Towards a Green Investment Policy Framework - Case Study Series

MOBILISING PRIVATE INVESTMENT FOR BUS RAPID TRANSIT SYSTEMS

The case of Metrobus, Mexico City

Prepared by CTS EMBARQ Mexico

This case study is part of the OECD project on Mobilising Private Investment in Low-Carbon, Climate-Resilient Infrastructure. The aim of the project is to assess and promote good practice policies that help countries encourage private sector investment in low-carbon climate-resilient infrastructure. The present case study, prepared by CTS EMBARQ Mexico, was developed for the OECD Roundtable Discussion on “Mobilising Private Investment in Low-Carbon, Climate-Resilient Infrastructure”, 25 September 2012. It builds on the OECD paper “Towards a Green Investment Policy Framework: The Case of Low-Carbon, Climate-Resilient Infrastructure” (COM/DAF/INV/ENV/EPOC(2011)4/REV2).

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Mobilising Private Investment for Bus Rapid Transit systems: The case of Metrobus, Mexico city

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Abstract

Based on the case study of Metrobus, a Bus Rapid Transportation system in Mexico City, the current paper analyses how private investment can be mobilised towards low-carbon, climate-resilient infrastructure. Metrobus exists despite important barriers to its implementation, and after seven years of existence, the structure has shown a remarkable ability to learn and adapt, financially and in other regards, in order to continue system operation and expansion.

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## Abbreviations

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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>BRT</td>
<td>Bus Rapid Transit</td>
</tr>
<tr>
<td>CDM</td>
<td>Clean Development Mechanism</td>
</tr>
<tr>
<td>CO$_2$eqT</td>
<td>Equivalent tons of Carbon Dioxide</td>
</tr>
<tr>
<td>COP 16</td>
<td>Conference of Parties in Cancun</td>
</tr>
<tr>
<td>DPO</td>
<td>Decentralized Public Organism</td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse gas</td>
</tr>
<tr>
<td>LCR</td>
<td>Low-carbon climate-resilient</td>
</tr>
<tr>
<td>MCMA</td>
<td>Mexico City Metropolitan Area</td>
</tr>
<tr>
<td>PROAIRE</td>
<td><em>Programa para Mejorar la Calidad del Aire en la Zona Metropolitana del Valle de Mexico</em> (Programme to Improve Air Quality in the MCMA)</td>
</tr>
<tr>
<td>PECC</td>
<td><em>Programa Especial de Cambio Climático</em> (Special Programme for Climate Change)</td>
</tr>
<tr>
<td>PROTRAM</td>
<td><em>Programa de Apoyo Federal al Transporte Masivo</em> (Federal Support Programme for Mass Transit)</td>
</tr>
<tr>
<td>RTP</td>
<td><em>Red de Transportes Publicos</em> (Public Transport Network)</td>
</tr>
<tr>
<td>TDM</td>
<td>Transport Demand Management</td>
</tr>
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</table>
This case study is part of an overall project developed by the Organisation for Economic Cooperation and Development (OECD) to assess and promote good practices and policies to encourage private sector investment in low-carbon climate-resilient (LCR) infrastructure. The work entails synthesis and analysis of policies and practices in OECD and non-OECD countries, with deeper insights drawn from case studies. The key output of this workstream is the OECD report “Towards a Green Investment Policy Framework: The Case of Low-Carbon, Climate-Resilient Infrastructure”.\(^1\) This five-point policy checklist towards a Green Investment Policy Framework aims to integrate climate and investment policy to align incentives and establish strong enabling conditions for green private investment, with a focus on infrastructure. The case study at hand will aim at applying the framework to the specific case of Metrobus (a bus rapid transit system operating with large capacity buses on confined lanes) in Mexico City to see how it mobilised private resources, and what could be done to increase private participation in LCR infrastructure projects.

### Box ES2: Towards a Green Investment Policy Framework

The proposed “green investment policy framework” consists of five elements, notably: (1) goal setting and aligning policy goals across and within levels of government; (2) reforming policies to enable investment and strengthen market incentives for LCR infrastructure; and (3) establishing specific financial policies that provide transitional support for new green technologies. Two other elements help to establish enabling conditions for business and investment: (4) harnessing and scaling up resources that increase the social returns for private investment (e.g. training and R&D, risk assessment tools); (5) establishing practices that promote green business and consumer behaviour, such as information and education policies.

Source: Corfee-Morlot et al., 2012 forthcoming

### 3 Introduction

Cities that wish to remain competitive in the future will do well to consider climate change within their planning processes and guide decisions with an eye to adaptation and mitigation of the vulnerabilities this entails. One of these decisions regards infrastructure construction, which is of significance because it locks-in emissions patterns over the

lifetime of the project. Therefore, careful selection of infrastructure projects is important for urban competitiveness, but, once that choice has been made, how will the project be financed?

This is a very important question considering the 1.2 – 1.5 billion USD needed in annual infrastructure investment in developing countries to close the development gap (Fay, Iimi and Perissin-Fabert, 2010). Because only half of this is invested each year, and private participation constitutes only 25% this investment, harnessing private resources is essential to help close this gap.

Metrobus deserves recognition not only as a form of mass transit in Mexico City, but also because it broke with previous forms of mass transit operation, introducing a new form of concessions, operation and management. It currently serves over 700,000 passengers every day, which has increased access to basic public services while contributing to climate change mitigation. The study is organized as follows. Section 4 will set the groundwork to understand why transportation is important in building resilient cities, and how Metrobus can contribute to the low-carbon agenda in Mexico. Section 5 will analyse the Metrobus project within the elements towards an OECD policy framework for green investment, identifying key barriers and success factors to the implementation of Metrobus. Section 6 will present advances that have been implemented since Metrobus to address those barriers and encourage private investment in Mexico. Section 7 will present our recommendations, and section 8 will present conclusions.
"In 1973, C. S. Holling introduced the word resilience into the ecological literature as a way of helping to understand the non-linear dynamics observed in ecosystems. Ecological resilience was defined as the amount of disturbance that an ecosystem could withstand without changing self-organized processes and structures (defined as alternative stable states). Other authors consider resilience as a return time to a stable state following a perturbation. […] In practice, maintaining a capacity for renewal in a dynamic environment provides an ecological buffer that protects the system from the failure of management actions that are taken based upon incomplete understanding, and it allows managers to affordably learn and change.” (Lance, 2000, p. 425)

Resilience is “the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks” (Walker et al, 2004, p. 5).

4.1. Definitions – Based on the previous definitions, a resilient city is one that has developed capacities to cope with shocks and stresses to its social, economic, cultural and technical systems, as well as to its infrastructure, so as to still be able to maintain or reconstruct the same functions, structures, systems, and identity, all while learning from these shocks and changing in response to them. Specifically, climate-resilient cities are urban areas capable of absorbing and adjusting in response to the various impacts of climate change: enhanced hydrological cycle, more dramatic weather events and more extreme temperatures. Because these impacts can potentially affect a multitude of sectors and activities, climate-resilience requires a widening of the scope of urban planning, both spatially and temporally. However, urban areas should not only seek to adapt to climate change and its effects, they should also seek to mitigate these, and so, we are likewise looking at the low-carbon nature of cities. In combination, a low-carbon, climate-resilient (LCR) city will be well prepared for the potential shocks of climate change, as well as mitigate the effects through a pattern of low emissions. In the daily fabric of a city, achieving this LCR urban space requires a holistic development plan that spans the entire range of human activity.

4.2. Integrated public policies - In order to attain this holistic development, an integrated public policy plays a key role in enhancing citizens’ capabilities and facilitating access to urban services such as health, emergency, and security services. This access can be significantly aided by a well-coordinated urban transportation system, which diminishes social vulnerability while augmenting human capabilities, and thus alleviates poverty by increasing human development possibilities. A World Bank study on mitigation of greenhouse gas (GHG) emissions for Mexico's transportation sector (CTS, 2009) emphasizes the need to consider public policy-making for emissions mitigation in the transport sector, as an integral group of measures. This proposal is summarized in Figure 1:
4.3. Strategies - As presented in the Carbon-Emissions Mitigation Strategy, the transport related measures that can lead to low-carbon development are:

- **Land Use:** Refers to measures that promote the densification of urban areas by placing limits on the growth of new urban centres in peripheral areas. This reduces the length of average trips and the intensity of urban vehicle use.

- **Fuel and technology:** Policies that accompany the growth in vehicle stock by making it more environmentally sustainable.

- **Public Transport:** Includes optimizing routes in the public transport system and efficient mass transit systems that allow the existing collective transport routes to be reorganized, meeting demand with fewer units and reducing travel time. It also includes improvements to urban infrastructure (roads, bus stops and signals), public information, traffic monitoring and control, and improvements in the quality of passenger services.

- **Non-Motorized Transport:** Incorporates the promotion of less polluting options for mobility such as non-motorized alternatives. These systems prioritize pedestrians and cyclists, in addition to being efficient, accessible and non-polluting means of transport that have health benefits and recreational value.

- **Transport Demand Management (TDM):** The main objective of TDM is to implement measures that internalize the social cost of using private cars and instead promote the use of sustainable transportation. It comprises actions that...
influence travel behaviour and distributes these actions according to the transport system’s capacity and efficacy, as well as to the mobility needs of urban centres.

**Freight Transport**: Its objective is to optimize the logistics of freight, including the creation of freight enterprises and/or cooperatives, specialized terminals, freight transport corridors and information systems that will benefit truck drivers and operators.

**Cultural, institutional and financial structure**: While all the previous policies are based on the Avoid-Shift-Improve formula (Eichhorst, 2009), which seeks to avoid or reduce the number of necessary trips through urban integration, to shift transportation modes to non-motorized alternatives, and improve automobile and fuel technologies, the whole structure is influenced by this seventh element. If programmes which aim to change the previous six components of transportation fail to take into account this last one, their success is put at risk.

4.4. **Pathway** - This Carbon-Emissions Mitigation Strategy (CTS, 2009) shows that an emissions trend such as the one presented in Figure 2 is possible given well-governed and sound institutions that harness financial resources to this end.

**Figure 2. Alternative GHG emission pathway**

Source: CTS 2009.
4.5. Multi level governance - In order to implement the previous strategy and achieve the emissions pathway presented in Figure 2, actions must be taken at different levels. Also, these actions must consider mitigation, with an aim to attaining resilience. To understand the different aspects of the city that must be involved and planned for in order to achieve LCR development, we consider the framework presented by the Centre for Study of Science, Technology and Policy (CSTEP, 2011). This study details four broad planning areas that must be considered to improve the resilience of cities to environmental shocks associated with climate change. They are presented in Figure 3and detailed after.

Figure 3. Elements of Resilience.

Source: CTS Embarq Mexico, 2012. 
The elements that help ensure resilience shown in the previous figure work in the following ways:

1. **Emergency preparedness** to ensure that cities can quickly respond to shocks. This requires society and government to be prepared for natural or man-made hazards, which requires up-to-date knowledge of existing infrastructure, a reliable communication system and a clear command and control process. Adequate planning, education and preparation are needed to achieve a state of readiness for hazards or emergencies.

2. **Integrated planning** to limit the unsustainable growth of cities. A well-planned city works towards a “low-carbon, high-quality, liveable city” through the integration of “compact development, public transportation, energy-efficient buildings and educated citizens” (CSTEP, 2011, p.5). Transport systems and transport-oriented urban development play a crucial part in developing an integrated, planned city.

3. **Improved urban services** to provide connection in times of crisis. Integrated planning highlights the major role of urban development in relation to transport; while public transport is required to meet human mobility needs in order to reduce the impact of climate risks on the local population. The development of “a green, robust transportation system that is attractive and effective for all income levels” (CSTEP, 2011, p. 7) is central for a connected city.

4. **Good governance** to clarify the responsibilities of different public entities. A well-governed city is “ready for coming changes with an institutional cohesion that ensures that emergency preparedness, integrated planning and urban services are prioritized at all government levels” (CSTEP, 2011, p.10). Specifically, the present case study will highlight how governments might partner with the private sector to realize projects that work toward LCR.

This section has sought to lay the foundations for the analysis of the case study that will follow. It has introduced the concept of resilience, the importance of an integrated transportation policy in achieving this, and the different levels of planning that must act together to ensure cities develop along a LCR pathway. This engagement of stakeholders at different levels and from different sectors of society, all acting in alignment with an established set of policies and objectives, will aid cities in retaining and increasing their competitiveness at a global scale. We turn to the case study in the following section.
5 Metrobus Case Study

Introduction -

Government could set the conditions for a green investment policy framework that may in turn influence three key investment conditions: a) The existence of investment opportunities; b) the return on investment, including boosting returns and limiting the costs of investment; and c) the risks faced by investors throughout the life of projects. These investment projects could serve to reduce carbon emissions, while providing numerous other co-benefits and contributing to improving a city’s resilience.

The present study will expand on how a successful mitigation and adaptation public transport strategy was applied in Mexico City. The project analysed will be the Metrobus Bus Rapid Transit system, which corresponds to the third wedge of the carbon-emissions mitigation strategy present above. In order to achieve this strategy, the various elements of resilience were brought into play, each one with different levels of success and engagement.

The present case study will use Metrobus as an example of LCR infrastructure, and analyse the way private investment was mobilised in order to realise this project. The first part of this section (5.1) will be an overall description of the Metrobus system. The following sections will constitute the analysis of how this project was planned and executed, and will be guided by the OECD Policy Checklist for Green Investment (2012), which can be understood in the previously established framework.

Table 1 shows the Policy Checklist of the OECD, which sets out the case study structure.
Table 1. Policy Checklist for Green Investment

<table>
<thead>
<tr>
<th>Policy checklist for action</th>
<th>Impact on attractiveness for private sector LCR investment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Create a market, boost opportunities</td>
</tr>
<tr>
<td>1. Strategic goal setting and policy alignment</td>
<td></td>
</tr>
<tr>
<td>• Goal-setting and strategic planning, including infrastructure planning</td>
<td>X</td>
</tr>
<tr>
<td>• Multilevel governance to align policies and engage stakeholders</td>
<td>X</td>
</tr>
<tr>
<td>2. Enabling policies and incentives for LCR investment</td>
<td></td>
</tr>
<tr>
<td>• Policies to enable and mobilise private investment</td>
<td>X</td>
</tr>
<tr>
<td>• Open and competitive markets to green trade and investment</td>
<td>X</td>
</tr>
<tr>
<td>• Provide market incentives for low-carbon, resilient investment</td>
<td>X</td>
</tr>
<tr>
<td>• Regulatory policies to create markets and remove investment barriers to investment, public procurement</td>
<td>X</td>
</tr>
<tr>
<td>3. Financial policies and instruments</td>
<td></td>
</tr>
<tr>
<td>• Ensure a financial regulatory framework conducive to LCR investment</td>
<td>X</td>
</tr>
<tr>
<td>• Innovative financial tools and instruments to reduce risk or increase market liquidity</td>
<td>X</td>
</tr>
<tr>
<td>• Transitional direct support for LCR investment</td>
<td>X</td>
</tr>
<tr>
<td>4. Harnessing resources and building capacity for a LCR economy</td>
<td></td>
</tr>
<tr>
<td>• Foster innovation with R&amp;D policies</td>
<td>X</td>
</tr>
<tr>
<td>• Training and human capacity</td>
<td>X</td>
</tr>
<tr>
<td>• Administrative capacity for assessment, monitoring and enforcement</td>
<td>X</td>
</tr>
<tr>
<td>• Climate risk and vulnerability assessment</td>
<td>X</td>
</tr>
<tr>
<td>5. Promoting green business and consumer behaviour</td>
<td></td>
</tr>
<tr>
<td>• Promote responsible business in support of a green economy</td>
<td>X</td>
</tr>
<tr>
<td>• Information, education and public awareness policies</td>
<td>X</td>
</tr>
</tbody>
</table>

Source: OECD, 2012.

**Section 5.2** - Strategic goal setting and policy alignment will examine what policy goals Metrobus sought to meet. Any infrastructure decision is guided by a variety of objectives, not only those of the climate agenda, because consideration of all the co-benefits of any given proposal can help ensure that project selection is cost-efficient and coherent. Finally, the project only came to fruition due to the participation of numerous actors, whereas their engagement will also be discussed.

The enabling policies and incentives for investment in Metrobus will be analysed in section 5.3. This section will cover the market incentives that facilitated the Metrobus project, specifically the Clean Development Mechanism (CDM) and scrapping programme. Protection of property rights is covered in Section 5.2.2 regarding stakeholder engagement, because existing bus concessions on the various lines were valid at the moment of implementation and therefore involving the concessionaires in the project was easier than moving on without them.
Section 5.4 on financial policies and instruments to attract private sector participation, will present how Metrobus was financed. With the available data, it will show what parts of the system were publicly and privately funded, as well as what incentives the government had to include so to induce concessionaire participation.

Section 5.5 - Harnessing public and private resources and building capacity for a green economy will focus on barriers posed by knowledge and capacity. It will also discuss the learning process by which actors involved gained skills in the new processes required.

Finally, section 5.6 - Promoting green business and consumer behaviour, will examine public awareness campaigns used during the execution of the Metrobus project and green business practices. It will look specifically at the buses used for the system, which comply with specific emissions standards, as well as the public education campaigns carried out.
Description of Metrobus

“The [Metrobus] project has contributed to break-through the “Business As Usual” in Mexico City Transportation planning paradigm. Now it is possible to realistically envision an alternative to the costly implementation of metro and have a feasible cost-efficient solution to improve the City’s environment and mobility standards”. The elements of this breakthrough include changing “an unregulated, inefficient, atomized operation framework for buses to a modern, efficient, and reliable transport system with three important pillars: 1) the implementation of the physical infrastructure; 2) the creation of the managerial public entity to plan, operate and supervise the system; and 3) the negotiation and agreement of a financial structure of the contract with the public and/or private operators” (Nuñez, 2006, p. 2).

Metrobus is a Bus Rapid Transit (BRT) system, which can be likened to a “surface metro” (Cervero, 1998). These systems can operate with a variety of buses, according to the estimated number of passengers and the characteristics of the corridor, and can theoretically transport over 15,000 passengers per lane per hour, which is comparable to busy subway lines (Cervero, 1998). BRTs are usually popular transportation solutions because they are relatively easy to implement and cheap to build, especially when compared to rail options, which cost up to 10 times more per kilometre (CTS, 2009a). BRTs are typically characterized by (Hidalgo, n.d.):

- Dedicated, confined bus lanes.
- Enclosed stations.
- Electronic fee payment prior to boarding.
- Large buses, either articulated or bi-articulated.
- Advanced control systems to regulate times between buses, overcrowding, etc.
- Distinctive image.

Figure 4 shows an articulated Metrobus unit on confined lanes:
Metrobus initiated operations in June 2005, with a 20 km corridor along Insurgentes Avenue, one of the main streets in Mexico City. This route began operations with 84 buses, 34 stations and 2 terminals. By April 2006, this line was already transporting 260,000 passengers per weekday (Hidalgo, n.d.). Seven years after the Metrobus system was inaugurated, the initial corridor along Insurgents has been expanded (current Line 1), and three additional corridors have been implemented. See Figure 5 for a map of the current Metrobus system. It now covers a total of 93 kilometres, with 365 buses and a capacity of over 700,000 passengers per day distributed in 4 corridors:

a) Line 1.- Indios Verdes – Caminero,

b) Line 2.- Tacubaya – Tepalcates,

c) Line 3.- Tenayuca – Etiopia, and

d) Line 4.- Buenavista – San Lazaro. Includes an expanded service (with a higher fee) to the Mexico City International Airport.

These lines are presented on the following map:
Figure 5. Map of the Metrobus System

Table 2 details daily demand, total capacity, stations, terminals, buses and starting date of operation.

### Table 2. Metrobus Technical Details

<table>
<thead>
<tr>
<th>Metrobus</th>
<th>Km</th>
<th>Passengers (thousands)</th>
<th>Kilometres /year</th>
<th>Stations + Terminals +</th>
<th>Buses *</th>
<th>Start of operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line 1 Insurgentes Phase I Phase II</td>
<td>30</td>
<td>420</td>
<td>12,200,000</td>
<td>43</td>
<td>3</td>
<td>161</td>
</tr>
<tr>
<td>Line 2 Eje 4 Sur</td>
<td>20</td>
<td>160</td>
<td>5,625,000</td>
<td>34</td>
<td>2</td>
<td>96</td>
</tr>
<tr>
<td>Line 3 Eje 1 Poniente</td>
<td>17</td>
<td>130</td>
<td>4,050,000</td>
<td>31</td>
<td>4</td>
<td>54</td>
</tr>
<tr>
<td>Line 4 Centro Histórico</td>
<td>28</td>
<td>40</td>
<td>3,750,000</td>
<td>30</td>
<td>4</td>
<td>54</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>95</td>
<td>750</td>
<td>25,625,000</td>
<td>138</td>
<td>13</td>
<td>365</td>
</tr>
</tbody>
</table>

* Source: García, 2012. Line 1 includes 21 bi-articulated units, and all units on Line 4 are 12 metres long.

This section has presented a snapshot of the Metrobus system, from the first line opened, up to the current 4-line system. The follow section will begin the analysis of the system, following the OECD policy checklist.
Strategic goal setting and policy alignment

In order for LCR projects to be properly oriented, there must be a clear set of targets for infrastructure that follow a long-term vision and anticipate climate change. Additionally, policies must be aligned at different levels of government, and stakeholders must be engaged in order to achieve these goals. This section will analyse how Metrobus is a response to a grassroots development movement, which brought together different actors from civil society, government and the private sector in order to achieve a vision of sustainable transportation.

5.1.1 Strategic policy alignment

A clear clean air agenda and a co-benefit approach

Nationally, Metrobus was developed in Mexico, the first non-Annex I country worldwide to adopt unilateral objectives to mitigate GHG emissions. In the Conference of Parties in Cancún (COP 16), Mexico committed to reducing its GHG emissions up to 30% from a 2010 baseline scenario in the case of international financial support. In his opening speech, President Calderón mentioned the importance of such action and stressed that mitigation and economic growth are not contradictory (Konrad et al, 2011). Finally, Mexico received support and praise for its management and leadership within COP 16 by United Nations General Secretary Ban Ki Moon.

Locally, Metrobus grew out of a greater effort to address poor air quality in Mexico City, but evolved into a low-carbon, climate-change mitigating project due to World Bank participation. The Metrobus project began as part of the Programme to Improve Air Quality in the MCMA 2002-2010 (PROAIRE), directed by the Environmental Ministry for Mexico City. This program presented a broad set of recommendations towards improving air quality in the city. The program, which included plans to improve the city’s bus services by introducing cleaner vehicles, was also included as part of the World Bank Global Environmental Fund project, “Introduction of Climate Friendly Measures in Transport” (World Bank, 2002). This World Bank project was important for several reasons (Lobo, 2012): First, it helped prepare the project by creating an interdisciplinary team to work on it. It also provided 4.8 million USD for project planning, and was

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2 The group of countries included in Annex I (as amended in 1998) to the UNFCCC, includes all the OECD countries and economies in transition. Under Articles 4.2 (a) and 4.2 (b) of the Convention, Annex I countries committed themselves specifically to the aim of returning individually or jointly to their 1990 levels of GHG emissions by the year 2000. Non-Annex I parties are mostly developing countries that may volunteer to become Annex I countries when they are sufficiently developed.
insistent on the Carbon agenda; therefore, the Clean Development Mechanism was ever-present as an underlying element.

Metrobus qualifies as a low-Carbon project for several reasons. The system has increased travel speeds along the corridors on which it operates, and has induced a modal shift, from private vehicles to large-capacity buses, thereby reducing carbon emissions. Additionally, Metrobus has reduced total emissions by replacing 1108 highly polluting buses that had previously serviced the route. In total, the system reduced over 107,257 of CO$_2$eqT during the project’s first three years of operation (2005-2008). Currently, reductions are estimated at 40,000 CO$_2$eqT/yr although it is currently only reporting reductions for the original Insurgentes lines (Escalante, 2012).

While Metrobus was conceived as a measure to improve the city’s air quality, the various co-benefits it could offer were key in gaining the support of the various actors needed for the project to pass from concept to reality. Many of these co-benefits mirror the aims outlined by CSTEP as necessary to achieve greater resiliency: reducing the population’s Carbon emissions, creating “redundant and durable systems” and infrastructure, and coordinating transport through a central body in order to improve “feedback sensitivity” and increase data collection (CSTEP, 2011, p. 5, 6). Additionally, because the project required collaboration between the public and private sectors, it helped create an institutional precedent for public-private partnership that would aid in scaling up the system itself while also catalysing similar projects in other Mexican cities. The specific co-benefits that the project has cited include:

**Reduced travel times:** According to Voukas (2012), prior to the existence of Metrobus on Insurgentes, a trip from Indios Verdes to El Caminero, the northernmost and southernmost terminals of Line 1, took 2 hours and 40 minutes. With Metrobus, it now takes 1 hour and 23 minutes, nearly 50% faster. Travel time reductions have been similar for subsequent lines, with reductions of over 50% on Line 2, and over 40% on Line 3 (Voukas, 2012). By reducing the amount of time that individuals spend travelling, the project allowed for significant gains in human productivity—an estimated 180 million man-hours annually (MB, 2012).

**Speed gains on Metrobus corridors:** average speeds on Insurgentes increased from 12 km/hr to 19 km/hr for the confined busway, and to 17 km/hr for other traffic (Voukas, 2012).

**Modal shift:** 15% of users report having left their vehicles in order to use the Metrobus system, amounting to about 122,000 fewer daily trips in private vehicles (MB, 2012).

**Replacement of old units:** Because the corridors became the exclusive domain of Metrobus for public transportation, other microbuses and buses were no longer allowed, and a scrapping programme was put in place which destroyed 647 microbuses and 31 buses for Lines 1 and 2; and some 430 vehicles for Line 3. In total, the Metrobus has therefore resulted in the replacement of 1108 one-man, one-bus units (older, more polluting) with 365
clean units (all Euro III, IV or V compliant, with higher capacity and 95% lower emissions). (MB, 2012).

Health gains resulting from local air quality improvements (reduction of CO, NOx and PMs) and noise reduction (MB, 2012).

Road safety improvements: Considering only Line 1 Insurgentes, accidents were reduced 84% from 2005-2010, with a 54% reduction in the first year alone (Voukas, 2012).

Additionally, the Insurgentes Avenue has been revitalized due to the modal shift induced by the corridor. There are many new buildings, density has increased, and there are more businesses in operation.

Why Insurgentes? - Insurgentes was chosen as the first route in part due to the fact that relatively little investment in physical infrastructure would be required, thus reducing risk by minimizing costs and the time necessary for completion. The staggered construction of Metrobus lines also reduced risk by demonstrating the feasibility of BRT in the city and by generating best practices and lessons learned that could then be considered for construction of subsequent lines. Insurgentes was also chosen because it was a highly visibly thoroughfare, and it would hopefully become a recognizable project and be replicated elsewhere.
### Policy checklist for action

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Success Factors</th>
</tr>
</thead>
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<tr>
<td><strong>1. Strategic goal setting and policy alignment</strong></td>
<td></td>
</tr>
<tr>
<td>Current concessions scheme and the concessions law.</td>
<td>Civil society participation.</td>
</tr>
<tr>
<td>Political power of concessionaires.</td>
<td>Clear clean air agenda.</td>
</tr>
<tr>
<td></td>
<td>Very effective champion - Claudia Sheinbaum.</td>
</tr>
<tr>
<td><strong>2. Enabling policies and incentives for green investment</strong></td>
<td></td>
</tr>
<tr>
<td>Lack of PPP Law.</td>
<td>CDM Financing.</td>
</tr>
<tr>
<td></td>
<td>Scrapping programme.</td>
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<tr>
<td><strong>3. Financial policies and instruments to attract private sector participation</strong></td>
<td></td>
</tr>
<tr>
<td>Contractual agreements perpetuate perverse incentives.</td>
<td>Lack of sufficient government funding. Led to innovative financing schemes.</td>
</tr>
<tr>
<td>Concessionaires.</td>
<td></td>
</tr>
<tr>
<td><strong>4. Harness public and private resources and build capacity for a green economy</strong></td>
<td></td>
</tr>
<tr>
<td>Lack of knowledge, capacity or experience with similar projects.</td>
<td>NGO participation.</td>
</tr>
<tr>
<td>Unclear decision making process.</td>
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<tr>
<td><strong>5. Promoting green business and consumer behaviour</strong></td>
<td></td>
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<tr>
<td>Insufficient awareness campaigns.</td>
<td>Commitment to emissions reductions.</td>
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<tr>
<td></td>
<td>Innovative business model.</td>
</tr>
</tbody>
</table>

#### 5.1.2 Stakeholder engagement

**A very effective champion**

Leadership for the project was undertaken by Claudia Sheinbaum, Secretary of the Environment for Mexico City from 2000 to 2006. She created a planning and implementation team (the Project Implementation Unit) responsible for overseeing the project’s development, from obtaining the initial funds to undertake the feasibility studies, to convincing the mayor of the viability of the project. She was also a key negotiator with concessionaires. This process, from conception to realisation was long, requiring several years to gain district government support and international funding.

**An active participation from civil society**

Hidalgo asserts that the “involvement of international organizations, the academia, some professional associations, and local environmental groups helped in creating conditions for acceptance of the project at the highest level” (Hidalgo, n.d., p. 9).

**Intl orgs** - Mexico City’s Secretary of Environment also appealed to international organizations for supplementary investment, ultimately gaining support from the World Bank, the Japan Human Resources Development Program, the World Resources Institute/Shell Foundation, and the Hewlett Foundation. These organizations funded and
worked alongside the Environmental Ministry from developing the project through initial infrastructure studies all the way through the project’s implementation. The project was not the result of a cohesive strategic plan from the transport authorities of Mexico City, but of a project exploration between civil society and the Environmental Ministry for the Mexico City. This grassroot development process started with civil society, and was escalated through all the levels of the district government, until reaching the city mayor.

**Other organizations** - Specifically, environmental groups requested sustainable mobility solutions and put significant pressure on the government, while civil society organizations also worked with the Environmental Ministry for Mexico City in the design of the Metrobus project starting from 2000. This was aided by the objectives set by PROAIRE, a program to improve the air quality in the Mexico City Metropolitan Area, and the need to show results in this regard. Additionally, civil society played an important role in providing technical advice and contact to experts for project implementation. As part of the aim to accelerate the project’s implementation, public officials made project decisions without consulting the general public, though certain efforts were made to educate journalists, neighbours and pedestrians, mainly by civil society actors (Hidalgo, n.d.)

**The political agenda: threats and opportunities**

The head of the Mexico City government at the time, Andrés Manuel López Obrador (AMLO), officially committed to the project on the 2nd of August 2004, nearly four years after the conception of the project, and two years after work began in earnest to plan the system (Hidalgo, n.d.). The initial barriers to his approval were a lack of funding due to investment in the second tier of the city’s beltway, and the possibility of objections from public transport concessionaires. However, an increase in oil prices brought in unexpected funds, and investment became possible (Lobo, 2012; Nuñez, 2006). Prior to his approval, all planning had been done thanks to the funding secured by the Mexico City’s Secretary of Environment in a project that was not approved. It is noteworthy that López Obrador’s approval came at a high cost for Mexico City. Having decided by that point to run for President in the 2006 elections, he pushed for the project’s completion by the elections, which made it time constrained and politically sensitive, putting a lot of pressure on the Project Implementation Unit (Hidalgo, n.d.; Nunez, 2006).

**Stakeholder engagement**

Figure 6 presents the parties involved in the first line (Insurgentes) of the Metrobus system. The first element is Metrobus, a decentralised body of Mexico City’s government which plans, controls and manages services. The second element is the service operators, for instance, the original contract for Line 1 was given to Corredor Insurgentes, S.A. (CISA). The third group involved are fare collectors, which includes INBURSARSA as the bank, and two other companies that install, operate and maintain the fee collecting system. Finally, a trust fund was created to gather all collected fees so to pay out the corresponding amounts to the transportation companies based on the number of kilometres travelled. (Metrobus, 2012; Hidalgo, n.d.).
1. **Metrobus DPO** - One of the project achievements (Hidalgo, n.d.; Nuñez, 2006) was the creation of Metrobus Decentralized Public Organism (DPO) as an autonomous entity under the Secretary for Transport and Roads, on 16 March 2006. Metrobus DPO reports directly to Mexico City’s Mayor, and is commissioned to the system’s planning, control and supervision. Civil society organizations such as CTS EMBARQ Mexico are still involved in the planning and monitoring stages so to achieve an integrated transport system. Hidalgo states that the “project was implemented outside the existing institutional structure and, probably, it is one of the success factors, as the implementation team was focused on the project achievement and not concerned with the day to day traditional dealings of the existing agencies” (Hidalgo n.d., p. 10).

2. **Concessionaires** - Bus service on Insurgentes was originally provided by Ruta 2, a group of 200 concessionaires operating under the one-man, one-bus scheme. These concessions are protected by law, and any government intervention within these patrimonial rights would likely lead to lawsuits and public protest (Hidalgo, n.d.; Nuñez, 2006). Despite this, the government decided to replace individual...
concessions within a single concession for the entire fleet. Therefore, concessionaires originally operating on Metrobus route presented significant opposition to the project, and their objections represented one of the key obstacles to be overcome for implementation. These objections stemmed from fears regarding the new business model proposed or required for implementation. This was overcome only after exhaustive negotiations were undertaken between concessionaire leaders and the government beginning in May 2004 and lasting nine months (Hidalgo, n.d.).

a. **Microbuseros** – This negotiation led to the creation of firms that represented the interests of all microbus drivers along the given route. Hidalgo notes that, by promoting the formation of such unified, private entities to oversee Metrobus operations, the public sector may have promoted a more profitable business model, as the previously fragmented concessionaries under CISA “shared revenues, risks and responsibilities in the corridor rather than compete with each other for riders,” and might achieve economies of scale (n.d., p. 1). However, Hidalgo also notes that “direct assignment of the bus operation contracts and fare collection administration resulted in higher costs than those obtained in competitive bidding processes elsewhere in Latin America” (n.d., p. 2).

b. **CISA** - Once negotiations were completed with concessionaires for the Insurgentes corridor, operators were constituted into a private company under the leadership of Jesus Padilla, Corredor Insurgentes, S.A. They, along with Red de Transportes Publicos (RTP), a publicly owned and operated transport entity, were originally responsible for operations on the Insurgentes corridor. Sixty-four of the original forty-four buses belonged to CISA, with the other twenty belonging to RTP (Hidalgo, n.d.). Operators on the Insurgentes corridor are paid by kilometre travelled, initially negotiated at 24.9 MXN/km; although the contract with CISA allows for annual negotiations, and has led to near perpetual negotiations between them and Metrobus DPO.

c. **RTP** – Is a public transportation company that became involved in Metrobus for the same reason as the concessionaires – it already existed in the Insurgentes corridor. It has so far served as an example to the newly constituted operators, as well as an initial benchmark. (Escalante, 2012).

While concessionaires were involved to avoid social problems, this is not the only available scheme. In Cali, Colombia, they were compensated for the first three years of operations, and then a new company was constituted. In Panama, they were all paid to exit operations. Thus, alternatives exist. (Workshop, 2012)

3. **Fare collection and trust fund management** was originally assigned to INBURSA, a private bank, while the fare collection system was purchased from
Ascom directly by Metrobus DPO. INBURSA’s responsibilities include providing fare cards, collecting the money, and maintaining the system.

4. **Trust fund** - Fare is collected in a trust fund which is administered by Metrobus, with both public and private owners. This fund is meant to cover the following costs, in order (Escalante, 2012):
   i. Trust fund – Pays the bank that houses the trust fund, which generates interest at Interacciones Bank.
   ii. Payment of the bus credit.
   iii. Bus operation – Payment per kilometre.
   iv. Fare collection operation.
   v. Metrobus – Entitled to up to 5.6% of annual fare collection.
   vi. Other – Fleet Renewal Fund, Station Improvement, automated control centre, etc.

**System** - The previous explanation for the Metrobus system implementation has been largely limited to the first line. However, that line has been expanded, while other three new ones have opened. Table 3 presents actual stakeholders now participating in the operations of Metrobus.

**Table 3. Operation Stakeholders**

<table>
<thead>
<tr>
<th>Line</th>
<th>Operators</th>
<th>Private Trust Fund</th>
<th>Fare Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Corredor Insurgentes, S.A. de C.V.</td>
<td>CISA RECSA RTP</td>
<td>Inbursa</td>
</tr>
<tr>
<td></td>
<td>Rey Cuauhtémoc, S.A. de C.V.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Corredor Eje 4-17 de Marzo, S.A. de C.V.</td>
<td>CE4-17M RTP</td>
<td>IDEAR Electrónica</td>
</tr>
<tr>
<td></td>
<td>Corredor Tacubaya Tepalcates, S.A. de C.V.</td>
<td>CTTSA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Corredor Oriente-Poniente, S.A. de C.V.</td>
<td>COPSA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transportes Sanchez Armas JJ, S.A. de C.V.</td>
<td>TSAJJ</td>
<td>Movilidad Integral de Diseño, S.A.</td>
</tr>
<tr>
<td>3</td>
<td>Movilidad Integral de Vanguardia, S.A. de C.V.</td>
<td>MIVSA</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Conexión Centro Aeropuerto, S.A. de C.V.</td>
<td>Conexión</td>
<td>Inbursa</td>
</tr>
</tbody>
</table>


**Enabling policies and initiatives for green investment**

This **section** will analyse how investment was incentivised in Mexico City. Specifically, it will look at the incentives for LCR, which help correct externalities originating from the business-as-usual transportation sector. A large part of this is due to the general climate investment existing within the country and city; but in regards to this project, this was
largely discussed in the previous section under stakeholder engagement. The current state of private property protection law led to a negotiating process with previous concessionaires, leading to the involvement of the private sector within system operations. Other than that, it will look at how LCR was achieved, specifically through the CDM and the scrapping programme.

- Barriers

**Overall investment environment** While the Mexican government sought private investment in, and maintenance of, transportation infrastructure in the 1980s and 1990s; its efforts were of limited success. In 1997, for instance, the government was forced to dissolve and restructure many of the highway concessions awarded as travel demand fell short of expectations and interest rates increased with the peso devaluation of 1994. In turn, this incident negatively impacted future private investment in infrastructure as country risk had increased, and the government was unable to comply with the contractually obligated guarantees and adjustments (World Bank, 2003).

**Market structure: concessions schemes and concessions laws as a key barrier to implementation**

A major source of opposition to BRT systems in other Latin American cities has come from the existing transportation sector that the project threatens to displace (CDM, 2006). In Mexico, concessions law gave patrimonial rights to concessionaires and led to a closed, non-competitive, opaque process that could not be submitted to a public bidding process (Nuñez, 2006). The concessionaires also obtained improved work stability and benefits under this arrangement, and the government purchased outdated microbuses for scrapping.

**The absence of PPP law** - Despite the fact that the Metrobus BRT system combines public and private investment, it is not a Public-Private Partnership (PPP). The PPP Law was not approved in México until early 2012, and therefore, the figure did not exist when current Metrobus lines were being planned and implemented. Metrobus operations are still run by concessions, belonging to enterprises, instead of individuals. See section 6 for recent advances. Therefore, the fact that this association was managed without this law is noteworthy as one of the key accomplishments of the project. Concessionaire involvement was a reality that had to be dealt with, and this was done in spite of the lack of a legal figure to guide it (Lobo, 2012).

- **Success factors: the scrapping programme**

This **scrapping programme** served a double function. In order for Metrobus to attract adequate ridership, it needed to eliminate the competition from existing microbuses that served the route at a low price to users, but with high social costs in terms of road safety and air quality. Construction of the Metrobus system was therefore linked to this bus scrapping program, which compensated microbus owners for their old vehicles. It was also necessary to comply with the CDM requirements. Therefore, during the transition
period between elimination of the individual concessions and buses, and the beginning of operations as a company operating a fleet of buses; the government provided help with bus financing and scrapping through 150 payments of 100,000 MXN for destruction of old buses (Lobo, 2012).

Financial policies and instruments to attract private sector participation

Metrobus is being analysed for the current study because it is an example of how private investment was mobilised for LCR infrastructure. In this case, we are considering the entire Metrobus system, and the private sector was involved in several ways in its financing, from construction to operation. We will first briefly discuss how transportation infrastructure has been financed in Mexico, and then how the Metrobus system was financed, as well as some of the challenges this has represented.

In Mexico City, the public and private sectors have historically invested in and operated mass transportation systems separately. In fact, the sectors have increasingly competed for demand since the mid- to late 1980s, as the privately owned and operated microbuses have gained an increasing share of riders at the expense of the publicly owned Metro, trolleybus, and bus (Ruta-100) systems. Moreover, the government has had little success concessioning bus services to the private sector after Ruta-100 declared bankruptcy in 1995, in large part because competition from microbuses rendered the investment unprofitable (Gakenheimer et al., 2002).

One of the primary obstacles to generating private investment in fiscally constrained nations is a lack of revenues to cover large up-front costs of transportation infrastructure projects, such as the acquisition of vehicles (Lobo, Uniman and Aguilar, 2011). This obstacle has been overcome in the case of Metrobus through “the unbundling of transit service provision elements (e.g. separating infrastructure construction and maintenance from the operations),” while appealing to the co-benefits that the project would generate in order to draw from external funding sources (Lobo, Uniman and Aguilar, 2011).

Historically, an additional barrier to private investment in local projects such as Metrobus has been the highly centralized nature of transportation planning and investment in Mexico, compounded by the high degree of dependence of states on the federal government for funding (Loftus-Otway et al., 2009). Local projects requiring large upfront public investment must therefore compete with other demands for federal support. Metrobus addressed this issue through partnership with a large number of local and international private entities, the latter providing essential support for project planning and design. While the need to secure support from such diverse interests might
make projects more difficult to realize, it also ensured that the project advanced the wide-ranging goals of LCR development at a time when LCR planning was nascent.

The inclusion of international organisation as a key success factor

**CDM** - As the purpose of Metrobus at its inception was to address issues of local air quality and traffic congestion, it was difficult to demonstrate the project’s additionality—that World Bank funding would induce reductions in GHG emissions that would not have otherwise occurred—as the World Bank requires of Clean Development Mechanism (CDM) projects. The process of gaining CDM funding significantly delayed the project, though once acquired, the financial support and institutional prestige of the World Bank may have mobilized additional local funding and political support for the project.

Metrobus receives about a hundred thousand dollars a year for its CDM. The initial Insurgentes corridor was the only line planned to be registered as a CDM project; although it is believed that World Bank insistence on the carbon agenda at the moment played an important role. However, Metrobus DPO is inscribing all existing lines, and pre-inscribing those that are planned. The CDM will be renegotiated this year, and there is expectation of an income increase from this source, as emissions are currently paid at about 5 USD/CO$_2$eqT, currently equal to approximately 100,000 USD/yr (Escalante, 2012; García, 2012). This income has been used for opinion and follow-up surveys, operational analysis, a green station at Line 1 with solar panels, and bike racks.

The issue of availability of financing

As mentioned in section 5.2.2, one important barrier to the Metrobus BRT system implementation was **availability of financing**. At the moment the project was accepted, major infrastructure funding in Mexico City was being destined to the second tier of the beltway, and it was only due a windfall of revenues from an increase in worldwide oil prices that the project was possible.

**Metrobus financing** - Initial studies, planning and implementation of the project were largely funded through international grants, sought mainly by the Secretary of the Environment, Claudia Sheinbaum. Buses have been largely financed privately, except for contributions by the government in the first two lines. Infrastructure has been financed mainly by the government, except for Line 4. Both Lines 1 and 2 were financed through non-recoverable investments, and through an international public bid for infrastructure. On the other hand, financing for Lines 3 and 4 took different forms. These forms implied payment of debt for more than an administration and a half, and therefore had to be approved by the city’s Assembly. Table 4 presents investments in Metrobus:
Table 4. Metrobus Investments

<table>
<thead>
<tr>
<th>Line</th>
<th>Infrastructure</th>
<th>Fleet</th>
<th>Fare collection</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Privada</td>
<td>Pública</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1,277</td>
<td>327</td>
<td>109</td>
<td>1,713</td>
</tr>
<tr>
<td>2</td>
<td>850</td>
<td>255</td>
<td>85</td>
<td>1,190</td>
</tr>
<tr>
<td>3</td>
<td>1,200</td>
<td>250</td>
<td>-</td>
<td>1,450</td>
</tr>
<tr>
<td>4</td>
<td>450</td>
<td>250</td>
<td>-</td>
<td>700</td>
</tr>
<tr>
<td></td>
<td>3,777</td>
<td>1,082</td>
<td>194</td>
<td>5,053</td>
</tr>
</tbody>
</table>

Costs in millions of pesos.


Line 3 was financed via a “Payment for Services” scheme (Escalante, 2012) as follows. Metrobus rents the infrastructure for 10 years from the company that won the bid. The public bid was for Line 3 of Metrobus (lanes, stations, induced works, street and traffic lights), as well as a repayment of the avenues of Vallejo and Guerrero with hydraulic concrete, traffic and street lights, a median and certain intersections (approx. 12-14 km). The bid was for construction, maintenance and financial risk. Of the entire investment, only 1,200 million MXN was the infrastructure investment for Metrobus, which is being repaid over 10 years, 283 million MXN a year. After 10 years, it will be opened for bid again under the same scheme.

Line 3 – According to Escalante (2012), operation for Line 3 was given to a private company that united the 430 concessionaires that operated on the corridor initially, and a large private transportation company, ADO. These were constituted into MIVSA. Each of the initial concessionaires gave up their buses for scrapping, and their concessions earned them one stock in MIVSA. The concessionaires are therefore owners of 49% of the company, with the controlling 51% belonging to ADO. The number of stocks is fixed.

Line 4 was financed along with one of the segments of the second tier of the city’s beltway (Escalante, 2012). In addition to the cost for building the second tier of the beltway, maintaining it for the duration of the contract (20 years) and the financial risk estimated for the project, the government required bidding companies to include 700 million MXN for construction of this line, along with other small semaphore projects, several stations, and a bicycle path. Of these 700 million, 520 were used for Metrobus Line 4. The company that won the bid will recover this investment through fare paid to use the second tier of the beltway.

Line 5 – Looking to the future, Line 5 is already being planned, and at the moment, financing is expected to come from PROTRAM, the Federal Mass Transit Programme. Lines 1 and 2 were implemented before PROTRAM existed, and Lines 3 and 4 were not
funded through this mechanism due to slow loan processing times and availability of alternate sources for funding (Escalante, 2012).

**Drawbacks of the financing arrangements**

Infrastructure - Infrastructure is not repaid in this scheme, and according to Lobo (2012), this is due to social equity concerns because private vehicle infrastructure costs are absorbed by governments, as should public transportation costs. Regarding bus operation, according to Hidalgo, the negotiations with concessionaires led to fixed payments of 24.9 MXN/km. INBURA negotiated for 8% of total income for fare collection administration and the interest rate obtained to finance bus acquisition was of 14%. All of this was higher than planned, and a year after operations began, the system had not been profitable. By 2010, Metrobus had income worth nearly 10 million USD\(^3\), but after all the elements are paid from the trust fund, it is uncertain whether there will be enough left over for Metrobus DPO to receive its share. In 2010, the DPO had losses of just over half a million dollars (Informe de Cuenta Pública, 2010).

Political fares - Regarding open and competitive market conditions, Metrobus fares are determined by the public sector, and have therefore taken into consideration equity concerns in addition to profitability. Fares were initially set at 3.5 MXN a trip, but currently stand at 5 MXN due to the unsustainability of the initial fee. For the system to be self-reliant, the fee would have to be adjusted in accordance to operational costs (Hidalgo, n.d.).

Perverse Incentives - Hidalgo (n.d.) notes the possibility of several perverse incentives under the conditions established in the contracts with private firms. The first is that the compensation for kilometres travelled can be revised annually, potentially leading to permanent negotiations. Additionally, compensating operators per kilometre travelled, regardless of passenger demand, might promote environmentally inefficient operation (e.g. an incentive to not adjust service downward during non-peak hours). Finally, RTP receives payments at the same rate, which may exceed efficient rates of remuneration given that the entity already receives public subsidies, and purchases buses using public monies. This could lead to inefficient operations.

Finally, in terms of attracting private capital, concessionaires are a significant obstacle due to internal divisions, lack of credit history and a very high level of social conflict (Interviews, 2012). Therefore, they are a barrier to private investment in their current form. As single enterprises, such as the model introduced by Metrobus BRT system, this obstacle is partially or totally overcome. Loans for buses have only been possible because the government steps in as guarantor. It is one of Metrobus’ great achievements to have proven that this financing scheme was sustainable (Escalante, 2012).

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\(^3\) Average USD/MXN exchange rate for 2010 was $12.6286 (Banco de Mexico, 2012).
Harness public and private resources and build capacity for a green economy

Metrobus occurred despite significant barriers to implementation regarding innovation, human and administrative capacity, as well as emergency and climate change planning. There were skill bottlenecks, and everyone involved in the project was forced to assume a very steep learning curve.

Initially, concessionaires on Insurgentes had a very strong bargaining position, and were able to negotiate very favourable operating conditions. In subsequent lines, Metrobus DPO has benefited from the initial experience with what is now CISA and from a stronger bargaining position. This has allowed them to standardize their contracts. For example, although each line has had particular conditions, contracts for Lines 3 and 4 are now the same, and when the contracts expire for operations on the initial lines and they are opened for new bidding, operators will be entered into the same scheme as Lines 3 and 4.

There was an important knowledge barrier due to the fact that Metrobus was indeed an innovative project for the city, and there was no experience or capacity to deal with its implications (Hidalgo, n.d.; Nuñez, 2006). This led to:

- Systematic under-estimation of costs, interest rates and risks.
- Overly optimistic assumptions about operation.
- Low-capacity to negotiate with concessionaires (300-400) by the Environmental Ministry for Mexico City.
- Little data available for engineering and financial analyses, or of low-quality.
- Delay in creating Metrobus DPO.
- Approval of non-specific Terms of Reference.
- Lack of a knowledge accumulation strategy.

The above led to a slow local decision-making process, operating losses, and glitches at the opening of the system. During the initial stages of operation, challenges involved driver training, fare collection system management and bus scheduling.

Other obstacles were found in the decision-making process, and due to managerial weakness. These involved a very vertical structure for making decisions and decisions were made based on non-technical considerations, low levels of delegation, unqualified
staff, and a lack of interest in expert advice or BRT best-practices from other developing countries (Nuñez, 2006).

According to Hidalgo (n.d.) and Lobo (2012), human capacity building was an important part of the role played by civil society and NGOs, which provided technical assistance and trips abroad to learn about other systems. Additionally, some of the learning required by Metrobus DPO was provided by RTP, a public organism and transit operator that had both administrative and operational experience. Finally, much of the learning process occurred on-the-job (Lobo, 2012); for example, with drivers learning about the new layout and manoeuvres required once the system had already started operation. It also eventually led to accumulation of knowledge at a local level regarding management, operation and control of the system in Metrobus DPO, as evidenced by the opening of three additional lines in the last four years.

On the positive side, Metrobus has served as a detonator for similar projects both in Mexico City and in the rest of the country, specifically regarding the legal and technical scaffolding required for its replication. Additionally, according to Lobo (2012), Metrobus and Macrobus led to the creation of PROTRAM, the Federal Support Programme for Mass Transit, which is a significant potential source of funding for sustainable transport projects.
Promoting green business and consumer behaviour

Finally, Metrobus was conceived as an air-quality improving project, which evolved into much more, now representing a key alternative for moving around Mexico City. However, there were certain steps taken by Metrobus to ensure that it achieved its emissions reduction goals, and there are areas of opportunities regarding education and public awareness campaigns and policies. This section will briefly discuss them.

Emissions reductions - Metrobus is a low-Carbon transportation system because it has made a significant impact on transport emissions through several means. The first is the improvement of the operated buses fuel efficiency along the system’s corridors. The buses themselves are technologically superior to the microbuses that they replaced. Buses on all the lines comply with at least Euro III emissions standards, with units introduced after 2008 complying with higher Euro IV and V standards (MB, 2012). All of the Line 4 units are Euro V compliant, with 8 Euro V hybrid units in operation. In contrast, about one-third of the buses that Metrobus replaced were Euro I or older, while 50% are less advanced than Euro III (CDM, 2006). Furthermore, the project vehicles are of greater capacity than the microbuses they displaced (160-240, relative to 20-85 passengers, respectively) (CDM, 2006).

Better business model - In addition to reducing the environmental impact of the buses themselves, by coordinating the once-fragmented model of bus transit along the program corridors, Metrobus improved the environmental efficiency of this transportation sub-sector. Finally, Metrobus has also promoted the uptake of new clean technologies after the completion of individual lines. In October 2008, it began to adopt Ultra-Low Sulphur Diesel gasoline technology (CTS, 2009a).

One barrier the Insurgentes corridor faced at its opening was that the public education campaigns were of limited success. Many users were not prepared for the change in transportation systems. Ordinary buses were removed overnight, and using Metrobus involved novel features such as prepayment of fare, and the need to wait in stations located on the median, not anywhere along the side of the road. This lack of information led to frustration for users, and portrayal of negative reactions by the media. Once these problems were detected, guides and authorities were posted in the stations in order to provide information and organize users. Other educational campaigns were mainly undertaken by NGOs to increase project acceptance and awareness of its environmental and transportation benefits. These were mainly aimed at journalists, public transit users and pedestrians (Hidalgo, n.d.). According to Lobo (2012), problems during the first days of operation of the Insurgentes corridor led to a learning process by which much more attention was paid to user education in future lines. For example, Line 4 of Metrobus, which opened in early 2012, involved a significant educational effort in order to gain acceptance and facilitate usage of a different kind of BRT. Line 4 has more discrete stations, lower buses, fare payment on the bus instead of the station, and fare purchasing in convenience stores near the route (Metrobus, 2012).
On the operating side, though RTP provided its expertise in operating large-scale public transit systems to CISA and Metrobus, there were various problems in system operations for the first several weeks, with low operating speed leading to long-waiting times, and unfinished infrastructure (Hidalgo, n.d.). Additionally, drivers were not fully trained and operating schedules were not initially drafted due to a lack of confidence in the passenger demand figures.

**Summary**
Table 5 presents a summary of section 5 of this study. It briefly presents the main barriers and success factors, discussed in greater detail previously, which have influenced the planning, implementation and expansion of the Metrobus BRT system.

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Source: CTS Embarq Mexico, 2012.
Main barriers and success factors, in order of the checklist:

1. Metrobus benefited greatly from the participation of civil society and of Claudia Sheinbaum, Mexico City’s Environmental Ministry, in supporting and promoting the project. Without these elements it would have failed. Additionally, there was a clear clean-air agenda in place thanks to the participation of several international organizations and donors, which assured this component to be considered during the planning and implementation phases. The project however faced serious objections from concessionaires, which had to be overcome. This however, led to an innovative transport operation scheme, which involved both public and private sectors; one of the greatest accomplishments of the system. This form of concession towards a company instead of group of individuals has been replicated in other systems across the country.

2. The project also benefited from CDM financing and from the scrapping programme put in place by the government. The lack of a PPP law makes the partnership between government and concessionaires more remarkable; although initially involved an innovative arrangement which didn’t simplify an already complicated negotiation process.

3. The Insurgentes line was only possible in 2006 thanks to a windfall in oil revenues which filled public coffers, depleted from construction of Line 12 of the subway system. In subsequent lines, this has been remedied through creative and socially equitable financing options, such as Line 4, where private vehicle users somewhat subsidize public transport users. Financially however, the project has faced challenges from the initial negotiations with CISA on Line 1. These contractual agreements have been modified in subsequent lines, and when the contract is renegotiated, they will enter into the same scheme. Finally, although concessionaires were merely a reality that had to be dealt with, not really an obstacle to the process, they are not financially helpful. They constitute new companies, with no credit history of their own but whose members are of dubious credit-worthiness, seeking financing for millions of dollars’ worth of buses. This has continued to be an obstacle, and has only been solved by Metrobus DPO actor as guarantor to these loans (Escalante, 2012).

4. Metrobus was, in large part, the result of a grassroots movement for better transportation options within Mexico City. Therefore, it benefited from NGO participation, such as that of CTS EMBARQ Mexico. However, it faced serious obstacles due to a lack of experience with similar systems, and a steep learning curve due to the time-constrained nature of the project. An important barrier in this regard was the lack of previous with BRT projects, and any notion of the concept or realisation of such a project.

5. Finally, Metrobus is a clean, LCR transportation system, with large, efficient, low-emissions buses, that introduced an innovative business model to the transit sector in Mexico. One final area of opportunity is the public awareness...
campaigns, to educate users and gain public support for what initially seem like very disruptive projects.

### 6 Recent advances

The following section will first present advances that will hopefully ease and incentivize private investment in LCR infrastructure. Many of these have not been mentioned above because they were not very relevant for Metrobus, but might ease the process of private investment in LCR infrastructure in the future.

Several important advances have been made in recent years that aim to set the legal and regulatory framework to guide investment towards LCR infrastructure projects:

1. Generally, public investment in Mexican transportation infrastructure has been low as a fraction of GDP (3.2%) relative to other developing nations such as Chile (5.8%), and China (7.3%) over the same time period (Presidencia de la República, 2007). Likewise, and perhaps consequently, Mexico has suffered lower rates of private investment in its transportation infrastructure; Bolt (2011, p.4) suggests that the lack of private funding is a consequence of the lack of an “institutional and regulatory capacity to integrate infrastructure construction into a sustained [public] investment and development program”. Recognizing this issue, President Felipe Calderón created the National Infrastructure Fund (FONADIN 2007-2012), which emphasizes providing public money to attract investment in transportation infrastructure projects that provide high economic and social returns. Likewise, the federal government established the Mass Transit Program (PROTRAM, 2008) seeking to attract private investment in local infrastructure projects as such support slowed in the face of the global recession.

2. Because the Mexican government recognizes that climate change is a major environmental challenge, it created the Special Program for Climate Change 2009-2012 (PECC). Mexico assumes the challenge of reducing its emissions 50% by 2050 relative to 2000 levels, which means that emissions have to reach an inflexion point before 2020 and drop steadily until 2050 to reach a level of approximately 340 MtCO2e (SEMARNAT, 2009). Some of the main goals stated in PECC for the transit sector involve energy savings arising from energy efficiency rules for light duty and heavy duty vehicles, using both diesel and gasoline; fleet renewal; improvements in both cargo and passenger transportation; and developing modern urban public transportation systems in cities with more than 100 thousand inhabitants (SEMARNAT, 2009).

3. A more recent advance has been Mexico´s General Law on Climate Change. The law was submitted on March 25, 2010, passed in December 2011 by the Senate and recently by the Chamber of Deputies. It was signed on June 4th, 2012 by President Calderón. The main objective of the law is the foundation of a Federal
Intergovernmental Commission with expanded powers to bring together existing and possible mitigation and adaptation initiatives. It emphasizes the vulnerable geographic location of Mexico to climate change and focuses on the need for a regulatory framework to increase the capacity – with the help of a Green Fund for Mexico- to mitigate GHG-emissions and to adapt to climate change (Senado de la República, 2012). Among its objectives is the implementation of a National Register of GHG-emissions and of a carbon market in Mexico similar to the EU-ETS. This is significant because Mexico is not an Annex I state of the Kyoto Protocol and therefore this law is an important step that includes central milestones for both climate change mitigation and adaptation in Mexico. Recommendations regarding this law would include a greater focus on concrete action and timelines, as well as more strictly formulated and worded sanction mechanisms (Articles 58-59).

4. At a local level, Mexico City established a Green Plan (Plan Verde, 2012) that sets objectives for the next 15 years, including several inter-sectorial strategies and actions for the sustainable development of Mexico City. The program was developed based on the Green Consultation, which involved about 274,500 Mexico City voters (Archundia, 2007). The Green Plan defines seven areas of actions, including Mobility (Chapter IV) and Climate Change (Chapter VII). Chapter IV deals mainly with the extension of mass transport such as BRT and Metro, but also with the expansion of non-motorized transport. The chapter sets the goal of completing 10 Metrobus corridors in total by 2012, or two lines per year (as mentioned above four have been completed to date). Chapter VII sets the objective of fostering the production of renewable energy, in order to reduce the consumption of electricity and fossil fuels (SMA, 2011a). To oversee the completion of these objectives, the mayor created an advisory council (el Consejo de Evaluación y Seguimiento del Plan Verde), composed of over 20 individuals from both the public and private sectors, including academics and representatives of various civil society organizations. Given that the program compels action by a range of public and private entities, it has drawn on numerous sources for funding, though financial support has come primarily from the annual operating budgets of the related agencies. Although the Green Plan offers some concrete actions and objectives, it does not prevent politicians from implementing counterproductive actions such as expensive extensions to the road system (i.e., second tiers, super-highways, etc.).

5. Mexico City also passed the Law for the Mitigation and Adaptation to Climate Change and Sustainable Development in 2011. The law can be seen as an extension of the Green Plan, but with a focus on mitigation and adaptation. Of particular interest is the creation of an Environmental Fund for Climate Change. The Fund will receive its financial resources from the yearly budget, CDMs, donations and the global carbon market; whereas its resources will be used to support projects to mitigate GHG-emissions. A significant extension of Metrobus is specifically mentioned as a possible project, and this is one of the recommendations mentioned later in this section (SMA, 2011b).
Metrobus is a transit system with both private and public components, but it is not technically a public-private partnership because this figure did not exist in Mexican law (Lobo, 2012) prior to the introduction of the new Public Private Societies Law on January 16th, 2012. The law main objectives are:

- Increase investment and new possible PPS forms.
- Provide legislative certainty for private actors.
- Improve public fund efficiency.
- Speed up project development.
- Increase transparency in infrastructure investments.

Some highlights are that it condenses four laws into one, and increases transparency – including anti-corruption mechanisms - and available resources due to legal certainty. Furthermore, it focuses investments according to the National Development Plan and defines contractual obligations for both parties (Cámara de Diputados del H. Congreso de la Unión, 2012). According to the Entrepreneurial Coordination Council, this law might create 800,000 new jobs (CNN, 2011).

7 Recommendations

The following section will present and discuss the recommendations that have been drawn from both the realization of this project, and from the workshop and interviews done. These recommendations will aim to satisfy both of the main concerns of this study: the need to achieve LCR cities, and the need to mobilise private investment to accelerate this process.

1. The first recommendation is the **alignment of incentives in order to achieve urban vision**, such as that set out in the General Development Plan of the D.F. This includes incentives about how cities are built, but also related to how people move in and about the city. At one level, this requires strengthening the institutional framework within which projects are undertaken. In the case of Metrobus, the initial project champion was the Environmental Ministry, instead of the logical option, the Transportation Ministry. Additional elements helpful for aligning incentives also include:

   - The first element is **the development of the city based on a strategic master plan**. This is what the General Development Plan aims to achieve, nonetheless, specifically regarding Metrobus, it has not achieved its objectives. It set out to create 10 lines, and has finished 4 to August 2012. Both planning and financing are proceeding on a project-by-project basis which means higher costs. For
example, interest rates are negotiated for the buses needed for a single line, instead of the entire system, which would guarantee better rates. Additionally, this overall vision is important regarding Metrobus financing, specifically that of Line 4, because it was built with funds allocated from the construction of the second tier of the beltway. While this permitted Metrobus, it is also built with funds from a project that is a good example of non-LCR infrastructure. A coherent vision would not allow for inconsistencies of this sort.

- A second element is the development of incentives and financing opportunities for LCR projects. Specifically, this includes the existence of new financial products and instruments, bonds emissions by the city, mechanisms to capture land-value increases in areas benefited by the project, the use of publicity incomes to cover annual maintenance costs, and the possibility of investing the trust fund in order to generate interest payments.

- A much more specific element needed to truly align incentives towards an LCR development pathway is the elimination of fuel subsidies. These exist due to strong social and political pressure, and Mexican policy regarding the price of gasoline and diesel has been aimed at controlling the real price for these products over time. Consequently, vehicle consumers use artificially low fuel prices to decide whether or not to purchase a vehicle. This pricing policy works as a subsidy for vehicle owners and thus, promotes motorization. This subsidy hides the real costs of private vehicle use from consumers, thus guiding their decision away from the socially optimal solution, towards the individually optimal solution. Elimination of this subsidy would oblige consumers to internalise more of their externalities, and guide their choices towards greener solutions, such as public transportation, which would raise demand, and make investments more profitable.

2. Another recommendation is a law governing metropolitan issues. Currently, issues are resolved at municipal, state (and D.F.), or federal level. Cities that exist in two or more municipalities or states exist in a sort of limbo, with each entity responsible for the part of the city that is in its jurisdiction. Ideally, such a law would propose changes to the way projects are evaluated, include the concept of sustainable urban mobility, and be based on the Avoid-Shift-Improve model. Several other regulations are recommended: a federal law for public transportation, including requirements and specifications, including the use of green technologies; regulations of operation procedures for operation of BRT specifically, or transportation systems, generally.

3. In order to truly achieve a LCR city, legally regulated cost-benefit analysis considering all co-benefits, as well as environmental and climate change costs would aid in the selection of the most appropriate projects. There should be a series of codes or standards to guide project decision-making processes. This would immediately guide investment away from projects with high social costs and towards those that are best equipped to face the challenges presented by climate change. Projects would also do well to present opportunity costs. For example, subways are
typically about ten times more expensive to build per kilometre than BRT systems, so an analysis of capacity, demand and coverage that can be achieved with the same amount of money might help determine the most cost-effective solutions.

4. Additionally, we would recommend a thorough public awareness campaign ranging all the way from urban vision to the real costs of using cars. Campaigns could also be much more specific, such as those regarding Metrobus planning and execution, in order to increase public support of projects. Finally, awareness of the achievements of Metrobus in terms of emission reductions, and safety, time and speed gains, might go a long ways to easing opposition to the project during construction phases due to the congestion problems it generates.
Conclusions

Metrobus is remarkable, not only because it is an example of a low-carbon, climate-resilient transportation system, but because it succeeded against the odds. Initially, there was no support for the project, or notion of the type of system it represented. It faced myriad obstacles, from complicated concessionaire participation to lack of funding and political willingness to see it done. In subsequent stages, it has continuously faced a lack of funding, obstacles from existing concessionaires, and operational challenges.

Table 5 presents a summary of section 5 of this study. It briefly presents the main barriers and success factors, discussed in greater detail previously, which have influenced the planning, implementation and expansion of the Metrobus BRT system.

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campaigns, to educate users and gain public support for what initially seem like very disruptive projects.

The main conclusion drawn from the study, the interviews and the workshop is the need for a stronger institutional, legal, financial and planning framework to incentivise private investment in LCR transportation solutions. Institutionally, Metrobus was originally under the Environmental Ministry, then under Transportation and Roads, yet reports directly to the mayor. Reporting, operating and budget should be streamlined institutionally to facilitate replication and subsequent innovative projects. Legally, projects based on public-private partnerships, and seeking climate adaptation and mitigation solutions need to be regulated, enforced and incentivised. Financially, the creation of specific instruments tuned for large investments of this variety need to be created. In terms of planning, all of the above need to be subject to a master vision, not financed and executed in a piece-meal fashion.

Regarding the other elements of Figure 3 in the introduction to this study, Metrobus represents an advance in certain elements, such as the low-carbon transportation service supported by resilient infrastructure required as part of the services provided for urban survival and success. It also creates a bit of redundancy in transportation systems, as part of the integrated planning requirements. Other than that, however, the planning and implementation of Metrobus is lacking in certain other elements. Risk analysis and data collection; public awareness campaigns; law implementation and enforcement; and resilient and flexible metropolitan plans need to be reinforced. Climate change adaptation and mitigation have been tackled by the city, but as was seen in the planning stages for Metrobus, these were only tangentially considered. Full involvement of the carbon agenda in planning transportation systems, responsible for 37% of energy-related CO₂ emission in Mexico, with road transportation responsible for nearly 60% of these (IEA, 2011), is key in achieving emission-reduction goals.

Once the benefits of mitigation are factored into project appraisals, this could help in shifting investment towards greener, more low-carbon, and efficient investments. The costs of the current development pattern will become apparent and unsustainable, and eventually, will have to be internalized by society. The sooner this occurs, the lower those costs will be. Because of this, mitigation and adaptation should be included in project objectives from the outcome, as these will aid in selecting the best project in the long-run, and for the urban vision in place. Finally, transportation is a key component to human development, and is a huge challenge in urban settings. This has myriad effects on health, the environment, social cohesion, the economy, etc. When people live in attractive settings, breathe clean air, and can move around safely, quickly and in a dignified manner, everyone benefits. Transportation and urban development projects should keep this low-carbon, climate-resilient vision in mind.
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ANNEX: