SECTOR GUIDELINE

FOR CAF - GEF PROJECTS ON MASS TRANSPORT SYSTEM

CONTENTS

ABBREVIATIONS AND ACRONYMOS

Acronym	Description	Acronym	Description
CAF	Bank for Latin American Development	UMO	Urban Mobility Observatory (A CAF´s own designed Blueprint)
GHG	Greenhouse Gases	BRT	Bus Rapid Transit
GEF	Global Environmental Fund	CDM	Clean Development Mechanism
LAC	Latin American and Caribbean Region	ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plans		

1. INTRODUCTION

Among priorities being pinpointed by the GEF within its institution's focal climate change area, the transport sector-originating pollution is deemed as one of the main Greenhouse (GHG) emission sources, accounting for some 14% of total GHG emissions[1] worldwide. Transport-originating GHG emissions show a two-fold increase since 1970, while by 2011, transport GHG emissions in the LAC region accounted for 35% of all CO_2 emissions. Per capita transport emissions in the LAC region recorded a 12% increase between 2000 and 2009, while they showed a less than 2% rise worldwide[2].

Therefore, bolstering, backing up, and focusing efforts on the design and execution of mass transit projects, allowing for corrective measures to be merged to abating pollutant emissions and GHG, while enhancing quality of life for people living in the region, should be deemed as a priority. The overarching goal of the CAF–GEF Transport Projects addressing climate change mitigation is to buttressing developing countries and transition economy countries in their endeavours to moving towards a low-carbon emission-focused development.

Within the GEF-funded areas towards a sustainable urban transport sector, development activities such as new technologies, public and non-motorized transport infrastructure investments, and the implementation of comprehensive transport strategies, and systems reducing demand for private vehicle trips, roads included, are being highlighted. Over the scope of action of the GEF-6, US $ 210 million shall be allocated to a new programme addressing an urban low-carbon emissions development[3].

Aware of complexities as above being faced up to by large LAC region cities, CAF has been unswervingly working in a search for comprehensive solutions to come by through technical assistance to drawing up transport, urban development and mobility projects, being accordingly complemented with the provision of finance to sound and sustainable projects and programmes, with an aim to increasingly bolstering the sustainable transport concept, such as the Lima Metro Line 1 Structuring and Finance (2015); the Panama Metro Lines 1 and 2; the Electric Mass Transport System Project in Lima and Callao (2011); the Transport Sector Project in Bolivia (2011); the BRT - Bus Rapid Transit

[1] TOWARD SUSTAINABLE AND ENERGY EFFICIENT URBAN TRANSPORT, Energy Efficient Cities, Mayoral Guidance Note #4, World Bank and ESMAP. 2014
[2] CLIMATE CHANGE AND IDB BUILDING RESILIENCE AND REDUCING EMISSIONS SECTOR STUDY TRANSPORT, INTERAMERICAN DEVEOLPMENT BANK, 2014
[3] http://www.thegef.org/gef/node/11001

System in Bogota PHASE III (2013); the Mass Transport Programme in Bogotá (Transmilenio) (2010).

Consolidated figures and results attesting to the above are spelled out in publications summing up the evolution of mobility and urban development for fifteen metropolitan areas in Latin America, as shown in CAF Urban Mobility Observatory (UMO) records[4].

Mass transit systems in Latin America have an opportunity to making meaningful inroads in reducing emissions adding to the GHG effect, and should, therefore, be deemed as a key strategic setting for the worldwide fight against climate.

2. Objective

Setting forth criteria and guidelines making a contribution to the conceptual guidance, and methodological and procedural inputs allowing for a environmental and social evaluation of mass transport projects applying for GEF climate change finance with a particular focus on Sustainable Urban Transport projects.

3. Relevance

Guidelines are applicable to drafting up environmental and social impact Assessments (ESIA) and Environmental and Social Management Plans (ESMPs) addressing mass transit projects (road, rail, air transport, and seaport infrastructure and operation) generating emission reduction alternatives addressing GEF priorities, as shown in diagrams below. In a broader sense, guidelines as stated are applicable to reviewing initiatives and drafting up mass transport-related project proposals applying to the GEF finance.

Overall, pursuant to guidelines as set forth by the last two GEF meetings, sustainable transport is one of the main GEF lines of work to reducing GHG emissions under the climate change focal area. Diagram 1 shows priorities and programmes being included in the GEF Climate Change focal area. Acronyms CC1 and CC2 comprise priorities known as "*Fostering innovation, technology transfer, and Supporting Policy and Strategies*," and "*Validating the systemic*

[4] CAF. (2011). Desarrollo urbano y movilidad en América Latina. Caracas: CAF. Retrieved from http://scioteca.caf.com/handle/123456789/419

impact of mitigation options", respectively, through which sustainable urban transport system options-related programmes are carried out and objectives are achieved. So, the CC1 priority involves the Programme 1 the aim of which is to "*Promoting finance, implementing and demonstrating low carbon technologies and mitigation options*" while, the CC2 priority includes the Programme 3, the aim of which is to "*promoting low-emission urban transport systems.*" Specific sustainable urban transport working lines or areas are set forth. In this sense, and within the scope of the GEF projects, endeavours should be pooled towards activities adding support to policymaking dealing with fuel and transit or road use, strategies to upgrade vehicle fleet fuel efficiency, use of Public Transport based on BRT rapid transit systems, smart grid transport systems, transport infrastructure systems incorporating non-motorized modes, such as bicycles, and train transport, and GHG emission reduction projects in the sea and air transport sectors.

Chart 1. GEF 6. Climate Change Priorities and Programmes[5]

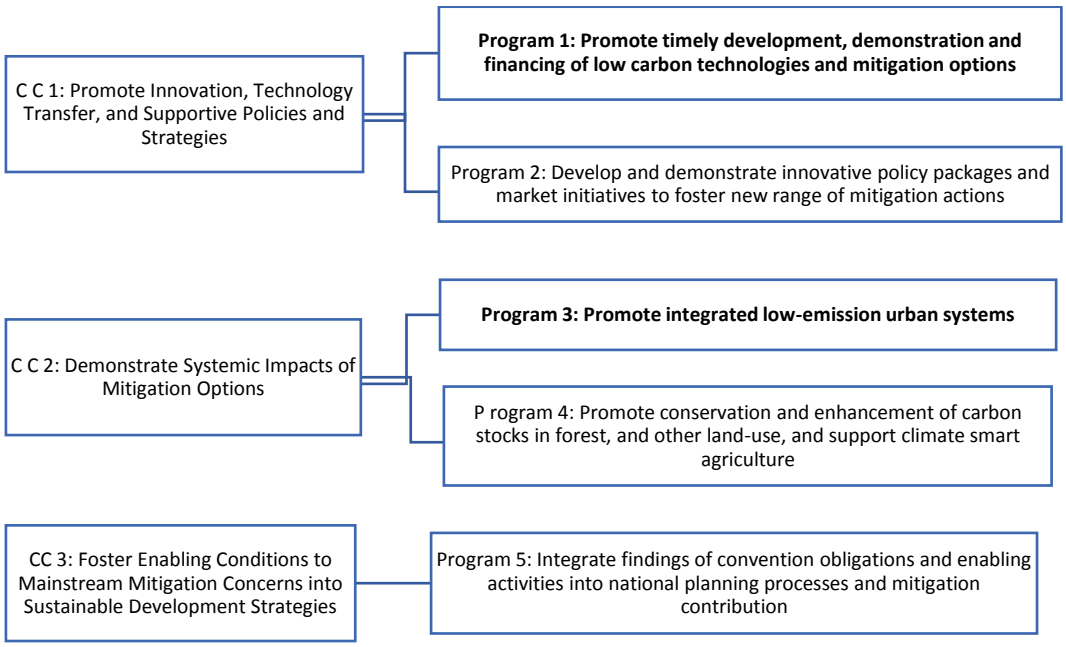

Chart 2. Sustainable transport, development areas being set up by the GEF([5])

[5] GEF-6 PROGRAMMING DIRECTIONS (Extract from GEF Assembly Document GEF/A.5/07/Rev.01 May 22, 2014)

Sustainable transport urgently requires the timely development,demonstration, and financing of low-carbon systems and supportive policies given the rapid increase of GHG emissions from the transport sources in developing countries

- fuel and road pricing
- strategies to improve fleet fuel efficiency;
- support for alternative fuels and advanced engine technology pilots
- demonstrations of smart transport grids,
- Public transport infrastructure such as bus rapid transit along with integration of non-motorized transport options.
- Policies and strategies to promote public transport and demonstrations of mitigation option
- innovative policies and mechanisms for fuel economy standards and vehicle registration mechanisms. (Objective 2, Program 3).
- efforts to catalyze GHG emissions reduction from maritime and aviation sectors may be considered for support.

4 Sector Profile

4.1 The relevance the sector has in the Latin American and Caribbean (LAC) Region

Cities in Latin America have over the last few decades undergone in-depth changes vis-à-vis their size and territorial arrangement. Mobility in many cities is low quality, supplying poor mass transport systems, congestion, air pollution and high traffic accident rates.

On the other hand, policy restricting vehicle use by plate number being implemented in several cities in LAC has shown mixed results. In the long run, Vehicle restriction policy do not necessarily encourage the use of public transport, instead people are being moved to purchase additional -often low quality and highly polluting- vehicles to circumvent this restriction.

Specific surveys in large metropolitan areas such as Mexico City, Sao Paulo and Santiago, attest to the fact that the air pollution situation is indeed severe, with pollutant concentrations much higher than limits being set forth by the World Health Organization. Evidence shows that individual transport (car and motorcycle) is responsible for about 85% of local pollutants emissions impairing human health[6].

[6] CAF. (2011). Desarrollo urbano y movilidad en América Latina. Caracas: CAF. Retrieved from http://scioteca.caf.com/handle/123456789/419

Public transport is prevalent in nine of the fifteen cities being surveyed in the LAC region, as recorded in the CAF reference paper (Belo Horizonte, Curitiba, Porto Alegre, Rio de Janeiro and São Paulo in Brazil; Bogota, in Colombia; Buenos Aires, in Argentina; Caracas, in Venezuela; Mexico City, Guadalajara and Leon, in Mexico; Lima, in Peru; Montevideo, in Uruguay; San Jose, in Costa Rica; and Santiago, in Chile). Public transport shows an over 50% use in Bogotá, Caracas, Mexico City, Lima and Montevideo, while individual motorized transport is predominant in Buenos Aires.

In Brazil, for example, car ownership is growing faster than the country's own GDP. Motorization rates in Peru have increased by 35%: from 52.34 vehicles / 1,000 people, in 2006 to 71/1000 in 2012 (Ministry of Environment, 2014) .On the other hand, motorcycle ownership growth rates have surpassed that of cars in many cities, and motorcycles now account for 10-49% of the vehicle fleet in LAC cities[7].

The BRT model systems being implemented in Bogota and Mexico City are successful examples of urban mobility. Both systems base their concept in BRT models: the first one used in Curitiba in 1992 through the bi-articulated bus operation, and the second one in Quito in 1997[8].

The Bogotá Transmilenio was the first BRT to come into operation in 2000, with a 60km-long route, dedicated stations, one-level passenger carrying service, and a fare pre-payment modality. In its early days, the articulated bus system carried up to 500,000 passengers a day. Currently, the system covers a 112.9km trunk track network, with 11 trunk roads in operation, 134 stations, nine portals and nine yards / garages. The system mobilizes some 1,926,985 passengers daily on average, covering 30% of the demand for public transport in Bogota[9].

The impact Transmilenio has prompted, has been the driving force buttressing a national plan to implementing the BRT in seven cities in Colombia. (ECLAC, 2008). This system is unique in Latin America. Transmilenio was the first project to be granted Clean Development Mechanism (CD) loans for GHG emissions reduction per unit transported. Over the annual accreditation period (2012), Transmilenio reported a 82.128 tonne carbon dioxide (CO2) equivalent reduction (UN Framework Convention on Climate Change (UNFCCC), 2013).

[7] CLIMATE CHANGE AND IDB BUILDING RESILIENCE AND REDUCING EMISSIONS SECTOR STUDY TRANSPORT, INTERAMERICAN DEVEOLPMENT BANK, 2014

[8] CAF. (2013, July 1). BRT: modelos exitosos de transporte masivo. CAF. Retrieved from http://scioteca.caf.com/handle/123456789/617

[9] hp://transmilenio.com.co/es/articulos/historia

Metrobus Mexico City, built in 2005, is a second successful endeavour running along a 20km lane on the Insurgentes Avenue (North-South corridor), with dedicated stations, one-level passenger carrying service, and a prepayment system. In its early years, this system, carried up to 260 thousand passengers a day on eighty-four articulated buses. With the construction of a second 20km lane in 2009, in a westbound route, the total daily capacity was increased **in** 125 thousand passengers a day, for a total of 385 000 passengers / day in that year. Currently, user demand is 440 thousand passengers / day, according to the official Mexico City Metrobus website[10].

Regarding infrastructure, less extensive Caribbean and Central American countries usually have higher road densities, and their population is faced up with significant access problems. To a lesser extent, the key land transport question in these countries is the expansion of their own road networks, and further, maintenance and rehabilitation of existing infrastructure. The situation is quite different in countries such as Peru, Bolivia and Brazil, which have yet to integrate their country hinterlands and their historically isolated rural population. Thus, solutions greatly expanding coverage and ensuring an on-going access for people in a relatively short period of time are indeed called for[11].

Regarding seaport infrastructure and operations, these are having a huge bearing on the region, since more than 80% of the region´s foreign trade[12] is conducted through seaports. The LAC region is facing a challenge to upgrading seaports management, optimization and regulation.

While the rail freight share in the region´s cargo transport is relatively small, it nevertheless shows a sound growth potential. Brazil is the country in the region with the largest rail freight share: 20% (measured in t/km); In Mexico, this share is 11% and in Argentina 7%, while the United States shows a 40% share[13].

The Latin American market shows a significant growth in the air travel sector. The number of passengers is growing faster than the global average, rising from

[10] http://www.metrobus.df.gob.mx/index2.html

[11] Transport Sector Framework paper. March 2014. Inter-American Development Bank

[12] Barbero, J. A. (2010). La logística de cargas en América Latina y el Caribe: una agenda para mejorar su desempeño. Technical Notes No. IDB-TN-103. Washington, D. C.: Inter-American Development Bank. Infrastructure and The Environment Department

[13] Barbero, J. A. (2010). La logística de cargas en América Latina y el Caribe: una agenda para mejorar su desempeño. Notas Técnicas No. IDB-TN-103. Washington, D. C.: Banco Interamericano de Desarrollo. Departamento de Infraestructura y Medio Ambiente

about 80 million passengers in 2003 to around 150 million in 2012. According to an IATA report, air passenger traffic in Latin America during the first nine months of 2012 reached a 10.1% rise. ALTA (Latin American and Caribbean Air Transport (for its acronym in Spanish) passenger traffic reached 179.7 million in 2014, i.e., a 5.6% increase over the previous year. Also, forecasts show that the sector activity in the region could show a two-fold increase over the next 10 years, and could triple in 20 years (Ricover, 2012)[14]. Likewise, air cargo volume has been showing a steady increase in recent years (5.7% between 2007 and 2011).

Achieving sector growth targets involves addressing challenges, such as: air policy and institutional framework; integration, connectivity and air regulation; energy efficiency and the use of alternative fuels; construction, expansion and operation of airports[15].

4.2 Methodological Approach

Mass transit projects intended to mitigate GHG emissions are focused on both, designing strategies bolstering the use of cleaner fuels, and on aspects leading to the reduction of polluting gases being emitted by mobile sources. The end goal these projects are seeking to achieving is having clean technologies vehicles generating less pollution (hybrid, gas or electric vehicles), and the implementation of more efficient transport systems in terms of emissions, such as bus rapid transit systems (BRT), smart traffic-lights transport systems, integrated transport systems incorporating different non-motorized transport modes, such as the bicycle and the train, and GHG emissions reduction projects in the maritime and aviation sectors, among others.

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The design and structuring of mass transit projects within the framework of climate change mitigation likely having access to GEF finance, and entailing activities involving low-carbon research and technological development options, besides pilot or demonstration projects, could involve the future construction, maintenance and overhauling of infrastructure, about which a Terms of Reference proposal for ESIAs is included in Annex below.

4.3 Procedure

[14] www.alta.aero

[15]

Mass Transit projects should embody identifying potential environmental and social impacts (enforcing safeguards), areas of influence, stakeholders, affected and / or benefited population, legal and regulatory aspects. Further, a review of aspects as follows should be included in the project:

- Transport network capacity, quality, coverage and connectivity.
- Sustainable transport, new technologies and adaptation to climate change.
- Evaluation of efficient transport modes to enhance competitiveness.
- Upgrading citizen integration by supplying a more universal access capacity.
- Enhancing quality of life of citizens.
- Implementing mass urban transport measures.
- Promoting public transport and modal interconnection.
- Encouraging transport policymaking incorporating demand management.
- Performing zone planning.

The general procedure to be abode by over the environmental assessment of a project and the latter's potential impact vis-à-vis GHG reduction is as follows:

- Setting forth the project boundary, by way of listing and identifying most harmful GHGs attributable to the project. Regarding transport projects, these GHG are CO_2, (Carbon dioxide), CH4 (Methane) and N2O (Nitrogen Monoxide).

- Establishing the baseline: A baseline depicting a non-project situation should be established prior to ascertaining the benefits likely to arise from projects vis-à-vis GHG emission reductions. The resulting baseline formulation should be as coherent as possible regarding parameters, data sources and assumptions.
- Calculating project emissions (primarily resulting from the use of fossil fuels and biofuels).
- Defining information sources being used for methodology purposes, as well as the deadline for validity of information.
- Estimating *ex-ante* emissions in a 20-year useful life scenario, bearing in mind all project design and implementation phases.
- Considering low-carbon alternatives to achieve development goals.
- Incorporating mitigation and / or compensation measures in the project design.

• Bearing in mind possible project alternatives, such as the current state continuing option, or a no-project option, together with the reorganization of other modal systems.

• Looking into currently existing potential investment, technological, and political constraints associated to alternatives being taken into consideration.

The execution of Mass Transit Projects aims to finding out whether projects of this kind are indeed contributing to GHG emissions reduction, and if emissions reduction mitigation measures are related with GEF priorities. Emission estimates may be done on the basis of different methodologies and tools. The GEF- designed methodology is summarized below.

4.3.1 GEF methodology to estimate GHG emissions[16]

Since a unique formula to be applied to the different existing projects is currently unavailable, the GEF methodology estimates direct and indirect impacts separately. Thus, a GEF project may have emission reduction results in three general areas:

1. Direct CO_2 emissions reductions achieved by investments directly related to projects outcomes. "Direct GHG Impact" GHG emission reductions are considered to be direct emissions within the five categories as follows, and are attributable to a project to be provided with finance:
    a. Efficient fuel use
    b. Intensity of fuel GHG emissions
    c. Intensity of transport use
    d. Transport mode selected
    e. Use of installed capacity
2. Direct CO_2 post-project emissions reductions, which have been achieved through investments being backed up by GEF on the basis of revolving financial mechanisms that are still active after project completion; "Direct GHG Impact Post-Project."
3. *Indirect Reductions*: A number of indirect impacts being achieved on the basis of market facilitation and project execution, and originating in a set of project replication activities called "Indirect GHG impacts."

[16] Global Environmental Facility (GEF) Manual for Calculating Greenhouse Gas Benefits. Transportation Projects. Prepared by the Institute for Transport and Development Policy for the Scientific and Technical Advisory Panel of the Global Environment Facility. 2014

This methodology has been drawn up for the five most common transport project types for GEF, and includes a number of Excel templates, called "Emissions Evaluation Model for Projects" (TEEMP Release 1.0):

1. Efficient transport projects
2. Public transport projects
3. Non-motorized transport projects
4. Transport demand management projects
5. Regional comprehensive transport initiatives

The general procedure for calculating emissions being applied on the basis of the GEF methodology is described as follows:

• Establishing a baseline calculating a non-project emissions scenario to be compared with a GEF project scenario.

• Calculating direct emissions for the GEF project scenario, using the TEEMP programme.

• Estimating post-project direct emissions reductions.

• Calculating indirect emissions reductions: these may be calculated using the "Bottom-up" methodology (this methodology establishes the most conservative measure in the range of possible indirect impacts), and the “Top down" methodology (calling for an expert opinion on the highest impact –the project is likely to replicate- within its own scope of influence).

Table 1 below shows a summary of the three types of GHG emissions reductions in GEF projects:

Table 1. Three types of GHG Emission Reductions in GEF Projects

Evaluation Tool	**Direct**	**Direct post-project**	**Indirect**
Definition of Reduction Type:	Project activities and investments whose outputs and secondary impacts are	Investments supported by mechanisms (e.g., revolving funds) that continue operating	Project components that encourage replication such as study tours,

	tracked in the project's logframe	after the end of the project	capacity building, public promotion, etc.
Log-frame level	Has a corresponding activity or investment with an output that is tracked in the log-frame	Not corresponding to a specific log-frame level	Outcome/impact on level of global environmental objective
Quantification method	Use of GEF TEEMP models with default values (or provision of additional data)	Based on assumptions of functioning post-project mechanisms	Based on the replication rate of the project using Bottom-up or Top-down methods
Quality of assessment	Highest level of certainty and accuracy for minimal data inputs (lower than the CDM)	Reasonable level of accuracy, medium level of certainty	Lower levels of accuracy and certainty

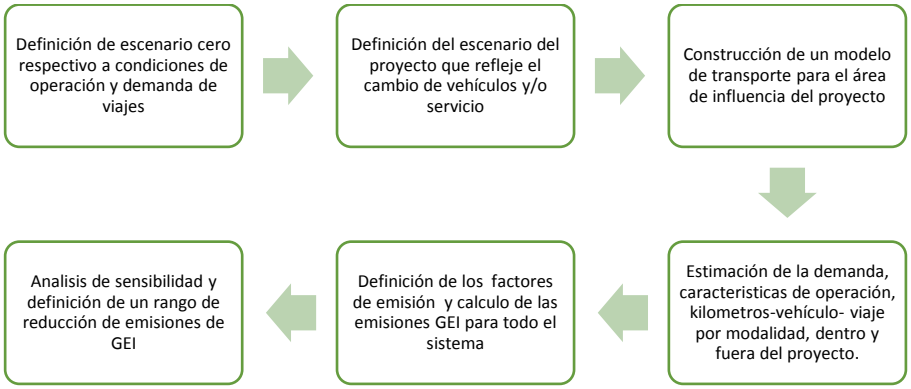
The fact that a large number of GEF-funded projects are focused on technical assistance, allows for the generation of conditions conducive to technology transfer. However, when project impacts are estimated, they are relevant to the whole project. In addition to a more elaborated environmental assessment, considerations as above are also attached to mass transport infrastructure development projects.

4.3.2 Some other methodologies

The use of some other methodologies such as the IDB approach, is shown in Figure 1

Figure 1. Methodology to estimate Transport Projects emissions[17]

[17] CLIMATE CHANGE AND IDB BUILDING RESILIENCE AND REDUCING EMISSIONS SECTOR STUDY TRANSPORT, INTERAMERICAN DEVEOLPMENT BANK, 2014.



1. Defining the non-project scenario vis-à-vis operating conditions and travel demand
2. Defining the project scenario to show change in vehicles and / or service
3. Building a transport mode specific to the project area of influence
4. Sensitivity analysis and definition of a GHG emission reduction range
5. Definition of emission factors and calculation of GHG emissions for the entire system
6. Estimated demand, operation characteristics, kilometres-vehicle-trip per transport mode, inside and outside the project

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Mass transit projects implementing the GHG mitigation approach can be assemble together as follows:

1. Changing vehicle technology or fuel switching projects (e.g. converting a taxi using petrol to a LPG system; changing a bus using diesel for a hybrid bus.)

2. BRT type mass urban transit projects, or metro: new mass transit systems basically, metro or light rail.

3. Transport projects integrated with other modal systems and urban planning.

Greenhouse gas (GHG) emissions reduction is the major impact to be mitigated in mass transit projects. There are several ways to achieving this goal:

1. Kilometre-based GHG reduction, with options including:

a. Changing fuel in vehicles (biofuel, gas, electricity)

b. Incorporating new vehicle technologies (hybrid vehicles, hydrogen-based batteries) using compressed natural gas (CNG) or liquefied petroleum gas (LPG)). (Projects to promote alternative technologies).

c. Technological upgrading in fuel consumption (maintenance, EcoDrive)

d. Changes in road infrastructure, (aiming to reducing congestion: smart traffic lights, and traffic management measures)

2. GHG reduction per unit transported, entailing a modal shift (from road to river transport, or private to public transport); changing the unit size; and changing passenger load factors, or a mix of these. (BRT System projects, projects promoting non-motorized transport). Conditions to scrapping old units should be duly borne in mind in the review: if the process is not carried out under controlled conditions, a new GHG emissions source could be generated, together with an inadequate management of solid waste).

3. GHG reduction by distance travelled: including infrastructure upgrading and reduction of congestion times with changes in traffic management (Comprehensive Urban Planning Projects)

For example, for fuel switching projects, the baseline represents GHG emissions in a non-project situation. Then, the post-change actual energy use is measured, as well as the emissions without the project. Multiplying this factor by the actual energy use over a yearly basis, baseline emissions are thus estimated.

For mass urban transport projects the baseline may be calculated[18] by estimating public transport emissions per travel, per passenger-kilometre, or per unit, and then extrapolating total units, or to do the calculations on the basis of recalled vehicles in the current system vis-à-vis the project.

A methodology is currently in place to estimating GHG emissions being originated from construction, operation and maintenance activities over the first year of the project. Estimates match the Project scope 1 (construction and operations, assuming a fixed demand) with scope 2 (non-project emissions)[19].

• Scope 1 measures direct GHG emissions from controlled or construction´s own sources, and the operation of the transport project companies. It includes both

[18] Líneas base en proyectos de transporte urbano. Survey commissioned to Dr. Jürg M. Grütter by the Inter-American Development Bank (BID) 6/2006,

[19] CLIMATE CHANGE AND IDB BUILDING RESILIENCE AND REDUCING EMISSIONS SECTOR STUDY TRANSPORT, INTERAMERICAN DEVEOLPMENT BANK, 2014

construction phase´s emissions, and emissions from vehicles and materials being used over road operation and maintenance. To estimate annual emissions, total construction phase emissions are divided by 25 (the average life of infrastructure projects)

• Scope 2 measures indirect GHG emissions from the external generation of electricity, heat or steam being used in the project; for example, emissions from electricity being used in the operation for lighting, or other equipment powered by electricity.

• Scope 3 measures GHG emissions indirectly resulting from the use of transportation infrastructure, such as vehicle traffic using a new or a refurbished road.

4.4 Sector-specific environmental and social impacts

In the event that mass transit projects involving climate change mitigation, should over the project execution stage incorporate construction, maintenance and rehabilitation activities dealing with infrastructure programmes, such an execution of transport projects may originate impacts such as:

• Infrastructure construction or development-originating environmental impacts on the biotic environment: impairment of preserved areas, wetlands, wildlife; impairment such as logging and removal of existing vegetation; impairment of species thriving in the project´s area of influence; on the abiotic environment: impairment of water sources, harnessing of materials, land use change, emissions generation over the construction process.

• Social impacts arising from the impairment of the project´s area of influence and due to changes in the area being intervened.

• Operation-derived impacts: Emission generation over the project operation (lower than the non-project scenario)

4.5 Mitigation measures and best environmental and social practices

Fostering sustainable mobility in cities involves transport integration, establishing more efficient mass transit systems (BRT, metro, etc.), promoting non-motorized transport (cycling), and combining demand management policymaking with urban planning and land use regulation, are the most effective measures to optimize urban transport, thus achieving a GHG emissions

reduction. The following two tables show mitigation strategies to be applied to transport projects for submission to the GEF[20]

Table 2. Overview of key transport mitigation strategies, their mitigation potential, and key policy implications.

	Mitigation option	**Mitigation potential**	**Policy/regulatory/institutional/ financial arrangements to promote the option**
Avoid: Excessive travel demands	- Preventing excessive demand - Urban planning: smart zoning with mixed use zones - E-services, telecommuting	- High - Medium	- Fuel pricing; provision of alternatives; taxes on externalities; - Zoning regulations; - Infrastructure; e-services.
Avoid: Too large vehicles	- Prevent the shift to larger vehicles	- High	- Fee-bate programmes; car weight taxes.
Avoid: Unnecessary fuel consumption	- Better maintenance of vehicles	- Medium (10-20% of vehicle fuel consumption)	- Educational programmes; regulations on regular vehicle maintenance.
Shift: Modal shifts	- Road and air freight to rail, shipping, and intermodal transport. - Air and road passenger transport to rail - Urban passenger transport to non-motorized transport; - Clean and efficient two-wheelers and public transport; - Bus rapid transport (+light rail transit)	- High - High - High - More than 50% (compared to LDVs)	- Provision of appropriate infrastructure and facilities for alternatives (road structures accommodating two-wheelers and walking, interconnectedness of modes, etc.). - Access restrictions - Usage proportional road fees

[20] Climate Change: A Scientific Assessment for the GEF. Nov 2012

	Mitigation option	**Mitigation potential**	**Policy/regulatory/institutional/ financial arrangements to promote the option**
Shift/Improve: New fuels	- Hybrid and all-electric vehicles - Biofuels	- High (35-50% for two-wheelers in India) - High (e.g. in Brazil)	- NiMH or Li-ion battery programmes to substitute lead-acid batteries. - Life-cycle assessment of fuels before use (Weinert *et al.*, 2008; Amjad *et al.*, 2011)
Improve: Road transport	- Increased fuel efficiency; - urban vehicles minimal idling losses integrated starter/generator systems; - regenerative braking supply power to the vehicle's electrical system; - efficient two-wheelers; - road system planning and optimization.	- High - ~10% - ~10% - 10-20% (of individual vehicle consumption)	- Fuel efficiency standards + fee-bate programmes; - Technological specifications inspection and maintenance programmes.
Improve: Shipping	- Slow steaming (speed reduction); - Fleet planning.	- ~30% - ~5-40% (of individual vehicle consumption) .	- Mandatory speed limits; - capacity-building.

Table 3: **Mitigation technologies, level of engagement, and related costs and GHG emission reduction potential (Adjusted from Kennedy, 2009c)**.

	Low cost GHG emission reduction low Minor engagement	***Medium cost GHG emission reduction Medium engagement***	***High cost GHG emission reduction high Major engagement***
Transport /	High occupancy vehicle	Financial penalties	**Conversion of**

Land use zoning	lanes; smart commute; car-pool networks; car share	for auto use (e.g. tolls, congestion charges)	**downtown areas to pedestrian use**
	Natural gas vehicles (e.g. municipal buses)	Incentives for use of low-emission vehicles	Infrastructure for plug-in-hybrid vehicles
	Bus rapid transit	Light rail transit	Subways
	On road bike lanes; bike share	Separate bike lanes	Bicycle highways

The promotion of non-motorized transport has a potential to reducing city traffic congestion and improving citizens´ quality of life. Discouraging overuse of private vehicles, upgrading infrastructure and current transport services, fostering urban design-pedestrian integration has proven to be an effective solution. Successful experiences in the LAC region for bicycle integration into the transport system include Bogotá, a city where an extensive 376km network of bike paths was built (Bogota City Hall, 2013) and Mexico City, with more than 2,000 public bicycles, 150 stations and 35,000 subscribers to its Ecobici programme (CAF, 2012). Over the last 5 to 10 years, Bolivia, Brazil, Chile, Colombia, Ecuador, Peru, Uruguay, and Venezuela have banned imports of second-hand vehicles.

Sustainable transport benefits in cities are bolstered through the use of clean technologies in vehicles. Eighty-passenger hybrid buses tests conducted in 2012 by the Clinton Foundation with IDB support in several cities in Latin America showed that these buses could reduce CO2 emissions. Tests results indicated an emissions reduction up to 35% (26% on average) vis-à-vis benchmark diesel buses, and a 30% decrease in fuel consumption. Although the purchasing cost of hybrid and electric buses is higher than that for traditional buses, the life cycle evaluation shows that adopting these technologies reduce total costs of cities and / or operators in the long-term (IDB; C40 Cities Clinton Climate Initiative, 2013)[21]

Table 4. Demand- and supply-side strategies for low-carbon mobility[22]

[21] Documento de Marco Sectorial de Transporte . Marzo 2014.Banco Interamericano de Desarrollo

[22] CLIMATE CHANGE AND IDB BUILDING RESILIENCE AND REDUCING EMISSIONS SECTOR STUDY TRANSPORT, INTERAMERICAN DEVEOLPMENT BANK, 2014

	Avoid	Shift	Improve
Objective	Reduce car dependency, reduce journey distances, and enhance the attractiveness of less contaminating modes of transport.	Offer alternatives to traditional means of transport and use incentives and regulations to encourage change to more efficient modes.	Improve the energy efficiency of existing systems using new technologies, operational structure and connectivity, or management practices.
Demand-side interventions	Fuel prices, road taxes, integrated strategies for managing travel demand, parking regulations, protection of vulnerable zones, restrictions on urban sprawl, land use planning.	Zero-emission zones, restrictions on motorized transport, parking regulations, public transport process, vehicle congestion charge. Public-transport-oriented urban development, development of logistics platforms.	Management practices, vehicle standards, fuel regulations, speed limits.
Supply-side interventions	Public-transport-oriented urban development, development of logistics platforms.	Public transport infrastructure, bicycle and pedestrian infrastructure, investment in railway systems, and development of waterway systems. Polices to foster private sector participation, multimodal integration	Optimize public transport routes, intelligent transport systems, efficient vehicle technologies, second generation biofuels, infrastructure for electric vehicles, aerodynamic design for freight vehicles, infrastructure maintenance.

5 ESIA/ESMP Terms of Reference (ToRs) – Transport Sector

5.1 Objective

Setting forth the contents of the Environmental and Social Impact Assessment (ESIA) Terms of Reference for mass transit projects, the design, structure and / or construction of which are being considered for climate change-focused GEF finance, and the implementation and operation of which shall be demanding infrastructure works.

The ESIA is performed to assess the environmental impacts of major construction projects, such as the construction of new urban road networks; construction of public transport systems, such as bus rapid transit systems (BRTS); Metro Rail Transit systems (MRTS); monorail systems, light rail system (LRT); and construction of public transport terminals, among other projects.

These Terms of Reference are generic in nature and should, therefore, be customised to the size and other project features, as well as to the regional and local environmental characteristics of the site where the project is intended to be executed.

5.2 Contents

First of all, mass transit projects should be defined in terms of their suitability to apply the ESIA pursuant to the CAF–GEF Projects Environmental Assessment Safeguard. Further, the structure, roles, and capabilities of the different institutions involved in the project should also be defined. The basic steps involved in the environmental and social impact assessment (ESIA) are set forth in next chapter, as well as the information required for Mass Transit Projects. Table below shows a standard Urban Transport Projects contents:

Table 5: Terms of Reference Contents Proposal for Urban Transport Project

Chapter	Description
Chapter 1: Introduction:	Project overview; ESIA process; proponent and stakeholders identification.
Chapter 2: Project Description	Identifying project type: a new project, or expanding an existing project. Project requirements, location, traffic /

	passengers volumes, project execution timetable, and estimated cost, etc.
Chapter 3: Review of alternatives	Review of several alternatives and technologies
Chapter 4: Project site Description	Description of the project area baseline.
Chapter 5: Environmental impact Mitigation	Expected environmental impacts, and mitigation measures suggested. Impact evaluation method, including surveys, and modelling techniques being drawn up to evaluating impacts. Detailed information on impacts, and impact mitigation measures over the construction phase should be provided.
Chapter 6: Environmental Monitoring Programme	Environmental monitoring programme, as planned.
Chapter 7: Further surveys	Details of complementary surveys as required
Chapter 8: Project Benefits	Details of benefits based on upgrading of the physical and social infrastructure, job-creation potential, and other tangible benefits.
Chapter 9: Environmental Cost / Benefit Analysis	Environmental cost. Project benefits
Chapter 10: Environmental Management Plan	Environmental Management Plan (PMA), including administrative and technical layout; summary matrix; estimated costs involved in project execution and operation.
Chapter 11: Summary and Conclusions	A comprehensive rationale to execute the project, and explaining how adverse effects are intended to be mitigated.

5.2.1 Overview and scope

The ESIA´s first step is an overview of the project, followed by the identification of the Proponent and stakeholders, and a calculation of the estimated value of the project, in addition to the following:

• *Objectives*: Definition of the project´s general and specific objectives, based on the project´s description, characterization and environmental assessment.

• *Information Sources*: Singling out information collection, process, and review methods.

• *Background*: Most relevant features vis-à-vis the environmental and social project scenario, preliminary surveys, regulatory framework in force, pre-feasibility study.

• *Scope*: Early identification of environmentally sensitive areas, natural resources likely to be affected; a particular focus on the evaluation of significant and relevant potential environmental impacts, while avoiding minimizing negative impacts and, instead, enhancing positive impacts.

• *Methodology*: Applying the different techniques in each of the disciplines being involved in the survey, and enforcing related safeguards, defining the field of study, and environmental parameters to be considered; assessment methods chosen; cost-benefit analysis; action plan.

5.2.2 Baseline construction

Most relevant urban transport project-related study area and key environmental parameters to be evaluated are: Soil (hazardous substances contamination); water (wastes discharge pollution); air (quality, noise, and vibration); and those related to the biological environment, human health (transport of hazardous substances such as fuels), socioeconomic and cultural aspects.

• Project location: Representatively specify the project location and area of influence, including geographical coordinates and geographic information systems (GIS)

• Identification of needs and potential information sources.

• Technical description of project: Definition of environmental equipment, project duration, technical specifications of the project at different stages, estimated harnessing of natural resources, project type, works description, construction methods, source of materials

• Technical description of project alternatives.

• Definition of the project scenario.

• Definition of emissions estimation methodology.

• **Preliminary assessment**: Project Classification in accordance with methodology being selected in relevant environmental assessment methodology´s Safeguard.

• Estimate of GHG emissions.

• Characterization of the project´s area of influence: definition of the project´s direct and indirect areas of influence, on the basis of the identification of environmental impacts likely to be generated over the project execution and operation phases.

Once information requirements have been identified, the baseline may be established through a series of specific field surveys and the collection of relevant information. Then, a comprehensive review of the abiotic, biotic and socio-economic settings is outlined in a summary table so as to allow for an environmental zoning to be made to determine the environmental bearing, potential, fragility and sensitivity of the area in a non-project situation.

Table 6. Characterization of the area of influence[23]

Setting	Component	Description
Abiotic Setting	Geological conditions	Local geology should be assessed on the basis of current surveys, and adjusted with remote sensors and field control-generated information, by type of project. Volcanic, seismic activity…
	Geomorphological conditions	Performing a detailed geomorphological review according to the project type
	Soil use	Identifying the current and potential soil use, defining soil use-related conflicts, and how they relate to the project
	Hydrogeological conditions	According to the project, identifying the hydrological regime and characteristic flows of main water mainstreams; describing and locating the catchment network, and identifying the river dynamics of water sources

[23] Retrieved from TÉRMINOS DE REFERENCIA, Ministerio de Ambiente, Vivienda y Desarrollo Territorial, Bogotá 2006.

		likely to be affected by the project, as well as possible changes in their natural flow regime
	Water uses	Making the overall inventory of current water uses and users of main water sources likely to be affected by the project. Chemical characterisation of water sources.
	Hydrogeological conditions	Once hydrogeological units are identified, singling out recharge zones, types of aquifers, water flow directions
	Geotechnical Features	Depending on the project, doing the geotechnical zoning and mapping
	Air	Determining current GHG emissions, noise and pollution levels
	Climate	Describing monthly and multi-annual climate conditions in the area, i.e., humidity, precipitation, based on information generated by existing meteorological stations in the region
	Landscape	Establishing regional landscape units and their interaction with the project
Biotic Setting	Earth ecosystems	Location of national parks, flora and fauna sanctuaries in the area being surveyed. Characterizing vegetative cover units. Estimation of the vegetative biomass to be affected by the project; the floristic composition for major vegetative units being identified, the associated fauna and land use
	Water ecosystems	Singling out water ecosystems and determining their dynamics and bearing on the regional setting
Socio-economic setting	Participatory guidelines	Project procedures and information regarding project implications vis-à-vis local authorities and communities being affected by the project
	Demographic scope	Population structure, demographic behaviour, living conditions
	Spatial scope	Local survey of public utilities and social services
	Economic scope	Property structure, productive processes, etc
	Cultural scope	Cultural characterization of ethnic communities and other ethnic groups

	Archaeological aspects	Ascertaining the archaeological and historical potential in the area
	Political-administrative scope	Identifying social stakeholders interacting in the area and representing the currently existing political power in the region
	Institutional organization and presence	Management of public, private, civil and community organizations having a relevant standing in the area
	Developmental trends	Establishing foreseeable developmental trends in the regional and local area of influence
	Information regarding populations likely to be displaced because of the Project execution	If the project alternatives involve processes of involuntary displacement of the population vis-à-vis their place of residence, working and production places, and social networking, the affected population and their socio-economic conditions should be identified

5.2.3 Environmental impacts evaluation

A project impacts should be assessed over the different construction and operation stages; this involves assessing positive and negative project aspects, considering the impairment the foreseeable impact might result in, and the time the impact is expected to last, among others. A general characterization shall be made of renewable natural resources the project shall demand, and which shall be used, harnessed, or impaired over the project´s different stages, including those natural resources demanding permits, licenses and authorizations accordingly.

• Phreatic waters: Water volume required. An overall description of Infrastructure and water collection and conveyance systems

• Groundwater: A survey of potential groundwater present in feasible wells. Adjacent groundwater sites, and likelihood for conflicts over the use of this water. Volume of water required

• Discharges to water bodies or soil: Identification of potential streams receiving wastewater discharges. A description of possible treatment systems; discharge points and water flow. A listing of resource uses downstream the dumping site.

• Use of watercourses: A description of typical works to be built up; the timing, and construction procedures

• Building materials: Specify potential sources, volumes and types of material to be used.

• Forest harnessing: Making an inventory of wooded areas to be logged down and removed, and compensation measures to be implemented.

• Air Emissions: When permission is required for air emissions, the type and estimated amount of pollutant emissions should be identified, as well as potential foreseeable impacts.

• Solid Waste classification, estimation of volumes and treatment of foreseeable domestic and industrial waste.

Environmental impacts are assessed and evaluated on the basis of a characterization of the area of influence and the environmental zoning, in a project or in a non-project situation. Further, vulnerability of environmental units identified should be assessed prior to the execution of the various Project construction activities and operation.

5.2.4 Environmental Management Action Plan

Environmental management strategies as required to prevent, mitigate, correct and compensate the impacts being generated by the project alternatives over the different stages, such as pre-construction, construction and operation should be duly submitted. The Environmental Management action plan seeks to minimizing the impacts identified in the EIA through a series of measures such as mitigation, management and monitoring.

Table 7: Environmental management strategies for transport projects[24]

Setting	Strategy	
Abiotic	Soil Management	Handling and disposal or surplus materials. Management of slopes. Landscape management. Handling of building materials. Handling of liquid wastes. Runoff management. Handling of solid and special wastes

[24] Retrieved from TÉRMINOS DE REFERENCIA, Ministerio de Ambiente, Vivienda y Desarrollo Territorial, Bogotá 2006.

	Water Resource Management	Handling of liquid wastes. Handling of solid and special wastes. Management of crossings of water bodies. Catchment management.
	Air Resource Management	Handling of emissions and noise sources
Abiotic Setting	Forest covers Management	Management of vegetation cover removal and husking. Management of flora Wildlife Management Forest harnessing management
	Wildlife rescue Habitats protection and conservation Vegetation rehabilitation	
	Water resource management	Management of flora Wildlife Management
Socio-economic Setting	Resettlement of involuntary displacement populations. Restitution of social networks of populations to be resettled. Compensation for disruption of relations with water resources. Management of services structure. Management of migratory processes	

5.2.5 Evaluation and Monitoring

An environmental monitoring plan involving the identification of critical parameters calling for monitoring at different stages over the project execution and operation should be drafted up by the project proponent, together with a monitoring and follow-up plan for project evaluation purposes.