Integrated Urban Mobility Systems as a Crediting Mechanism.

Proposal for Market Readiness

August 2012
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<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>ASI</td>
<td>Avoid – Shift – Improve</td>
</tr>
<tr>
<td>BANOBRES</td>
<td>National Works and Public Services Bank (Banco Nacional de Obras y Servicios Públicos)</td>
</tr>
<tr>
<td>BRT</td>
<td>Bus Rapid Transit</td>
</tr>
<tr>
<td>CDM</td>
<td>Clean Development Mechanism</td>
</tr>
<tr>
<td>CICC</td>
<td>Inter-ministerial Commission on Climate Change (Comisión Intersecretarial de Cambio Climático)</td>
</tr>
<tr>
<td>CO</td>
<td>Carbon Monoxide</td>
</tr>
<tr>
<td>CO₂</td>
<td>Carbon dioxide</td>
</tr>
<tr>
<td>CO₂e</td>
<td>Carbon dioxide equivalents</td>
</tr>
<tr>
<td>COP</td>
<td>Conferences of the Parties</td>
</tr>
<tr>
<td>CT</td>
<td>Technical Committee</td>
</tr>
<tr>
<td>CTF</td>
<td>Clean Technology Found</td>
</tr>
<tr>
<td>FINFRA</td>
<td>Fund for Investment in Infrastructure (Fondo de Inversión para Infraestructura)</td>
</tr>
<tr>
<td>FONADIN</td>
<td>National Fund for Infrastructure (Fondo Nacional de Infraestructura)</td>
</tr>
<tr>
<td>GCF</td>
<td>Green Climate Fund</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse Gas</td>
</tr>
<tr>
<td>GTC</td>
<td>Consulting Working Group (Grupos de Trabajo Consultivo)</td>
</tr>
<tr>
<td>IBRD</td>
<td>International Bank for Reconstruction and Development</td>
</tr>
<tr>
<td>MEDEC</td>
<td>México: Estrategias para la Disminución de Emisiones de Carbono</td>
</tr>
<tr>
<td>MRV</td>
<td>Measure – Report – Verification</td>
</tr>
<tr>
<td>NAMA</td>
<td>National Appropriated Mitigation Actions</td>
</tr>
<tr>
<td>PECC</td>
<td>Special Program on Climate Change (Programa Especial de Cambio Climático)</td>
</tr>
<tr>
<td>PIMUS</td>
<td>Sustainable Urban Mobility Plan Plan Integral de Movilidad Urbana Sustentable</td>
</tr>
<tr>
<td>PM</td>
<td>Particulate Matter</td>
</tr>
<tr>
<td>PROTRAM</td>
<td>Federal Mass Transit Program (Programa de Transporte Masivo)</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Name</td>
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</table>
| SCT          | Ministry of Transport and Communications  
(Secretaría de Comunicaciones y Transporte) | |
| SEDESOL      | Ministry of Social Development  
(Secretaría de Desarrollo Social) | |
| SEMARNAT     | Ministry of Environment and Natural Resources  
(Secretaría de Medio Ambiente y Recursos Naturales) | |
| SHCP         | Ministry of Finance  
(Secretaría de Hacienda y Crédito Público) | |
| UNFCCC       | United Nations Framework Convention on Climate Change | |
| UTTP         | Urban Transport Transformation Program | |
1 Executive Summary

Transport activity is increasing around the world as economies grow, and this is specially the case for emerging economies, where an expansion of trade flows and rising personal income are increasing demand for motorized mobility. This current transportation activity is driven by the combustion of fossil fuels, representing 26% of the total world energy used (IPCC 2007).

Transport sector CO₂ emissions have increased by around 27% since 1990 and its growth rate is the highest among end-user sectors, it actually account for 13% of GHG emitted worldwide. In Mexico, it is responsible for 20.4% of the total national emissions. Based on the current trends, all efforts to reduce GHG emissions in order for temperature increases from global warming to remain below 2° C will not be achieved unless CO₂ contribution from the transport sector is appropriately addressed.

New mechanisms like the Nationally Appropriate Mitigation Actions (NAMAs) opens a window of opportunity for the sector to encourage sustainable transport and access new and additional source of funding.

This Market Readiness Proposal displays a road map for the development of a crediting NAMA on Integrated Urban Mobility Systems in Mexico. The instrument seeks to build upon two already existing urban Transport Programs, the Federal Mass Transit Program (PROTRAM), part of the National Infrastructure Fund (FONADIN), and the Urban Transport Transformation Program (UTTP) both managed by the National Works and Public Services Bank (BANOBRAS).

The proposed Instruments promotes the integration of key components like: Mass Transit Systems, optimization of existing routes, vehicle technology and alternative fuels, non-motorized transport (bicycle paths and walking facilities), transport Demand Management (parking, car-sharing) and Intelligent Transit Systems (SIT), that are currently being instrumented as independent elements in the programs mentioned above and are key elements to achieve a reduction in the GHG from the urban transport.

It also determines the scope of the instrument and analyses important technical issues like the boundary and possible leakage, defines the crediting baseline, key component of any crediting instrument, and recommend indicators to Monitor, Report and Verify the GHG mitigation potential of the instrument.

The preliminary investment plan and the regulatory and institutional issues that need to be worked out in order to have an operational instrument are also included. Last but not least this MRP suggests a timetable for the implementation of the instrument.
2 Assessment and Rationale for focusing on Urban Transport

2.1 Background

Urban areas around the world are both home to more than half of world’s population and responsible for 80% of greenhouse gases emissions (GHGs) (UN-Habitat 2011). This estimation should not surprise us if we consider that cities concentrate production activities (industrial, commercial, services, etc.) and require intensive inputs such as electricity, water, urban transport, solid waste disposal, etc. for their day to day operation.

Figure 2.1 G-20 Countries 1950 – 2010

Source: Population Division of Economic and Social Affairs of the United Nations Secretariat

Figure 1 shows the increase of urban population in the last six decades in G-20 countries, showing how Mexico has moved from a mostly rural country, in the early 50’s, to an urban country, with more than 78 percent of its population concentrated in urban areas (INEGI 2010). The accelerated increase in urban population and the high rates of motorization have contributed to an uncontrolled expansion of urban areas in the country. These create social and environmental pressures, as cities have struggled to manage rapid population growth and generate a steady increase in trip distances and travel time.

This rapid growth in the vehicle stock, low quality public transport services and uninviting environment for walking and cycling, increases the production of GHG emissions and contributes to urban degradation, atmospheric pollution, congestion, traffic accidents, sedentary life styles and social exclusion, significantly deteriorating the population’s quality of life. For example, only in Mexico City the estimated daily loss is 3.3 million man-hours due to traffic congestion, equivalent to a productivity loss of nearly 33 billion pesos a year (IMCO 2011).

This model of development, combined with a series of tax incentives (such as gasoline subsidies, costing the country 166 billion dollars in 2011) (SCHP s.f.), has fostered an explosive growth in car...
ownership rate, which in 2010 reached 25 million units (FONADIN 2010), making it one of the highest motorization rates in Latin America (table 2.1). If this tendency continues, it will come up to 70 million vehicles in 2030 (World Bank 2009). However, 75 percent of commuters continue to use public transportation -usually highly polluting-, or non-motorized transportation (CTS EMBARQ México 2007). However, most of the 55.785 million pesos considered for transportation in the 2012 Federal Budget (DOF 2011) are aimed for urban road network construction.

Table 2.1 Motorization rate and GDP per capita in Mexico

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Automotive per 1000 habitants</td>
<td>GDP per Capita USD</td>
<td>Automotive per 1000 habitants</td>
<td>GDP per Capita USD</td>
<td>Automotive per 1000 habitants</td>
</tr>
<tr>
<td>Mexico</td>
<td>95,34</td>
<td>4.783,0</td>
<td>99,20</td>
<td>5.388,5</td>
<td>103,52</td>
</tr>
</tbody>
</table>

Source: Gartner, Andrés, Centro Tecnológico de Transporte, Tránsito y Seguridad Vial, Estudio sobre tasa de motorización. Relaciones y Determinantes.

2.2 GHG Emission drivers and projections

The high motorization change rate – growing at approximately 7.5% per annum nationally - increases the participation of the transport sector in the emission of GHG (INE 2009). This motorization rate will continue to increase in the next 20 years, following the worldwide trend (figure 2).

Figure 2.2 Motorization rate in different countries

Source: Lee Schipper, University of California at Berkeley, 2009
Important factors explaining the increase in motorization in Mexico include the increase in per capita income, the availability of inexpensive vehicles (new and used), and the relatively low cost of transport fuels. Other factors that contributed to increasing energy use and therefore GHG emissions are the deteriorating quality of public transportation, the inadequate enforcement of vehicle emission standards, the neglect of transportation needs in urban development plans, and the lack of regulation of freight.

The transport sector is responsible for at least two thirds of the greenhouse gases produced in urban zones, becoming a local problem, with global impact (INE 2009). Today, this sector contributes around 20% of GHG in the country (see figure 3). If the current motorization trends and the increase in distances and time travel continue, the transport sector shall increase its contribution to the climate change in an accelerated manner. As presented in figure 4, transport emissions will double its emission levels as compared with 2000, while other sectors are expected to grow much less or decrease.

Figure 2.3 Mexican GHG emissions by sector


Figure 2.4 GHG Emission Trends by sector
2.3 Mexico’s Climate Policy

Mexico has taken strong actions with regards to climate change both domestically and at the international level. In 2005 it created the Inter-ministerial Commission on Climate Change (CICC) that coordinates the activities of the Federal Ministries in charge of formulating and implementing national policies for mitigation of GHG emissions and for adaptation to climate change impacts.

As part of its International efforts regarding GHG reductions, in 2007, the Federal Government Published its National Strategy for Climate Change which led to the Special Program on Climate Change 2009-2012 (PECC), which seeks to demonstrate that GHG emissions mitigation is possible without jeopardizing economic development (CICC 2009).

The PECC is projected to reduce 50 million tons of CO$_2$e by 2012. This means a 6% deviation from the baseline estimate (786 million metric tons CO$_2$e) as a consequence of the implementation of a series of unilateral actions in sectors such as energy (including transport), agriculture, forestry and land use, and waste.

In the long-term, the PECC aims to reduce 50% of GHG emissions by 2050, as compared to 2000 levels, and reach a flexible convergence towards global average per capita emissions of 2.8 tons of CO$_2$/yr. This target is conditional to the availability of sufficient incentives and international support as part of a new financial architecture for climate change of which Nationally Appropriated Mitigation Actions (NAMAs) are an important component.

As part of its long-term strategy, in June 2012 the Federal government published the General Law on Climate Change, which sets the bases for a transition to a competitive, sustainable and low
carbon economy. The Law calls for the right to live in a safe environment and provides a framework for the elaboration and implementation of public policies for adaptation to climate change and mitigation of GHG emissions by the Federal, State and Municipal governments.

It also establishes the attributions for the three levels of government related to public policy mitigation actions for the different sectors like energy, transport, agriculture, forestry and land use, and waste. Some of the actions proposed for the transport sector include (DOF 2012):

- Developing strategies, programs and projects that mitigate GHG and promote Integrated Mass Transport Systems.
- Promoting the increase of Sustainable Mass Transport Systems, with high efficiency standards, that favors the substitution of fossil fuels.
- Promoting the development of Non-motorize transport infrastructure.
- Developing efficiency standards for new light and heavy duty vehicles.

### 2.4 Mitigation potential in the Transport Sector

In recent years, a paradigm shift has been taking place in the transport sector on how best to mitigate climate change. The new thinking moves away from a singular focus on measures to improve (I) technology and places increasing emphasis on measures aimed at avoiding (A) the need to travel by motorized transport and shifting (S) travel toward more sustainable, lower-carbon modes of transport. With its broader understanding of mitigation, this new “avoid-shift-improve” (ASI) approach has resulted in a number of transport policies and programs that can enable developing countries and cities to limit the growth in GHG emissions from the sector.

The MEDEC Study (World Bank 2009) applied the ASI approach, by analyzing 11 interventions in the Transport Sector, 9 of which address Urban Mobility. For each of those interventions the mitigation potential, the co-benefits (time savings and health impacts) and cost were estimated. The interventions evaluated related to urban mobility were:

- Densification of urban areas
- Energy efficiency standard for light duty vehicles
- Hybridization of public transportation (buses)
- Optimization of transportation routes
- Rapid mass transit systems (Bus Rapid Transit–BRT)
- Non-motorized transportation
- Vehicular restrictions through inspections and maintenance

The maximum annual emission reduction obtained from those measures that avoid trips (urban densification) and shifts trips to more sustainable modes (Bus system optimization, Bus Rapid Transit and Non-motorized Transport), was equivalent to 55.8 MtCO₂e per year (World Bank 2009). Therefore adequate policies that encourage cities to mitigate GHG are necessary.
In order to have a functional Integrated Mobility System, elements that incorporate the ASI approach need to be considered, therefore the NAMA being proposed as a market readiness instrument should include the following components:

- **Mass Transit Systems**
- **Optimization of existing routes.**
- **Vehicle technology and alternative fuels**
- **Non-motorized transport (bicycle paths and walking facilities).**
- **Transport Demand Management (parking, car-sharing)**
- **Intelligent Transit Systems**

It is important to mention that although urban development is not being evaluated as an integrated element of this NAMA, key mechanisms that integrate public transportation and urban planning need to develop between the different levels of government.

### 2.5 Non-GHG Benefits

In addition to reducing GHG emissions, the main transport co-benefit of an Integrated Urban Mobility NAMA is to improve the quality of life of the users and bring accessibility to the urban poor.

In addition to reducing GHG emissions, Integrated Urban Mobility approaches expected to reduce travel times, air pollution and traffic fatalities and injuries. By reducing the distance traveled in motorized vehicles, there are reductions in congestion, air pollutant emissions and traffic incidents. Reduced congestion results in time savings. Reduced air pollution leads to a decrease in health impacts and the public cost associated with them. And finally and improved mobility system will improve road safety and reduce traffic injuries and deaths.

Estimations for the period between 2005 and 2015, regarding the implementation of Metrobus Line 1 (Mexico mass transit line using buses), showed a reduction of 144 tons of total hydrocarbons (HC), 690 tons of oxide of nitrogen (NOx), 2.8 of fine particulate matter (PM2.5) and 1.3 tons of sulfur dioxides (SOx) annually (INE 2006).

In addition, mass transit systems using buses like Transmilenio in Bogota and Metrobus in Guadalajara have shown a decrease of 46 to 60% of accidents and fatalities compared to the previous operations (EMBARQ 2012).

As more general integrated mobility NAMA, this crediting instrument will be more effective in considering also the co-benefits. By doing so, it is expected that the costs of transactions will be less, as a more holistic approach is used. Still, the relative size of revenues will be low as compared with the total cost of capital of the mobility NAMA, but the NAMA will contribute
extensively to adequate monitoring, reporting and verification of GHG and calculation of co-benefits. The co-benefits will include reductions in time travel, air pollutant emissions, road traffic injuries and deaths, etc. In that sense, the NAMA contributes to local development needs, as well as the reduction of GHG emissions.

2.6 Policy context, analysis, implications and role of using market instruments in achieving the mitigation goal

2.6.1 Policy context
Transport is responsible for 20% of the total emissions of GHG in Mexico, and is the second fastest growing sector regarding energy consumption. For that reason, it is of high priority to the national government to start thinking about low emission development strategies that can become instrumented mitigation actions.

Urban Transport is a public service and therefore falls under the competence of the states and municipalities. Nevertheless, to promote urban transport systems in the country toward a more sustainable, efficient, cleaner and cost-effective systems, the Federal Government launched the Federal Mass Transit Program (PROTRAM in Spanish) in 2009. The program is part of the National Infrastructure Fund (FONADIN in Spanish) managed by the National Works and Public Services Bank (BANOBRAS in Spanish). The program provides funds for preparation and implementation in mass-transit infrastructure, particularly Bus Rapid Transit (BRT) lines, in cities with more than 500,000 inhabitants.

PROTRAM promotes investment in mass transit through direct federal financial participation and provision of federal loans and guarantees. The program will partially support, up to 50% of the cost of planning studies and infrastructure investments that incorporate private sector participation of at least 34% of the total investment and have important environmental and social benefits.

In the same year and with the objective of complementing the mass transport projects funded by PROTRAM, the Clean Technology Fund (CTF) and the International Bank for Reconstruction and Development (IBRD) provided a loan for USD 350 million to BANOBRAS. This loan was packaged to offer loans to local governments and private concessions in complement to the PROTRAMS’s financial support of measures under the National Urban Transport Transformation Project (UTTP) designed by the World Bank. The UTTP can also finance projects of local entities that PROTRAM could not finance because of their size (less of 500,000 inhabitants), as well as complementary infrastructure like pedestrian and bicycle facilities (World Bank 2009).

PROTRAM involves several transport, health and environment objectives, including a policy to steer the transport sector towards a low carbon development path. In this context, the UTTP explicitly aims “to transform urban transport in Mexican Cities to a lower carbon growth path”, by
improving the quality of service and deploying equipment, infrastructure and operational strategies that reduce CO₂ emissions (World Bank 2009). An interesting aspect of the UTTP approach is that it picks up on the potential climate benefits of PROTRAM and includes measures to enhance the mitigation potential of the program. An example is the inclusion of a funding window for designing integrated transport systems. Investing in transfer stations, bicycle paths, public parking, etc., works synergistically with a BRT investment. It enhances the value of the BRT line for the users by making it more accessible and at the same time encourages wider adoption. The main components of the UTTP are:

- Capacity Building and Institutional Strengthening.
- Development of integrated transport systems to reduce CO₂ emissions.
- Acquisition of transport units with low-carbon technology and scrapping of old transport units.

The following figure describes the structure and eligibility criteria for both Programs, PROTRAM and UTTP.

Figure 2.5 Structure and project eligibility of PROTRAM/UTTP

Source: Adapted from: (Mier y Teran, 2010) and (BIRF, 2010).

2.6.2 Analysis of the current situation

The Mexican Government has already spent significant resources in defining two programs (PROTRAM and UTTP) and has defined measures targeted at removing multiple barriers for mass-transit implementation in Mexico. These programs operate at the national level which gives them significant scaling-up potential. In addition, PROTRAM goals are an integral part of Mexico’s
Special Program on Climate Change which gives it a strong link to national and international climate policy. All these factors provide a good basis for using PROTRAM/UTTP as a mechanism for crediting NAMA.

By promoting an Integrated Urban Mobility, NAMA components that are currently lacking or that are not actually included as a requirement for obtaining funding from both programs will be integrated, and some of them evaluated in terms of GHG reduction in this document, helping the overall system achieve a major mitigation potential and co-benefits. Moreover, a NAMA will be particularly beneficial in creating an adequate Monitoring-Reporting-Verification MRV framework, which is currently missing.

As of today, PROTRAM has 40 projects in 23 cities of which 14 are in the process of identification, 14 in the preparation stage, 6 under evaluation and authorization, 4 under tender and 2 under construction. There is only one of the PROTRAM projects asking for funding from the UTTP, with potential for more projects.

### 2.6.3 Role of the NAMA

So far, the Kyoto Protocol’s Clean Development Mechanism (CDM) has not succeeded in decisively promoting sustainable land transport. As of March 2011, out of the 5,935 CDM projects in the CDM pipeline, only 0.56% have been submitted as ‘transport’ projects. Out of the registered ones, only 6 of them take place in the transport sector (UNEP 2012). Mexico has currently two transport projects under the registration pipeline, Metrobus Line 1 in Mexico City and Macobus System in Guadalajara.

Based on the small participation of transport projects in this crediting instrument, key barriers had been identified as main contributors of the lack of CDM in the transport sector (Sakamoto, Dalkmann and Palmer 2010).

- **Methodology:** difficulty in proving additionally, developing a baselines and defining the boundaries of the project.
- **Finance:** High transaction, monitoring and abatement costs (both real and perceived) and the relatively low cost effectiveness of the mechanism to cover project costs, as CDM with revenues often represent far less than 1% of total project costs; and
- **Awareness:** lack of knowledge and guidance at local level and need for capacity building.

Therefore if developing countries, like Mexico, are to adopt low carbon mobility, new mechanisms like the National Appropriated Mitigation Actions (NAMA) open a window of opportunity to overcome the barriers that made the CDM so difficult to work for Transport. The advantage of this new instrument is that it could be tailored to that country’s specific situation, resources and priorities, therefore making it a good candidate for success regarding transport interventions. Finally, it also has the great advantage of being program-based rather than a project-by-project approach.
It is expected that this NAMA enables both PROTRAM and UTTP in widening its reach and speedup mitigation actions. Furthermore, the reductions achieved by the NAMA could provide complementary support to the programs, by financing its institutional strengthening, enhancing the capacity building required for the development of successful projects and the development of assessment methodologies which would allow BANOBRAS and FONADIN to estimate the mitigation potential as well as evaluate the co-benefits for each of the actions.

However, one of the most challenging components of a crediting NAMA will be the development of the Monitor, Reporting and Verifying methodology and framework. These components relates with defining the boundary of the NAMA and ensuring that leakage does not occur.

3 Preliminary design of the Integrated Urban Mobility NAMA

3.1 General Description of the Instruments

The Integrated Urban Mobility NAMA is being promoted by the National Bank of Public Works (BANOBRAS) with the support of the Ministry of Environment and Natural Resources (SEMARNAT). The NAMA aims to reduce GHG emissions by covering new and existing actions of the actual programs of BANOBRAS and FONADIN (UTTP and PROTRAM) through the optimization of existing conventional public transport systems in high-density urban centers. Several soft and hard technologies are considered, including: Bus Rapid Transit (BRT) systems; light rail and trams; suburban trains and metros; multimodal integration (non-motorize transport, parking); optimization of existing routes, transit management; among others.

Through the implementation of the NAMA, the Government expects to enhance and complement existing financing sources from PROTRAM and UTTP to provide technical assistance and capacity to local governments in the development of their projects with an integral perspective, as well as to ensure the continuity of the current programs through long-term climate funds and market mechanisms.

The NAMA will address cities with more than 500,000 inhabitants, benefiting 66 million people living in the area, which accounts for more than 78 % of urban population of the country (see table 3.1).

<table>
<thead>
<tr>
<th>Table 3.1</th>
<th>Indicators of the Metropolitan areas in Mexico, 1960 – 2005</th>
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<tr>
<td><strong>Indicative</strong></td>
<td><strong>1960</strong></td>
</tr>
<tr>
<td>Metropolitan Area</td>
<td>12</td>
</tr>
<tr>
<td>Metropolitan Municipalities and Districts</td>
<td>64</td>
</tr>
<tr>
<td>States with Metropolitan Area</td>
<td>14</td>
</tr>
<tr>
<td>Total Population (million)</td>
<td>9.0</td>
</tr>
<tr>
<td>Total Population Percentage</td>
<td>25.6</td>
</tr>
</tbody>
</table>
In a long term, is in the interest of BANOBREAS and FONADIN that the NAMA broadens its scope to include smaller cities that are not currently able to apply to PROTRAM and are starting to develop similar mobility problems than those encountered in the Metropolitan Areas of Mexico.

### 3.2 Program Participation and their role

Since both of the existing urban transport programs are being operated through BANOBREAS, the responsibility of implementing the NAMA will fall on them, with the support of SEMARNAT. This will be based on the understanding that the General Law on Climate Change acknowledges the role of the Federal Government in the formulation and conduction of the national policy regarding climate change, as well as the states and municipalities to realize the proper regardiing mitigation actions that fall under its regulatory scope, therefore aligning the NAMA with the Law.

Also the actual PROTRAM decision-making structure, involving several Federal agencies conforming the Consulting Working Group (GTC in Spanish), which is the main decision body and is led by the Ministry of Finance (SHCP), will prevail. The Agencies participating in this group include the Ministry of Transport and Communication (SCT), Ministry of Social Development (SEDESOL), Ministry of Environmental and Natural Resources (SEMARNAT). The GTC will operate as it currently does, analysing the projects in the pipeline of PROTRAM from a technical, social, environmental and financial point of view to determine basic feasibility. The final decision on funding rests on FONADIN’s Technical Committee (CT), which is also steered by the Ministry of Finance (SHCP). The following tables show the current role of public entities at the national and local level involved in Urban Transport Policy in Mexico.

#### Table 3.2 Public entities involved in transport and climate policy in Mexico

<table>
<thead>
<tr>
<th>Federal Level</th>
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<tbody>
<tr>
<td><strong>Entity</strong></td>
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<tr>
<td>Ministry of Finance <em>(Secretaria de Hacienda y Credito Publicos)</em></td>
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<tr>
<td>Ministry of Commerce <em>(Secretaria de Economia)</em></td>
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<tr>
<td>Ministry of Environment and Natural Resources <em>(Secretaria de Medio Ambiente y Recursos Naturales)</em></td>
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<td>Ministry of Energy <em>(Secretaria de Energia)</em></td>
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</table>
National Commission for the Efficient Use of Energy (Comision del Uso Eficiente de la Energia)

Promote energy efficiency and sustainable use of energy.

Ministry of Social Development (Secretaria de Desarrollo Social)

Promote urban mobility projects, by establishing mechanisms for their operation, strengthening, restructuration and technical assistance.

BANOBRAS/FONADIN (Banco Nacional de Obras y Servicios Publicos) / (Fondo Nacional de Infraestructura)

National development Bank that hosts the FONADIN and is the recipient of the CTI and IBRD loan. FONADIN: National fund for investment on infrastructure in the areas of communication, transport, water, tourism and environment.

NAFIN (Nacional Financiera)

National development Bank that leads the scrapping program.

State level

<table>
<thead>
<tr>
<th>Entity</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Government</td>
<td>Planning and management of public services including public transport (there is a very small number of states that manage this at a municipality level)</td>
</tr>
</tbody>
</table>

Municipal level

<table>
<thead>
<tr>
<th>Entity</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal Government</td>
<td>Planning and management of public services including public transport</td>
</tr>
</tbody>
</table>

Urban Transport in Mexico falls under the responsibility of state governments and with some few exceptions, of the Municipalities, therefore the implementation of the NAMA will allow them to fulfill their mitigation obligation stated in the Climate Change Law.

The General Law on Climate Change attributes authority and responsibilities to each of the three levels of government regarding mitigation policy. The following tables list the roles of each of them.

Table 3.3 Responsibility of the three levels of government stated in the General Climate Change Law

<table>
<thead>
<tr>
<th>Government Level</th>
<th>Role</th>
</tr>
</thead>
</table>
| Federal Level    | ➢ Develop and conduct national Climate Change policy  
|                   | ➢ Develop, coordinate and implement policy instruments, foreseen by Climate Change Law.  
|                   | ➢ Establish procedures for public consultation, in public & private |
sectors in order to develop the Climate Change National Strategy and Special Program

- Establish, regulate and implement actions of mitigation and adaptation to climate change, on the following areas:
  - National Development Planning
  - Federal Transport and Communications
  - Regional and Urban Development
- Create, authorize and regulate emissions trading
- Promote scientific and technological research, development, transfer and deployment of technologies, equipment and process for climate change mitigation and adaptation
- Formulate and adopt methodologies, in order to develop, updating and publication of the emissions inventory
- Convene States and Municipalities to develop mitigation and adaptation actions in the scope of their competences.

**States Level**

- Develop, conduct and evaluate government Climate Change policy
- Develop, regulate, direct and implement mitigation and adaptation actions, according to the National Climate Change Strategy and Special Climate Change Program in the following areas:
  - Infrastructure and efficient sustainable transport
  - Land use planning of human settlements and urban development in coordination with municipalities and districts.
- Establish criteria and procedures for evaluating and monitoring the implementation of State Climate Change Program. Set goals and indicators of effectiveness and impact of the actions of mitigation and adaptation
- Conclude agreements of coordination with the Federation, States and Municipalities, to implement mitigation and adaptation actions.
- Develop strategies, programs and projects for emission mitigation of GHG to promote public and private efficient sustainable transport
- Agreeing with social and private sectors on the implementations of actions and investments towards fulfilling the State Climate Change Program

**Municipal Level**

- Develop, conduct and evaluate municipal Climate Change policy in accordance with the National and State policy
- Formulate and implement policies and actions to address Climate Change in line with the National Development Plan, the National Climate Change Strategy, the Special Climate Change Program, the State Climate Change Program and the applicable laws, in the following areas:
  - Local ecological regulation and Urban Development
**3.3 Program Overview**

The crediting instrument proposed in this document is focused on Integrated Urban Mobility Systems, taking advantage of the already existing Programs, PROTRAM and UTTP. Until now both Programs have been operating in an independent manner, therefore the NAMA will seek to integrate the two Programs and add supplementary mobility components that are not being considered like Transport Demand Management and Intelligent Transit Systems.

It is expected that with the integrations of the programs and all the components of in the Integrated Urban Mobility Systems, the mitigation potential of the systems will be enhanced.

It is expected that the reduction achieved by the NAMA could provide complementary support to this new program, by financing its institutional strengthening and enhancing the capacity building required for the development of successful projects and supporting the development of assessment methodologies.

In order to have an operational NAMA, it is crucial to take advantage of the existing PROTRAM and UTTP structures. One of the key tools in the procedures of PROTRAM is the Integrated Sustainable Mobility Master Plans (PIMUS in Spanish), which frames the overall transport policy and provides a comprehensive approach to transport planning at the city level. The PIMUS is a prerequisite to applying for funds to PROTRAM, therefore the PIMUS or a similar Plan will need to include the components of an Integrated Urban Mobility System NAMA.

Since resources would not start flowing to the NAMA until the reductions are posted on the crediting market, upfront initial investments will be required in order to include the new elements. The proposal for making the market instrument functional is described below, however a detailed description is included in the sections pertaining to the Investment Plan and the Regulatory and Institutional Framework.

1. The new program will consider multimodal integration (Non-motorized infrastructure, optimizations of existing routes, parking) and the vehicle technology proposed as a criteria for applying to the funds (institutional arrangements will need to be done to the actual PROTRAM and UTTP statutes). It is important that project applying to the program are promoting integrated systems and considering the different components of the NAMA.
2. Financial Support will be given to those projects that include the multimodal component and clean technology.

3. As soon as the Project is operational and the mitigation achieved will be posted in the crediting market by SEMARNAT and BANOBRAS will receive the money generated by the CRE sells.

4. The funds obtained will go directly to BANOBRAS and will be distributed among the parties involved with the development of the project: BANOBRAS and the State or Local Government.

5. The resources allocated to BANOBRAS will be used for the following:
   a. Institutional strengthening: provide training, technical assistance and develop MRV and co-benefit methodologies to evaluate the projects

The Program will need to encourage integrated projects that not only focus on transport infrastructure, but do include the other elements. Therefore an approach with the local governments to promote the inclusion of these new elements as part of integrated mobility systems that will enhance cities their capacity to reduce GHG has to take place. Since the support of BANOBRAS to the state and municipal government will be restricted to the inclusion of the elements, a percentage of the resources obtained from the crediting market will go to them.

### 3.3.1 Scope of the NAMA and its components

Given that the transport sector is the second GHG emitter in the country and having almost 80% of the population living in urban areas, attention is needed in those sectors. Although there are existing programs that already tackle urban mobility problem, they need to be strengthened and the NAMA provides a good opportunity to do so.

The NAMA will cover elements that allow local governments to develop Integrated Urban Transport Systems that will eventually reduce the number of kilometers traveled, reduce existing fleet, and promote the use of less polluting modes of transport therefore mitigating GHG. The main components of the crediting instruments are:

- Mass Transit Systems
  - Bus Rapid Transit
  - Light Rail and Trams
  - Suburban Trains and Metros
- Optimization of existing routes.
- Vehicle technology and alternative fuels
- Non-motorized transport (bicycle paths and walking facilities).
- Transport Demand Management (parking, car-sharing)
- Intelligent Transit Systems

A description of each of the components and their importance in the mitigation of GHG is described below.
• **Mass Transit systems**

Although mass transit systems include Bus Rapid Transit, metro, light rail, suburban trains, etc., for the purpose of this study, only BRT systems will be evaluated. The BRT being considered refers to the transit service that is bus-based, uses bus lanes for trunk routes, with their own rights-of-way, with fixed stops and with size buses of 18 meters, and operates at high level of performance, especially with regards to travel time and passenger-carrying capacity.

The development of BRT systems is a cost-effective alternative of mass transit system, since the capital costs of implementing BRT lines can be lower than up-front costs of constructing LRT lines, considering the relatively small budgets which are normally assigned to Mexican cities in order to invest on transport infrastructure. These systems involve a scheme of centralized public transport organization that allows greater control of the authority.

Technological advances in vehicles, tariff systems and related communications have played a key role in the development of the requirements for this public transport system. The system and real-time information technology have had a dramatic impact on improving operational efficiency and customer service. BRT transport systems combine efficiency and flexibility elements suitable for medium-size cities.

This type of system is considered eligible for mitigating GHG emission, since it substitutes smaller vehicles with high capacity ones, and it also tends to promote a modal shift of around 15% from passenger cars and taxis.

• **Optimization of existing routes.**

The continuous growth in Mexican cities has come with an increase in the vehicular fleet and the rise of GHG. This growth in the vehicular fleet includes not only private passenger, but also the fleet giving services of public transport in the cities.

This component involves restructuring the public transit system’s feeder routes through the removal of redundant vehicles. If complemented by improvements in urban infrastructure (roads, bus stops, traffic signs); public information; traffic monitoring and control; and vehicle improvements, this measures represents an important option for mitigating greenhouse gas emissions in urban public transportation, given that the growth of the private vehicle fleet (and related issues of urban sprawl and congestion) has been, at least in part, the result of inefficient transportation systems.

The route optimization in this sector represents an opportunity to mitigate urban GHG and achieve transit order into the cities, by reducing the number of buses and therefore the kilometers driven and the fuel consumed.

According to several studies developed by the Transport area of CTS EMBARQ Mexico, the oversupply in transport in Mexican cities may be of up to 30%. However it is important to explain that it is necessary to develop a route analysis for each of the 29 metropolitan zones being
covered in the instrument, since this percentage can’t be generalized due the fact that conditions are completely different among the cities.

• **Vehicle technology**

Although other technologies could be included in the crediting mechanism like Ultra Low Sulfur Diesel and Natural Gas vehicles, for the purpose of this analysis we will only focus on hybrids. Hybrid vehicles refer to the ones in which electrical energy provides part of the driving force, this power coming from a battery and an internal combustion engine which also drives a generator. Hybrid technology requires batteries connected to a car engine, and a way to re-generate energy is by moving heat or braking.

Currently there are a very small number of hybrid buses used in Mexico. However, the percentage of performance improvement of a hybrid bus, compared to a traditional one, is of 30%. In terms of GHG emissions, this technology reduces up to 75%, compared to conventional diesel buses. In terms of the criteria regarding air pollutants, emission of particulate matter (PM) from hybrid buses equipped with particulate matter filters are almost 90% lower than a conventional diesel bus without a particulate filter. NOx emissions of hybrid electric buses are 30% to 40% lower than conventional diesel vehicles. Furthermore, the present rates hybrid diesel buses emissions for carbon monoxide (CO) are the lowest in comparison with other technologies.

However, the main restriction for the introduction of hybrid buses is that the costs outweigh the benefits. Although there are significant savings in terms of fuel used since the higher performance of the vehicle, the costs are still too high to be a technology that can be easily introduce in Mexico.

• **Non-motorized transport (Public bicycle system).**

The non-motorized mobility energizes public spaces, fostering a safer environment, improving the accessibility, promoting active ground floors shifting the way people moves around. Among the different non-motorized transportation options, this study will focus on cycling since it has been considered as one of the best non-motorized transportation options for short trips. This is particularly true in congested areas.

Bicycles also represent an equitable conveyance due to the low costs involved (for both investment and maintenance of the bicycle). They also allow the inclusion of different socio-economic groups.

Adequate infrastructure construction is required In order to obtain more benefits from non-motorized transport, the development of public bicycle systems guarantees and integrates multiple mobility modes. In general, the infrastructure needed for bicycles is cheaper compared to the large investments required by motorized vehicle systems.

The planning of a public bicycle system connected to mass transit systems can be vital to the success of low-cost alternatives and major environmental benefits. Even modest changes to non-
motorized transport modes could bring significant benefits in terms of health and air quality (BANOB拉斯 2009).

The use of public bicycle systems should be included in the transport network of the cities to create wide operational possibilities in conjunction with other transport systems as BRT’s, subways, among others. Taken together, transfer times could be reduced and health, environment, social and economic benefits could be potentiated.

- **Transport Demand Management (Parking meters)**

The reason this component is analyzed as part of the proposed NAMA is because it has been identified that free use of public space as parking encourages car use. Drivers looking for a parking spot might cause congestion, which results in waste of time, noise, stress and pollution.

One strategy to avoid this situation consists in implementing parking fees in the most troubled areas. Parking fees in public places also help in optimizing land use, providing more space and minimizing the number of vehicles that obstructs traffic looking for parking or parking in a double row. These prices should be adjusted based on the availability and occupation of the road (Palma 2004).

When the number of available parking spots is reduced and parking costs are high, drivers start looking for different alternatives. For example, they start their trips earlier or later than usual, in order to avoid peak hours. Carpooling or switching to another mode of transport, are other alternatives for drivers (Feeney 1989). According to Shoup (Shoup 2005), approximately 1 in 7 curbside parking spaces are opened as a result of implementing parking fees.

The introduction of parking fees has brought important benefits in different cities around the world, mostly related to the reduction of miles traveled by cars searching for an available spot. An increase in the price of parking in municipal facilities resulted in a 30% drop in the occupation of parking spots. At the same time, public transport and bike to work increased by 25% with car users who changed their mode of transport (Hermann 2011). In Mexico City, it is estimated that 30% of the bearing surface is occupied by parked cars, causing severe traffic problems in the city (Medina 2012).

- **Intelligent Transport Systems (ITS)**

Nowadays, leading cities around the world are using Intelligent Transport Systems (ITS) to address different traffic conflicts. ITS are used to evolve transport systems from single modes to integrated ones, improving transport services and providing an improved value proposition to customers.

In the urban transport, ITS can contribute to the main transport policy objectives. The linkages with other modes, e.g. public transport become increasingly important. This can result in a reduction of congestion through better management of demand and capacity that will benefit all road users.
New assistance systems and information services for the driver will make driving more comfortable. For example, dynamic traffic management based on real-time data from roads, vehicles and even mobile phones can improve the strategies to mitigate congestion. Also the use of navigation systems in the car reduces distances driven to the trip destination and can lead to a more relaxed and thus safer driving.

There are relatively few ITS systems and services that specifically address environmental objectives. But ITS can help to reduce emissions and save energy through better demand management including the use of road charging and access management. Better multi-modal information and feedback to drivers "eco-driving" are also valuable instruments. For example, with electronic fee collection systems charging road vehicles can be flexible, according to vehicle type and emissions category.

Although all the elements described above are important and fundamental in order to achieve an Integrated Mobility System, due to the lack of data regarding mitigation potential of the Intelligent Transit Systems, these were mentioned but not evaluated in the mitigation potential of the NAMA.

### 3.3.2 Defining the NAMA boundary

As it has been defined previously, the NAMA will be a program, set forward by BANOBARS that will focus on the 29 metropolitan areas of the country that has more than 500,000 inhabitants, therefore the boundary for emission reduction calculation will be set at metropolitan level for each of 29 areas.

Some already approved methodologies for transport projects in the CDM define the spatial boundary of the projects in different ways: one of them focuses on passenger trips (ACM 0016), while another one considers the urban area (AM0031). This distinction depends basically on the type of mobility systems being implemented.

In our case, we are discussing the implementation of Integrated Urban Mobility Systems; therefore work still need to be done in order to define what could be the proper boundary for this crediting instrument. The net reduction of NAMA will only include the emission reduces by implementing the different components of the Integrated Mobility System.

It is important to clarify that although the boundary has not been define, for systems like trams, rails, etc. the electricity from an interconnected grid used for the propulsion of the transport system included in the project boundary, should be considered.

Since the NAMA includes different components like optimization of routes, parking, non-motorize transport, etc., the implementation of all of them simultaneously will reduce congestion levels in the implementation zone improving the vehicle speed. Leakage may come from rebound effect of this increase in velocity, making more private car users use the roads.

To avoid double counting, especially with any CDM project activity, it is very important that BANOBARS sets an agreement of understanding with the different metropolitan areas applying to the NAMA, where it is stated that once they have applied for funding of their Integrated Mobility
Systems to BANOBRAS, the reductions achieved by the system will be considered NAMA reductions, and cannot be offered as CDM credits.

In this regards, it is worth mentioning that although the agreements achieved at COP 17 established the continuation of the Kyoto Protocol after 2012, we have seen in the past that for transport interventions, CDM hasn’t been the best option due to a series of constrains related basically to additionality.

### 3.3.3 Gases being covered in the NAMA

The greenhouses gases being included or excluded in the NAMA and its justification are described in the following table. It is important to mention that for the calculation of the baseline and the mitigation potential all of them were converted to CO$_2$e.

<table>
<thead>
<tr>
<th>Source</th>
<th>Gas</th>
<th>Included</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile sources emissions of the different modes of road transport which are part of the Integrated Mobility System (BRT, buses, passengers cars, taxis)</td>
<td>CO$_2$</td>
<td>Yes</td>
<td>Major source of emission from the transport sector.</td>
</tr>
<tr>
<td></td>
<td>CH$_4$</td>
<td>Yes</td>
<td>It will only be included when using gaseous fuels.</td>
</tr>
<tr>
<td></td>
<td>N$_2$O</td>
<td>No</td>
<td>It is a minor source of the total CO$_2$e emission in the transport sector.</td>
</tr>
</tbody>
</table>

### 3.3.4 Defining the crediting baseline

The crediting baseline is a key component for any crediting system since it establishes the basis for issuing GHG credits. In the case of the Integrated Mobility Systems NAMA, credits will be issued according to a crediting baseline that leads to “net reductions in GHG emissions”.

For this NAMA, the crediting baseline should be specified in absolute terms (e.g. ton of CO$_2$e per year). The first reason on choosing absolute term emissions is that due to the complexity of the transport sector, an absolute approach will be much easier to quantify. The second is that, from a crediting perspective, the quantification of the total emissions is what we are seeking and last but not least, the objectives of reduction stated for 2050 by the Mexican government in the General Climate Change Law, are set on the base year 2000 absolute emission.
For our instrument, the “business as usual” (BAU) baseline will be a forecast of emissions, assuming that none of the components in the NAMA has been implemented. The crediting baseline would be determined assuming that some BRT systems are implemented as part of the PROTRAM. For the NAMA the creditable reductions will be based on the total emissions reduced resulted from applying simultaneously all the 5 components described previously of the Integrated Mobility Systems (considering 2015 the fixed year and a period of evaluation of 10 years).

Figure 3.1. BAU and crediting base-line

Source: CTS EMBARQ Mexico

3.4 Quantification of emission reduction

The quantification on emission reductions for the NAMA instrument will be based on the number of cities applying to PROTRAM and UTTP to undertake a project on Integrated Urban Mobility. As it has been mentioned, the NAMA will focus only in cities with 500,000 inhabitants.

The methodology to develop a crediting baseline for the Integrated Urban Mobility will be described in the next section of the document. It is worth mentioning that the actual quantification of the emissions reduction will be fully developed on the next phase of this NAMA. Basically, the type of information needed to quantify the mitigation potential includes: vehicle fleet, intensity use of each mode, gross efficiency of each mode and fuel information. The information would be obtained from official databases of the Ministry of Transport and Communication (SCT), The National Institute of Statistics and Geography (INEGI), the Mexican Petroleum Institute and the Mexican Transport Institute (IMP)\(^1\).

\(^1\) http://vinculando.org/transportes/estadisticas_del_autotransporte_federal_de_carga_en_mexico.html
For the purpose of this project, and in order to be able to evaluate the mitigation potential of the instrument, the following key assumptions for the implementation of each of the NAMA components are suggested.

**Table 3.5** NAMA Components Assumptions and direct impacts
<table>
<thead>
<tr>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>• Flexibility of a bus-based scheme and less costly than a rail system.</td>
<td></td>
<td>• Construction of 10 kilometers/year of bus-lane road during each of the following years.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Confined bus lanes.</td>
<td></td>
<td>• 15% of BRT’s passengers stopped using their own car. The 85% remaining shifted from ordinary public transport to the new system.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Stations and buses designed for faster and safer access.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Greater passenger capacity, which promotes a modal redistribution of mobility.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C2 Transport Demand Management (Parking meters)</td>
<td>• High cost of parking meter discourages the use of private cars and increases the use of public transport.</td>
<td>No new parking systems are implemented</td>
<td>• 10% of the car owners (subcompact, compact, L&amp;S, SUV) are affected by the implementation of parking meters.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Decrease on VKT by private vehicles</td>
<td></td>
<td>• It is assumed that those people stop using their car once a week due to the costs involved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• This means 14% reduction of the kilometers traveled per car per year.</td>
<td></td>
</tr>
</tbody>
</table>

2 Available data from Metrobus
3 Available data from Metrobus
C3
Optimization of existing routes

- Redundant routes of public transport are removed, reducing unnecessary travels.
- No routes are optimized
- No routes are optimized
- 67.3% of the total bus fleet and 20% of the total light vehicles (combis) are used for public transportation.
- 40% of existing routes have an oversupply
- 70% of the oversupplied routes will be optimized by the end of the evaluation period.
- The ratio of public buses and public light vehicles is 1 to 5.

C4
Vehicle technology (Hybrids)

- Improved efficiency and less fuel consumption.
- No hybrid buses are introduced
- No hybrid buses are introduced
- 11% of the public buses sales since 2015 are hybrid buses.
- The percentage of improvement in the performance of a hybrid bus compared to a traditional bus is 30%.

C5
Non-motorized transport (Public Bicycle Systems)

- Safe and organized systems promote the use of bicycles, reducing the use of private cars.
- No new public bicycle systems are introduced
- No new public bicycle systems are introduced
- Implementation of 4 public bicycle systems in a similar scheme to ECOBICI program (Implemented in Mexico City since 2010), from 2015 to 2025.
- According to ECOBICI data, for the first year 704,054 kilometers where travel using this mode. An increase 12 times in this number

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4 According to own estimate.
in five years would be assumed.
A maximum potential GHG reduction can be estimated by modeling all the 5 components at the same time. To do so, it would be necessary to consider the linkages between the different components. This means the BRT system would be modeled first, then the implementation of parking meters and then the route optimization component. After this, it would be necessary to determine if the optimized routes could cover the exceeding demand result of the parking meters implementation. If the result was that no extra supply of public transport would be needed, the calculations for hybrid buses can be done based on the fleet obtained after the implementation of component 3 (optimization). Component 5 would be modeled independently because there is no direct linkage with the other components. Then, the maximum mitigation potential would be calculated as the sum of the mitigation potential of each strategy.

Although we are proposing that a percentage of the credits goes to the implementing entity (states or municipalities), the net GHG reductions will be assessed against the national crediting baseline defined before. The percentage of credits giving back to the entities will be proportional to the amount of the co-funding given by them for the implementation of the Integrated Mobility system.

### 3.4.1 Methodology for the establishing of crediting baseline

In this section a description of the methodology that can be used to calculate the BAU base-line, the crediting baseline and the evaluation of the mitigation potential will be described. It is worth mentioning that the methodology for calculating CO₂ emissions was originally developed for a previous study (World Bank 2009) and therefore incorporated the whole road transport sector of the country. However, work has been done in order to identify the percentage of the fleet of cities with more than 500,000 habitants. For the evaluation of the mitigation potential of the NAMA components, care was taken that only that fleet was affected. Nevertheless, it is recommended that in the future for a more accurate baseline, information on the vehicle fleet of the 29 metropolitan areas of the country that has more than 500,000 inhabitants is obtained.

The methodology was constructed by using a “bottom-up” approach (based on end-use and activity data). The input data for this methodology include: Vehicle fleet, use intensity of each mode, gross efficiency of each mode and fuel information.

These input parameters are used to calculate the following variables: fuel consumption, mileage by vehicle type, net emissions and total emissions.

Broadly speaking, the calculation of these variables is described below:

1. The fleet (number of vehicles) is multiplied by the use intensity (km/year/vehicle) to obtain Mileage (km/year). This variable is used to calculate fuel consumption and total emissions.
2. Gross efficiency (km/L of fuel), is multiplied by a loss factor on road to obtain net efficiency (km/L). Thus, dividing the mileage by the net efficiency, we obtain the total fuel consumption per year (L/year).
3. Finally, through dividing the emissions factor (kgCO₂/L) by the net efficiency, we obtain the net emission rate (kgCO₂/km). This is multiplied by the mileage and resulting in the total emissions per year (Mt CO₂ / year).

With this information, a first general estimation of the GHG for the selected 29 metropolitan areas was estimated. The GHG emissions were forecasted from 2010 to 2025, assuming average annual economic growth of 3.2%. The number of vehicles of the selected 29 metropolitan areas was estimated proportionally to the population living in those areas.

Emissions were calculated per type of vehicle (subcompact, compact, luxury and sport (L&S), Sport Utility Vehicles (SUV), Mass Transit Systems, buses, heavy and light duty). As a result, it was estimated that in 2010 total emissions in the 29 metropolitan areas was about 97 MtCO₂e and will be up to 135.51 MtCO₂e in 2025. The corresponding emissions for each type of vehicles are shown in Figure 3.1.

Figure 3.1 Total GHG emissions in the transportation sector in Mexico (2010-2025)

Source: CTS EMBARQ Mexico with data of SCT, INEGI, IMP and IMT

As previously mentioned, on the next phase of this project the methodology for the specific quantification emission reduction will be fully developed and adapted to the NAMA.
3.5 Monitor, Reporting and Verifying (MRV)

According to the Bali Action Plan, all Climate Change mitigation actions must be “measurable, reportable and verifiable” (MRV) in order to control all the process. The MRV methodology is commonly used to monitor national emissions inventories and determines if the goals of specific mitigation actions are achieved.

Developing countries are being asked to be increasingly transparent in their own climate actions, especially in relation to those which are internationally supported. In the case of a crediting instrument, these elements become critical, therefore have to be considered in the planning of those types of instruments.

The first letter of the MRV methodology refers to Measurement and/or Monitoring. This includes all the actions involved to calculate, determine and track the value of a specific parameter. The main objective is to monitor, in a determined period of time, the selected indicators and compare them with the baseline. It is recommended that all the selected parameters are measured ex ante and ex post, in order to ease the evaluation of the impacts and benefits of the program. The obtained results of the Measurement and Monitoring will be Reported and Verified as described below.

The second letter refers to Reporting, which consists of compiling all the relevant data obtained of the measurement and monitoring. For this section, it is proposed to establish a national platform for the different entities and institutions working on action related to mitigation of GHG, which would be designed and managed by SEMARNAT, following the same guidelines to improve the efficiency of this process. Here are some suggestions about the issues that the platform should include:

- Baseline Methodology.
- Description of the mitigation measure and implementation process implementation.
- Objectives of the measure.
- Analysis of direct and indirect impacts.
- Measurement methodology and results for each indicator.
- Assumptions.
- Emission factors used.
- Results obtained in terms of emission reduction and cost benefit estimate.

Finally, the “V” refers to Verification of all the reported data. This verification should include a cross-check of the initial goals, the calculations and the results of the monitoring. In case that the initial goals are not accomplished, it is necessary to identify the reasons and propose possible solutions. It is also recommended that the Verification includes a statistical analysis and a thorough verification of all relevant documents, reports, etc. A process of verification should be performed by the same institution that is implementing the mitigation program. However, for the case of this crediting instrument the designation of an independent verifier to perform this process is recommended.
Even though no specific guidelines have been fully defined for MRV, there are some basic questions that can be used as a guide for this methodology. Those questions include what to measure report and verify, how to measure, report and verify, which tools are needed, who would be responsible, how often. Therefore, the first step is to determine the specific parameters or indicators that would be used to answer those questions.

In this study, specific indicators were identified for each of the mitigation components of the NAMA, according to the established goals. These indicators and a brief description of each one of them are listed in the table below. The components of the NAMA were identified using the following categorization (which is also used the table below).

- **C1**: Mass Transit Systems (BRT)
- **C2**: Transport Demand Management (Parking meters)
- **C3**: Optimization of existing routes
- **C4**: Vehicle technology (Hybrids)
- **C5**: Non-motorized transport (Public Bicycle Systems)

It is considered that all indicators (listed on table 3.6) have to follow the same reporting process. This process comprises a periodically report of the indicators, following the appropriate and corresponding methodologies. Annual reports are recommended in general for all indicators and components.

Even though a detailed MRV methodology will be developed in the second phase of this project, the most relevant indicators have been identified (described on table 3.6). Basically, for all the components proposed for the NAMA, it will be necessary to measure the CO\textsubscript{2} emission reductions (multiplying fuel consumption by corresponding emission factor). It is suggested that SEMARNAT, would be responsible for compiling this information. However, Appropriate State Transport Agencies of the metropolitan areas where the NAMA is implemented will be responsible to collect, control and administrate all the data required for the MRV.
Table 3.6 MRV Indicators description
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Strategy</th>
<th>How to measure / monitor</th>
<th>Verification sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEI Emissions per year (MtCO₂/year)</td>
<td>C1, C2, C3, C4 and all together</td>
<td>Fuel consumption multiplied by the corresponding emission factor.</td>
<td>Verify if the calculated emissions meet the mitigation goals previously established.</td>
</tr>
<tr>
<td>Kilometers of bus-lane built for BRT per year (km/year)</td>
<td>C5</td>
<td>Kilometer savings</td>
<td></td>
</tr>
<tr>
<td>Kilometers traveled by BRT (km/year)</td>
<td>C1</td>
<td>Appropriate State Transport Agencies register and monitor the kilometers traveled by BRT per year</td>
<td>Verify that the traveling registers match with the reports.</td>
</tr>
<tr>
<td>Number of vehicles using parking meters per year (#vehicles/year)</td>
<td>C2</td>
<td>Concessionaire creates a data base with the number of vehicles using parking meters per year</td>
<td>Verify the information that has to come directly from automatic report systems of the parking meters. Check that all the parking meters reported by the concessionaire exist and are fully operational.</td>
</tr>
<tr>
<td>Frequency of use of the parking meters per year</td>
<td>C2</td>
<td>Concessionaire registers the number of times a single vehicle uses parking meters per year and calculates the statistical frequency of all the vehicles using parking meters. It is recommended that a modal shift survey is applied to complement this parameter and determine if users are really decreasing the use of their cars.</td>
<td>Verify all the data matched with the reports and check the results and methodology of the survey.</td>
</tr>
<tr>
<td>Average Occupancy in public transport vehicles (#passengers/vehicle/year)</td>
<td>C1, C3</td>
<td>New public transport systems must have register and control systems from which specific data bases can be obtained. This includes the number of passengers per vehicle per year</td>
<td>Verify through a representative sample of routes, the registers of average occupancy in a specific period of time.</td>
</tr>
<tr>
<td>Number of scrapped vehicles per year</td>
<td>C3</td>
<td>Appropriate State Transport Agencies register the number of public transport vehicles scrapped</td>
<td>Verify that the scrapped bonus, matched with the plates and number of oversupplied vehicles from the</td>
</tr>
<tr>
<td>(#vehicles/year)</td>
<td>per year as part of the optimization program</td>
<td>optimization study.</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------------------</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td>Number of optimization studies carried out ex ante (#studies)</td>
<td>C3</td>
<td>Appropriate State Transport Agencies register the number of routes that there were analyzed.</td>
<td>-</td>
</tr>
<tr>
<td>Percentage of progress in route optimization (%/year)</td>
<td>C5</td>
<td>Appropriate State Transport Agencies calculate the number of routes that have been optimized. Compare this information with the established goals and determine the percentage of progress</td>
<td>Verify if the percentage of coverage meet the established goals. If not, identify the reasons, propose possible solutions and redefine the goals</td>
</tr>
<tr>
<td>Fuel consumption (liter/year)</td>
<td>C4</td>
<td>Buses owners register the fuel consumption of hybrids per year</td>
<td>Verify if the consumption of fuel in hybrid buses is in fact reduced as originally assumed (30% approx.). If not, identify the reasons. Determine if that reduction could possibly be achieved and what is needed to do so.</td>
</tr>
<tr>
<td>Number of new hybrid buses per year (#hybrids/year)</td>
<td>C4</td>
<td>Bus assemblers create a data base with the total number of hybrid buses sold per year</td>
<td>Verify sales statistics and reports</td>
</tr>
<tr>
<td>Kilometers traveled by bicycles (km/year)</td>
<td>C5</td>
<td>The concessionaire of the public bicycle system creates a data base that includes the kilometers traveled by bicycle per year</td>
<td>Verify, with a representative sample, that the bicycles are in fact traveling the kilometers reported. Verify that the automatic report systems work properly and the information in the data base is correct.</td>
</tr>
<tr>
<td>Percentage of progress in coverage by the public bicycle system (%/year)</td>
<td>C5</td>
<td>The concessionaire of the public bicycle system calculates the area covered and the number of bicycle stations built per year. Compares this information with the established goals and determines the percentage of progress</td>
<td>Verify if the percentage of coverage meet the established goals. If not, identify the reasons, propose possible solutions and redefine the goals.</td>
</tr>
</tbody>
</table>
3.6 Market Opportunities

The current work undertaken in NAMAs is based on the Bali Action Plan which establish that developing countries should work toward the development of this type of instruments with the aim of achieving sustainable development, and was reaffirmed by United Framework Convention on Climate Change (UNFCCC) during the 16th Conference of Parties (COP 16) Cancun Agreement, where decisions were made in order to set a registry to record NAMAs and facilitate the matching with financing, technology and capacity building support.

Following the decision at COP 16, during the COP 17 meeting in South Africa, UNFCCC support toward NAMAs was reflected in a number of decisions and developments around its operationalization, such as the registry, which was launched in May at Bonn Climate Change Conference, and the UNFCCC aims to have it completed by COP 18.

The establishment of this register will allow developing countries like Mexico to trade its emission reductions resulted from the implementation of NAMAs until 2020, since the Durban Platform will be working on a new agreement that will bring all countries in to establish legal mitigation goals starting in 2020. Meanwhile in the period before 2020, Mexico will be able to put into the crediting market the GHG credits produce by the crediting instruments like NAMAs.

Once the new International agreement under UNFCCC has been set, Mexico can use the credits resulting from this NAMA internally, if eventually Mexico builds a domestic Cap and trade system.

3.6.1 Green Climate Fund

One future potential source of financing for NAMA could be the Green Climate Fund, once it is operational.

At the sixteenth session of the Conference of the Parties (COP), held in Cancun, the Parties decided to establish the UNFCCC Green Climate Fund (GCF), as a mechanism for mobilizing a share of the proposed international climate financing. The Cancun Agreements proposed that the pledged funds are to be new, additional to previous flows, adequate, predictable, and sustained, and are to come from a wide variety of sources, public and private, bilateral and multilateral, including alternative sources of finance.

The Fund will promote the paradigm shift towards low-emission and climate-resilient development pathways by providing support to developing countries in their efforts to combat climate change through the provision of grants and other concessional financing in order to limit or reduce their greenhouse gas emissions and to adapt to the impacts of climate change. It aims to assist developing countries mitigation and adaptation projects, programs, policies, and activities. The GCF is to be capitalized by contributions from donor countries and other sources, including both innovative mechanisms and the private sector.

The potential benefit from the GCF is that the institution will become as large as expected and will serve as the predominant institution for climate change assistance in the developing world.
The GCF is currently in an implementation phase. While the basic design of the fund has been agreed to by Parties, many aspects of the GCF have yet to be determined. Nevertheless in the near future it could become one of the main sources to finance the implementation of NAMAs.

### 3.7 Investment plan

As discussed in the previous sections, the NAMA will draw from existing funding opportunities, in the form of grants and loans according to the following eligibility criteria:

#### 3.7.1 Financial structure

1. As currently established, State/Local Governments are eligible to obtain funding from two separate sources, both administered by BANOBRAS:

   a. The first one of these sources is considered within the FONADIN/PROTRAM structure, and consists of grants and loans for up to fifty percent (50%) of the total investment requirement, with the remaining fifty percent (50%) of financing to be provided by the State/Local Government and the participation of the Private Sector. This source of funding has been applied towards the development of Integrated Transport Corridors, which include Bus Rapid Transit (BRT’s); Light Rail and Trams; and Suburban Trains and Metros.

   b. The second source of funding is considered within the BANOBRAS/UTTP structure, and consists of loans provided for financing the technological components related to the operation of Integrated Transport Corridors, as well as to the technological requirements for Multimodal Integration and Signalling, Traffic Lights and Transit Management.

2. As envisioned for the NAMA, these two separate sources of funding would be integrated into one new program, which would use the existing funds from both FONADIN/PROTRAM and BANOBRAS/UTTP in order to finance the development of an Integrated Urban Mobility Systems for cities with 500,000 inhabitants or more, which incorporate all components of the NAMA and have a Integrated Plan for Sustainable Mobility (PIMUS). As such, and in order for the PIMUS to address both the transportation and sustainability concerns of the city, the PIMUS should include the following elements:

   I. Development of Integrated Transport Corridors, which may include:
      a. Bus Rapid Transit
      b. Light Rail and Trams
      c. Suburban Trains and Metros
   II. Optimization of existing routes
   III. Vehicle technology and alternative fuels
   IV. Non-motorized transport (bicycle paths and walking facilities)
   V. Transport Demand Management (parking, car-sharing)
   VI. Intelligent Transit Systems
3. The NAMA incorporates a series of new elements which were not previously considered under either the FONADIN/PROTRAM or the BANOBRA/UTTP structures. As previously discussed, these new elements will result in an overall reduction of GHG emissions, allowing the NAMA to result in a mechanism that addresses both the mobility and sustainability concerns discussed in earlier sections of this document.

4. The development of the PIMUS will require Pre-investment studies for each of the components described before. Following from the existing FONADIN/PROTRAM Rules, grants will be available to fund up to fifty percent (50%) of these Studies; with the State/Local Government providing the other fifty percent (50%). Alternatively, the State/Local Government may choose to develop the required Pre-investment Studies by itself; and present them to the relevant decision-making agencies for approval.

5. Once the Pre-investment studies have been approved and all the required conditions have been fulfilled, the initial investments required for funding the development of the different components of the NAMA will be financed through two different sets of provisions. This distinction is required in order to differentiate between elements in the PIMUS where Private Sector participation and management may be both feasible and desirable; and the elements in the PIMUS which seem better suited for management at the State/Local Government level. As such, the NAMA considers that the development and operation of Integrated Transport corridors should include the participation of private actors, while the other elements of the NAMA fall under the category of Public Goods, as the general population enjoys the provision of services such as the optimization of existing routes, incentives for vehicle optimization, bicycle paths and walkways, the establishment of parking meters and car-sharing, and Intelligent transit Systems.

6. The first set of provisions will apply only to the first element of the NAMA, namely, Integrated Transport Corridors; while the second set of provisions will apply to the remaining elements of the NAMA.

a. **Financial Provisions for Integrated Transport Corridors**
   Within the first set of provisions, the initial investment required for the first element in the NAMA, regarding Mass Transit System, including Bus Rapid Transit (BRT); Light Rail and Trams and Suburban Trains and Metros, will be funded through a combination of a grant for up to fifty percent (50%) of the required investment, and the remaining fifty percent (50%) through the integration of equity and debt from State/Local government and private actors. Additional resources in the form of guarantees and/or subordinated debt may be available, as long as the total participation from the Federal Government does not exceed sixty six percent (66%) of the investment requirements for the project.

b. **Financial Provisions for Transport Demand Management (parking, car-sharing); Non-motorized transport (bicycle paths and walking facilities); Vehicle technology and alternative fuels; Optimization of existing routes and Intelligent Transit Systems.**
Acknowledging the difficulties for private sector involvement in the development and management of the Integrated Urban Mobility System components included in this second set of provisions, the initial investment requirements will be funded solely through a combination of grants and loans for up to fifty percent (50%) of the total investment required; with the remaining fifty percent (50%) to be financed with resources from State/Local funds.

7. Given the inclusion of sustainability criteria for the NAMA and in order to make the investment requirements attractive for the States and Local Governments, the financial mechanism allows for a partial recovery of the investment in the NAMA through a carbon market or possible from another type of performance-based payment system. As soon as the Integrated Urban Mobility System is fully operational, the GHG emissions reduction will be verified by the appropriate agencies and the resulting reductions will be posted on the crediting market by BANOBRAS.

8. BANOBRAS will then proceed to distribute the funds obtained from sale of the achieved net emission reductions to the crediting market according to the following criteria:

   a. BANOBRAS – Financial Intermediation Fee

      The funds obtained from the Intermediation Fee would then be used for Technical Assistance for developing Integrated Mobility Systems, as well as for the Institutional Strengthening of BANOBRAS’ “Climate Change Transport Unit”.

   b. State/Local Governments – Treasury

      The resulting funds would be allocated in relation to the total investment percentage incurred by State/Local Governments in the development and implementation of the NAMA.

*Figure 3.3 Illustrates the proposed mechanism for initial investment and crediting funding*
3.8.2. Timeline for the proposed activities

The following table describes the expected timeline for Project Implementation and Investment flow structure described previously, once the NAMA is fully operational.
Table 3.8 Preliminary Timeline for NAMA project Implementation and Investment Projections for a specific Metropolitan Area:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Time required</th>
<th>Time Elapsed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pre-investment Studies</td>
<td>6 months</td>
<td>6 months</td>
</tr>
<tr>
<td>2. Application for Funding and Approval</td>
<td>4 months</td>
<td>10 months</td>
</tr>
<tr>
<td>4. Bidding process</td>
<td>6 months</td>
<td>1 year</td>
</tr>
<tr>
<td>5. Construction</td>
<td>10 months</td>
<td>2 years</td>
</tr>
<tr>
<td>6. First year of operation</td>
<td>12 months</td>
<td>3 years</td>
</tr>
<tr>
<td>7. Verification</td>
<td>6 months</td>
<td>3 years</td>
</tr>
<tr>
<td>8. Credit sale</td>
<td>4 month</td>
<td>4 years</td>
</tr>
<tr>
<td>9. Distribution of funds</td>
<td>3 month</td>
<td>4 years</td>
</tr>
</tbody>
</table>

3.8 Regulatory and Institutional Framework

This section describe how the Trust fund and the two Programs addressing Urban Transport issues were created, following by a set of recommendation that need to be addressed in order fully operationalized the Integrated Urban Mobility NAMA.

3.8.1 Current regulatory and institutional Framework

FONADIN

1. On February 7 2008, the Mexican Federal Government published a Decree ordering the creation of the National Infrastructure Fund (FONADIN), intended as a mechanism to coordinate Federal Public Investment in infrastructure, focusing in the areas of Communications, Transport, Water, the Environment and Tourism.

2. The Second Article of the Decree ordered the National Works and Public Services Bank (BANOBRAS) to modify an existing trust, established to support the privatized Highways in order to transform it into the new trust, FONADIN.

3. In addition, the Decree ordered the modification and extinction of another existing trust, the Fund for Investment in Infrastructure (FINFRA). It was also established that the assets pertaining to FINFRA be transferred into the newly created FONADIN.

4. On May 6, 2008, FONADIN was formally established as a financial entity for the Mexican State to drive the National Infrastructure Plan; with BANOBRAS acting as the trustee institution.
5. FONADIN’s purpose is to promote and encourage the participation of public and private actors in the process of planning, development, construction, maintenance and operation of Infrastructure Projects, FONADIN’s role is to provide financial support through grants and loans, in accordance to the established Programs.

PROTRAM

2. On December 17, 2008, FONADIN’s Technical Committee approved the integration of a Consulting Working Group (GTC) established to provide technical support for the evaluation and supervision of PROTRAM projects.
3. The objective of PROTRAM is to provide financial support to Mass Transit Projects, in the form of grants and loans, consistent with an Integrated Plans for Sustainable Urban Mobility (PIMUS). These grants and loans are to be supplemented by the State and/or Local Government supporting the Project, promoting participation from the Private Sector.
4. Additionally, PROTRAM’s objectives include support for the institutional strengthening of Local Authorities in the topics of planning, regulation and administration of PIMUS for Urban, Metropolitan and Suburban development.

UTTP

1. During 2009, BANOBRAS obtained loans from the Clean Technology Fund (CTF) and the International Bank for Reconstruction and Development (IBRD), totaling USD 350 million and destined to finance the National Urban Transport Transformation Project (UTTP) designed by the World Bank.
2. BANOBRAS, through UTTP can provide loans to Local Governments and the Private Sector in order to support the following activities:
   a. Reduce emissions of GHG and environmental pollution through the development of efficient systems for sustainable transport.
   b. Improve the quality of Mass Public Transport in cities and metropolitan areas throughout the country.
   c. Provide incentives to achieve a transformation of Urban Transport.
   d. Promote the use of Clean Technologies in Urban Transport.

3.9.2. Proposed regulatory and Institutional Arrangements for the Operationalization of the NAMA

The development of the NAMA would include the following modifications to the existing institutional arrangements:
1. In order for the proposed financial mechanism to work as an integrated approach that considers developing a series of GHG emission reduction initiatives, a modification to PROTRAM Rules will be required to include the sustainability elements described through the NAMA and establishing Integrated Urban Mobility systems as the eligibility criteria for Funding.

2. PROTRAM/UTTP funds will be integrated into one source of funding, which will be available to State/Local Governments for the development of the NAMA, according to the criteria established in the previous section.

3. The development and operation of the NAMA will require some additional funding for PROTRAM, destined for institutional strengthening in the form of technical capacity.

4. Furthermore, FONADIN/PROTRAM Rules will now need to include Carbon Trading as a funding mechanism, allowing States and Local Governments to receive a return on their investment, proportional to the percentage invested in the development of the Integrated Urban Mobility Systems.

**Schedule for implementation**

<table>
<thead>
<tr>
<th>Activities</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 0: Design of the Integrated Urban Mobility NAMA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identification of NAMA components</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Define preliminary boundary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Describe crediting baseline</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop indicators for MRV methodology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Define operational structure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Define data needs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Phase 2: Implementation of the Integrated Urban Mobility NAMA              |      |      |      |      |      |      |
| Modifications of current Programs to host the NAMA                        |      |      |      |      |      |      |
| Promote the instruments within states and municipalities                   |      |      |      |      |      |      |
| Identify pilot entity                                                      |      |      |      |      |      |      |
| Case and crediting Baseline development                                    |      |      |      |      |      |      |
| Develop monitoring infrastructure                                         |      |      |      |      |      |      |
| Develop reporting infrastructure                                         |      |      |      |      |      |      |

| Phase 3: Pilot Project Activities                                          |      |      |      |      |      |      |
| Initiation of Pilot project                                               |      |      |      |      |      |      |
| Verification of reductions                                                |      |      |      |      |      |      |
| Credit generation                                                         |      |      |      |      |      |      |
| Results and evaluation                                                    |      |      |      |      |      |      |

**References**


Feeney, Bernard P. “A review of the impact of parking policy measures on travel demand.” *Transportation Planning and*, 1989: 229/244.

FONADIN. 2010.


SCHP. n.d.


