2 million, and the government provided 17 percent of the project cost (USD 2.365 million). The remaining 53 percent (USD 7.405 million) comes in the form of enterprise co-finance provided by the participating companies. A breakdown of funding by source is

shown in Figure 5.4.5. A flow chart showing the financing partners and financial flows indicating the project implementation and organisation structure is shown in Figure 5.4.6.

Figure 5.4.5: Project Funding Sources (USD)



Source: World Bank. 2011. *China - Guangdong Green Freight Demonstration Project*.
<http://documents.worldbank.org/curated/en/2011/03/13978677/china-guangdong-green-freight-demonstration-project>

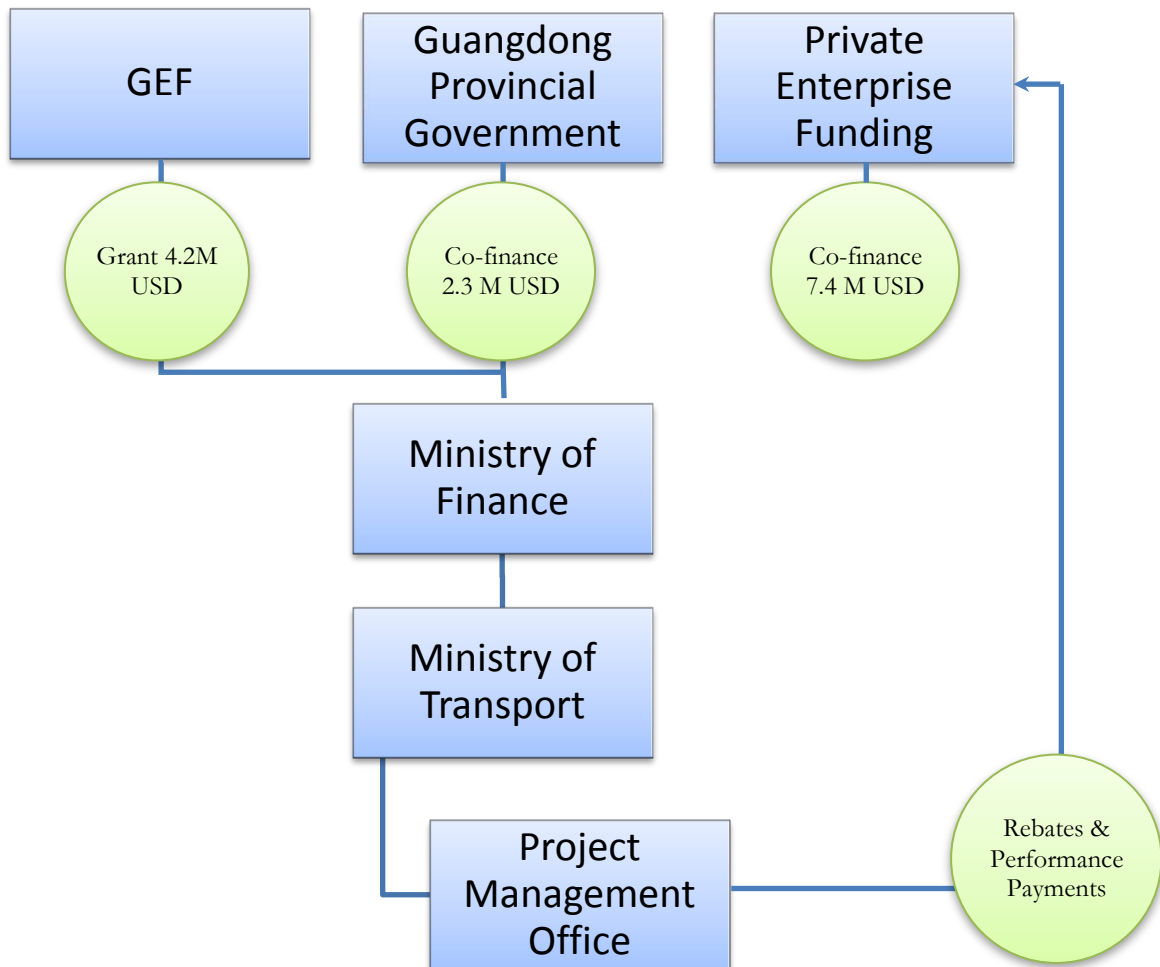


Figure 5.4.6: Project Financial Flow Chart

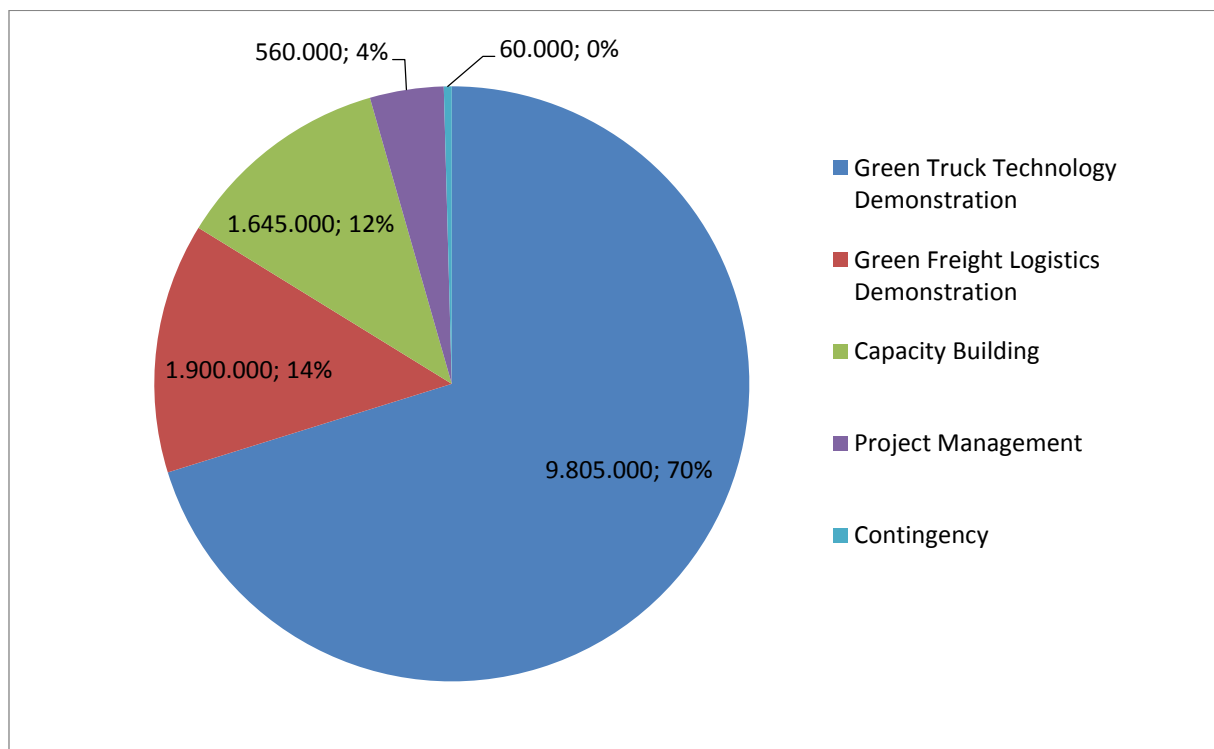
Source: CS based on World Bank (2011)

Figure 5.4.7 shows funding by major project component, and Table 5.4.1 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 share of the Guangdong provincial government’s funding was used for the Green Freight study demonstration and outreach in the form of the project website and promotion.

The largest share of the project cost is provided by the companies themselves, in what is called enterprise co-financing. The participating companies have a clear incentive investing in new technologies that have the potential of reducing their fuel consumption and lowering their operating costs. The performance of these new technologies, however, was unproven. Thus, some incentives were needed to get these companies to take the final step and invest in these new technologies. These incentives are provided by the GEF grant. The GEF grant provides participating companies with incentives to invest in these new technologies in two ways:

- **Green Freight technology rebates** – A transfer in the form of a rebate for investing in a technology that improves fuel efficiency. These rebates lower the cost of the technology for the purchaser. The point of giving these rebates is to make the cost of the new technology the same (or nearly so) as the older technology so that the decision to purchase the new technology is no longer based on difference in price between the new and old technology;
- **Performance-based payments** - Provide incentives to participating companies to properly operate these fuel saving technologies and monitor the results.

Figure 5.4.7: Uses of Project Funding (millions of USD)



Source: World Bank. 2011. *China - Guangdong Green Freight Demonstration Project*.

<http://documents.worldbank.org/curated/en/2011/03/13978677/china-guangdong-green-freight-demonstration-project>

Typically, GEF funds have been used to make for down payments on purchase of complete new trucks or retrofitting of old trucks, and for making principal payments towards capital costs. The point of doing this has been to remove the amount of the initial investment needed as a barrier to the selection of the new technology. For example, in the case of trucks, replacing an old truck with a new, fuel-efficient truck is expensive. Many truck operators do not have the capital needed to make a down payment required for purchasing a new truck. Thus, the penetration of the fuel saving technologies that are in the new trucks is limited by the ability of those purchasing these trucks to make the down payment. GEF funds used for making down payments on new trucks help to accelerate the penetration of these new technologies. The enterprise co-financing is based on similar logic – a truck operator when making a decision about an investment should not have to make the choice between a fuel saving technology and a less fuel efficient technology based on the price of the new technology. Thus, the rebates in this case study, together with the investment of the truck operator, together make up the “enterprise co-financing” model.

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.

Table 5.4.1: Cost Estimates by Financier (millions of US dollars)

Component	Total Cost (USD)	GEF Co-finance (USD)	Government Co-finance (USD)	Enterprise Co-finance (USD)
Component 1: Green Truck Technology Demonstration				
Trade Fair	150,000	150,000	0	0
Incentive payments	9,337,000	1,965,000	0	7,372,000
Driver training	70,000	70,000	0	0
Vehicle monitoring equipment	148,000	115,000	0	33,000
Vehicle monitoring and evaluation	100,000	100,000	0	0
Sub-Total	9,805,000	2,400,000	0	7,405,000
Component 2: Green Freight Logistics Demonstration				
Logistics brokerage study and demonstration	540,000	540,000	0	0
Drop and Hook operation study and demonstration	1,360,000	460,000	1,000,000	0
Sub-Total	1,900,000	900,000	1,000,000	0
Component 3: Capacity Building				
Green Freight policy research	90,000	90,000	0	0
Government and enterprise management training	250,000	250,000	0	0
Project website	1,155,000	100,000	1,055,000	0
Project promotion	150,000	110,000	40,000	0
Sub-Total	1,645,000	550,000	1,095,000	0
Component 4: Project Management/Implementation Support				
Technical advisory and quality Assurance	100,000			
Technical assistance for implementation of Green Truck technology component	60,000	60,000	0	0
Procurement agent	50,000	50,000	0	0
Project completion report	10,000	10,000	0	0
Evaluation and dissemination workshops	50,000	50,000	0	0
PMO incremental operating cost	290,000	20,000	270,000	0
Sub-Total	560,000	290,000	270,000	0
Total Baseline	13,910,000	4,140,000	2,365,000	7,405,000
Contingency	60,000	60,000	0	0
TOTAL COST	13,970,000	4,200,000	2,365,000	7,405,000

Source: World Bank. 2011. *China - Guangdong Green Freight Demonstration Project*. Washington, DC: World Bank. <http://documents.worldbank.org/curated/en/2011/03/13978677/china-guangdong-green-freight-demonstration-project>

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.

5.4.3 Benefits

U.S. EPA Smartway suggested that the potential fuel efficiency gains of the six technologies introduced (tires, pressure monitoring, fairings, skirts, nose cones, driver diagnostics), along with driver training, could be in the range of 7 to 26 percent.⁶⁷ However, the Phase I demonstration showed that the fuel savings and emission reductions were not as high as anticipated based on Smartway results in the United States; only a subset of these technologies were determined to be beneficial in the Guangdong Province operational conditions. This difference can be explained by differences between the U.S. and China in driving behavior, travel speeds, and driving conditions. The actual fuel efficiency gains, based on an analysis of fuel savings data provided as part of the monitoring programme, were much lower than the initial estimates and showed an average fuel savings of between 5 to 6 percent.⁶⁸

The project team also tracked other indicators including total private sector investment (investment in the six fuel saving technologies) 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 5.4.3 shows the latest status report (November 2015) at the time of writing with these indicators measured against their targets.⁶⁹

Table 5.4.3: Project Development Results Indicators

Indicator	November 2015	Target
Total private sector investment leveraged through the project (million USD)	6.6	0.3
Number of existing or newly purchased trucks installing Green Truck technologies	1,345	435
Number of drivers participating in the project training programme	3,200	600
Establishment of a project website	Complete	Complete
Number of government officials and enterprise representative trained through the project	200	25
Organisation and implementation of the Green Freight trade fair	Complete	Complete

Source: GEF Guangdong Green Freight Demonstration Project, Results Framework (website, November 2016)

Initial estimates suggested that by installing fuel saving technologies in 1,200 vehicles participating under the demonstration project, an estimated total of 26,760 tons of GHG emissions would be reduced over eight years from this component of the project (3,334 tons per year).⁷⁰ As of the time of the most recent status report, the project had exceeded its targets, with technologies installed on 1,345 trucks. Scaling the same benefits per truck as the initial estimate would lead to an emissions benefit of about 3,700 tons per year.

⁶⁷ Project Appraisal Document, GEF, Annex 7, GEF Incremental Cost Analysis.

⁶⁸ Ke Feng, Project Lead, Communication, January 16, 2015

⁶⁹ Results framework, GEF Guangdong Green Freight Demonstration Project, <http://www.worldbank.org/projects/P119654/gef-guangdong-green-freight-demonstration-project?lang=en>, accessed October 2014.

⁷⁰ World Bank. 2011. China - Global Environment Facility (GEF) Guangdong Green Freight Demonstration Project: Project Appraisal Document.

The Green Freight Logistics Demonstration, the second component of this project, was first projected to provide an increase in fuel efficiency of 10 percent for 60 percent of the registered trucks in Guangdong province. If these assumptions were to hold true, it would result in a total reduction of 1.2 million tons of CO₂e annually (Table 5.4.4). Over an average life span of eight years for a truck in China, the programme would therefore reduce total emissions by 9.6 million tons.

Table 5.4.4: Projected GHG Emission Reductions due to Logistics Efficiencies

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

Source: GEF Project Appraisal Document, Project Benefits

World Bank staff indicated that the drop and hook (for improving the efficiency of logistics operations) demonstration has been a success and they are able to use this demonstration project to streamline those operations.⁷¹ As of yet, however, there is no information on the actual, observed benefits of the logistics demonstration projects.

5.4.4 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."⁷² The project also supports the objectives of the GEF Technology Transfer Fund, by facilitating a broader application and deployment of innovative energy efficiency technologies.

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, the 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.

Against the target of realising a 10 percent increase in fuel efficiency for 60 percent of registered trucks in Guangdong province, the project seems to have a long way to go to realise its objectives. However, the more modest goal of having 1,200 trucks participate in the programme has been exceeded.⁷³

The pilot project in Guangzhou was instrumental in demonstrating what technologies would be most beneficial. While the original project concept was based on experience in the U.S., the pilot was instrumental in demonstrating which technologies were applicable in 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 at which trucks travel in China, this technology did not provide much

⁷¹ Ke Fang, World Bank, personal correspondence, November 2014.

⁷² GEF Climate Change Strategy, http://www.thegef.org/gef/sites/thegef.org/files/documents/document/GEF-5_CC_strategy.pdf

⁷³ Results framework, GEF Guangdong Green Freight Demonstration Project, <http://www.worldbank.org/projects/P119654/gef-guangdong-green-freight-demonstration-project?lang=en>

benefit. The low rolling resistance tires and gap fairings turned out to be more effective for improving fuel efficiency and reducing emissions.

The international project sponsors also chose to focus on win-win technologies that were accepted by all involved parties. Technologies that would require extensive regulatory approval were not included in the list of technologies for the project. 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 such as getting permissions/regulatory approval for installing these new technologies on the trucks.

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 pressurised. Without this type of monitoring technology, it would be much harder to verify the benefits of the programme.

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 operational efficiency through both driver behaviour and logistics. Rebates and performance-based payments in the form of grants or loans serve as incentives to trucking companies and suppliers of technology to invest in the clean technology. 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.⁷⁴ 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 behaviour.

Regarding suitability of this type of project for climate finance, more evidence is needed on scale-up and success of implementation. To-date, only a direct impact of 1,345 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.

For future green freight projects, this case study suggests that there may be situations in which elements of the private sector (possibly with support from climate finance loans or small grants to cover perceived risks) are able to finance up-front capital costs of technology, based on repayment from vehicle owners/operators through fuel savings. Logical roles for climate finance grants include education, cooperation on developing institutional arrangements, and evaluation to measure the effectiveness of the technology and track adoption over time.

⁷⁴ SmartWay Finance Projects (2008-2010), <http://www.epa.gov/cleandiesel/projects-finance.htm>

5.5 EcoParq Parking Management System – Polanco, Mexico City

This case study examines the potential role of climate finance in transport demand management through using parking management 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 project was led by the Mayor’s office of Mexico City, working with various national and local government agencies, a parking management operator, and an international nonprofit organisation.

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

- EcoParq website, including general resources and annual revenue reports. <http://www.ecoparq.df.gob.mx/>
- Impacts of the ecoParq Programme on Polanco, ITDP. <https://www.itdp.org/impacts-of-the-ecoparq-programme-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.

5.5.1 Description

EcoParq was conceived as a response to Mexico City’s traffic congestion. The plan focused on regulating parking spaces and improving the overall management of the city’s public spaces. Until this programme came into existence, parking in Mexico City’s was largely free and unregulated by the public sector, but instead controlled by independent operators called “franeleros.”⁷⁵ These independent operators made anywhere between USD 578 and 2,311 per month. This system resulted in a poorly managed parking sector and this together with poor enforcement and the widespread prevalence of parking on sidewalks and blocking driveways meant increased waiting and cruising times for drivers looking for a parking place.

This project started in the 2012, in Mexico City’s Polanco district (Figure 5.5.1), by introducing 426 multi-space meters (Figure 5.5.2). Prior to the start of this project, parking was unregulated in the Polanco district. The parking rates for the new parking meters were set based on parking prices charged in the city (parking meters have existed in Mexico city for years, but were hardly ever used and violators were almost never fined for not paying for parking). EcoParq operates from 8 a.m. to 8 p.m. on weekdays and charges a flat rate of USD \$0.15 per 15 minutes.⁷⁶ There is a three hour time limit for parking in Polanco. EcoParq was incrementally expanded to cover the following neighbourhoods:

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

⁷⁵ Overview of EcoParq, ADB Case Studies, <https://go.itdp.org/display/ADBdemo/ecoParq>

⁷⁶ 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.

For the purposes of this study, only the first phase of this project in Polanco has been considered. We restricted the case study to the Polanco district because of the availability of baseline and post-implementation data. This data was either not available, or only very limited data was available for the other districts to which the project was later expanded.



Figure 5.5.1: Map of EcoParq Zones

Source: EcoParq Zones, <http://www.ecoparq.df.gob.mx/index.php/zonas>



Figure 5.5.2: EcoParq Elements

Clockwise from top left: Parking meter operation, Instructions to operate the parking meter, Enforcement personnel carrying immobilisation devices, EcoParq logo.

Source: EcoParq Website, <http://www.ecoparq.df.gob.mx/>, Publímetro, <http://www.publimetro.com.mx/>

The ecoParq proposal was included in Plan Verde, Mexico City's sustainable development plan first prepared under Mayor Ebrard, and then continued and extended by the next Mayor, Miguel Mancera. Numerous stakeholders were involved in planning and implementing the project. These stakeholders included national and local government agencies and private operator. The list of the agencies involved in this project included:

- 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).

From the start of the project, the Institute for Transport and Development Policy (ITDP), an international consulting company specialising in urban transport issues, advised the city on baseline data collection, contracting, branding, and enforcement issues. 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 programme’s benefits, ITDP was able to persuade local governments to instruct parking operators to collect baseline and post-implementation data to perform assessments.

5.5.2 Financing and Funding

The project is funded by private operators. The revenue sharing formula and providing resources for enforcing the parking policy and curbing of illegal parking and violations are used as leverage by the Federal District in attracting a 100 percent private investment for implementing the project. The capital costs were around USD 9 million, with annual operation costs of about USD 4.5 million. OEB is responsible for purchasing and installing the meters, setting up signalling and wayfinding systems, and operating the complete system. The cost of purchasing and installing a parking meter is approximately USD 10,000 to 12,000.⁷⁷

The concession agreement gives OEB the rights for operating the parking management system for a period of 10 years. In exchange for investing in, installing, operating, and maintaining the parking management system, OEB gets 70 percent of the revenue generated from the parking meters. OEB pays 20 percent of its share of the parking meter revenues to the Secretariat of Public Safety for enforcing the parking policy, limiting parking violations, and fining violators. The remaining 30 percent of the revenues collected from the parking meters goes to AEP, the agency responsible for recovering public space in neighbourhoods. The use of parking revenues received by the AEP is governed by the Committee on Transparency and Accountability which included neighbourhood associations, the Miguel Hidalgo District, and AEP. The funding flow is shown in Figure 5.5.3.

⁷⁷ Andres Sanudo, Interviewed November 26th 2014.

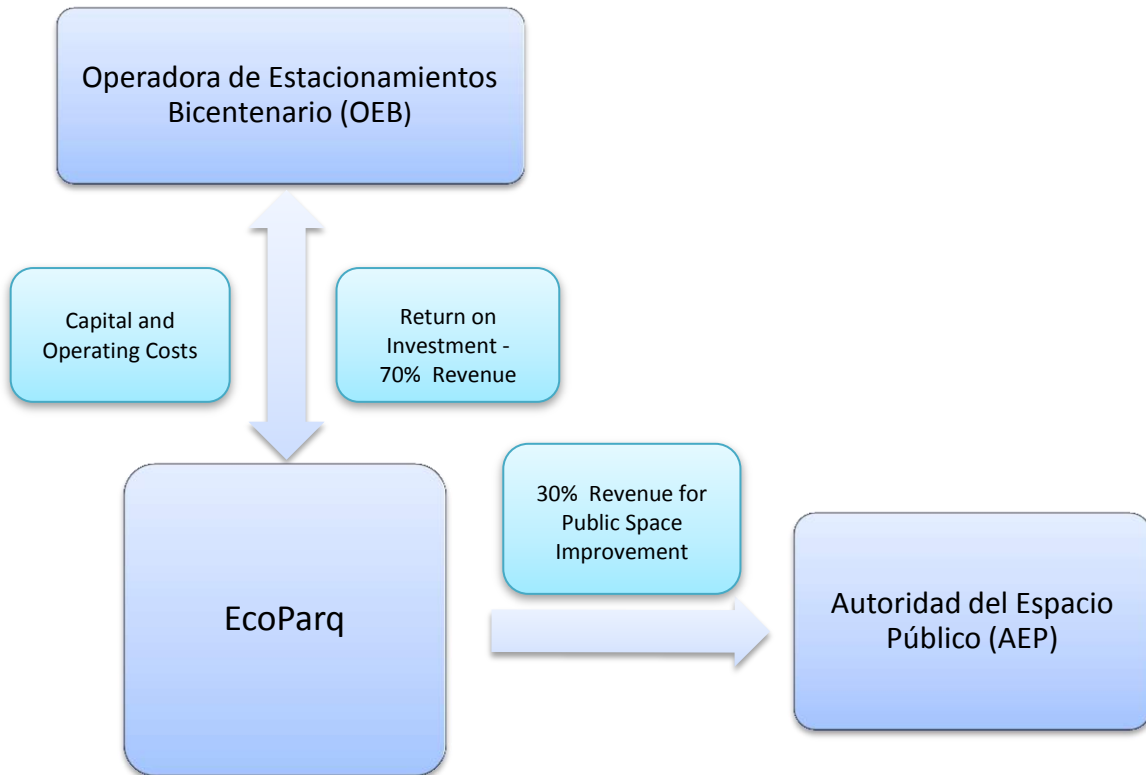


Figure 5.5.3: Project Financial Flow Chart

Source, CS based on information on EcoParq website, <http://www.ecoparq.df.gob.mx/>, accessed November 2014.

Based on data published by EcoParq, USD 3.3 million was collected in 2012, of which USD 1 million was transferred to the AEP for the recovery and renewal of public spaces in the district. Figure 5.5.4 shows the monthly revenues of by OEB and the amounts transferred to AEP each month in 2012. The revenue collection appears to be 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.

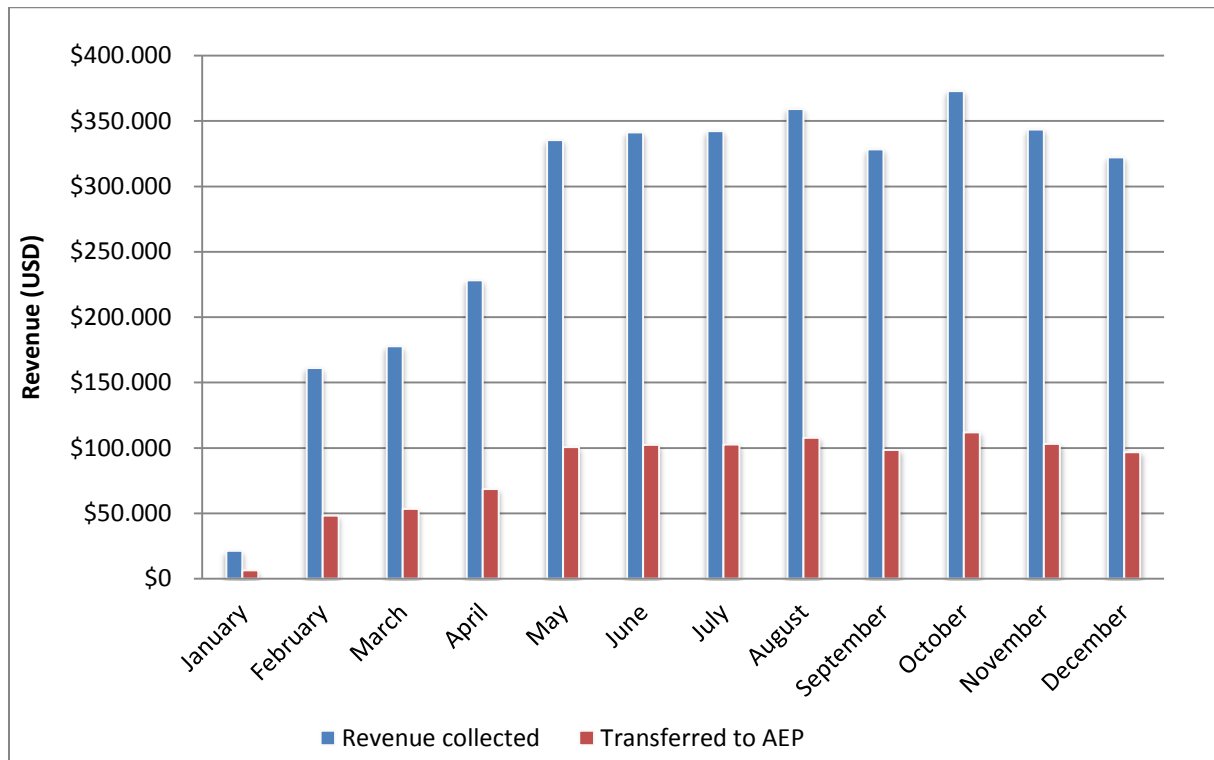


Figure 5.5.4: EcoParq Revenue, Polanco, 2012

Source: Revenue Generated from January to December, 2012, EcoParq, Polanco
http://www.ecoparq.df.gob.mx/docs/transparencia/2012/ecoparq_Polanco_2012.pdf

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 immobilisation or towing, ticketing revenue is estimated to have generated USD 1.33 million in Polanco for the year 2012.

5.5.3 Benefits

The major benefit of ecoParq has been in regularisation 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 5.5.1. These benefits are estimated based on surveys to estimate cruising times before and after project implementation.⁷⁸

Prior to the start of the ecoParq project, the demand for parking used to exceed supply by almost 30 percent, i.e., on average, at any given time, there were 13 cars for every 10 parking spaces (this included illegally parked cars and blocked entrances). After the start of the ecoParq project it became significantly easier, at any given time during the hours of operation of ecoParq, to find a parking space, and there were 10 parking spots available for every 5.5 cars. Figures 5.5.5 and 5.5.6 show daily average occupancy in Polanco before and after ecoParq implementation.

⁷⁸ Cruising times after implementation were based on observed parking occupancy after implementation, and on relationships between cruising time and occupancy based on pre-implementation data.

Table 5.5.1: Benefits of EcoParq – Travel Time Savings and GHG Reductions

	Before EcoParq Metering	After EcoParq Metering	Savings	Benefit (USD)
Average Cruising Time per Vehicle (min)	13 min 26 sec	3 min 04 sec	--	--
Annual Cruising Time (hours)	8,720,000	1,990,000	6,730,000	876,000
Annual Cruising Distance (km)	104,700,000	23,900,000	80,800,000	--
Annual Gasoline Spent Cruising (liters)	9,900,000	2,200,000	7,700,000	6,140,000
Annual GHG Emissions Spent Cruising (tons)	23,000	5,000	18,000	525,000

Source: ITDP, Impacts of the EcoParq Programme on Polanco. Benefits converted from Mexican pesos to USD at 0.075 pesos/dollar.

EcoParq also had a large impact on the turnover rate – a measure of the length of time that cars were parked in a parking spot. Before ecoParq, on average, on-street parking spaces showed a turnover rate of 3.5 times per day. After the start of ecoParq, this increased to between 4.5 to 5.5 times per day. EcoParq made it much easier to find a parking spot and so drivers were less inclined to leave their car parked for a long time once they had found a parking spot, especially during peak periods.

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 annualisation 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 CO₂ was assumed to be USD 30.

Based on the above assumptions, ecoParq Polanco was 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.⁷⁹ 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 5.5.5 and 5.5.6). 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.

⁷⁹ Implementación de parquímetros en Polanco. Estudio de Línea Base. México: Instituto de Políticas para el Transporte y el Desarrollo, Andres Sanudo

Figure 5.5.5: Daily Average On-Street Occupancy, Polanco before Project Implementation (April 2011)



Source: ITDP, Impacts of the EcoParq Programme on Polanco.

Figure 5.5.6: Daily Average On-Street Occupancy, Polanco after Project Implementation (May-Oct 2012)



Source: ITDP, Impacts of the EcoParq Programme on Polanco.

5.5.4 Conclusions

The ecoParq project appears to have successfully realised its objectives of managing parking so as to increase availability of parking spots, reduce traffic congestion caused by drivers cruising to find a parking spot, and reduce emissions. Expansion of the project to other districts suggests that it is also replicable. ITDP's baseline study and its report on the "Impacts of the ecoParq programme 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.

There is also scope for greater collaboration between project stakeholders to maximise 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.

The ecoParq project has been successful for several reasons. These include:

Potential for Private Revenue – Demand for parking in the project neighbourhoods 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 immobilised and nearly 1,200 were towed in Polanco in the year 2012.⁸⁰ The cost of enforcement appears to be more than covered through ticketing revenue, which is returned to the Federal District.

The ecoParq project appears to be providing measurable GHG reductions and other public benefits without the need for public investment. Revenue sharing and favourable 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 realise revenue. The steady scope of expansion of the ecoParq programme with increased revenues and the increased involvement of investors and operators in new neighborhoods where the programme has been expanding since 2012 is a clear indication of a successful programme.

Regarding suitability for climate finance, the project is noteworthy in that no climate finance was required in this case. The project concept 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, guaranteeing a revenue stream for private operators should revenue intake fall short of what is needed to cover operating costs, or overcoming higher risks in areas with less revenue potential.

⁸⁰ EcoParq, http://www.ecoparq.df.gob.mx/docs/transparencia/2012/ecoParq_Polanco_2012.pdf

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 assessed 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.

5.6 Fuel Economy Policy, Chile

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

- “Developing Chile’s Automotive Fuel Economy Policy” (2011), http://www.unep.org/transport/gfei/autotool/case_studies/samerica/chile/CHILE%20CASE%20STUDY.pdf;
- GFEI Initiative – <http://www.globalfueleconomy.org/about/Pages/AboutHome.aspx>;
- GEF (2012), Project Identification Form: Stabilizing GHG Emissions from Road Transport Through Doubling of Global Vehicle Fuel Economy: Regional Implementation of the Global Fuel Efficiency Initiative (GFEI);
- 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>.

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.

5.6.1 Description

Growing importance of light-duty vehicle GHG emissions. Chile is the fifth-largest consumer of energy in South America, but unlike other large economies in the region, it is almost completely dependent on energy imports to meet its demand for energy.⁸¹ As is in most developing countries, transportation is the largest source of Chile’s energy-related CO₂ emissions which, in the absence of mitigation measures, are projected to double by 2020. The transportation sector is growing even faster than the rest of the economy, and accounts for about 28 percent of GHG emissions, and two-thirds of this comes from passenger transport. Chile’s motorisation rate over the last 20 years has increased dramatically from 78 vehicles per 1,000 inhabitants to 180, with the number of larger vehicles increasing significantly.⁸²

⁸¹ Chile: Country Analysis Note (July 2014) – <http://www.eia.gov/countries/country-data.cfm?fips=ci>

⁸² “Transportation in Developing Countries: Greenhouse Gas Scenarios for Chile” Pew Center on Global Climate Change (2002)

Chile has a history of supporting international agreements 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 and mandated specific energy efficiency measures.⁸³

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 threat of climate change and potential oil shortages has spurred efforts to improve vehicle standards. Many countries are developing their own fuel economy or GHG emission standards,⁸⁴ and more are expected to initiate similar measures in the coming years to address concerns of fuel security and support sustainable transport (Figure 5.6.1).

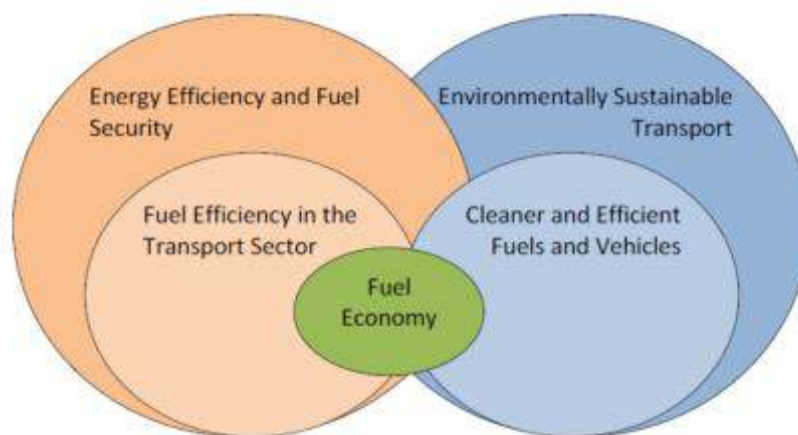


Figure 5.6.1: GFEI Fuel Economy Framework

Source: Global Fuel Economy Initiative, <http://www.globalfueleconomy.org/about/Pages/AboutHome.aspx>.

For example, in 2013 Mexico implemented a new fuel efficiency standard for light-duty vehicles (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. Starting in 2010, United Nations Environmental Program (UNEP), the International Energy Agency (IEA), the International Transport Forum (ITF), and the FIA Foundation, with support from the GEF and other international funds and organisations, launched a new global initiative – the GFEI (www.50by50campaign.org), which combined expertise and resources from all four partners for a comprehensive programme 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 5.6.2). The initiative’s objective is to “promote further research, discussion and action to improve fuel economy worldwide.”⁸⁵ GFEI estimates that cutting global average automotive fuel

⁸³ “Developing Chile’s Automotive Fuel Economy Policy” (2011)

http://www.unep.org/transport/gfei/autotool/case_studies/samerica/chile/CHILE%20CASE%20STUDY.pdf

⁸⁴ Automobile GHG emission standards are typically measured in grams per kilometer (gCO₂/km) or grams per mile (gCO₂/mile).

⁸⁵ GFEI Initiative – <http://www.globalfueleconomy.org/about/Pages/AboutHome.aspx>

consumption (L/100-km) by 50 percent would reduce emissions of CO₂ by over 1 gigaton (Gt) a year by 2025 and over 2 Gt by 2050.

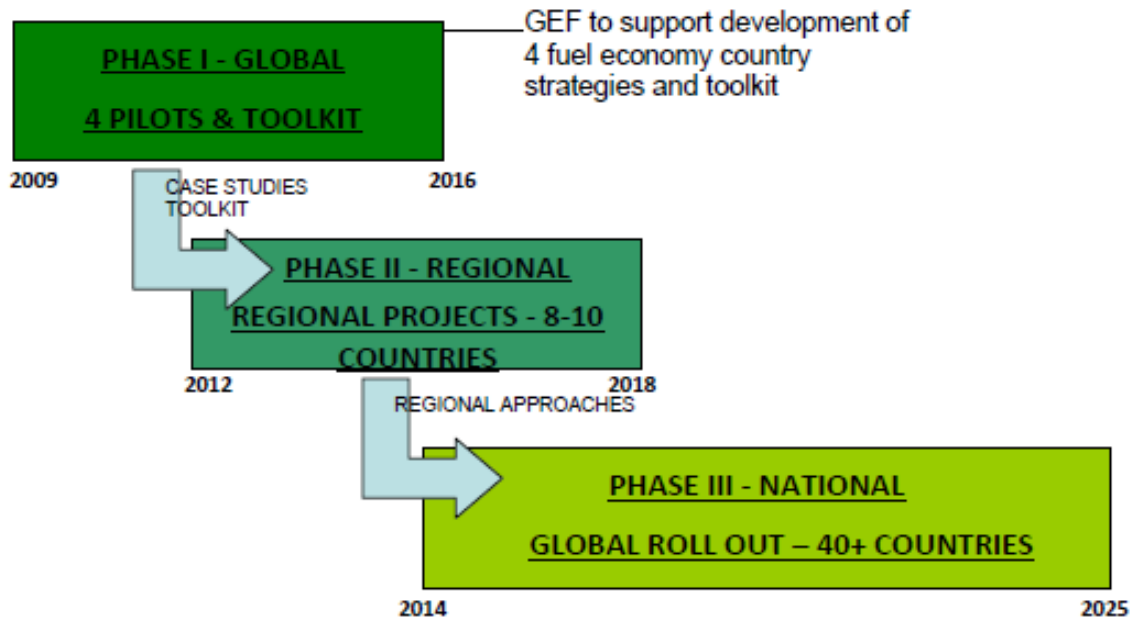


Figure 5.6.2: GFEI Strategy Development and Implementation

Source: Global Fuel Economy Initiative, <http://www.globalfuelconomy.org/about/Pages/AboutHome.aspx>

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 analysed 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 (for air pollutants, not GHG emissions) to EURO V;
- 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 5.6.3). With the results of the baseline analysis, Chile prepared a fuel economy policy that was submitted to congress for approval 2012.

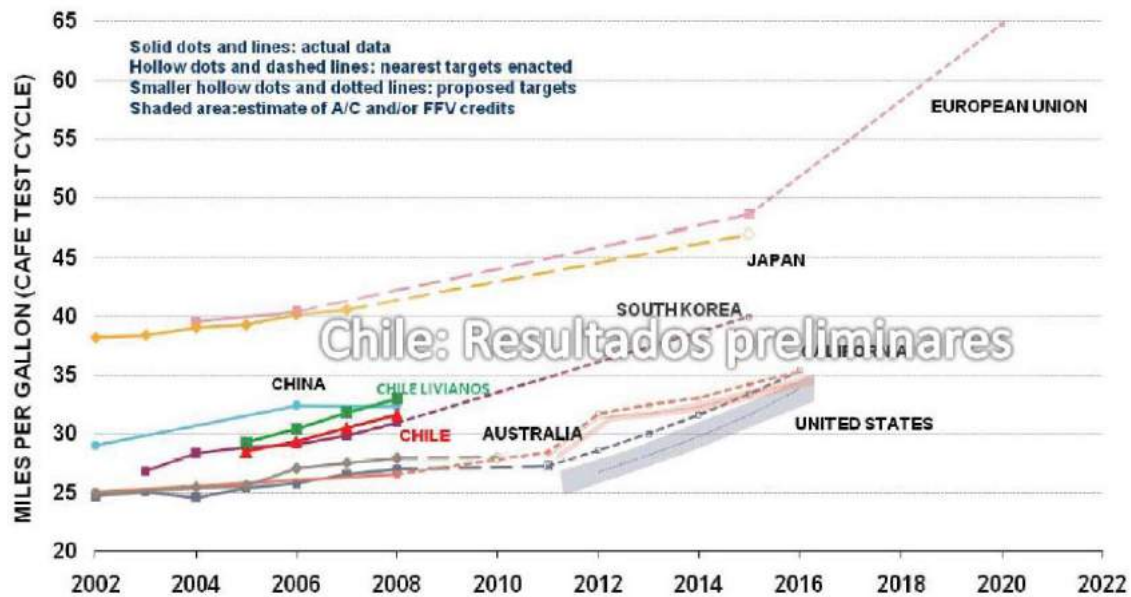


Figure 5.6.3: Actual Fleet Average Fuel Economy Data Through 2008 and Nearest Targets Enacted or Proposed thereafter by Region

Source: UNEP / CMMCh (2010) - Environmental Monitoring of the Chilean Automotive Market

Vehicle Fuel Economy Testing and Labelling. On the 1st of February 2013 GFEI and CMMCh’s efforts yielded fruit when the Chilean Government launched the first LDV fuel economy labelling 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 programme 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 programme were supported entirely by vehicle importers and retailers.

The mandatory labels provide information on CO₂ emissions, fuel economy (highway, city, and combined), model, and manufacturer (Figure 5.6.4). 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 CO₂.

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 programme 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.



Figure 5.6.4: National Fuel Economy Label - Chilean Ministry of Energy

Source: <http://www.consumovehicular.cl>

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.”⁸⁶ Feebates⁸⁷ 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 programme has been successfully utilised 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.⁸⁸ 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.

⁸⁶ GFEI http://www.unep.org/transport/gfei/autotool/approaches/economic_instruments/fee_bate.asp

⁸⁷ Feebate = FEEs on inefficient vehicles + ReBATEs on efficient vehicles.

⁸⁸ GFEI http://www.unep.org/transport/gfei/autotool/approaches/economic_instruments/fee_bate.asp

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_x/km). This tax was included as part of a large tax reform package (Article 3 & Article 10 from Act 20780, September 2014).⁸⁹ Article 3 of the Act defines the additional tax using the following calculation:

$$\text{Tax UTM}^{90} = [(35/\text{urban fuel efficiency (km/L)}) + (120 \times \text{g/km NO}_x)] \times (0.00000006 \text{ sales price})$$

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_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.

5.6.2 Financing and Funding

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 5.6.5).

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.

⁸⁹ 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>

⁹⁰ Unidad Tributaria Mensual, a Chilean currency unit to calculate taxes, fines and custom duties.

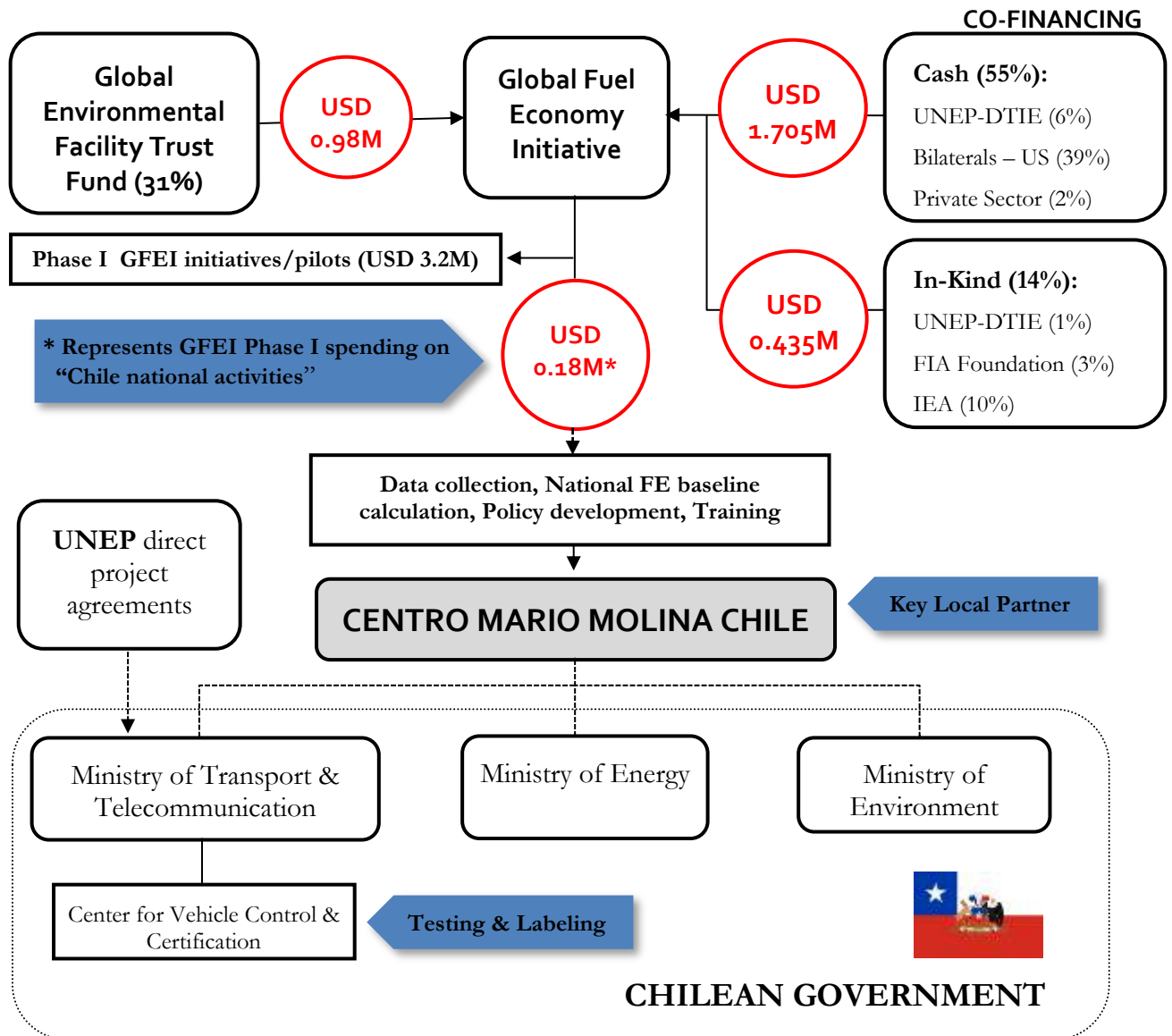


Figure 5.6.5: Project Financing and Implementation Structure

Source: CS based on analysis of multiple sources, including GEF (2012), Project Identification Form: Stabilizing GHG Emissions from Road Transport Through Doubling of Global Vehicle Fuel Economy: Regional Implementation of the Global Fuel Efficiency Initiative (GFEI); UNEP, Project Document: The Global Fuel Efficiency Initiative; and Chile Air Quality Programme, Clean Transportation, Ministry of Environment, <http://portal.mma.gob.cl/>.

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

5.6.3 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, many 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.⁹¹

In Chile, it was estimated that the labelling and feebate policy measures would yield a 5 percent reduction of CO₂ emissions from the total national new 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.⁹² However, the feebate will likely not be adopted, and no data are available to verify whether any emission reductions have been achieved from the labelling policy or the new vehicle taxes.

5.6.4 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, policy for labelling of new vehicles, and developing a fiscal instrument (feebate) to incentivise 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 NO_x emissions as part of a larger tax reform bill. The policy that mandates vehicle testing and labelling 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, in this case USD 180,000 from the international community.

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.

⁹¹ Global Fuel Economy Initiative. 50 by 50: Making Cars 50% More Fuel Efficient by 2050 Worldwide.

⁹² UNEP -

<http://www.unep.org/climatechange/ClimateChangeConferences/COP18/Booklet/CLEANERCARSWITHTHEGLOBALFUELECONOMYINITIATIVE.aspx>

Regarding the potential 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 realised, 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 programme resources for testing and vehicle importers and retailers for labelling.

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.

Annex 2: Expert Group Members

- Ko Sakamoto, Asian Development Bank
- Jane Romero, Asian Development Bank
- Gunjan Parik, C40 Cities Climate Leadership Group
- Sean Kidney, Climate Bonds Initiative
- Matthew Jordan Tank, European Bank of Reconstruction and Development
- Carola Menzel, Frankfurt School of Finance
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- Graham Smith, HSBC
- Ravi Bugga, International Finance Corporation
- Daniel Sutter, INFRAS
- Michael Replogle, Institute for Transport and Development Policy
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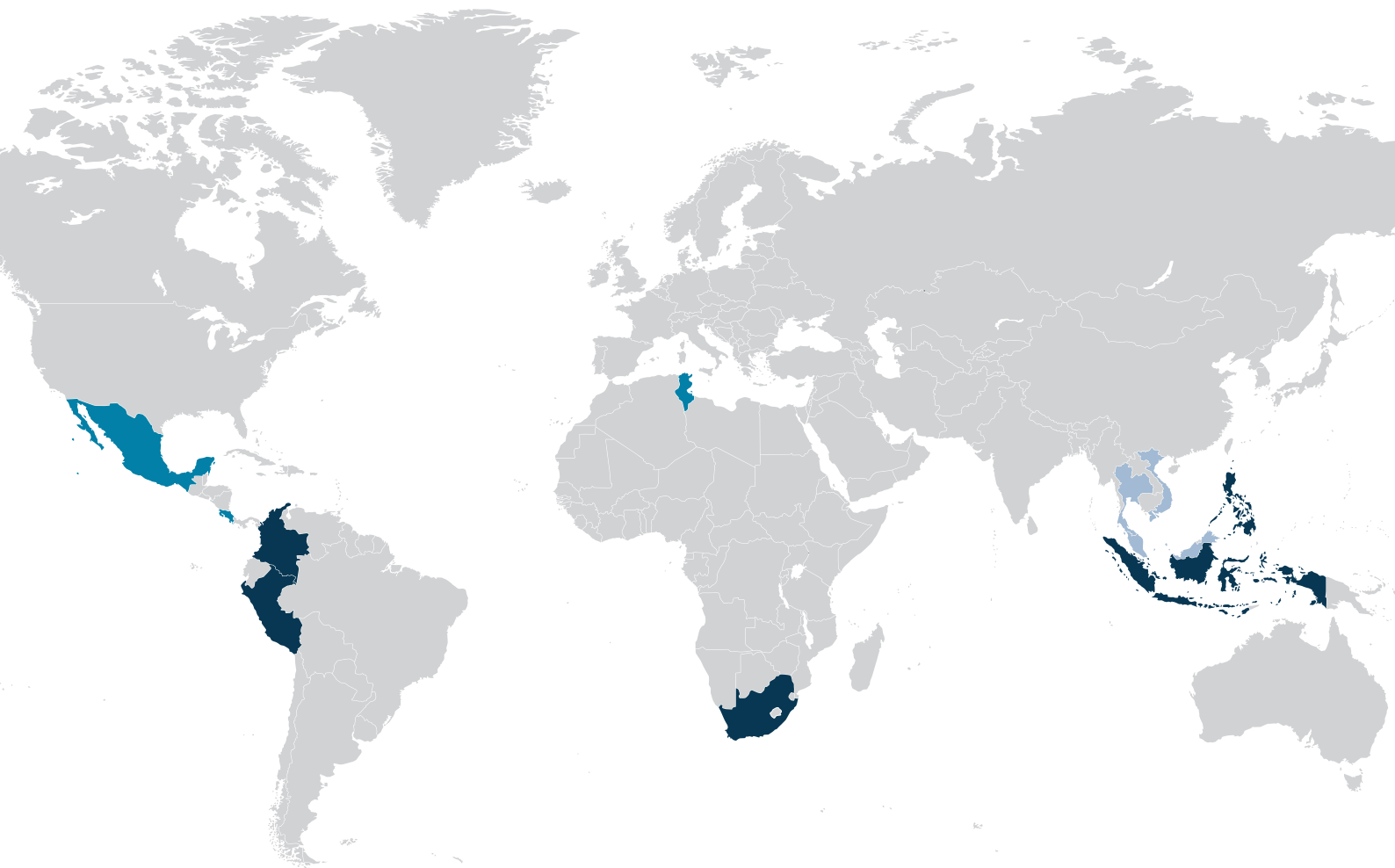
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