CHILE
Sustainable Transport and Air Quality for Santiago (GEF)

GEF Project Brief
Latin America and Caribbean Region
LCSEN

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Project Financing Data

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Borrower/Recipient: REPUBLIC OF CHILE
Ministry Of Hacienda

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Project implementation period: Four Years
A. Project Development Objective

1. Project development objective: (see Annex 1)

1.1. To help reduce greenhouse gases (GHG) from ground transport in Santiago through a promotion of a long-term modal shift to more efficient and less polluting forms of transport, and adoption of sustainable low-GHG transport measures. To that end, the project will support the implementation of the 2000-2010 Urban Transport Plan for Santiago (PTUS), a comprehensive multi-sector plan, which is consistent with the overall objectives of the GEF operational program on sustainable transport. The plan’s specific objectives are to (i) maintain share of public transport (60% of total trips); (ii) promote rational transport demand, internalizing all costs from car travel; (iii) promote land-use policies that take into account environmental and transport dimensions helping reduce the average trip length; (iv) promote better coordination between agencies dealing with transport related policies and issues; and (v) reduce air pollution from public transport by 70% (from 2000 levels). A major outcome of PTUS will be the restructuring of the city’s transport system starting in 2005; the system of bus routes and the concession process will be modified, allowing substantial gains in efficiency and profitability for the bus operators. Section B.2 and Annex 6 - "Preliminary elements for a new public transport system development", provide additional information about the plan’s genesis, programs, and preliminary measures.

1.2. To help improve Santiago’s air quality, through reducing emissions of air pollutants like SOx, CO, PM, and NOx (which together with VOCs contribute to the formation of smog or tropospheric ozone (O3)).

2. Key performance indicators: (see Annex 1)

Performance will be measured using two types of indicators. Long-term performance indicators, related to the implementation of PTUS; and Project performance indicators, to measure the achievement of the development objective. See Annex I for a better understanding of indicators and their relation to PDO, CAS, and Project Components.

2.1. Implementation of Urban Transport Plan for Santiago

(i) Share of public transport maintained;
(ii) Land-use policies in place to favor reduction of average trip length and number of private car trips;
(iii) Barriers for introducing clean technologies for transport removed (technological, financial, regulatory);
(iv) Non-motorized transport share of total trips increased;
(v) Average trip length reduced;
(vi) Air quality indicators improved in spite of economic and demographic growth;
(vii) Reduced carbon intensity per travelled km; and
(viii) Evidence of behavioural change towards a rational transport demand.

2.2. Project Performance Indicators

(i) Component 1: a) Increased use of bicycle as a transport mode, in particular within the comunas of Santiago, Providencia, and Nuñoa; and b) reduced number of bicycle accidents per 1,000 bicycle trips in those comunas.
(ii) Component 2: a) Upgrading of local emissions testing laboratory (3CV); and implementation of
test comparing economic, environmental, and technical performance of 3 commercially available technologies for buses (hybrid diesel-electric, diesel, and CNG); b) Review and development of business schemes and management structures for the operators of the new public transport system of Santiago, including program to retrain bus drivers; c) Program for monitoring environmental, social, and operational effects of new bus system in place; and d) Assessment of scrapping options for displaced buses resulting from the bus system reform.

(iii) Component 3: a) Identification of incentives to develop housing programs and transport projects in the Anillo Central area developed; and b) Assessment of options to integrate land-use and transport policies.

(iv) Component 4: a) Development of detailed engineering studies for traffic calming measures in the city center; and b) Assessment of institutional, legal, and technical options for road pricing in Santiago; and removal of corresponding barriers.

(v) Component 5: Institutional coordination of urban transport policies, incorporating environment, and land-use dimensions.

(vi) Component 6: Number of people declaring a more rational use of transport modes, in particular private car use;

(vii) Component 7: Incorporation of GHG emission reductions into the nascent program to trade emission reductions of NOx from mobile and point sources in Chile.

B. Strategic Context

1. Sector-related Country Assistance Strategy (CAS) goal supported by the project: (see Annex 1)

Document number: 23329-CH Date of latest CAS discussion: January 23, 2002

Ia. Global Operational strategy/Program objective addressed by the project:

The project is consistent with the goals and strategic approach set out in the 2002 Country Assistance Strategy (CAS); also, in its pipeline, as part of the Non-Lending Services, the CAS already identified the development of a Sustainable Transport and Air Quality Management Project.

Supporting a plan to enable a more efficient and cleaner transport allows for a sustainable, and equitable growth. Transport efficiency contributes to improve productivity while allowing for a reduction in air pollution and GHG emissions. The poorer segments of population benefit as accessibility is improved through an enhanced public transport system and better options for non motorized travel. From an environmental perspective, reducing the average trip length implies less use of fuel, and consequently less emissions of local and global pollutants. The most vulnerable population, the poor in particular, are prone to be more exposed to air pollution. Not only the economic and community activity in poorer neighborhoods takes place near congested areas (where the vehicle fleet tends to be older and more polluting); also, some of the poorest areas of Santiago, such as Pudahuel, are exposed to a higher concentration of local pollutants as a result of photochemical and dispersion conditions of the city, where thermal inversion further contributes to exacerbate the effects on health. Consequences of air pollution are quickly translated into decreased productivity and increased health treatment costs, affecting the family income. In general, air quality contributes to achieving a better quality of life, which together with a competitive economy, and an adequate transport system establish favorable conditions to attract direct investment flows.

In line with the CAS objectives, the project will (i) enhance sustained economic growth and social progress through increasing average urban transport speed and improving accessibility, making the city more appealing and favoring a larger labor market (i.e., the number of jobs accessible from any point of
the city). This will increase the economic output of a region which already yields 47% of Chile’s GDP, and will generate a trickle-down effect that will most likely have a very positive impact on the poor. It will (ii) **heighten inclusion of the most vulnerable groups**; a more reliable and quick public transport system is expected to address the low levels of mobility of the poor, reducing their exclusion through improved access to services and opportunities at affordable prices and reasonable travel times, hence contributing to a more socially inclusive growth pattern. The project will (iii) **improve environmental conditions** in a city where pollution reaches very high levels and primarily affects the poor. Reduction in emissions of air pollutants and GHG will result from a less intensive use of fuel, to be achieved through supporting measures to rationalize public transport supply, promote modal shift to public and non-motorized transport, and to relieve congestion through a better use of road space. The project will also (iv) **promote public private partnerships** through a renovated concession mechanism for private operators to provide public transport services; and through innovative measures such as travel demand rationalization. To end with, the project will **modernize the state and build its capacity**: (a) as mentioned above, it will increase the state capacity to handle PPPs, (b) it will reinforce CONAMA’s capacity to deal with global environmental issues and participate in the reinforcement of the state technical capacity and its ability to enforce environmental regulations with minimal impact on the pace of economic growth, (c) strengthen coordination between public entities in charge of transport planning, urban planning and environmental management and (d) strengthen the recently created entity (PTUS-CO) responsible for urban transport at the level of Santiago’s metropolitan area.

Complementing this GEF project, and as a result of the continuous dialogue on transport and environment, the Government of Chile has formally requested an IBRD loan to help finance the implementation of the restructured public transport system for Santiago, in particular the building of 30 km of segregated busways which will become part of the new trunk lane system (out of 80 km foreseen by PTUS). The project would also fund other components of PTUS, such as the implementation of additional bikeways; the implementation of CONAMA’s program for emission reductions trading; improved accessibility to low-income neighborhoods; implementation of traffic calming measures and pedestrian areas in the city center; and technical assistance to public private partnerships for public transport projects. The project development objective is to reduce air pollution and GHG emissions produced by urban ground transport modes, while contributing to improve safety and efficiency of Santiago’s transport system. The GEF project will help remove barriers for the implementation of key elements of PTUS, such as road pricing or the rational use of transport modes; and will also help prepare some of the elements to be funded under the loan; in particular it will advance the studies and designs for traffic calming measures, for upgrading CONAMA’s emission reduction trading program, and for supporting the creation of enterprises to operate within the new bus routes system under a reduced number of vehicles. Commitment from the Government of Chile is strong, as PTUS is not only a critical plan for the development of Santiago and its metropolitan area, but it also highly supported by President Lagos and his administration.

2. **Main sector issues and Government strategy:**

2.1 **Issues**
The Transport System and Travel Characteristics

Santiago is served by a road and public transport system, which is generally well managed and continuously being improved. Modern traffic engineering techniques – including a real-time computer controlled signal system – are applied to the street network. The 40-km metro, the first section of which was inaugurated in 1975, is an example of efficient mass transit management and serves 747,000 passenger trips per day. Most public transport passengers, about 4.5 million per day (2001), travel on the 7,635 buses which are mostly owned by individuals or very small companies. In addition, there are suburban railway lines, route taxis (colectivos) and regular taxis.

Chile’s sustained rate of economic growth has a large impact on Santiago’s air quality and on its aggregate environmental service capacity. With about 5.3 million inhabitants, Santiago ranks seventh among urban areas in Latin America and concentrates about 40% of Chilean population. While population growth has decelerated from 4.5% per annum during the 1950s to about 1.4%, residential settlements continue to expand over an area of more than 600 square kilometers. This adds to its intense economic activity. Transport demand grows at a high pace, inflicting pressure on the urban transport system through increased traffic and congestion, and generating increased GHG emissions and air pollution.

Between 1991 and 2001, the population increased by 30%, car registrations by 103%, and the number of person trips (by all modes including walking) by 69%. Of great concern from the viewpoint of air pollution is the growing use of the private car which has increased from 12.3% of motorized person trips in 1977 to 38.09% in 2001. Vehicle ownership rates rose from 320 cars per 1000 households in 1977 to 360 cars per 1000 households in 1991 and 560 cars per 1000 households in 2001, with still higher figures in the up-scale districts such as Las Condes, Providencia and Vitacura.

As a whole, Santiago's transport system is much less chaotic than in other cities of Latin America and highly competent transport planning entities combined with political commitment to tackle urban transport issues have shaped a fairly well organized and reliable transport system. Nevertheless, the urban transport sector still suffers from acute problems which are still to be addressed and which can be summarized as follows:

2.1.1 Air pollution

Much of Santiago’s pollution problem stems from its climate and topography. A thermal inversion acts as a cap over the city during fall and winter (April-August), inhibiting the dispersion of pollutants, which is further obstructed by the mountains surrounding the city. For more than ten years, the Government has declared pre-emergency or emergency days when ambient levels of particulate reach unhealthy levels. Fortunately, the measures taken in the last ten years have led to substantial improvements, reflected by a much lower occurrence of emergency days. Nevertheless, air pollution levels are still too high and transport is the major contributor to local emissions; in October 2000, transport accounted for 91% of CO emissions, 84% of NOx, 48% of PM10, 34% of SOx, and 38% of VOC emissions.

The relatively high levels of emissions and concentrations of airborne pollutants affect health and quality of life. Ozone and PM2.5 are the pollutants of most concern in Santiago, as their concentrations still exceed the air quality norms for the city. Besides their direct effect on health, PM10, NOxx and SOxx are major precursors for the formation of PM2.5, which inflicts serious health impacts, including increased morbidity and mortality; and NOxx and VOCs are also precursors for ozone formation, which has in
itself serious local social costs, while contributing to global warming. In addition to the global warming potential (GWP) of tropospheric ozone, transportation is a major source of GHG, mostly in the form of CO2. In Chile, transportation is the major source of energy-related GHG emissions, accounting for about 37% of CO2 emissions. CO2 is emitted as a direct result of fossil fuel combustion; in Santiago, these emissions are mostly associated to the use of gasoline and diesel. Thus, measures aimed at improving efficiency of transport flows, at promoting modal shifts to non-motorized, or to less energy intensive modes of transport, and at adopting cleaner fuels and vehicles will not only help address local air pollution but will also reduce GHG emissions.

A relatively recent study estimated that the annual costs of traffic-generated air pollution exceed US$500 million in Santiago. It discussed the relative decline of PM10 and carbon monoxide emissions in recent years, but noted that ozone levels had generally been increasing. It also estimated that the transport system emitted nearly 4.2 million tons of CO2 in 1994, of which 68% were produced by passenger cars, taxis and light trucks.

2.1.2 Exponential increase of car use and ownership

With about 5.3 million inhabitants, Santiago ranks seventh among urban areas in Latin America and concentrates about 40% of Chilean population. Even though population growth has decelerated, residential settlements continue to expand and to generate increasingly long trips, more and more difficult to be served satisfactorily by public transport. In addition to this, Chile’s sustained rate of economic growth resulted in an increase of car ownership in Santiago from 320 cars per 1000 household in 1977 to 560 cars per 1000 households in 2001. During the same period of time, the number of person trips (by all modes including walking) went up by 69% and the average length of these trips went up as well. This growth in mobility, associated with an ever-higher share of motorized trips made by car (12.3% of motorized person trips in 1977 to 38.09 % in 2001) has been inflicting pressure on the urban transport system through ever-growing traffic and congestion. Considering the characteristic geographical conditions of the city, where the mountain chain around the city favors a thermal inversion in the colder months, this has a worrisome impact on Santiago’s air quality.

2.1.3 Relative deficiencies in the organization of the current bus system

In spite of a public transport reform which took place in the 1990s (which included the introduction of bus regulated standards on age, size, and useful life), there are still many elements that can be corrected to achieve a still more efficient bus system. Presently, bus operators are still competing in the streets (competition in the market instead of for market segment through competitive bidding) on the very same routes, which generates operating inefficiencies and dangerous driving behaviors when touting for passengers. As bus ownership is quite fragmented (most owners own no more than a single bus) and as there are very few formal sizable companies, transport supply is poorly coordinated, chaotic and does not adapt to demand levels. Oversupply during off-peak hours contribute to unnecessary congestion and pollution, and increase operating costs. Also, bus routes are long and cross the city from one extreme to the other, and most of them run through the city center and the most heavily loaded axes, adding further to already high levels of congestion. Finally, there is no tariff integration between bus routes, which helps create inequities as the poorest classes get affected facing higher travel costs and less accessibility.
2.1.4 Lack of inter-agency coordination at the metropolitan level

Coordination amongst the agencies dealing with transport and air pollution issues is still incipient. This stems from the diversity of sectors and actors involved and from the absence of a coordinating transport body at the agglomeration level. However, environment and transport planning agencies have initiated a pro-active coordination around common goals and objectives, centered on the improvement in the quality of life. PTUS has incorporated both the local and global environmental dimension, and it is now clear that implementing the plan will bring about health benefits, and a less degraded city, while helping mitigate climate change.

2.2 Government Strategy

2.2.1 Institutional Responsibilities for Urban Environmental Management

At the national level, strategic transport investments are made by the Integrated Bank of Projects under the Ministry of Development and Planning (MIDEPLAN). The Ministry of Public Works and Transport (MOPT) is responsible for roads of national and regional importance, and the Ministry of Housing and Urban Development (MINVU) for most urban street construction and regional land-use development plans. SECTRA, subordinated to MIDEPLAN, and also responding to MOPT, and MINVU, is the agency responsible for transport planning throughout Chile, and hosts the primary role to support transport planning and investment. To address environmental issues, including traffic generated air pollution, the National Environmental Commission (CONAMA) was created in 1994, reporting directly to the President of the Republic. While MOPT, MINVU and CONAMA have policy and spending authority for most urban projects, their regionally decentralized services (SEREMITT, SEREMI and CONAMA-Metropolitan Region, respectively) are generally the executors of those projects.

At the local level, Greater Santiago is divided into 34 districts (comunas). Each of them is a relatively autonomous government entity with a Mayor and its own departments such as Public Works and Finance. Most districts fund the maintenance and construction of public spaces, including streets, bus stops, bikeways and sidewalks, with financial support from national authorities. While they have direct control over local land use, subject to MINVU approval, most investment decisions concerning the street system are taken by SEREMI. Also, an Executive Commission for the implementation of Santiago’s Urban Transport Plan (CGTS) has been appointed by the President of Chile.

2.2.2 Urban Transport Plan for Santiago

In late 2000, the Government announced its 2000-2010 Urban Transport Plan for the City of Santiago (PTUS), which main goal is to improve the quality of life in the metropolis and the individual neighborhoods and to help in correcting social imbalances. This would be attained through a reduction in the average trip length, which in general will provide better traffic flows, lesser time of travel, improved air quality from reduced emissions of air pollutants, improved access to public transport, and improved mobility. PTUS includes the following programs: (1) Public Transport Modernization; (2) Road Investments and Traffic Control; (3) Location of Educational Institutions; (4) Promotion of New Commercial and Service Centers; (5) Change in Residential Land-Use Trends; (6) Non-Motorized Transport; (7) Immediate Action Program; (8) Urban Goods Transport; (9) Monitoring and Control; (10) Financing; (11) Communications and Citizen’s Participation; (12) Institutional Aspects.

PTUS was designed in consultation with the authorities in charge of handling transport related issues,
including land-use management and environmental matters (the plan is consistent with the Decontamination Plan for Santiago recently launched by CONAMA, and aimed at reducing air and noise pollution from mobile and point sources of emissions). PTUS is considered to be a major reform plan, expected to substantially change the city.

Executive Commission for Transport in Santiago – CGTS. In an attempt to ensure inter-institutional coordination at the highest level, so that cross-sectoral policies and programs in PTUS could be effectively implemented, the President of Chile appointed this special commission. CGTS is chaired by the Minister of Works, Transport and Telecommunications, and includes the Minister of Housing and urban development, the Sub secretaries of Public Works, Transport and Housing, the Intendente of the Metropolitan Region, and the Executive Director of CONAMA.

Proposed Investments. Amongst the specific investments and actions proposed by PTUS are (a) the expansion of the metro system – about 6 km of line extensions have already been tendered (b) three new suburban railway services; (c) a network of 15 segregated busways; (d) the reform of the public bus system (Annex 6 - "Preliminary elements for a new public transport system development"); (e) a taxi service reform and conversion to CNG propulsion; (f) US$700 million program to improve the road network; (g) the application of a road pricing policy; (h) the promotion of non-motorized transport; and (i) harmonization of land-use and transport policies in order to reduce average trip lengths.

Immediate Action Program. PTUS contains a program of immediate actions which are currently being implemented, comprising a package of low-cost public transport improvements operational since March 2001 and fine-tuned in early 2002:

- Exclusive public transport axes: From 7:30 to 9AM on each weekday, seven radial avenues are now reserved for buses, taxis and emergency vehicles.
- Parallel avenues operating one-way for private car traffic, to provide the needed additional traffic capacity taken away from public transport axes.
- On the ten-lane Alameda Bernardo O’Higgins near the city center, six lanes have been physically segregated and reserved full-time for buses; while only four lanes remain accessible for taxis and private cars.

The immediate action measures of PTUS have set a very interesting precedent and demonstrate that air and noise pollution, and traffic congestion can be substantially mitigated with a very limited budget: a US$ 1.5 million package of public transport priorities has been successful, with travel time reductions in the order of 14% to 35% accruing to bus passengers without causing undue delays to car users and bus occupancy rates having increased by 16%, while PM10 concentration went down by 14%.
3. Sector issues to be addressed by the project and strategic choices:

This project will support the implementation of Santiago’s Urban Transport Plan 2000-2010 (PTUS), which addresses the main issues affecting transport and mobility in the city. Transportation is the main source of air pollution, by far the most important environmental problem of Santiago. Thus, in order to minimize airborne pollutant emissions and concentrations, the plan includes a set of measures to promote and favor the use of public transportation, and non-motorized transport modes. It also seeks to coordinate land-use planning with transport planning and to enhance the use of cleaner fuel and vehicles. All these measures will have an important effect in mitigating climate change, while allowing for a reduction in travel time. The project will strive to accelerate the introduction of these measures by concentrating on seven elements or project components, each one contributing to abate GHG emissions with different degrees of intensity, and with different implementation time periods. A quantitative analysis will be carried out during the project, based on the ASIF methodology and on the use of local models ESTRAUS and MODEM.

2.3.1 Supporting Public Transport Reform

A public transport reform took place in the early 1990s, whereby the fleet of buses was regulated, introducing quality standards for the bus specifications regarding age, size, and useful life. However there are still many elements that can be corrected in order to achieve an efficient bus system. Today, there is what could be called the “war for the penny”; as many operators share the same routes and busways, there is an incentive for not respecting bus stops. Also, bus routes are long and cross the city from one extreme to the other, making travel long and relatively expensive, as any change of route implies additional bus fares. The new system will consist of a trunk network, feeder routes, and transfer stations, which will allow more cost-effective transport for the users, as there will be a single integrated fare. Also, modal integration will be facilitated, as the metro and electric trains will be part of restructured mass public transport system within the same fare structure. Finally, it is expected that cleaner technologies will be introduced together with the use of much cleaner fuels which will be available in the Metropolitan area of Santiago starting in 2003.

2.3.2 Rational use of transport

As indicated above, transport demand has increased as a result of economic and population growth. Ownership of private cars is also augmenting exiting pressures on traffic flow, and generating emissions of both GHG and local air pollutants. Transport use is not always rational from an environmental and economic point of view; many trips, in particular car trips, are made without any planning and with disregard to travel time, contribution to traffic, or pollution. All external costs, and some internal costs, are absent from the transport decision. One of PTUS goals, and a strategic choice of the project is to internalize those costs, and inform the travel decision maker of possibilities for reducing time, cost, and pollution. A combination of better planning, diminished use of expensive car travel, and modal shift to more efficient and less time consuming transport modes will have important impacts in reducing the motorized average travel length.
2.3.3 Inter-agency Coordination

Coordination amongst the agencies dealing with transport and air pollution issues is still incipient. This stems from the diversity of sectors and actors involved. Environment and transport planning agencies have started a proactive coordination of policies aimed at common goals and objectives, basically those centered around the improvement in the quality of life. PTUS has incorporated the environmental dimension, and it is now clear that implementing the plan will bring about health benefits and a less degraded city.

Although there is not a metropolitan authority in charge of developing and implementing air quality management plans, there are some councils and commissions focused on this type of inter-agency coordination. CGTS is clearly the body with the highest political leverage at the moment, as the urban transport plan will inevitably produce improvements in air quality. Also, there is the Committee on City and Land of Santiago, which tries to articulate policies on land-use, transport, and environment.

The project will strive for a more interactive coordination between agencies, through the development and implementation of strategic environmental evaluation and planning tools. Also, through direct support to CGTS to ensure a better coordination of land-use and transport plans, programs, and projects.

C. Project Description Summary

1. Project components (see Annex 1):

The project will strive to accelerate the implementation of PTUS, by concentrating on 7 components, each one contributing to abate GHG emissions with different degrees of intensity, and with different implementation time periods. Preparatory studies under GEF funding (PDF-B) have helped specify the activities under certain components. Annex 7 - "Detailed Project Description", includes a more detailed description of each component.

1.1 Promotion of bicycle use

The objective of this pilot program is to promote the use of bicycles as a mode of transport and aims at diverting travelers from motorized modes, especially private cars, then having a direct effect in reducing GHG emissions, as less fuel would be burnt per traveled km.

The project will include (a) 19 km of GEF-funded bikeways connecting the Comunas of Santiago, Providencia, and Ñuñoa; (b) 21 km of bikeways about to be built in the same Comunas with government funding, (c) the implementation of a promotional strategy aiming at changing travel behavior to achieve a sustainable modal shift to bicycles; and (d) a safety strategy to minimize bicycle accidents and to maximize personal security. As the primary aim is to reduce air pollution and GHG emissions, the component would target existing and potential car users – the number of which is rapidly increasing with generally favorable economic growth – and thus focus on zones with relatively high car ownership; this would be in contrast to similar bikeway programs elsewhere, such as Lima, which primarily addressed the transport needs of the low-income population. On the other hand, the project will help catalyze future investments and raise bicycle use in other parts of the city.
1.2 Modernizing the bus system

This component will support the development of the new bus system for Santiago, which will not only provide a more efficient use of buses (reducing bus fleet, increasing bus occupancy, and increasing average speed), but also will provide an opportunity to renew the bus fleet both at the city level (through the penetration of proven clean bus technologies), and at the national level the component is structured in 3 sub-components:

1.2.1 Technical assistance for evaluating the economic and environmental impact of clean technologies for buses

This component will provide technical assistance to compare technical and environmental performance and associated costs of hybrid-electric buses with CNG and diesel ones. The project will allow the economic and environmental evaluation of the potential introduction of the hybrid diesel-electric technology to Santiago’s public bus fleet. As emissions reduction benefits and related costs will be determined, regulators will have the relevant information needed for the establishment of more stringent emission standards for Santiago. CGTS is in the process of allocating the contracts for bus operation along the major Santiago corridors under a newly restructured public transport system; in this respect, the outcomes from this project will allow the regulators to determine emission standards so that operators can be obliged to have bus fleets with a mix of conventional and cleaner vehicles.

1.2.2 Implementation Framework for Bus Reform

In order to complement the building of segregated busways, for which a complementary World Bank loan will be utilized, technical assistance under this component will support a review of management and business organization measures that are required to effectively operate the new corridor infrastructure, including a system of business organization, the concessions for specific bus line operations, and the structuring of integrated fares. It will also fund the formulation of a program to retrain existing bus drivers that would leave the public transport business, and to assist them in inserting them in other sectors of the economy. Moreover, this component will support the establishment of a framework to monitor the environmental, social and operational effects of the new system.

1.2.3 Renewal of the bus fleet

The project will finance a strategic study to define ways of synchronizing and coordinating the removal of “not-so-old” buses from the streets of Santiago, which will be displaced by the new articulated EURO III buses which will run in the trunk lanes. The study will identify options for ensuring a national modernization of the bus fleet to rationalize public transport capacity.

1.3 Assessment of land-use incentives and policies to reduce motorized travel

This component aims at rationalizing the location of centers of activity, reducing trip lengths, improving traffic flow, and promoting modal shift. The component will be structured in 3 sub-components:
1.3.1 Developing the Central Ring of Santiago (Anillo Central)

The project will fund studies to calculate the environmental impacts of urban development policies aiming at spurring the development of housing projects located on the Anillo Central, based on potential policy options. Thus, the study will help decision-makers to better evaluate the development of currently available central sites according to the expected impact on transport, air pollution and global warming.

1.3.2 School Location

The GEF grant will fund studies to assess the economic and environmental impact of locating new school facilities so that the average trip length can be reduced. This is key now that the full school day (Jornada Escolar Completa or JEC) is being established, requiring schools to expand to attend a double student load before 2010 nationwide. In addition to this, secondary education was recently made compulsory, which further increased higher capacity requirements.

1.3.3 Housing Policy

The project will provide technical assistance to the authorities in charge of housing policies and regulations, so that the transport and environment dimensions can be better integrated into policy making. Recommendations would be aimed at the reduction of the average trip, or at a modal shift to less polluting transport modes.

1.4 Improving Traffic Flows

1.4.1 Traffic Calming at City Center

This subcomponent would fund studies to identify sound traffic calming measures to reduce car traveling at the historic center of Santiago, including a diagnostic phase, a design phase, stakeholder consultation, and integrating the need for GHG emission reductions into the specific engineering designs for the civil works.

1.4.2 Road pricing

This component aims at reducing and rationalizing the use of private vehicles, by means of road or congestion pricing measures which would internalize external costs imposed on society by car drivers. Pricing would not only help reduce traffic volumes, but could also generate additional sources of finance for transport improvements. The grant will fund a study to investigate the likely social, environmental and economic effects of various forms of road pricing, the conditions under which it is likely to be acceptable, and the best mechanism for its implementation.

1.5 Strategic environmental assessment

The project will fund advisory work to ensure coordination of sector policies, programs, and projects (ppp) dealing with transport, urban development, and environment. To that end, the project will help develop tools to integrate environmental management within the scope of the development of urban transport plans and policies, including land-use pattern changes, pricing, and tariff schemes.
1.6  Travel Harmonization

The project will support a study to evaluate the feasibility of implementing a large scale program to make a rational use of private cars and integration of travel modes in family groups, including the identification of private entities interested in co-financing and/or participating in the implementation of the overall program; and the implementation of a medium scale pilot phase. The project will draw from the successful experience of 1997 carried out by SECTRÁ in Santiago for a small number of households. The objective is to reduce travel frequency and time, based on the systematic record of travel needs and practice. Using the private car more efficiently according to pre-established travel plans will allow important reductions in fuel, time and emissions.

1.7  Decontamination Bonds

The project will fund a study to evaluate options for promoting further local investment in sustainable transport by integrating GHG emission reductions into the new Decontamination Bonds Program to cap air quality emissions in Chile. The initial setup will be focused in Santiago, considering that most of the transport related emissions in the country are generated in the city. This program, currently being established by CONAMA, will allow emission reductions resulting from sustainable transport measures, to compensate emissions from existing polluters exceeding the norms, and/or from new polluters required to compensate for adding new emissions into the system. The system has been devised to enable NOx and PM reductions. GEF incremental support would also help raise the awareness of the opportunities for emission off-set investments in sustainable transport, and ensure that the program can also take into consideration the additional green house gas benefits of these investments (provide extra “credit” or incentives for investments that include additional global benefits). To help the system become operative, the project will provide technical assistance to assess needs and options for including the transport related greenhouse gas benefits into the permit clearinghouse; further support for devising methodologies to measuring carbon reduction benefits in the transport sector; address aspects of integrating the transport sector into proposed financial mechanisms; and studies and awareness raising activities that promote the sustainable transport market potential. The expected result is an impact assessment in terms of potential CO2 reductions in the transport sector, a strategy for building a solid local carbon market; the identification of pilot sustainable transport projects; and technical assistance support for early transport demonstration pilots. (GEF contribution is estimated at $500,000)

<table>
<thead>
<tr>
<th>Component</th>
<th>Indicative Costs (US$M)</th>
<th>% of Total</th>
<th>Bank financing (US$M)</th>
<th>% of Bank financing</th>
<th>GEF financing (US$M)</th>
<th>% of GEF financing</th>
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<tr>
<td>Promotion of Bicycle Use</td>
<td>4.61</td>
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<td>0.00</td>
<td>0.0</td>
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<td>0.0</td>
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<td>21.1</td>
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<td>0.0</td>
<td>1.10</td>
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<td>Decontamination Bonds</td>
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<td><strong>Total Project Costs</strong></td>
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<td><strong>0.00</strong></td>
<td><strong>0.0</strong></td>
<td><strong>6.98</strong></td>
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<td><strong>Total Financing Required</strong></td>
<td><strong>13.95</strong></td>
<td><strong>100.0</strong></td>
<td><strong>0.00</strong></td>
<td><strong>0.0</strong></td>
<td><strong>6.98</strong></td>
<td><strong>100.0</strong></td>
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</tbody>
</table>
2. Key policy and institutional reforms to be sought:

2.1 Increasing car ownership in Santiago’s peculiar climatic situation imposes ever growing challenges to contain traffic-generated emissions. The recent publication of the new ten-year transport plan (PTUS) indicates the Government’s intent to face those challenges through a major public transport restructuring– and its objectives coincide with those of GEF. However, the full implementation of that plan is by no means certain, in part because of budget limitations during this period of economic stagnation, in part because of opposition that can be expected from automobile clubs and similar organizations. The Government has thus welcomed a possible GEF operation for Santiago, knowing that such a support would give greater impetus to their transport/air quality management strategy, while creating condition to reduce GHG emissions.

2.2 The possibility of implementing road pricing in Santiago has been seriously considered for more than a decade, and there is a continuing debate on the topic. Institutional and political hurdles have delayed its implementation, and GEF’s participation could play a pivotal role in helping decision-makers to resolve pending issues such as the application and acceptability of road pricing. The Chilean Congress debated the concept in 1991 but, due to fierce opposition, the proposed Law had to be reformulated in 1994. Eventually, the House of Deputies approved a Law in 1996, followed by the Senate in 1997. Unfortunately, the Law is written in a way that makes congestion pricing very delicate to apply, due to countless restrictions and provisions. Further changes are required in this legislation to enable the introduction of road pricing. The project will develop studies (legal, economic, technical) to help reduce the existing political barriers.

2.3 The new Strategic Environmental Assessment and Planning tools may require formal changes in procedures with respect to the development of transport and land-use planning, programs and projects.

3. Benefits and target population:

3.1 Target Population

The major benefits will accrue to the Residents of Santiago and people living in the Metropolitan Region which are making daily trips to the city. All inhabitants are affected by air pollution. Environment-friendly actions will have an effect over the metropolitan region. The project will help to put in place policies, institutions, and infrastructure to sustain measures to reduce GHG emissions, which will have global impact.

3.2 Benefits

The major benefits will be the reduction in emissions of local and global pollutants, which translate into health improvements for the target population affecting attendance to school, better performance, and improved productivity. Also, shorter travel times, and less congestion offer better quality of life for the Metropolitan area of Santiago, which will also favor the investment climate. Contribution to the reduction of GHG emissions will also have global impact, as all climate change effects will be lowered as a result of the project.
4. Institutional and implementation arrangements:

The Executing Agency for the project will be the Executive Commission for Transport in Santiago, which will be in charge of coordinating with other local and national agencies such as SECTRA, the Ministries of Transport and Public Works, Planning, and Housing, and the local municipalities. UNDP will continue to act as the local disbursement agent, as it has done during preparation and PDF-B implementation. With regards to the different project components, there will be different implementation arrangements as explained below.

4.1 Promotion of bicycle use

This component will be primarily implemented by the Comunas of Santiago, Ñuñoa, and Providencia, in particular in what respects to the building of bike pathways, safety devices, and connecting works. As per the implementation of the campaign to promote bicycle use, the project would be implemented by the Executive Commission for Transport in Santiago-CGTS, with the participation of public and private parties, including Metro, as relates to facilities for parking bicycles, and to shower and locker facilities.

4.2 Modernizing the Bus System

The field test will be implemented by private companies in association with 3CV. Private companies will provide the buses to be tested, as well as the routes where the tests will be run. 3CV and CONAMA-RM will coordinate the development of driving cycles for Santiago, and will oversee the field test development. The Executive Commission for Transport in Santiago-CGTS will be in charge of coordinating overall implementation of the whole component.

4.3 Land-Use Component

This component will have a diverse institutional participation. (a) Development of Anillo Central will be mainly implemented by private real estate companies, and with an active participation of the Ministry of Housing. (b) School Location will depend on close coordination with local municipalities and the Ministry of Education. (c) Social Housing will depend on policies and regulations by the Ministry of Housing. In all cases the Executive Commission for Transport in Santiago-CGTS will be in charge of coordinating overall implementation of the whole component.

4.4 Improving Traffic Flows

This component will be implemented by the Executive Commission for Transport in Santiago-CGTS and will require a close coordination and participation of the local Comunas, the Ministries of Transport, Housing, and Planning, and the Congress.

4.5 Travel Harmonization

In this component, the Executive Commission for Transport in Santiago-CGTS will be the implementing body, although an active participation of public and private enterprises is required to be able to implement a large scale project.

4.6 Strategic Environmental Planning and Assessment

This component will be primarily implemented by the Executive Commission for Transport in Santiago-CGTS, although an active participation of the Ministries of Transport, Housing, CONAMA, and its local dependencies is also required.
4.7 Decontamination Bonds

This component will be implemented by CONAMA, and will require an active participation of market participants.

D. Project Rationale

1. Project alternatives considered and reasons for rejection:

A project to purchase hybrid electric buses and test them was initially considered. However, the Bank does not have the policy of participating in actual bus purchases. On the other hand, being a project to be implemented by the private sector, it was decided that support for a technically sound test was a better use of the GEF resources, given that results could be extrapolated to other cities, without actual involvement in the purchase of new technologies. Once results are available on the different technologies, the market is expected to define the mix of technologies present in the buses.

From the different bus technologies commercially available that could be incorporated into the test, it was decided that only Diesel, CNG and Hybrid options were to be compared because: a) diesel constitutes the baseline (option that would be in place without GEF funding); b) CNG constitutes an option with strong political approval and some field experience; c) hybrid-diesel constitutes a robust option in terms of potential reductions in emissions of greenhouse gases. Options discarded included LPG, electrical, and fuel cell powered buses due to perceived risks in the first case, and especially high costs attached to the latter technologies.

The project at its preparation stage considered two options for allocating the grant toward the technological test. One option required upgrading of local facilities for laboratory testing of heavy duty vehicles at the existing laboratory 3CV. In this case, a counterpart funding would be required, and a permanent capacity to perform this kind of testing would be set available in the country. The other option, on the other hand, was to contract the laboratory tests with third party providers. Based on the preparatory studies, and on the declared commitment by the Government of Chile to provide the required counterpart investment, it was decided to opt for the first option, as within the same range of costs as if contracted with third parties, it allows for the development of a sustainable local capacity.

2. Major related projects financed by the Bank and/or other development agencies (completed, ongoing and planned).

<table>
<thead>
<tr>
<th>Sector Issue</th>
<th>Project</th>
<th>Latest Supervision (PSR) Ratings (Bank-financed projects only)</th>
<th>Implementation Progress (IP)</th>
<th>Development Objective (DO)</th>
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<tr>
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<tr>
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<td>Ozone Protection Policy and</td>
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<td>Institution Strengthening</td>
<td>Water, Sanitation and Flood Protection</td>
<td>Valparaiso Water Supply and Sewerage Project (02)</td>
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<td>GIS-Applications with Highways</td>
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<td>Inter American Development Bank - IADB</td>
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<td>Conservation of Natural Forest</td>
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<td>German Cooperation Agency-GTZ</td>
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<td></td>
<td>Regional Planning in the Coastal Zone of BioBio Region</td>
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</table>

**IP/DO Ratings:** HS (Highly Satisfactory), S (Satisfactory), U (Unsatisfactory), HU (Highly Unsatisfactory)

The US$75 million World Bank loan supporting the Urban Streets and Transport Project (1989-1995) contributed substantially to the construction of a busway and other bus corridor improvements, and also financed studies aimed at reducing congestion and air pollution, and at improving traffic models and planning tools. The performance of SECTRA, which was responsible for carrying out the studies, was rated as highly satisfactory.

The Chile Environmental Institutions Development Project, which was carried out between February 1993 and December 1999 and was the first operation for environment in Chile, assisted the Government in implementing sectoral policies and plans aimed at: (a) establishing the institutional framework to
manage environmental protection and conservation of natural resources, and (b) strengthening environmental management of priority sectors (e.g., forestry, mining and industry). Under component A, the project helped establish environmental and emissions standards (norms) and prepare plans for the decontamination of highly polluted areas. Between 1996 and the end of 1999, the project helped finance work on 20 national norms, of which 14 were approved. The principles used to establish norms are some of the latest worldwide (allowing for flexibility in standards based on the carrying capacity of the receiving bodies), and are beginning to incorporate greater use of economic instruments (such as in encouraging offset agreements for air pollution).

The Inter-American Development Bank (IADB) has approved a $1,250,000 grant from the Multilateral Investment Fund to support modernization of the surface mass transit system of the metropolitan area of Santiago. The resources have been used in developing the concept design and concession schemes for the restructured public transport system to be implemented under PTUS. IADB is currently discussing with the Government of Chile about potentially co-financing infrastructure for the trunk or feeder routes.

UNDP is currently participating as procurement agent for IBRD’s Air Quality and Sustainable Transport Project (PDF-B phase), and it is expected that its participation will continue under the second phase (full size IBRD/GEF project).

The Clean Air Initiative (CAI) for Latin American Cities is a special initiative spearheaded by the World Bank Institute (WBI) and the Latin American and Caribbean region of the World Bank, aimed at promoting dissemination of best practice and capacity building on air quality management in Latin American Cities. With a current operating budget for CY2003 of about 0.5 million, the CAI brings together the efforts of leaders from the public and private sectors, NGOs, research and academic institutions, government agencies and international institutions, which cooperate to improve the capacity of city leaders to address air quality management. The CAI is proposed as the vehicle for disseminating the lessons learned under this innovative project outside of Chile and its outreach is now global as the CAI is being expanded to other regions (Asia, ECA, Africa). In Santiago, the CAI provided the opportunity for sharing the city’s experience in its air pollution decontamination plans among partner cities (Buenos Aires, Santiago, Mexico City, Lima-Callao), and set the grounds for advancing with the Air Quality and Sustainable Transport Project.

The Ministry of Finance of Chile officially requested the World Bank in October 2002 to examine in coordination with the Executive Commission for Transport in Santiago-CGTS the possibility of a World Bank loan to support the implementation of the PTUS through financing part of the infrastructure required for the bus trunk routes, transfer centers, bus stops, bikeways, traffic calming measures in the historic center of Santiago, road pricing equipment, and an environmental component related to emission trading. This initiative led to the inclusion of several design modifications which were to be included under the final phase of the GEF project.

The World Bank’s Urban Transport Project financed part of the new developments in transport of Bogota. This project helped finance the development of Transmilenio, a rapid bus system using segregated bus lanes, a route network with an integrated fare structure and feeder routes, a modern concession scheme, and articulated buses. Also, the project funded part of the 250 km bikeways network. These developments dramatically changed the city traffic flows, increasing bus and bike use and helping decrease travel times. Also, the project has added to the recovery of public space, safety, improved accessibility, and citizen culture development which have become a model to follow in the region. A second project currently under negotiation, Bogota’s Urban Services Project, will help further expand Transmilenio and its feeder routes, promote the use of bicycles, strengthen the local capacity for
managing air pollution and improve mobility, and improve neighborhoods.

The World Bank is collaborating with Mexico and Lima through similar GEF interventions through Air Quality and Transport projects. In Mexico, the GEF will be financing the development of sustainable transport corridors, where segregated rapid bus systems can be complemented by bikeways and promotion of bicycle use. Also, the project will strive to incorporate the global dimension into the local planning processes. In Lima, a GEF project will be linked to an IRBD/IADB loan to develop similar segregated bus lanes for rapid transit systems according to the model followed in Bogota. The project will have a component to promote the use of bicycles, and a component to help modernize the bus fleet. Finally, as in Mexico, GEF funds will be used to develop the framework for developing the rapid transit systems under the new concession schemes.

3. Lessons learned and reflected in proposed project design:

The Bank has a long-standing involvement in the sector of air quality management in general, and its interrelationship with urban transport in particular. The first loan in this regard, approved in 1992, had the objective of reducing traffic-generated air pollution in Mexico City. Stemming largely from that participation, the Clean Air Initiative in Latin American Cities was set up in 1997, which has been highly successful in disseminating experiences among major cities, including Santiago; similar clean air initiatives have now been started in East Europe, Asia and Africa. In addition, recent strategy papers on Pollution Management and Urban Transport discuss extensively the effects of urban traffic on air quality, and urban transport operations in Bogotá, Buenos Aires, Lima and São Paulo include air quality management components in their design. Some of the lessons learned include:

3.1 Air quality management and urban transport development involve long-term issues that require long-term responses

Changes in personal travel behavior – a key element to reduce traffic-generated air pollution – are unlikely to occur unless there is a long-term government commitment to sustainable transport. Similarly, improvements in air quality require the kind of long-term vision that has been spelled out in Mexico City with the publication of the Air Quality Management Plan for 2002-2010. The proposed project would support similar long-range plans that have already been formulated in Santiago for transport and air pollution.

3.2 Planning for the long term, however, requires flexibility

Experience in Mexico City has shown that, despite the best planning efforts in the preparatory stage, the need for adjustments in air quality activities becomes evident only during the implementation of the plan. Similarly, the Implementation Completion Report for the Bogotá Urban Transport Project states that “flexibility should be encouraged in some subcomponents, procedures or new technology areas. This occurred in the case of the Transmilenio components where adaptations had to be made in various areas (platforms, bike paths, bridges, surfacing materials, etc, and with very satisfactory results”. Therefore, while each component of the proposed project has been defined in considerable detail, the Grant Agreement should leave room for modifications during its implementation.
3.3 The Bank’s involvement should support an overall Government strategy

This applies to most World Bank operations. The more successful urban transport and air quality projects, such as the one in Bogotá – and indeed the Chile Urban Streets and Transport project – confirm this maxim. The proposed GEF project would fully support the objectives of Santiago’s air quality strategy and the Santiago Urban Transport Plan 2000-2010 (PTUS) by testing key elements of the existing government policies.

3.4 Community Participation is Vital For Success

The PAD for the recently approved GEF grant to support the introduction of climate friendly measures in transport of Mexico City stresses that a “participatory approach, incorporating public opinion in the project, is required to establish legitimacy of the project”. Similarly, the Bogotá experience demonstrates the importance of community involvement which contributed to the public acceptance, even pride, for several “project outputs, notably TransMilenio and the bike paths”. The proposed project – especially the components aiming at increase bicycle use – was prepared in close consultation with civil society and district governments; this collaboration would continue during project implementation.

3.5 More construction of bikeways does not ensure the increased use of bicycles

In 1996, about 46 km of Bank-financed bikeways were successfully implemented in Lima, connecting an industrial area with low-income residential zones. However, the number of cyclists did not increase significantly, as the project did not include a coherent strategy to overcome the cultural barriers inhibiting bicycle use. Even in Bogotá, where over 200 km of bikeways were built in the last four years, the growth in cycling has been modest, and the Government intends to implement – under the next Bank-financed project – a promotional strategy to raise bicycle use. Therefore, an important component of the proposed project would initiate the process of cultural change through a multi-pronged promotional strategy aimed at making bicycle use more attractive in the minds of the population.

4. Indications of borrower and recipient commitment and ownership:

This project is basically supporting an existing plan (PTUS) that not only is a priority for the Government of Chile (as manifested in the creation of the national Office for Coordinating PTUS Implementation) but also has a clear support by the local Comunas and local governmental agencies. Based on the implementation of the PDF-B Grant: “Sustainable Transport and Air Quality”, National and local authorities have requested the Bank to advance with the project proposal to be submitted to the GEF Council. There has been a recent invitation to the Bank to allocate resources for a potential loan to support the infrastructure requirements for the new public transport system implementation. A further update on the progress of this loan, would be provided at the time of CEO endorsement.

5. Value added of Bank and Global support in this project:

The World Bank has a long and proven wide world experience and technical skills related to the implementation of transport, urban development, and environmental projects. Its presence at the sector level in various countries in transport, water, energy, health, and environment oriented projects provide a unique cross-referenced perspective which allows to replicate good experiences, while learning from experience.
Further, the Bank offers advantages in terms of funding leverage. Not only a loan operation would be prepared to help fund part of the infrastructure required investments for PTUS’ new bus system, but also it could be potentially complemented with other services available to support the participation from the private sector, such as the IFC and MIGA products. Besides, PTUS offers opportunities for funding under the Prototype Carbon Fund (PCF). Not only Santiago has good quantitative tools in place to help measure potential impacts of transport projects in terms of GHG emissions reduced, but also, the Government commitment is very high and long-term. Potential PCF projects could be developed for (a) a light train, where measurable public transport demand would be transferred from other more polluting modes (buses and private cars); and (b) a scheme for promoting ESCO-like maintenance and servicing programs that could ensure reduced fuel use and therefore reduced GHG emissions that could be sold at the carbon market.

E. Issues Requiring Special Attention

1. Economic

☐ Summarize issues below ☐ To be defined ☑ None

Economic evaluation methodology:
○ Cost benefit
○ Cost effectiveness
☒ Incremental Cost
○ Other (specify)

2. Financial

☒ Summarize issues below ☐ To be defined ☑ None

Counterpart funding is being provided to implement various components, namely, the building of bicycle pathways, travel harmonization, and the field testing of bus technologies. Without this counterpart funding, the project will not be able to start. Therefore, besides ensuring the right allocation of resources, it will be necessary to coordinate its timeline with government allocation cycles, so that the project may start as planned without additional delays.

3. Technical

☒ Summarize issues below ☐ To be defined ☑ None

The new Bus System needs to be in place (routes, frequencies, and conditions for operation defined if not tendered) to implement the field tests effectively, under real conditions. Also, the quality of diesel for the tests will have to be compatible with the new specifications of sulfur content projected for 2004 (50 p.p.m.); if not already available, it will be necessary to ensure its provision during project implementation.

The tests will build on the experiences of similar operations in New York City, and Mexico City. It is therefore important that the tests are robust from a technical stand point, as their result will be used widely at both local and international levels to promote or justify investments, policies and programs. To that end a study has been commissioned as part of the on-going preparation process to devise the testing
protocols.

Modeling will be important. It will not only allow the simulation of results, but will strengthen the institutional capacity for planning and monitoring of policies, programs and projects related to sustainable urban transport.

4. Institutional

4.1 Executing agencies:

The project will be managed by the Executive Commission for Transport in Santiago - CGTS, institution created for the implementation of the PTUS. This commission was established in an attempt to ensure inter-institutional coordination at the highest level, so that cross-sectoral policies and programs in PTUS could be effectively implemented. The President of Chile appointed this special commission. CGTS is chaired by the Minister of Works, Transport and Telecommunications, and includes the Minister of Housing and urban development, the Sub secretaries of Public Works, Transport and Housing, the Intendente of the Metropolitan Region, and the Executive Director of CONAMA.

4.2 Project management:

The project will be managed and coordinated by the recently appointed Executive Commission for Transport in Santiago-CGTS. It is expected that the office will be sustainable and have budget during the time of project implementation.

4.3 Procurement issues:

The project will have procurement of works (bikeways), goods (computers, software), and consultants, which in all cases will follow the Bank rules for contracting. A detailed procurement plan will be developed by project appraisal.

4.4 Financial management issues:

UNDP has been the procurement agency for the preparatory PDF-B phase, and it will continue to be the contracting agency for the full size project. Its fee will be paid by the Government of Chile.

5. Environmental
5.1 Summarize significant environmental issues and objectives and identify key stakeholders. If the issues are still to be determined, describe current or planned efforts to do so.

The project will involve relatively minor works to insert bikeways into existing streets, and thus no settlements will be affected. Nonetheless, the construction will follow the environmental guidelines from CONAMA, to ensure that materials, noise, and traffic flow get well managed. The bikeway designs will be subject to an independent safety audit, and the construction contract will involve an environmental assessment and management plan. As to the rest of the project, there will be environmental benefits. The field test will take place on operating routes. The rest will be studies with indirect benefits in the future.
The project will involve the construction of 19 km of bikeways which will connect existing bikeways. No significant adverse environmental impacts of the project are envisaged, as project activity will be taking place in urban areas with considerable development and human activity and previous intervention. Environmental activities during construction will be limited and may include: (i) interruptions to vehicular and pedestrian traffic; (ii) noise; (iii) impacts on safety of road users; (iv) limitation of access to dwellings or businesses. To mitigate these impacts, the project will follow environmental guidelines for construction prepared by CONAMA RM. No resettlement of persons as a result of the project is envisaged.

5.2 Environmental category and justification/rationale for category rating:  C - Not Required

Category C- EA not required

5.3 For Category A and B projects, timeline and status of EA

EA start-up date:
Date of first EA draft:
Expected date of final draft:

5.4 Determine whether an environmental management plan (EMP) will be required and its overall scope, relationship to the legal documents, and implementation responsibilities. For Category B projects for IDA funding, determine whether a separate EA report is required. What institutional arrangements are proposed for developing and handling the EMP?

The project is a category “C”, with special attention to the construction of 19 km of bikeways, with no significant adverse environmental impacts involved. The project will have an Environmental Management Plan which will include: The environmental specifications, rules, and guidelines for contractors, including construction waste disposal, an assessment of compliance of all proposed works with existing national legislation; cyclist and pedestrian safety measures, and, environmental education of bike path users so that the surrounding environment is not degraded and the bike path quality can be maintained and sustained with minimal external intervention. On the institutional component CGTS, through its Environmental Unit will be in charge of coordinating with CONAMA-RM the implementation of the environmental policies on the development of the PTUS. Besides complying with the Bank’s rules, CGTS will have to comply with the ruling from CONAMA, which has a very strong environmental management compliance program.

5.5 How will stakeholders be consulted at the stage of (a) environmental screening and (b) draft EA report on the environmental impacts and proposed EMP?

Several NGO’s in Santiago will be consulted during the preparation phase, also communities will be involved in raising awareness. See section 6.2 below.

5.6 Are mechanisms being considered to monitor and measure the impact of the project on the environment? Will the indicators reflect the objectives and results of the EMP section of the EA?

Yes, for the bus field test, the protocol will be the indicator. For the construction of the bikeways, the EMP will have monitorable indicators. As per the other components, there will be a modeling of baseline
and different project scenarios to measure the impact of the project.

6. Social
6.1 Summarize key social issues arising out of project objectives, and the project's planned social development outcomes. If the issues are still to be determined, describe current or planned efforts to do so.

The project will develop a communication strategy to promote the use of bicycles, and a better use of public transport system. Community participation will play a key role in motivating cultural change with regards to the increased use of non-motorized and public transport, a rational use of cars, and with regards to land-use measures such as densifying the Anillo Central. Also, the new schooling zones need to be informed of public preferences to be effective in achieving transport objectives.

Active participation and community involvement is a key issue for the success of PTUS and of the project. Not only some of the components rely on participation, but also, in order to really effect change in the long term, the project requires cultural and behavioral changes, which can only be induced by means of effective communication strategies and participation plans.

6.2 Participatory Approach: How will key stakeholders participate in the project?

During the development of the PTUS, Public Participation has become a very sensitive issue for the authorities in Chile. On the formulation process of the PTUS and the GEF project, during its PDF-B preparatory phase, several NGO’s and interested parties have been involved in the decision making process, through meetings, written comments in a public website, and a participatory workshop. The following stakeholders have actively participated in the preparation process: central government authorities (Ministries of Housing, Public Works and Transport, SECTRA, Metropolitan Region Governor (Intendente), and CONAMA); local authorities (representatives from the Comunas of Santiago, Ñuñoa, and Providencia); universities; multilateral organizations (UNDP, IADB, and ECLAC), NGO’s (Ciudad Viva, Ciclistas Furiosos, Arriba de la Chancha, etc); and bus operators and associations.

PTUS has a strong strategy for ensuring stakeholder participation at the community level. The following are its elements:

- Work with community organizations at the barrio level on the design of the new system (reach of trunk and feeder services, design & security of bus stop places, interior layout of new buses, type & conditions of night services, information needs, etc) and to monitor advance at different stages.
- To incorporate key specific actors (i.e. university students and the like) into specific tasks at the different stages of the modernization process (i.e. information to users at some critical moments of the process, continued monitoring of performance of the new system, etc).
- To build regular links and contacts between the community, the public transport operators and the municipalities.
- To make available a web page for information exchange and suggestions gathering (www.sectra.cl)
- To make available a special telephone line for consultations and suggestions.

The current strategy is to identify the parties involvement and their attitude to participate in the process. For every party involved in this process a plan will be designed and their recommendations will be taken
in to account. Also there is a permanent website, where the parties can have access to the development of the project. During the GEF-PDF-B project preparation, this tool has been heavily used as a community tool.

For more details, refer to Annex 9 - "Participatory Plan".

6.3 How does the project involve consultations or collaboration with NGOs or other civil society organizations?

The NGO's and other civil society will participate in the project through an implementation plan, which is based on the requirements of several interested parties who have been involved on the development of the project since the formulation of the PTUS. This plan aims at the integration of several NGO's as well as groups directly involved on the design and implementation of the PDF-b grant.

6.4 What institutional arrangements are planned to ensure the project achieves its social development outcomes?

CGTS has shown the need for a permanent metropolitan authority for Santiago, to ensure coordination amongst stakeholders, and especially between governmental agencies. Therefore, the implementation of PTUS will be handled by CGTS while the new official body is created. All sector agencies are expected to remain performing as such, but CGTS will coordinate the policies to ensure consistency with PTUS.

A Working Group will be created to ensure an adequate flow of information and communication from and to the bus operators, in particular with relation to their worker rights and conditions within the new public transport system. Another permanent working panel will be constituted, with the participation of mayors, heads of the transit and public works departments, head of the District Secretary of Planning, and other local officials. Municipalities grouped around Areas of Public Transport Services; the agenda of topics include urban planning and transport; specific coverate; segregated lanes for public transport; modal exchange stations; transfer stations; and bus stops. Similarly, a permanent Consultative Body will be created to deal with NGO, both to inform them and also to affect the design phases of specific measures to implement PTUS.

6.5 What mechanisms are proposed to monitor and measure project performance in terms of social development outcomes? If unknown at this stage, please indicate TBD.

Indicators have been provided in section A of this document, and in Annex I. Measurements will involve surveys, field data gathering exercises regularly undertaken by SECTRA, plus the activities foreseen under the project components, and the use of existing modeling and air quality monitoring capacities.

7. Safeguard Policies
7.1 Do any of the following safeguard policies apply to the project?

<table>
<thead>
<tr>
<th>Policy</th>
<th>Applicability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Assessment (OP 4.01, BP 4.01, GP 4.01)</td>
<td>Yes ☑ No ☐ TBD ☐</td>
</tr>
<tr>
<td>Natural Habitats (OP 4.04, BP 4.04, GP 4.04)</td>
<td>Yes ☑ No ☐ TBD ☐</td>
</tr>
<tr>
<td>Forestry (OP 4.36, GP 4.36)</td>
<td>Yes ☑ No ☐ TBD ☐</td>
</tr>
<tr>
<td>Pest Management (OP 4.09)</td>
<td>Yes ☑ No ☐ TBD ☐</td>
</tr>
<tr>
<td>Cultural Property (OPN 11.03)</td>
<td>Yes ☑ No ☐ TBD ☐</td>
</tr>
<tr>
<td>Indigenous Peoples (OD 4.20)</td>
<td>☐ Yes ☐ No ☐ TBD</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Involuntary Resettlement (OP/BP 4.12)</td>
<td>☐ Yes ☐ No ☐ TBD</td>
</tr>
<tr>
<td>Safety of Dams (OP 4.37, BP 4.37)</td>
<td>☐ Yes ☐ No ☐ TBD</td>
</tr>
<tr>
<td>Projects in International Waters (OP 7.50, BP 7.50, GP 7.50)</td>
<td>☐ Yes ☐ No ☐ TBD</td>
</tr>
<tr>
<td>Projects in Disputed Areas (OP 7.60, BP 7.60, GP 7.60)*</td>
<td>☐ Yes ☐ No ☐ TBD</td>
</tr>
</tbody>
</table>

7.2 Project Compliance
(a) Describe provisions made by the project to ensure compliance with safeguard policies which are applicable.

The environmental analysis provided a Category "C" for the project, only requiring environmental guidelines for the development and construction of 19 of Bikeways.

(b) If application is still to be determined, describe current or planned efforts to make a determination.

8. Business Policies
8.1 Check applicable items:
☐ Financing of recurrent costs (OMS 10.02)
☐ Cost sharing above country 3-yr average (OP 6.30, BP 6.30, GP 6.30)
☐ Retroactive financing above normal limit (OP 12.10, BP 12.10, GP 12.10)
☐ Financial management (OP 10.02, BP 10.02)
☐ Involvement of NGOs (GP 14.70)

8.2 For business policies checked above, describe issue(s) involved.

F. Sustainability and Risks
1. Sustainability:

Much of the project is intended to remove barriers that prevent the pursued measures to take place in the first place, and thereafter to become sustainable. Most components depend on behavioral changes which will triggered by the project. Financial sustainability will depend in most cases on those changes, and only the component on bicycles directly involves infrastructure development.

(i) Promotion of bicycle use. Increased bicycle use is already part of Santiago’s stated transport objectives. In view of the strong support by Government and civil society, this component is likely to sustain itself after completion of the GEF project. It is also expected that the non-motorized transport component would have a positive demonstration effect which would (a) strengthen political support for the PTUS bikeway program, (b) provide incentives for District Mayors to initiate similar programs and (c) in combination with the travel harmonization concept mentioned above, contribute to an overall modal shift which could be replicated in other cities. In addition, it is hoped that a positive outcome of this subproject will convince the Metro management to provide bicycle parking facilities at more rail rapid transit stations.

Bikeways will be maintained by the Comunas, as they not only serve the purpose of facilitating non-motorized transport but also of enhancing public space. Its use, though, will depend on cultural pattern changes to be effected by the project. The Comunas have already formally committed to invest in the bikeways that make part of the GEF co-funded network.
(ii) Modernizing the bus system. Sustainability is one of the key elements with regards to the gradual change in bus technologies. As the routes are to be allocated for a relatively long period of time, the initial technological upgrade is guaranteed to last. In addition, the construction and use of segregated bus lanes, operated with large articulated buses running on clean technologies is a gradual process expected to expand over time until the main routes network gets rationalized and modernized; this means a sustained and growing potential demand for clean technologies. Besides, CONAMA is considering the introduction of a subsidies plan that would add a larger boost for the introduction of clean technologies to the city. Moreover, as the technologies become more commercially available, and production lines get maximized at the suppliers’ end, investment and maintenance costs (batteries) for operators are expected to decrease over time. The concept of linking emission performance to routes concessions has a high potential for replicability in other Latin American cities such as Bogotá, Mexico, Sao Paulo and Lima. Emission reduction results will be key to promote the replication scheme through the Bank’s Clean Air Initiative, and directly through on-going Bank operations.

In this case, the studies are aimed at promoting the modernization of the bus fleet. The laboratory at 3CV will be upgraded, and both co-funding and future maintenance will come from the government. Once the project is completed, there will be local capacity able to perform similar tests (including laboratory) for any other heavy-duty vehicles available in the future. All other elements are not dependent on financial support, but on stakeholder conduct. Bus owners will be induced to renovate their fleet based on te development of standards, and on the removal of risk barriers. Since not all routes and services are to be concessioned immediately, the project will provide for informing the bidding processes taking place from 2005 onwards. Since this is a test, the results will need to determine whether more stringent regulation on fleet emissions can be developed.

The study on options for modernizing the bus fleet in Chile is aimed at informing decision makers on options available, and on impacts and related costs. The expected follow-up is the development of policies and programs to incentivate the fleet renewal. The study to support the framework for the new bus system, will be followed by programs for drivers and bus owners reinsertion to productive activities; lines of credit, and further training are some of the options already envisioned.

(iii) Land-use incentives, Land-use pattern change is a long term process that is likewise expected to last. The team believes that localization of additional housing and services can be oriented towards certain goals but is also conscious that this process obviously takes time. The expected benefits to be reaped from this component will need time to materialize and the relevant time-scale is to be measured in years, if not in decades. The other side of that coin is that once the urban pattern is consolidated, and once development has materialized along certain corridors or areas that are propitious to sustainable transport behaviors, this cannot change overnight and these transport behaviors can reasonably be expected to be long-lasting, and to yield important benefits. The question is then to make sure that the same guidelines regarding land-use will be followed after the GEF grant closes. This will depend to a great extent on the success and attractiveness of the real estate developments projects to be designed under the GEF grant and this is why a lot of emphasis will be put on public outreach and on the quality of the design of these projects. The involvement of students from the Catholic University and from MIT should generate appealing and innovative proposals from an urban landscaping perspective, which will obviously increase the likelihood of success of these environment-friendly real estate development project(s), even more so since the mandate of these universities is to design projects that fits into an overall program of urban sustainability.
Here, the project will undertake studies that are expected to affect land-use policies. Financial sustainability is not a direct issue at this stage. Once the real estate options get developed, the market is expected to sustain the component.

Improving Traffic Flows:

(iv) **Road pricing.** In this case, sustainability will depend on the design of the tarification schemes, once they can take place from a legal and political perspective. The project is contributing to remove those barriers; financial sustainability is directly linked to the particular design of road pricing scheme being developed. As an example, as far as the experience in London shows, financial sustainability is not an issue. **Traffic calming.** Here, maintenance will come from the Comuna involved, as this type of measures is linked to the municipality’s own public space development.

(v) **Traffic calming.** Here, maintenance will come from the Comuna involved, as this type of measures is linked to the municipality’s own public space development.

(vi) **Travel harmonization.** This component requires a behavioral change that is theoretically triggered by self-interest, since participants are not forced into changing their behavior by decrees or laws, or not even induced to do so through incentives which may not be sustainable over time. Participants are expected to change their way of traveling through being provided with a more accurate and comprehensive information about available transport alternatives, that may greatly differ from their current perception which may be incomplete. If, as expected, participants reap sizable benefits, in time and/or money savings, from these changes, the sustainability of the concept can be taken for granted. The consultants in charge of the program will need to identify for each participating household attractive alternative modes of travel, and/or alternative destinations easier to reach by clean modes and that deliver the same services as the current ones. Then, when informed about this wider array of choices regarding travel modes and destinations, the members of the participating households should adapt their travel behavior to this new information and adopt new transport-related strategies, that, for being more attractive, will be sustainable. As with the other components, once results are attained and published, replicability will be pursued in other Latin American cities mainly through the Clean Air Initiative. Financial sustainability is directly linked to the cultural change induced in the participants, and on the ability of the project to foster replicability.

(vii) **Decontamination Bonds.** As with the road pricing, financial viability and sustainability strongly depends on the design. How well demand and supply can be matched will inject sustainable liquidity to the market.

1a. Replicability:

The project will include workshops to enable debate in some of the components and to facilitate participation from stakeholders. Also, the project will have a launching workshop, and a workshop at the end to disseminate results. Budget breakdown by component will take place during appraisal

The impact of the PTUS is expected to be felt beyond Santiago’s boundaries, so that similar projects can be developed in other cities of the region. As the case of Colombia where the implementation of
Transmilenio has created a wave of new projects aimed at restructuring public transport, it is expected that this type of projects will spur subsequent operations dealing with transport and environment, while helping mitigate climate change.

Components such as the promotion of the use of bicycles; promotion of cleaner bus technologies and fleet renewal; traffic calming at historic and congested areas; strategic environmental planning; and land-use policies linked to transport objectives all have elements that make them replicable in other cities where cars are rising as a function of economic growth and urban sprawl, while public transport tends to be chaotic and insufficient. Methodologies for developing this type of project components, as well as for measuring impacts and monitoring implementation can be easily replicated or adapted to a different socio economical and infrastructure setting. This has already been recognized, in the transport restructuring plans in Santiago and Bogota, which have shared elements with each other. Lima is certainly learning from the Bogota experience with bike routes, while Santiago is considering lessons learned from both cities. As long as there are measurements and records of costs, benefits, and implementation steps, all these experiences become replicable.

2. **Critical Risks** (reflecting the failure of critical assumptions found in the fourth column of Annex 1):

**Promotion of Bicycle Use**

The Government and several citizen’s groups have been calling for a cultural change in travel behavior, with the shift from car use to non-motorized transport being one of the objectives. The PTUS calls for the construction of 1,000 km of bikeways, and individual districts such as Providencia are carrying out their own municipal bikeway programs. However, financing of the ambitious PTUS bikeway program is not assured, and SECTRA officials indicated that a relatively small GEF-supported bicycle promotion subproject would give the overall program a much-needed impetus. Moreover, this subproject would place special emphasis on promotional campaigns, in collaboration with NGOs and the private sector – a dimension that has not yet been much developed in the PTUS.

While the proposed subproject can count on the full support of the Government and NGOs, it is by no means certain that the number of cyclists would increase rapidly enough for this concept to be perceived successful. There is certainly great risk attached to the subcomponent on promotion, as the best possible campaign is no guarantee of increased demand for bike travel. Besides, there are few experiences in the developing world about promotion of modal shift to bicycles. Therefore, the strategy will consist of a close monitoring, so that any required changes in the political approach can be modified soon enough to ensure the best use of GEF resources. A similar pilot project in Lima, implemented in 1997 under the Bank-supported Peru Transport Rehabilitation Project, resulted in a moderate increase in bicycle usage, but the bikeways built under that project are still not frequented enough to convince many motorists that bikeways are a wise use of scarce road space. Learning from that experience, the proposed Santiago subproject would put special emphasis on the promotion and monitoring aspects, and concentrate its bikeway investments in high-density corridors which could generate relatively high (and thus visible) bicycle volumes. Also, the quality of the bikeways will be higher in comparison to the Lima’s experience; the experience in Bogota, where substantial increase in the use of bicycles is evident, shows that a good quality infrastructure brings safety and status, helping attract new users. Also a good design near transport corridors will set the conditions to facilitate modal change.
Road Pricing

The fact that road pricing is explicitly included in the list of priorities that have to be pushed forward in the framework of the Santiago Urban Transport Plan 2000-2006 shows a will, both at the technical and political level, to promote the concept. In addition, the endorsement of international institutions such as the GEF and the WB should give a bit of a boost to the issue and help Executive Commission for Transport in Santiago – CGTS to convince the various stakeholders of the soundness of road pricing in the case of Santiago and have a positive impact on the media and therefore on the public opinion. It is therefore not unreasonable to consider that the context has changed since the last time the legislation referring to road pricing was discussed in Parliament.

Restructuring of Bus System

The main component of PTUS will be the restructure of the bus system, which may encounter opposition for its implementation. A strike from the bus owner associations has already taken place, and although it was successfully managed by the Government, and helped showing the strong Government commitment to PTUS, it also evidenced the risks involved in this kind of endeavor. Also, since the city of Santiago is divided into 38 municipal governments, which belong to different political parties, there is substantial political risk attached to the plan implementation. To mitigate these risks, the Government is negotiating with the opposition which controls a fair share of the municipalities in the metropolitan region, and is incorporating the bus owner views into the design of the new bus system. Similarly, surveys and participation from all other stakeholders, in particular the bus users, will ensure popular acceptance and backing for the new developments.

<table>
<thead>
<tr>
<th>Risk</th>
<th>Risk Rating</th>
<th>Risk Mitigation Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>From Outputs to Objective</td>
<td>M</td>
<td>The comunas of Providencia, Nuñoa and Santiago have had issued letters of Commitments. Also there has been a broad participatory process during the design and formulation of the bike paths.</td>
</tr>
<tr>
<td>1. Interest in biking as transport mode</td>
<td></td>
<td>A study to develop a campaign for promoting the use of bicycle is being finalized. Its implementation will help not only raise awareness but also will induce modal change, as long as private cars get restricted, and bike ways become available.</td>
</tr>
<tr>
<td>Sufficient budget for building and maintaining bikeways in participating comunas (Santiago, Ñuñoa, and Providencia)</td>
<td></td>
<td>Key stakeholders have committed themselves to the bus test. There is a strong commitment from the Government.</td>
</tr>
<tr>
<td>Stakeholder collaboration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Necessary testing equipment available</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>Availability of buses to be tested</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Willingness of operators to participate in field tests</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation of stakeholders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government commitment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 30 -
<table>
<thead>
<tr>
<th>Part</th>
<th>Component</th>
<th>Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>Government commitment to coordinate land-use and transport dimensions of planning</td>
<td>M</td>
<td>There have been a previous development of an integrated software called Mussa, to measure the impact on the PTUS on land and urban Development. There have been a close coordination with local authorities through the Ciudad y Territorio committee integrated by several national governmental institutions</td>
</tr>
<tr>
<td>4.</td>
<td>Political willingness, Legal feasibility, Political willingness, Legal feasibility</td>
<td>S</td>
<td>There are some approaches executed by the Central government to implement this project. It is expected with the GEF involvement to conduct more research and to build a new approach to this issue</td>
</tr>
<tr>
<td>5.</td>
<td>Inter-agency collaboration</td>
<td>M</td>
<td>There is a broad consensus on the Central Government and the CGTS on the need of implementing the SEA methodology on the development of PTUS</td>
</tr>
<tr>
<td>6.</td>
<td>Behavioral changes are sustainable over the long term, Public acceptance</td>
<td>S</td>
<td>Private sector should get involved on the implementation of this component. Previous work has been done in Chile and there is interest from the former actors to participate in this stage</td>
</tr>
<tr>
<td>7.</td>
<td>Participation of stakeholder</td>
<td>N</td>
<td>The country has moved several steps on the establishment of a clearinghouse mechanism, the project supports CONAMA's initiative</td>
</tr>
<tr>
<td></td>
<td><strong>From Components to Outputs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Counterpart funding effective</td>
<td>S</td>
<td>There is a strong commitment from the comunas of Santiago, Nuñoa and Providencia. Also the private sector is involved in the expansion of the bike paths</td>
</tr>
<tr>
<td>9.</td>
<td>Effective participation of private partners, Regulation in place</td>
<td>M</td>
<td>Talks with private sector have taken place. The Buses will be provided for the test. The regulation still needs strong support from the international experience</td>
</tr>
<tr>
<td>10.</td>
<td>Political acceptance, Coordination of transport and land-use measures</td>
<td>M</td>
<td>Inter institutional dialog has been established through the Ciudad y Territorio comite</td>
</tr>
<tr>
<td>11.</td>
<td>Political acceptance</td>
<td>H</td>
<td>A first approach has been developed during PDF-b stage. It is expected to have broader</td>
</tr>
</tbody>
</table>
G. Project Preparation and Processing

1. Has a project preparation plan been agreed with the borrower (see Annex 2 to this form)?
   - Yes - date submitted: 12/01/2001
   - No - date expected:
   Yes. A PDF-b grant by GEF was requested and it is now under final stage of implementation

2. Advice/consultation outside country department:
   - Within the Bank: Peer reviewers
   - Other development agencies:
   - External Review STAP reviewer. Ex-Mayor from Bogota

3. Composition of Task Team (see Annex 2):
   See Annex II

4. Quality Assurance Arrangements (see Annex 2):
   See Annex II

5. Management Decisions:

<table>
<thead>
<tr>
<th>Issue</th>
<th>Action/Decision</th>
<th>Responsibility</th>
</tr>
</thead>
</table>

Total Preparation Budget: (US$000)    Bank Budget:  Trust Fund:
Cost to Date:  (US$000)
☐ GO  ☐ NO GO

Further Review [Expected Date]

Juan Lopez-Silva  
Team Leader

John Redwood  
Sector Director

Axel van Trotsenburg  
Country Manager
Annex 1: Project Design Summary
CHILE: Sustainable Transport and Air Quality for Santiago (GEF)

<table>
<thead>
<tr>
<th>Hierarchy of Objectives</th>
<th>Key Performance Indicators</th>
<th>Data Collection Strategy</th>
<th>Critical Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sector-related CAS Goal:</strong></td>
<td>Sector Indicators:</td>
<td>Sector/ country reports:</td>
<td>(from Goal to Bank Mission)</td>
</tr>
<tr>
<td>Promote Sustainable Development</td>
<td>Acknowledgement about income growth while transport needs met</td>
<td>CAS, ESW, survey, sector report and updates</td>
<td>Political acceptance</td>
</tr>
<tr>
<td>Improve quality of life</td>
<td></td>
<td></td>
<td>Macroeconomic Stability</td>
</tr>
<tr>
<td><strong>GEF Operational Program:</strong></td>
<td>Outcome / Impact Indicators:</td>
<td>GHG emissions inventory</td>
<td>Long term commitment to promoting reductions in GHG emissions related to transport</td>
</tr>
<tr>
<td>Promoting environmentally sustainable transport</td>
<td>• Improved sustainability of the transport sector</td>
<td>Transport Plan and Reports</td>
<td></td>
</tr>
<tr>
<td>Specific objective: reduce GHG emissions from urban and surface transport sources in recipient countries by facilitating recipient countries’ commitment to adopt sustainable low-GHG transport measures, and disengagement from unsustainable measures common in many parts of the world.</td>
<td>• Reductions in GHG emission associated to modal shift</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Reduced carbon intensity of trips</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Global Objective:</strong></td>
<td>Outcome / Impact Indicators:</td>
<td>Project reports:</td>
<td>(from Objective to Goal)</td>
</tr>
<tr>
<td>Reduce the GHG emissions from ground transport in Santiago through a promotion of a long-term modal shift to more efficient and less polluting forms of transport. The project will support the implementation of the 2000-2010 Urban Transport Plan for Santiago –PTUS.</td>
<td>• Urban Transport Plan for Santiago implemented:</td>
<td>Government agencies reports:</td>
<td>Long term government commitment to implement the measures in PTUS 2000-2010</td>
</tr>
<tr>
<td></td>
<td>• Modal share of public transport maintained</td>
<td>Government agencies reports</td>
<td>Private sector interest in adopting cleaner technologies</td>
</tr>
<tr>
<td></td>
<td>• Land-use policies in place to favor reduction in avg trip length</td>
<td>Bank supervision reports</td>
<td>Public acceptance of higher costs attached to car use</td>
</tr>
<tr>
<td></td>
<td>• Barriers for introducing clean technologies for transport removed (technological, financial, regulatory).</td>
<td>Mid-term evaluation</td>
<td>Cooperation between stakeholders for integrated transport and land-use policies</td>
</tr>
<tr>
<td></td>
<td>• Non motorized transport share of total trips increased</td>
<td>Completion Reports</td>
<td>Public awareness about air pollution and traffic effects</td>
</tr>
<tr>
<td></td>
<td>• Average Trip length</td>
<td>Public opinion surveys</td>
<td></td>
</tr>
</tbody>
</table>
### Output from each Component:

#### 1. Use of Bicycle is promoted

- **Output Indicators:**
  - At least 2.5% percentage points increase in modal share of bicycle trips
  - Improved public perception about bicycle use
  - Enterprises commitment to facilitate bicycle use by means of installing parking places, showers, and/or lockers
  - At least 15 km of bikeways built and operating.
  - Adoption of parking programs for bikes in Metro

- **Project reports:**
  - Project reports
  - Origin-Destination surveys
  - Agency reports
  - ICR

- **(from Outputs to Objective):**
  - Acceptance of bus system reform by stakeholders
  - Interest in biking as transport mode
  - Sufficient budget for building and maintaining bikeways in participating comunas (Santiago, Ñuñoa, and Providencia)
  - Stakeholder collaboration

#### 2.1 Hybrid Diesel-Electric Bus Technology tested and compared to CNG and diesel buses

- **Output Indicators:**
  - Driving cycles for Santiago developed
  - Estimation of associated costs to compared technologies
  - Estimation of GHG emission reduction from scenario penetration of technologies
  - Cost-effectiveness comparison amongst technologies tested
  - Trained personnel at relevant institutions such as 3CV, to test bus technologies both in laboratory and field conditions

- **Project reports:**
  - Reports from test
  - Supervision reports

- **(from Outputs to Objective):**
  - Necessary testing equipment available
  - Availability of buses to be tested
  - Willingness of operators to participate in field tests

#### 2.2 Design of business model

- **Output Indicators:**
  - Evaluation of business

- **Project reports:**
  - Study reports

- **(from Outputs to Objective):**
  - Participation of stakeholders
| 2.3 Program for modernizing national bus fleet in place | • Program of incentives for fleet renewal developed | Study report | Government commitment |
| | • Monitoring system for tracking down displaced buses in place | Agency report | Participation of bus operators |
| | Consultation with transport operators | | |
| 3. Evaluation of land-use policies coordinated with transport demand and supply | • Report on options for land-use incentives, and transport and environmental impact | Geo-referenced maps | Government commitment to coordinate land-use and transport dimensions of planning |
| | • Framework for locating Housing programs, taking into account transport dimension | Agency reports | |
| | Consultation with bus operators | Travel O/D Surveys | |
| 4.1 Barriers for adoption of road pricing policies significantly reduced or eliminated | • Project of law revised | Public acceptance surveys | Political willingness |
| | • In-depth analysis of legal implications | Agency reports | Legal feasibility |
| | • Identification of measures to implement in Santiago | Study reports | |
| | • Identification of technology needs | | |
| | • Evaluation of international experiences | | |
| | | Cost-benefit assessment | |
| 4.2 Traffic calming measures designed for Santiago’s city center | • Evaluation of public acceptance | Public acceptance surveys | Political willingness |
| | • Identification of measures | Agency Reports | Legal feasibility |
| | • Design and costing | Study reports | Co-financing secured |
| | • Strategic Environmental Assessment of PTUS | Supervision reports | Inter-agency collaboration |
| | • Incorporation of SAE to national system for environmental assessment | Assessment reports | |
| 5. Methodology for strategic planning and evaluation of urban transport and land-use plans in place. | Newly adopted | Pilot project results | Behavioral changes are |
| Sustainable adoption of sound travel demand practices | Behavioral patterns for travel demand.  
- Number of participants in pilot keep new patterns of travel demand after 2 years  
- Development of emission reductions program, incl. Institutional setup  
- Clearinghouse mechanism designed | Supervision reports  
ICR  
Public surveys  
Supervision reports | Sustainable over the long term  
Public acceptance  
Participation of stakeholders |
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<tbody>
<tr>
<td><strong>Project Components / Sub-components:</strong></td>
<td><strong>Inputs: (budget for each component)</strong></td>
<td><strong>Project reports:</strong></td>
<td><strong>(from Components to Outputs)</strong></td>
</tr>
<tr>
<td>7. Program for Decontamination Bonds upgraded to incorporate GHG</td>
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</table>
| 8. Promotion of bicycle use. | 4.61 Million | Supervision report  
Audit reports, financial report, quarterly and annual progress reports, and Bank mid term review | Counterpart funding effective |
| 9. Modernizing bus system | 5,080 Million | Test Reports  
Supervision reports | Effective participation of private partners  
Regulation in place  
Political acceptance  
Coordination of transport and land-use measures |
| 10. Assessment of land-use incentives and policies to reduce motorized travel | 1,032 Million | Supervision report  
Audit reports, financial report, quarterly and annual progress reports, and Bank mid term review |  
Political acceptance  
Public support |
| 11. Improving Traffic Flow | 1,280 Million | Supervision report  
Audit reports, financial report, quarterly and annual progress reports, and Bank mid term review |  
Political acceptance  
Public support |
| 12. Strategic environmental assessment | 0.46 Million | Supervision report  
Audit reports, financial report, quarterly and annual progress reports, and Bank mid term review |  
Political acceptance  
Coordination of transport and land-use measures |
| 13. Travel Harmonization | 0.4 Million | Supervision report  
Audit reports, financial report, quarterly and annual progress reports, and Bank mid term review |  
Willingness to participate in pilot program |
| 14. Decontamination Bonds | 0.9 million | Supervision report  
Audit reports, financial report, quarterly and annual progress reports, and Bank mid term review |  
Regulation in place  
Willingness to participate in program |
| 15. Project Management | 0.19 million | Supervision report  
Audit reports, financial report, quarterly and annual progress reports, and Bank mid term review | Political commitment  
Information Available |

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Annex 2: Incremental Cost Analysis
CHILE: Sustainable Transport and Air Quality for Santiago (GEF)

Overview

This project will help reduce GHG emissions from ground transport in Santiago, through a promotion of a long-term modal shift to more efficient and less polluting transport modes. To this end, the project will co-finance measures aimed at removing barriers for changing cultural behavior and transport demand patterns; improving the public transport system; promoting cleaner fuels and technologies; and incorporating the environmental dimension in urban transport, and land-use planning.

Context and Broad Development Objective

With over 5 million people, Santiago de Chile concentrates much of Chile’s economic and political activity over 50,000 ha. Transport in Chile contributes to almost 40% of all GHG emissions, and Santiago hosts most of the emission sources. About 40% of the country population lives in the city, and 50% of Chile’s GDP is generated in Santiago, which has experimented a relatively accelerated economic growth (over 6%) during the last decade. As a result, the urban sprawl is expanding quickly and the use of private car is intensifying. From 1991 to 2001, households owning at least a car augmented from 36% to 56% causing trips in private cars to increase from 18.5% to 38.1%. Conversely, for the same period, trips by bus have fell down from 59.6% to 42.1% of all motorized travel modes. The intensity in the use of cars pairs with an inefficient public transport system to produce traffic congestion, and a carbon intensive transport. This tendency brings about dire consequences in terms of GHG emissions and air pollution.

Barriers for an efficient and less carbon-intensive transport

Achieving an efficient transport system in a city is major and difficult task and may not suffice to attain the goal of reducing emissions and sustaining them in the long term. It also requires the participation of stakeholders, who play a key role in the selection of transport modes, and moreover in the intensity of transport use. Also, transport users decide where to live, and how and where to conduct their businesses, not necessarily thinking about the best transport mode combination. Therefore, one of the main barriers for achieving a less carbon-intensive transport is (i) the resistance to change cultural patterns or behavior. The use of bicycles as a transport option; rationalizing the demand for car or motorized transport use through travel harmonization practices; making a better use of mass public transportation; and attending schools or services located near the household location or work place are some of the areas addressed by the project that require cultural change.

Other barriers include (ii) the inefficient public transport system. As long as the mass public transportation is not efficient enough to reduce travel time under reasonable costs and comfort, the car will continue to be the preferred transport mode. The (iii) lack of adequate infrastructure for non-motorized transport is also a barrier that needs to be overcome. Bicycle use can only be incremented if safe, well located, properly designed bike ways are available, and complemented by parking places, showers, and lockers. Besides cost, there is also (iv) a technological risk attached to the newer and cleaner transport technologies. Finally, the (v) regulatory framework us a barrier to the adoption of newer schemes as road pricing, and use or zoning of public space.
Strategy for overcoming barriers and Global Benefits

Late in 2001, a PDF-b project was approved by GEF to help prepare an Air Quality and Transport Project for Santiago. Basing on the 2000-2010 Urban Transport Plan for Santiago (PTUS in Spanish), considering the Decontamination Plan for Santiago prepared by CONAMA, and in light of GEF Operational Policy on Sustainable Transport, a series of measures were studied during 2002 to help develop this GEF proposal. The following measures or components have been identified due to their potential for both addressing air pollution and reducing GHG emissions: (1) Promoting the use of bicycles; (2) Modernizing the bus system; (3) Assessment of land-use incentives to reduce motorized transport; (4) Improving traffic flows through road pricing and traffic calming; (5) Strategic Environmental Assessment and Planning; (6) Travel Harmonization; and (7) Decontamination Bonds.

Most measures promoted under the project will be effective in the long-term. Reductions in GHG emissions will be felt as a result of PTUS implementation; as the addition of net effects from all measures. Preparatory studies under PDF-b, using a much conservative approach, have already shown potential CO2-equivalent reductions as a result of PTUS implementation. Below is the estimated potential impact from all control measures supported by the project, based on the level of information available. However, not all of these potential reductions could be compared against each other, as different assumptions, and implementation timeframes have been used for studying each type of measure. The Strategic Environmental Assessment component will enable a comparison between and amongst components to show local and global impacts at different points in time.

1. Promotion of bicycle use

The introduction of even a moderate shift from motorized modes of transport to bicycles could provide substantial benefits in terms of GHG emissions reduced. For the GEF-supported Marikina (a district of Metro Manila) bikeway project, it was estimated that an increase of bicycle usage from 1.6% in 2000 to 2.8% in 2015 would yield aggregate benefits of US$4 million for an initial investment of US$2.1 million. A decrease of 3% in the veh-km traveled by private cars and taxis as a consequence of modal shift to bicycle trips in metropolitan Santiago would help reduce CO2 emissions by 1.15% at about 126,000 tons per year.

2. Modernizing the bus system

(a) Technical assistance for evaluating the economic and environmental impact of clean technologies for buses. It is expected that the hybrid buses in the public transport fleet will allow reductions in emissions of airborne pollutants over 60% of EURO II standards currently used in Chile, and up to about 15-30% in GHG emissions (the latter achieved as the hybrid bus requires less fuel to run). Based on ASIF methodology and taking into account the total fleet of the new bus system, if we assume a scenario of 561 hybrid buses (about 25% of the 2005 trunk fleet), it would mean a reduction of about 23,516 tons CO2 per year.

(b) Technical assistance to develop an implementation framework for bus reform. Reforming the bus system in Santiago generates important gains in efficiency for the operators and for the transport system of the city as a whole. These gains will not only provide operators a better return on investment, and users shorter travel times, but emissions will get reduced as a consequence of fewer buses needed, of
increased use of bus capacity, of higher average speed, and of modal shift. Based on the information obtained from the PDF-B preparatory studies, the projected bus system will offer annual reductions in the order of 586,000 tons of CO2.

(c) Renewal of the bus fleet in the regions. The new bus routes system is designed to operate with less buses than the current fleet. About 4,000 buses will have to be replaced in order to comply with the technology standards for the city. As these buses will probably go to other cities or countries, older buses are expected to be substituted. If the project succeeds in avoiding that the older buses remain in operation after all 4,000 are replaced, there could be annual reductions of CO2 emissions in the order of 880,000 tons.

3. Assessment of land-use incentives and policies to reduce motorized travel

(a) Developing the Central Ring of Santiago. Density patterns are obviously closely linked to transportation and therefore energy use and greenhouses gases emissions. Different studies (Naess, 1993, INRETS, 1995, Newman and Kenworthy, 1998) have shown a strong correlation between the energy use par capita in passenger travel and urban density. Preliminary simulations show that a set of real estate development projects (sq. m2 6,000,000 of housing projects, i.e. almost 50,000 homes, and sq m2 915,000 of non-housing projects) strategically located along the Anillo Central, and implemented in lieu of other real estate development projects of the same amplitude but located further away from the center, would generate substantial benefits in terms of travel patterns and subsequent emissions: transport-related CO2 emission in the Great Santiago would decrease by 6.7% while PM10 and PM2.5 emissions would drop by an estimated 8%, if and only if these real estate developments projects were to be accompanied by consistent transport policies to avoid further congestion, i.e. mainly a substantial increase and improvement of public transport supply.

(b) School Location and Housing Policy. Both sub-components are aimed at promoting a reduction in the average traveled veh-km, which is expected to allow for lower emissions of GHG and local air pollutants. This will be achieved through a combination of lower transport demand (shorter trips), and modal shift to public and non-motorized transport.

4. Improving Traffic Flows

(a) City Center Revitalization. This component aims to reduce car use in the city center, allowing for reductions in CO2 emissions derived from modal shift. In 2001 the amount of travel trips to the city center was 4.1% of the total trips; assuming that 30% of this trips will go to the Central Triangle, and that with measurers as traffic calming we reduce the amount of trips by 50% a reduction of 20,931 Tons of CO2 per year would be possible, equivalent to 0.19% of total emissions. Also, less traffic in the city center will bring about local environmental benefits derived from lower exposure to air pollutants in a relatively closed area.

(b) Road pricing. GHG emission reductions are directly linked to the reduction in the use of private vehicle trips. Road pricing has significant potential to reduce congestion by lowering vehicle-km traveled, since effective road user charges reduce traffic demand. Since environmental impacts such as GHG emissions increase with rising motor vehicle use, road pricing would have a positive impact on global warming. Different options have already been tested through traffic models under the PDF preparatory studies, and the results show the importance of designing correctly the proposed road-pricing mechanisms to maximize benefits and avoid possible negative side-effects. A preparatory study shows that a scheme where car drivers would have to pay 1000 pesos (US$ 1.4) to enter a small area in the
center of Santiago there would be none or very little environmental benefits, since there would be a trade-off between car users who would decide to switch to public transport and car drivers, whose destination is not located on the tolled zone but whose current itinerary goes through it, who would then opt for a longer itinerary. On the other hand, a more extended toll zone in the city, whereby car drivers would be required to pay the same amount when entering a wider area defined by Americo Vespuccio ring road, or when driving within this area, would actually deter many more car users from using their vehicle. This shift to public transport, and the impact on current congestion levels, would reduce transport-generated CO₂ emissions in the Great Santiago by 9.6%. In addition to this, and since fewer private vehicles would use the roads, public transport commercial speed would rise and generate substantial time savings to their users. To end with, proceeds from the toll could be used to finance public transport improvements, to optimize the traffic signal system or to untie local bottlenecks on the road network.

5. **Strategic environmental assessment and planning**

Current tools for policy making rely on the use of transport models inter-phased with an emission model assessing emission changes due to changes in direct transport measures (e.g. newly segregated busways, changed traffic patterns, introduction of cleaner vehicles or fuels). However, effects from structural changes such as pricing or tariffs, or in land-use patterns, cannot be easily measured. This component would strive for a better inter-agency coordination about cross sectoral issues arising from transport and urban development planning; complementarily, it will help develop a system to introduce environmental evaluation of all aspects with transport planning, linking transport to air quality, climate change and environmental impact assessment.

6. **Travel Harmonization**

This innovative approach, which promotes a more rational use of motor vehicles, has (in two Australian schemes) resulted in the reduction of car trips by 23%, and of vehicle-km traveled by 21%. In Santiago there has already been a demonstration experience, which allowed reductions in average travel km by 23.3%. Such a scheme is expected to yield substantial reductions of GHG emissions at very low cost. A reduction of 10% in car-km could mean a reduction of CO₂ of over 340,000 tons, a total 3.1% reduction.

7. **Decontamination Bonds**

CONAMA is currently developing a National Program of Decontamination Bonds, to control the increase of emissions of air pollutants due to the booming economic activity. New polluters on the system will have to compensate by buying emission permits, which can be traded on the local market. Chile is one of the leaders in Latin America in the use of market based instruments for environmental management (they already have an incipient market for NOₓ emission permits from fixed emission sources). Chile has a well developed financial market, including a vibrant stock exchange and a good level of secondary markets.

Incorporating carbon emissions offset by sustainable transport projects in the program will allow to place a limit to the CO₂ ever growing emissions; the potential impact in terms of potential CO₂ emissions reduced will result from the studies. The project is aiming at allowing sustainable transport investments to take place in exchange for measures to avoid generate GHG emissions elsewhere. To illustrate, there has been a recent deal whereby a power plant located in the city of Santiago has been allowed to expand its
generating capacity. To compensate for the additional NOx emissions into the city’s airshed, the power plant will finance conversion of taxis running on gasoline to CNG. At the end, a net reduction in emissions was obtained, while a much larger reduction in exposure was ensured (as taxis inflict a more direct effect on people and hardware).

**Baseline Scenario and costs**

The baseline scenario assumes the implementation of measures consistent with Santiago’s Urban Transport Plan – PTUS, mainly those aimed at restructuring the public transportation system. PTUS is a program focused to reducing air pollution and improving transport, without consideration of GHG emission reduction. In the absence of GEF, PTUS would have only focused in achieving a renewed plan for routes, concession schemes, and integrated fare for the bus system without much consideration of technologies such as the hybrid diesel-electric buses. Also, studies to develop road pricing or land-use incentives to reduce travel distances would not take place. In the same line, studies on incentives for school and housing location as a way to reduce the average traveled km. would not take place with the needed celerity. Finally, the program on decontamination bonds would remain focused to local air pollution objectives. Total expenditures under the baseline scenario are estimated to be at least USD6.272 million.

As per the baseline scenario in terms of GHG emissions, the annual level of emissions derived from the current trips taking place in the city in year 2000 is about 7 million MT CO2-Equivalent. This results from over 20,000 million veh-km resulting from a total of trips.

**Alternative Scenario and Costs**

The proposed alternative will seek to demonstrate the benefits of measures aimed at promoting a change to less carbon intensive transport modes; a reduction of average traveled distance (avg vehicle-km), and a more efficient use of transport (more passengers per vehicle kilometer). In order to make these measures possible it is necessary to ensure an institutional coordination of sector policies and sustainable mainstreaming of the environmental dimension into land-use and transport planning. Following is an incremental cost analysis for each component:

1. **Promotion of bicycle use**

The baseline of this component includes the already budgeted plans for recreation bikeways in the Comunas of Santiago, Providencia, and Ñuñoa. Without GEF, the bikeways paths would be built considering the particular recreation goals of each Comuna, and without any need of standardization. The GEF project will ensure that the bikeways built effectively address transport needs, locating them according to Destiny-Origin surveys and declared preferences surveys. Also, considering specific transport needs such as work and education. And linking to the existence of other transport modes such as the Metro. Also, the GEF alternative will ensure that a promotion campaign is designed and implemented to promote and sustain the cultural change needed to induce modal shift from motorized transport. Finally, as the transport oriented bikeways network promoted by the GEF alternative requires a safety component, this will be all incremental.
2. Modernizing the bus system

2.1. Evaluation of Bus technologies. The baseline includes most of the equipment needed to upgrade the chassis dynamometer emissions testing laboratory for heavy-duty vehicles. Incremental costs are linked to part of the laboratory equipment, co-financing the development of Santiago’s driving cycle, and the field tests and coordination.

2.1 Implementation Framework for Bus System Reform. Here the baseline includes the existing studies on the new bus system. The alternative project includes additional studies on the business structure, so that the new system gets supported and can start sooner attracting cleaner technologies under the new operation concessions.

2.2 Renewal of bus fleet. This component is all incremental. Without the GEF, the old buses displaced from Santiago would simply end in other cities contributing to increase GHG emissions. The incremental costs are attached to the initial study.

3. Assessment of land-use incentives and policies to reduce motorized travel

The baseline for this component is the local contribution to studies, and use of existing modeling tools. The alternative will ensure that these studies take place, oriented to measure the potential reduction of GHG emissions.

4. and 5. Improving Traffic Flows and Strategic Environmental Assessment

The associated baseline for these studies is the existing modeling capacity which would be used to determine impacts in air pollution and traffic congestion related to the implementation of such measures. The alternative project will ensure that the global dimension is counted in, and measured.

6. Travel Harmonization

In this case, without GEF the implementation of the program would probably not take place in the short or medium term. A small pilot has already been implemented and some results evidence the potential for reducing the emissions greenhouse gases; however, the GEF co-funding can spur a larger program, where private sector will pair with the Government to achieve results. Incremental costs account for half of the foreseen investment.

7. Decontamination Bonds

The associated baseline is the slow development of an emission permits trading system, where air pollutants such as NOx only get targeted. GEF participation will ensure that the system is well defined from the beginning, in particular with reference to the monitoring and verification methodologies and protocols, so that future verified carbon emission reductions can be traded internationally, attracting foreign investment.

The total cost of the GEF project alternative is estimated at USD13.952 million.


**Incremental Costs**

Implementation of the barrier removal strategy noted previously would require funding of incremental costs, which would be the difference between the cost of implementing the baseline scenario versus that of the GEF Project alternative. GEF funds are sought to support incremental costs. The total cost of the GEF Project alternative is US$13.952 million, as compared with the baseline case of $6.952 million. Thus, the incremental cost of the GEF Project alternative would be $6.98 million. The table below show the contribution of GEF to the development of the alternative project.

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<tr>
<td>Promotion of Bicycle use</td>
<td>Baseline</td>
<td>2</td>
<td>Construction of 20 Km of intra comuna Bikeways mostly for recreation</td>
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<td>Alternative</td>
<td>4.61</td>
<td>Construction of an additional 19 Km of Bikeways.</td>
<td>Reduction of motorized trips and associated GHG emissions</td>
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<td>Modernizing de Bus System</td>
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<td>Driving Cycle of Santiago developed</td>
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<td>Estimation of Reduction of GHG emission from transport scenario penetration of technologies</td>
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<td>Assessment of land-use incentives and policies to reduce motorized travels</td>
<td>Baseline</td>
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<td>Report on options for land use development</td>
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<td>Framework for locating houses programs taking in to account transport dimension and measurement of CO2 emission reductions from this type of intervention</td>
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<td>Analysis of the legal implication. Identification of measures to recover investment costs from road and public space development</td>
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<td>Increment</td>
<td>Strategic Environmental Assessment of PTUS</td>
<td>Incorporation of global environmental dimension into land-use and transport planning</td>
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<td>1.28</td>
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<td>Data and options for reducing carbon emissions from a better traffic flow and reduced car use</td>
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<td>Strategic Environmental Assessment (SEA) and planning</td>
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<td>Development of local and global emission reduction program.</td>
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<td>Increment</td>
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<td>Project Management</td>
<td>Baseline</td>
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<td>Improved Efficiency and Managerial knowledge</td>
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<tr>
<td>Alternative</td>
<td>13.952</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Increment</td>
<td>6.98</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

(*) Emission reductions roughly estimated using different time implementation assumptions, available at the time of project preparation. Cross-feeding effects have not been deducted, and a whole long-term effect is assumed. The Strategic Environmental Assessment component will evaluate overall effects and effects attached to different scenarios of intervention at different times in the future.

(**) Assuming 23,516 MT tons from hybrid buses penetration; 586,000 MT from overall bus system restructuring without
technological change; and about 80,000 MT from bus renewal (4,000 units)
The format of my review
In the following, I refer to page numbers in the 45-page “project concept document” (PCD) (dated December 8, 2002) I received via e-mail.

General editorial comment
Because the PCD is not yet finished, I have not bothered to make any specific editorial comments. Some obvious general editorial comments: the final document ought to have a table of contents, an acronym list, and uniform font and formatting style.

General comments
Allowing that the project description is just a draft, it is pretty good at this stage. There is reasonably good background information. Most of the proposed components are adequately described, appropriate, and reasonably likely to be at least partially effective. Some general ways to improve the proposal:

An outline or introduction or overview at the beginning would be helpful.

There is some confusing repetition of information in several sections, particularly in pp. 6-9 vs. 10-19.
If you haven’t already, you might want to take a look at the recent report called:


**Response** / All the above points have been taken into account for the final version of the PCD. O’Ryan is one of the local consultants hired under the PDF-b component to evaluate technological options.

This report presents a lot of good background information on transportation and related problems in Santiago (similar to what you present, but more extensive), and then develops a high-GHG and a low-GHG emissions scenario for transportation in Santiago. Some of the measures considered are similar to the ones you propose, but some are different.

You might want to consider additional GHG- and pollution-reduction measures. Your proposed components to do not include reducing the fuel use per mile of passenger vehicles, or switching from gasoline or diesel to low-carbon, low-emissions fuel. One often overlooked but very effective way to reduce fuel use per mile is to facilitate the use of mini-cars, such as are popular in Japan. For safety reasons, mini-cars should be segregated from conventional, heavy, high-speed vehicles. This requires careful land-use planning and transportation-infrastructure design, but these already are general components of your proposal.

**Response**/ The project contemplates the analysis of emerging technologies with better fuel consumption rates (Hybrids). Also it is decided that, with PTUS implementation in 2005, all the buses circulating in Santiago will be Buses complying with the Environmental Standard Euro III and the Diesel, in the metropolitan region to be equal or less than 50 ppm of sulfur content.

Similarly, you might want to look at the freight sector. According to the O’Ryan et al. (2002) report cited above, 35-40% of total CO2 emissions from transportation in Chile come from the freight sector, with nearly a quarter of the total coming from freight trucks alone. Even if one considers Santiago alone, freight transport accounts for on the order of 10% of CO2 emissions from transport. Your proposal does not address the freight sector at all, and so misses altogether the chance to reduce the significant emissions from the sector. Shifting freight from trucks to rail can reduce GHG emission per ton-mile by about 75%. Converting diesel trucks to natural gas can immediately reduce PM and NOx emissions, albeit not GHG emissions.

**Response**/ As the project states the GEF involvement aims at supporting the implementation of the PTUS with its main objective of reorganizing the Public Transport in Santiago. The freight sector is not being considered at this stage.

Finally, you ought to at least discuss vehicle taxes, fuel taxes, and parking charges and controls as additional measures designed to induce people to use alternatives to single-passenger automobiles. Parking controls or parking charges have been shown to be particularly effective at reducing single-passenger commuting by automobile.

**Response**/ All these measures will be discussed in more detail during the next phase of the project and with
the implementation of the components allocated under the Traffic Calming Measures.

It would be nice if you could make preliminary estimates of the GHG-emission impacts of all of the components, and then present them in a single table, along with the component costs. This would give GEF an idea of the cost-effectiveness of its investments.

**Response** The impact of the measures included in the project are not always comparable in terms of reduced GHG emissions, as they differ very much in scope, and implementation timeframe. Also, most measures depend on the degree of stakeholder participation, as they are indirect, aimed at removing barriers, not at directly removing GHG emissions.

Given that the bus demonstration program is the most costly component of proposed project and also arguably the most pertinent to the GEF, there should be a more extensive technical discussion of the technology, operation, costs, and expected emissions benefits of the program. There is by now sufficient actual experience with or good simulation of these technologies to support a more in-depth discussion of what the project intends to do and what benefits it expects. In this regards, the discussion of CNG and hybrid buses would benefit from the recent and comprehensive book on bus systems by the IEA:


The book discusses hybrid-electric buses, fuel-cell buses, CNG vs. diesel, and other fuels and technologies, and has case studies for cities Indonesia, Bangladesh, Brazil, India, and Mexico.

**Response** The project team has already taken concepts from this book and from the experience executed in New York with Hybrid Buses. Also, the hybrid technology to be tested is Brazilian. The case of Mexico has been developed in parallel. A more detailed technical discussion will be added to the PAD.

The discussions of road-pricing and land-use-planning measures should be a little more informed by the very large literature on these subjects. Major transportation journals periodically have special issues devoted to these topics; see for example the recent issue of *Transport Policy* devoted to road pricing (Volume 9, pp. 175 --, 2002). The analysis of the interaction between land use and transportation is particularly complex, and not useful reduced to correlations between density and vehicle ownership or use.

**Response** This has been revised by the Project Team and more information has been added to the final PCD. During appraisal, additional information will be added as needed.

The strategic environmental assessment, travel harmonization, and decontamination bond components are too rudimentary at this point. They should be elaborated more.

**Response** These components were developed in more detail on the final PCD, and will be complemented during appraisal.

Finally, some of the discussions of necessary institutional changes and interactions among agencies and between the public and private sector ought to be more clearly elaborated.

**Response** These points are more discussed during the Final PCD. Also during the appraisal phase, these will be more discussion in more detail.
Specific comments page by page

p. 2., Key Performance Indicators. I always have trouble with this section of GEF proposals (!). I assume that what GEF wants are indices that measure the extent to which project objectives are attained. If so, then the first problem with your list is that you have expressed most of the “indicators” as desired outcomes (e.g., “non motorized transport share of total trips increased”) rather than as measures related to program objectives (e.g., measures of modal share, which are related to the objective of curbing the use of private automobile). Second, it is not clear how items 2.1 iii, 2.1 v, and 2.2 iii are to be expressed as measurable indices.

*Response* These notes have been corrected on the final document of the PCD. Both indicators of project (long-term) and of process (short term) success have been added.

p. 2-3, part B1. The background for this section needs to be better developed. For example, tell us more about the CAS – what it is, and why it is pertinent here.

*Response* These notes have been corrected on the final document of the PCD.

p. 3. section 2. Give more background on the transport system and travel characteristics. The O’Ryan et al. (2002) report referenced above has good information for this.

*Response* These notes have been complemented on the final PCD.

p. 3, bottom. The second to the last sentence is unclear (syntax muddled; what is a “most preventive action?).

*Response* These notes have been corrected on the final PCD.

p. 4, top. Is PM10 a “major precursor for the formation of PM2.5?” Regarding footnote 3 (ozone), recent work has indicated that the black carbon component of PM2.5 contributes significantly too global warming; see for example:


*Response* These notes have been corrected edited properly. We have also noted the contribution of tropospheric ozone to global warming.

p. 4, second paragraph: See also:


*Response* More information has been included on the final PCD. Ortuzar has been contracted as consultant for the preparatory studies (PDF-B).

p. 4, bottom half. Again, the O’Ryan et al. (2002) report has an expanded discussion of the institutional situation.
Response/ More information has been included on the final PCD.

p. 5, “Objectives of the Plan,” bullet 5. There is no conceivable way that the PTUS will reduce emissions of “global pollutants” by 70% compared with the current situation. Indeed, O’Ryan et al. (2002) show that even in a “low” GHG emissions scenario, emissions of GHGs are still likely to increase, albeit at a lower rate than in the “high” GHG emissions scenario.

Response/ It was an error in the text that has been corrected. It refers to local contaminants from motorized transport.

p. 6, section 3, first paragraph. It is not true that all measures designed to mitigate urban air pollution will also mitigate climate change. For example, retrofitting dirty diesel buses to burn CNG will reduce emissions of PM and NOx, but not emissions of GHGs.

Response/ We agree. The project aims at finding less intensive and more fuel efficient technologies to reduce emissions of GHG

p. 7, fn 7. Actually, I don’t think assuming an increase of 2 percentage points for the bicycle modal share is “conservative”. In the U. S. anyway, that would be a huge increase for a major city.

Response/ Agreed, we change the qualification as it was. Recent studies have shown that, shares on modes of transportation can change up to 3% as seen in Bogotá, city where 270 KM of bikeways will be in place shortly. The estimative presented on the project are based on conservatives assumption of the changes that might take place in Santiago with the construction of the 19 Kilometers funded by GEF and 20 more Kilometers funded by the private sector. Another aspect here is the involvement on the civil society and NGO’s on the design process, so far these groups have showed a great attitude towards the implementation of these components, and will result on the success and the increase of the expected results.

p. 7, Modernizing the bus system. This is one of the most feasible and significant measures in the whole project, and so should be elaborated more fully. The IEA book cited above could provide ideas on how to elaborate this section. (Note: I see that there is more elaboration in Part C. Perhaps you should combine the two section – this one with the bits from Part C -- to avoid confusing disjointedness.)

Response/ The document has been improved to avoid duplication. Additional information on the Testing protocol will be added to the PAD.

p. 7, part (b), bus reform, and p. 44, Annex VI. The bus reforms should be explained in more details. (Or else this section should be combined with the similar section from Part C.) Since results from MODEM and ESTRAUS are going to be used in the GEF project to evaluate the impacts of the bus reforms, there should be a better write up of these models. In particular, we need more information on the ESTRAUS model.

Response/ Although the final report on the details for the new system is still being produced, we have added an annex with the key elements of the reform. During appraisal this information will be updated.

pp. 7-8, part (c). This section should be combined with the “bus renewal” section from Part C. In any event, I don’t follow the reasoning here. Are you suggesting that the buses displaced by the EPA 94 buses can either be scrapped, or else deployed in completely new routes that would serve completely new trips which in the alternative (scrapping of the buses) would not exist? The latter is completely improbable. If the old buses are used in other places, they might shift the modal split a bit, and might even generate some new net
travel, but it is impossible that all the trips on the old buses would be net “new” trips in the final transportation equilibrium.

Response/The reasoning is to avoid that all displaced buses from Santiago simply co-exist with much older equipment in other cities. The program provides an opportunity to not only renew the public transport fleet in Santiago, but also in other cities.

p. 8 (a) school location. What mechanism will change the location of the schools? Legislation? Incentives? This section here is too spartan to be of use. I suggest dropping it and referring the reader to the discussion of school location in Part C.

Response/ The document has been modified to reflect the contribution of the project, which will be the assessment of opportunities to coordinate school zoning policies with sustainable transport.

p. 8 (b) central ring. What simulation models were used to determine the effects of this (component? MEPLAN? In any event, more details of the proposed simulation and evaluation methods are needed, because this is simultaneously one of the most potentially important long-term actions, and also the most difficult to model.

Response/ The model used is MUSSA (http://www.mussa.cl), which is a recent developed land management model tool developed by Chilean authorities. More details have been added to the document.

p. 8 (c) housing policy. I believe that the there are a lot more energy and emissions-relevant differences between infill and peripheral development than just the average length of trips. Within transportation alone, one has to consider mode choice, destination choice, number of trips, and more. But there are non-transportation effects, too, related to heating and cooling, infrastructure, and telecommunications. I recall reading at some point that not all of these differences favor infill over peripheral development, which, if correct, means that a comprehensive model of multi-sector energy use, transportation, land use, and more, is needed to properly tease out all of the effects. Furthermore, housing location is not the only pertinent planning variable; one can and should simultaneously plan for the location of industry, commerce, services, and infrastructure. Put another way, one shouldn’t compare peripheral with infill housing development; rather, one should compare two optimally designed complete alternatives, one featuring intelligent multi-modal peripheral development, the other featuring central-city infill. Although this greatly complicates the comparison, it is realistic, and at least ought to be considered.

Response/ Comments taken and will be incorporated into TOR during appraisal

p. 8 (d) city center. How will measures such as traffic calming reduce trips by a full 50% (which really is quite a lot)? And what happens to any trips no longer made by car in the city center? Do some of them just go elsewhere? [I see that there is a bit more elaboration in Part C. The two sections should be combined.]

Response/ Text has been corrected; the reduction of 50% had been included as hypothetical scenario to show relevance of GHG emission reductions associated with the measure. More specific information will be added on this sub-component during appraisal.

p. 8-9 road pricing. There is no doubt that one can manipulate prices in such a way as to discourage people to use cars, and probably even reduce GHG emissions. This does not mean, however, that such a scheme is economically “rational” in the sense of maximizing social welfare. Indeed, a truly “rational” pricing
scheme requires long-run marginal social-cost *everywhere* in the society – not just on cars, not even just on all transport modes, but everywhere (although with limited substitution between transportation and non-transportation sectors, it might be sufficient just to price all transportation modes correctly). You must price buses, trains, public infrastructure – everything – correctly, accounting for pollution, infrastructure (or congestion) costs, accident costs, service costs, and so on. As part of doing this, you must estimate full lifecycle emissions for public transportation operation, including the metro.

For details on my arguments about pricing, see:

M. A. Delucchi “Should We Try to Get the Prices Right?,” *Access*, Number 16, University of California Transportation Center, Berkeley, pp. 14-21, Spring (2000).

For lifecycle GHG analysis applied to transportation options in Chile, see the O’Ryan et al. (2002) report mentioned above.

You ought to consider a broader set of economic/pricing measures. In particular, measures that affect the cost and availability of parking can have a dramatic impact mode choice.

This section should be combined with the similar section in Part C.

*Response*/ *We agree with this statement, and considerations will be added to TOR development during appraisal.*

p. 9, strategic assessment. This is a worthy but probably overly ambitious goal. Such a unified suite of models is difficult to achieve. I suggest either devoting a lot more serious attention to this, or dropping it altogether.

*Response*/ *For the development of the PTUS the introduction of the environmental variable is a priority at the government level. Not only the introduction of climate friendly measures are pursued, it also looks for a more comprehensive approach on how to integrate development and environment, seen as the perspective of the transportation sector. Other changes have been introduced on the final PCD.*

p. 9, travel harmonization. What exactly is this? What are the Australian examples? If this really is a cost-effective way to reduce GHG emissions, it should be elaborated upon.

*Response*/ *Experience not only in Australia but is Santiago itself has shown that rationalization of trips always results in a reduction of trips length and more efficient trips. This can be achieved by education certain groups of the population and introducing these measures as a sustainable plan. The concept has even been patented as “Travel Blending”.*

p. 9, decontamination bonds. Is this a proposition to study a possible CO2 emissions trading scheme (incorporated into an existing emissions trading scheme for urban air pollutants)? If so, you need to say more than “we will study” this. A lot has been written about this already, and you should acknowledge this and give us a better idea of how you might implement the scheme and what you might expect from it, with particular attention to the institutional, economic, and industrial characteristics of Santiago. An example of recent literature is:

p. 10, promotion of bicycle use. On what basis do you expect that significant numbers of people who own cars will choose to ride bicycles instead? I understand why you target areas of high car ownership – because of the theoretical potential to eliminate a lot of car pollution – but against this theoretical potential one must recognize that the propensity to ride bicycles is a decreasing function of wealth, vehicle ownership, and the quality of the road network for cars. Maybe it is more socially beneficial to provide infrastructure in support of cycling where it is more of a necessary mode rather than a luxury mode. Moreover, as far as I know, the only safety “strategy” that really makes cyclists feel secure (and hence has any chance of attracting people away from cars) is complete grade separation of cars and bicycles. After this, what seems to matter next is the provision of convenient, safe bicycle parking or storage, and facilities for changing clothes. I suspect that next to these, educational campaigns and the like accomplish very little. (Of course, they cost relatively little, too...)

Response/ On regards to this component a comprehensive plan is under development funded by the GEF under the PDF-b Studies. A final outcome of this study will be ready at mid March 2003, which will be added to the PAD during appraisal and certainly to develop TORs. Along with building a bikeway network, with high specifications (defined as an investment of 100,000 per kilometer built), a plan to address issues as safety and security are also part of the Project. Specific measures are been identified and on the final PCD and the appraisal stage all these information will be available for analysis and development. The experiences in Bogota and Manila have shown that an increased use of bicycles in the order of 1.5-3% of trips is possible under comprehensive schemes (i.e. promotion, good infrastructure, safety).

p.11-13, bus program. See my comments above. Also, you ought to consider using a Euro V bus, because these can have emissions benefits similar to those of CNG (see the IEA bus report mentioned above). The discussion of emissions testing is good, but there is nothing said about what costs are going to be estimated and how. Do you intend to project lifecycle capital plus operating costs, under some future conditions? If so, tell us more about the expected methods and data of the analysis.

Response/ Currently, legislation in Chile requires Euro II buses; with the implementation of PTVUS it has been decided that all the new buses have to comply with Euro III standards. Buses with other enhance pollution control systems are not available in the country, nor it is the fuel. On the economical analysis, the test protocol for the Bus Test currently under development contemplates the analysis of the economical variable, which is consistent with the requirements of the above point. The text has been improved to reflect this.

p. 12, bus reform. This section should be merged with the similar section earlier in the report (p 7, part (b), so that all of the information is in one place. As it stands now, the earlier section has insufficient background, and this section is missing some useful bits from the earlier section.

Response/Text improved to reflect comments.

p. 12-13, renewal of bus fleet. Again, this section should be combined with the similar earlier section (pp. 7-8, part (c)). See my comments on that section.

Response/Sections have been combined.
pp. 13-14, central ring. See my comments on the similar section earlier in the report (p. 8 (d) city center). Also, the order of sections here should follow the order used earlier (“central ring” after “school location”), unless the sections are merged (which is the best idea).

Response/This has changed significantly since the first draft. Comments have been taken into account in the final version of the PCD.

p. 14-15, school location. The discussion of school location seems excessive and out of proportion to the GHG-reduction benefits that it is likely to provide. It would be nice to have some indication of the likely magnitude of the benefits.

Response/This has changed significantly since the first draft. All comments have been included on the final version of the PCD.

p. 15, housing policy. See my comments on the similar section earlier in the report (p. 8 (c), housing policy).

Response/Comments addressed above.

p. 15, fns. 13 and 15. Eliminate the duplicate.

Response/Ok, Will do this of the final version of the PCD

p. 16, city center. See my comments on the similar section earlier in the report (p. 8 (d), city center.) The two sections should be combined.

Response/This has changed significantly since the first draft. All comments considered on the final version of the PCD.

pp. 16-17 road pricing. See my comments on the similar section earlier in the report (p. 8-9 road pricing). Refer also to the recent issue of Transport Policy (volume 9, pp. 175 --, (2002)) on road pricing. The sections ought to be combined.

Response/ We agree with this statement, and the changes are reflected on the final PCD

p.17, strategic assessment. See my comments on the similar section earlier in the report (p. 9 strategic assessment). The sections ought to be combined.

Response/Sections combined.

pp. 17-18, travel harmonization. See my comments on the similar section earlier in the report (p. 9 travel harmonization). The sections ought to be combined.

Response/Sections combined.

p. 18, decontamination bonds. See my comments on the similar section earlier in the report (p. 9 decontamination bonds). The sections ought to be combined.
Response/Sections combined.

p. 19, 2.1. What is the nature of the reform that is to be sought here?

Response/PTUS implementation, in particular the restructure of the public transport system.

p. 19, 2.2. What legislative changes specifically are needed?

Response/ Road pricing principles.

p. 21, D. Project Rationale. See my “general comments” at the beginning of this review. A specific question here: why were fuel-cell buses rejected? The GEF is interested in them, and the O’Ryan et al. (2002) report on sustainable transportation in Chile includes them in its analysis.

Response/From the perspective of project implementation and economical analysis on the implementation of the PTUS, fuel cell buses are not being considered due to its high capital cost and the willing of the government. Also, GEF has stopped considering this option.

pp. 21-22, related projects. I just skimmed this section.

Response/ This has been completed on the final version of the PCD

p. 24, bikeway construction. I agree with this (see my comments above. p. 10 promotion of bicycle use), but wonder why it is imagined that “cultural change” is likely to be effective, or even possible. I don’t know of any evidence that this sort of enlightenment campaign can do anything to overcome the effects of wealth and concerns about safety and convenience.

Response/ See comments above.


Response/ This has been completed on the final version of the PCD.

p. 29, travel harmonization. I agree that once a person becomes more informed, he or she will make decisions on the basis of their new enlightenment rather than their previous ignorance. But each new generation will have to be educated in order for the behavior to be sustained across generations.

Response/ The final version of the PCD contains a more detailed scope of this component.

p. 29, bicycle use. What do you mean when you say that “this component is likely to sustain itself after completion of the GEF project”.

Response/ Once the project is implemented, a communication and promotion campaign will have taken place, and the modal shift will be expected. Normally, potential bikers that face favorable conditions will maintain their preferences.

p. 29, hybrid buses. There are two other key and related factors: economic and operational viability of the new systems. They won’t be expanded or even sustained for long if they prove too costly or difficult to operate.
Response/ We are aware of the situation, this is the main reason for to have a Lab Test and a Field test, in order to evaluate the operational and capital cost of the technologies under evaluation.

p. 30, rationalization of trips. I would add that the sustainability of land-use patterns depends greatly on the permanence and effectiveness of the policies and economic forces that govern land use. And here I think is a weakness in this proposal: I believe that strong central planning is needed to ensure sustainable land development, and I did not see any indication that this sort of planning will be pursued in Santiago.

Response/ The final version of the PCD contains a more detailed scope of this component.

p. 30-31. I think that the potential problems with the bicycle component are serious. Putting bicycle routes in high-density corridors, in order to maximize visibility, is not likely to work if the bicycles must mix in any way with road traffic.

Response/ The designs will avoid that potential mix and will favor complete segregation over pavement. Final designs will be appended to the PAD.

p. 31, road pricing. There may be a bit of wishful thinking here, but perhaps that is OK!

Response/ We agree

pp. 32-36, Annex I. The second column should be called “performance indicators or general evaluation guidelines,” and in it should have indicators or guidelines or measures but not desired outcomes.

Response/ These are the guidelines for PCD development at the World Bank

The right-hand columns are not labeled clearly. It looks like what you have in the rightmost columns are simply goals. I suggest calling them that.

Response/ This has been taken care at the final version of the PCD

pp. 39-41, Annex IV. The emission factors, Fij, should not be end-use carbon emission factors, but rather full fuel-cycle CO2-equivalent emissions. In other words, one must consider all the linked sources in the transportation fuel and vehicle lifecycle (not just end use), and all GHGs, not just CO2. The analysis must be done for all modes, including the metro, intercity trains, and the like. An application of this full fuelcycle analysis to transportation scenarios in Chile is given in the O’Ryan et al. (2002) mentioned above.

Response/ All factors considered are IPCC-consistent and take into account full fuel-cycle emissions. In any case, all calculations will be checked during appraisal.

pp. . 42-43, Annex V. This is useful information.

p. 44, Annex VI. See my comment above, p. 7, part (b), bus reform.

Response/ see above
1. **Changes to public transport plan**

1.1. Current extended bus routes that run from one end of the city to the other will be replaced by a network of trunk routes and feeder lines, which will complement the metro network to be extended.

1.2. These systems would run on a graded and integrated fare structure, operated by means of a magnetic ticket or smart card (preferably contact-less) and automatic fare collection devices.

1.3. The interchange between one mode of transport to another requires the creation of a series of transfer stations to facilitate passenger boarding particularly in intersections with heavy traffic of different modes of public transport. (To accommodate the high concentration and constant flow of people, these transfer stations could be coupled with shopping centers, converting them into clear opportunities for private investment).

1.4. The new route network would keep public transport off the downtown triangle of Plaza Italia to Teatinos street and Alameda to Mapocho streets. In other words, no public transit vehicles would cross the downtown area. Only one circulator bus preferably using electric technology would run within this triangle. Several streets would be converted to pedestrian walkways. Thus, the quality of life of people who carry out their activities within the capital city’s civic and commercial center would improve substantially.

1.5. Public transportation along the Alameda-Providencia-Apoquindo corridor would be run by one concessionaire using electric traction vehicles operating on a fixed-schedule basis in coordination with the Metro and on a demand-responsive short-distance system during peak hours.

2. **Change in technology in a significant proportion of the public transport fleet**

Both in terms of construction (high quality standards) and propulsion (CNG, hybrids, or electrical), as well as the introduction of alternative vehicle technologies such as trams, light rail, and articulated or O-Bahn buses along several corridors. This would not only modernize the fleet but also substantially reduce the public transport system’s contribution to the pollution problem in Santiago.

3. **A change in the tendering methodology**

For public transport services, replacing the current system of “throughout carriage concessions” (crossing the city from one end to another) to “service area concessions” (i.e. Santiago would be divided into 8 or 10 “service areas” according to existing studies on transport demand. Transport service operators would bid for a full package of public transport routes within a specific area along trunk roads, along Metro and trunk line corridor feeder routes, and along shuttle routes to cover passenger demand in specific zones). Licenses would be awarded on the basis of the provision of all necessary services, both high and low revenue generating services (to avoid market “descreme” practices and service deterioration, similar to the concession system for telephone services).
4. **Enterprise structure for bus operators**

Thorough entrepreneurship of public transport operators, mainly through tax mechanisms (from presumptive income to real income) and service contract obligations.

4.1 Changes in recruitment practices and training programs. Bus companies will have to pay drivers a fixed salary.
4.2 Complete modernization of service infrastructure such as terminals, maintenance shops, etc.
4.3 Exclusive operation of service areas will allow formation of enterprises subject to varied sources of capital raising (i.e. stock issuance, limited and open societies, consortia).

5. **Main changes to small vehicle public transport**

1.1 Competitive tendering to award collective fixed taxi routes integrated preferably to mass public transport trunk-line corridors, thus greatly reducing the competition of these taxis with mass transport vehicles.

1.2 Regulate taxicabs, reducing the number of vehicles in operation and introducing a quota system in accordance with the city’s potential demand and in compliance with strict service quality and security norms.

1. **Infrastructure and Information Systems.**

All of these changes would also produce a series of additional improvements in other aspects such as roads construction and passenger information systems using state-of-the-art information and communication technologies, etc.

2. **Main changes to other modes of transport of goods and people**

The intermodal nature of the Plan raises the need to establish distinct and comprehensive policies for other types of urban motor vehicles. The Plan includes specific proposals regarding other modes of people transportation: private cars, shuttle trains, rural and inter-city buses that use urban thoroughfares, company buses to transport employees, school buses. A series of proposals have also been incorporated regarding urban and inter-city cargo transportation.

Specific measures to reduce air-borne emissions from these vehicles have also been considered, such as halting the importation into the capital of new light diesel vehicles, introducing stricter controls and mandatory technical standards for cargo trucks, etc.
Additional GEF Annex 5: Detailed Project Description
CHILE: Sustainable Transport and Air Quality for Santiago (GEF)

1. Promotion of Bicycle Use

The GEF-funded bikeways would run along the following corridors: Condor – Santa Victoria (1.9 km), San Eugenio – Bustamante (1.1 km), Matta Oriente – Republica de Israel (1.7 km), Avenida Grecia (2.0 km), Campos de Deportes – A. Varas – Santa Isabel (4.5 km), Simon Bolívar (3.6 km), Lota (1.2 km), Montecarmelo (0.4 km), and Macul – Chile España (2.6 km). They will complement the 21 km of bikeways to be built with government funding, and the existing Pocuro bikeway (8 km) in Providencia.

The investments in the GEF funded bikeways are expected to average USD105,000 per kilometer. In addition, the national and local governments will contribute counterpart funds in the order of USD 2 million, equivalent to 50% of the total investment. The Comunas have issued letters of intent, confirming their plan to build the complementary bikeways and committing themselves to the maintenance, cleaning and lighting of all bikeways to be built under the Project.

The configuration of the proposed bikeway network is shown below:

The physical works will be complemented by an action program aimed at maximizing traffic safety and personal security for the increasing number of cyclists in the three Comunas. Before tenders are issued for the bikeway construction, an independent safety and security audit of the final designs will be carried out (still with PDF-B funding). During construction, specialists will closely monitor the implementation and ensure that appropriate standards are used to ensure the cyclists’ safety. Traffic safety campaigns and education will also be carried out as part of the promotional campaigns (see below).

Moreover, this Project component includes the implementation of a three-year program of promotional
actions, with the overall objective of increasing bicycle use in the three Comunas. This plan will include such actions as (a) collaboration with citizen’s groups to develop grass-roots support for non-motorized transport, (b) publicity campaigns to develop an attractive image of the bicycle as transport mode, (c) traffic safety campaigns directed at drivers and cyclists, (d) special events such as bicycle outings (cicletadas) and car-free Sundays in selected streets, (e) approaches to major employers to promote bicycle use among their staff, including the installation of showers and bicycle parking, (f) provision of bicycle parking in public spaces and car parks, (g) establishment of a website to provide information useful for cyclists, and (h) interventions to increase cycling as a feeder mode to the metro. In addition, a pilot program will be carried out in collaboration with a university and a high school to establish conditions enhancing the use of non-motorized transport (cycling and walking) by their students.

2. Modernizing the Bus System

2.1 Technical assistance for evaluating the economic and environmental impact of clean technologies for buses

The tests will be developed using a state of the art emissions laboratory for heavy duty vehicles located at the 3 CV facilities. The 3CV laboratory would be upgraded, so that all relevant equipment gets in place. The chasis dynamometer will be retrofitted and the laboratory will be furnished with gas analyzers, a Constant Volume Sampler System (CVS); a Particulate sampler; an AC/DC clamp on power Hitester Hioki model; and a Measurement System for exhaust gases. GEF funds will be complemented by local resources; the grant amount was determined by the preparatory PDF-b study, and the amount was determined based on the costs of contracting third parties to carry out the laboratory tests. Representative driving cycles for Santiago will be developed, taking into account the new layout for the bus system, to be effective starting 2004.

Complementary to the laboratory tests, the operating conditions of the buses will be closely monitored throughout a year, to determine costs, and technical performance. The first stage will evaluate the buses initial conditions, establish a baseline scenario, driving cycles and set out the methodological approach. All equipment needed for the 3CV lab will be purchased. Second phase will start the performance tests, and will include basic training for operating the new lab equipment. Also, it will calibrate the testing protocol according to the new lab facilities. Third phase will include the first set of laboratory tests at the 3CV facilities and will take place after 6 months of monitored operation of the buses, using driving cycles developed under the project. Fourth phase will consist of a second set of laboratory tests to be conducted after twelve months of bus operation. Cost and performance monitoring will measure oil and fuel consumption, tires and parts degradation, and maintenance requirements, including labor. The technical protocols for the testing are being finalized under an on-going study financed with GEF resources (PDF-B) as part of the preparation process.

The test will include at least 6 buses: Two (2) Hybrid Buses, one 10-12 meters long with Euro II engine, and one articulated Euro III hybrid. Two (2) CNG Buses (EURO II and EURO III); and two diesel buses: one Diesel Euro II , and one Diesel Euro III articulated bus. The GEF will fund the tests, while private bus owners and developers will provide the 6 Buses and will allow their operation on real representative bus routes. Tests are estimated to cost about USD1 million, which include co-funding for the 3CV upgrade. Counterpart funds will be in the order of USD 2.910 million (including USD800,000 from ENA for upgrading the 3CV facilities). The testing for the bus technologies will take place using over 10 buses provided and operated by the private sector on existing routes. Parties expressing interest in contributing to this so far include Chile Association of Bus Operators, Transelectric, Quilical, and Mercedes, and
Volvo.

This test will be harmonized with the one taking place in a similar GEF project for Mexico. Experts from both cities will share their experiences. Also, the testing protocols will be compared to develop harmonized procedures. Since the project in Mexico will start sooner, the Chilean test will use all resulting lessons learned for their approach. Both Bank project teams have already initiated the coordination of bus testing activities.

2.2 Implementation Framework for Bus Reform

The business structure of bus services in Santiago has resulted in a costly and environmentally unsustainable surface public transport system. Key issues include: (a) lack of an organizational model that would facilitate efficient public transport operation, (b) dispersed operations that hinder the effective control of bus services and contribute to traffic congestion, (c) lack of professional management among bus operators, and (d) an unattractive image which induces potential bus passengers to use private vehicles instead. The experience of Bogotá’s innovative bus corridor system has demonstrated that the creation of the right business environment is vital for achieving sustainable public transport services by improving their commercial viability. On the basis of the Bogotá model, the Santiago Transport Strategy for 2003-2005 includes the implementation of about 30 km of segregated busways, for which the Chilean Government has requested a World Bank loan. As learned in Bogotá, the physical busway construction must be complemented by a well-conceived program of institutional measures to create the business environment a social mitigation plan required for reforming the bus transport system.

These studies are estimated to cost USD 500,000, of which USD 400,000 would be financed by GEF. They are subject to a letter of intent from the Government, confirming its wish to have the busways funded under a World Bank loan.

2.3 Renewal of the bus fleet in the regions

The implementation of the bus routes, and more specifically of the trunk routes on segregated busways is expected to allow the road-based public transport system to run more efficiently with a reduced number of buses. Due to higher speeds and to the introduction of articulated buses, approximately 4,000 buses are expected to be removed from the streets of Santiago. These buses, which might not be eligible to run in Santiago under Santiago’s own standards regarding age and emission levels, are still much newer and cleaner than most of the buses which are circulating in the cities of the other regions. These buses are hence expected to be sent to other cities where a renewal of concessions will also take place. The study financed under this component will evaluate options to avoid the increase of the existing public transport capacity. One likely option would be to require local bus operators to replace their old buses with those from Santiago, through incentives that could be basically linked to the concession awarding process. The study would identify cities where concessions are about to be renewed, would design a legal and institutional framework that will make it possible to achieve the renewal of the existing bus fleets and would define the necessary incentives to make this happen. It would also design a strategy to make sure that the displaced vehicles are not sold on a secondary market and are properly scrapped according to adequate environmental norms. This way, the objectives of local and global emission reduction would be achieved.

The GEF will fund this study in an amount of USD60,000. It is subject to a letter of intent from the Government, confirming its wish to have the busways funded under a World Bank loan.
3. Assessment of land-use incentives and policies to reduce motorized travel

3.1 Developing the Central Ring of Santiago (Anillo Central)

The population of the city center in Santiago has unfortunately been decreasing for decades and urban sprawl is of great concern. A preparatory PDF-funded study showed that developing housing at Santiago’s central ring (Anillo Central) would have a positive environmental impact, as emissions of both GHG and local air pollutants would be decreased as a result of a reduced average trip length. The Central Ring of Santiago not only has lots available for real estate developments projects, but also enjoys a good access to public transport means. Simulation using ESTRAUS, MUSA, and MODEM models have shown that complementary transport development in the area, such as circular routes over the ring would bring considerable reductions in emissions. The studies will help orient land-use policies so that the average trip length gets reduced thanks to the need of shorter trips, and where modal shift to public and non motorized transport is promoted. Potential articulation to the location of social housing programs and subsidies will also be studied.

The GEF will fund these studies with an amount of USD200,000.

3.2 School Location

This component will help assess the feasibility of rationalizing school location considering the transport dimension. Different school location scenarios will be examined and modeled in order to provide decision-makers with information on the environmental impacts of each envisaged strategy, in terms of both local and global pollution, the ultimate goal being the rationalization of school-related trips and the reduction of their average length. It will also examine the effects of the JEC which will severely add to travel demand in the morning peak hour.

The GEF will fund these studies with an amount of USD200,000.

3.3 Housing Policy

It was decided in agreement with the “Mesa de Trabajo Ciudad y Territorio” that the GEF support would focus its intervention through an analysis of the consistency and compatibility of the various sector policies that affect land-use and transport, namely the policies designed by the Ministries of Housing, Economy and Transport regarding land-use, social housing, transport infrastructure investment plans, air pollution, etc. The GEF would allow decisions makers to take knowledgeable decisions regarding housing location policies, that will take into account criteria linked to the impact of those policies on travel patterns, air pollution and GHG emissions. Within the same logic as the other two sub-components, the project will promote a rational location of housing, so that urban spread is minimized and access to public transport is ensured.

The GEF will fund these studies with an amount of USD150,000.
4 Improving Traffic Flows

4.1 Traffic Calming at City Center

This component has as its objective to reduce car traveling within Santiago’s city center. This will be done through the implementation of measures such as traffic calming, pedestrian facilities implementation, and parking restrictions in the area of the Triangulo Central de Santiago (Zone between Alameda Libertador Bernardo O’Higgins, The Mapocho River and Autopista Norte-Sur). Also it is expected to enhance current programs of pedestrians corridors actually under execution and to reduce the incentives to car use, through measures pointed to restrict the amount of parking spaces on downtown. The ultimate purpose of this component is to get the plan agreed by city center businesses and other stakeholders, and have the detailed engineering designs ready for implementation so that works could start as soon as the proposed WB credit is approved.

This component is estimated to cost USD 720,000, of which USD 700,000 would be financed by GEF. It is subject to a letter of intent from the Government, confirming its wish to have the busways funded under a World Bank loan.

4.2 Road Pricing

Various studies or a multi-pronged study would be necessary before defining a technically sound scheme. The implementation (electronic systems, minor civil works, tolls, operating costs) is not considered under GEF’s financing due to its substantial cost. The main items which should be dealt with are the following:

- Analysis of institutional and political barriers: Learning from the history of road pricing in Santiago, the reasons would be examined why the political context make it impossible to implement a system which had been envisaged for years, with the objective of finding a practical and more effective future approach to overcome these barriers.

- Inventory of international experiences (Norway, Singapore, London, etc.).

- Choice of the pricing mechanism: several options would be examined, such as area-wide pricing, pricing limited to the central city; and corridor-based congestion-pricing. Options of charging schedules include flat, distance-related, and time-differentiated tariffs.

- Choice of the technology: review and investigate the technical options for congestion pricing in Santiago and their potential public and political acceptability.

- Legal base for dedicating revenues: The Government’s fiscal policy does not permit the earmarking of taxes. It must be determined under which legal and institutional arrangements the revenues from congestion charges can be regarded as user fees.

- Sustainable transport fund: In this vain, consideration would be given to the creation of a fund which would utilize the revenues from congestion pricing for improvements to public transport and non-motorized transport.

- Surveys (possibly stated preference surveys) and modeling: these surveys will help the technical
team and the decision makers to examine potential user response by means of behavioral research, including stated preference analysis and traffic simulation modeling.

- Environmental impact and GHG emission reduction assessment: The aforementioned comprehensive analysis of changes in travel behavior would provide the elements necessary to carry out the environmental assessment of road pricing, focusing on GHG emissions.

- Information campaign to facilitate political acceptability of road pricing: In collaboration with Government and civil society groups (including the Automobile Association), public relations specialists would define an information strategy.

The GEF will fund these studies with an amount of 400,000, out of which 50% will be dedicated to surveys and modeling and 50% to specific studies to define the legal framework, design the communication campaign around the concept, choose the best-suited technology for the Santiago scheme, etc.

5. Strategic Environmental Assessment

Current tools for policy making rely on the use of transport models inter-phased with an emission model assessing emission changes due to changes in direct transport measures (e.g. newly segregated busways, changed traffic patterns, introduction of cleaner vehicles or fuels). However, effects from structural changes such as pricing or tariffs, or in land-use patterns, cannot be easily measured. This component would strive for a better inter-agency coordination about cross sectoral issues arising from transport and urban development planning; complementarily, it will help develop a system to introduce environmental evaluation of all aspects with transport planning, linking transport to air quality, climate change and environmental impact assessment. This approach will be used over a long-term period of time, as validation requires important changes such as technology renewal and land-use pattern change to have effect.

GEF will fund studies and workshops to develop and implement a strategic environmental planning and evaluation methodology. The GEF will fund these studies with an amount of USD360,000.

6. Travel Harmonization

During the preliminary phase, neighborhood(s) would be identified where this program is most likely to succeed. Then, GEF funds will be used in a first instance to finance the census of the trips for a few thousands households (this number will be determined in the preparation phase) and the drafting of alternative travel patterns for the households involved in the pilot. Also, to assess the potential role of companies in supporting travel harmonization projects; GEF resources will also be used to develop a large scale program for voluntary travel harmonization, while monitoring travel needs and actual traveling practice during a fixed period of time. This will involve developing questionnaires, surveys, monitoring indicators, and actual monitoring during and after the project is implemented, and calculating environmental impact and cost effectiveness. Then, complementary actions would be taken which would require GEF financing such as street sign improvements, publication of a Community Directory with an inventory of the shops and services available in the targeted neighborhoods, the realization of a specific web-site to facilitate car pooling, etc. part of the grant would also be required for the follow-up of the program, notably to assess its impact in terms of the reduction in car trips.

The GEF will fund these studies with an amount of USD200,000.
**7. Decontamination Bonds**

CONAMA is preparing a project of law to establish a legal and comprehensive ground for the so-called *Decontamination Bonds*. These are economic instruments designed to place a cap in emissions to the Metropolitan Area of Santiago. The concept is as follows: any new polluter has to compensate by more than 100% its net pollution contribution to Santiago’s emissions, through purchasing contamination permits (called *Decontamination Bonds*) or through investing in reducing emissions in other sectors. Thus, a coal-power plant located in Santiago will have to scrap old buses, or convert taxis to CNG, or simply purchase emission permits in order to expand its capacity. Until now, via environmental licensing, CONAMA has managed to control growth in the generating power in industry and utilities, and has acted as a clearinghouse, helping find environmental options to invest in. Also, the system had only addressed point sources of pollution. To advance the Decontamination Bonds, CONAMA is pushing a project of law at the Congress. The new law will extend the coverage to mobile sources, and will create a basis for creating a more liquid emissions permits market. The project will help upgrade the system, to enable carbon emission reductions to be traded.

The project will provide resources to facilitate sustainable transport projects to be funded by the emerging market of emission permits. The system’s supply curve will derive from the incremental marginal cost of those transport projects. The demand curve will be dictated by the excess in emissions resulting from a command and control measure; placing a reduced cap for the city’s overall emissions will generate demand for emission permits. The underlying concept is that for a polluter it can be less expensive to purchase an emission permit, than incurring in costs to reduce its emissions in-house.

Today the market does not exist as such. Demand and supply do not meet; CONAMA’s intention is to generate a clearinghouse mechanism to help bring together demand and supply of emission permits. A fund may help do that without the need of coordinating the involved parties, and will help inject liquidity and reliance into the system. The GEF study will help determine the best ways to ensure the CO2 emissions of sustainable transport projects are incorporated into the system. It will also ensure that emission reductions resulting from the system can be accepted and traded internationally.
MODEM

These modelling tools have been developed by the Chilean Government to strengthen the local transport planning capacity through technical instruments which, when used in combination, provides decision makers with valuable and reliable information on the impacts of transport planning decisions on a wide array of issues such as air quality and land use.

In order to estimate the level of emissions of atmospheric pollutants, MODEM is fed by ESTRAUS, which forecasts public and private transport flows, which are then “translated” into levels of emissions through emission factors that are continuously updated. MODEM is based on a methodology to estimate emissions which was developed by CONAMA, on the basis of emission inventories for Santiago and other cities such as Gran Valparaiso, Temuco, Rancagua and Concepcion.

MODEM is capable of providing specific results on pollutants associated with several automotive emissions, on an hourly, daily or annually basis, either locally or city wide. The information produced by the system can be seen in GIS Format. The definition of the Urban Transport Plan For Santiago was supported by these models. MODEM was developed from October 1999 until March 2000 by Universidad de Chile, Laboratorio de Transito DICTUC and Catholic University in Santiago.

MODEM includes an economic valuation module, which allows to evaluate, from an economical point of view, different environmental regulations, aiming at reducing the emission generated by the transport sector.

The most important elements of the methodology to calculate emissions are the emission factors. The model uses an array of different factors according to the type of source, the emission control devices and the technologies being used. These factors are usually expressed for transport in grams per kilometre and also depend on average speed. Following this, the system uses 111 curves of emission in function of speed, to determine emissions of seven compounds for each vehicular category.

Regarding this project, the final analysis is under way in order to provide the most reliable information. Final results are expected to be available by March 2003 and will be incorporated during the appraisal period.

ESTRAUS

ESTRAUS is a set of programs, whose first version was developed in Chile at the end of the 80’s. The system allows to see several scenarios on urban development, constituting itself in a powerful tool to support strategic processes on decision making activities.

Based on the origin – destination surveys, and minimizing cost and travel time, ESTRAUS models the generation of trips, attraction, distribution, modal partition and allocation. The last three stages are modeled with an algorithm of simultaneous balance that, unlike a sequential model, obtains a solution that considers the dynamic interaction of the three stages and gives values which reflects the situation of balance among them.
ESTRAUS allows to make an integral analysis of the urban transport system, modeling to every available way and all types of users. At the same time, it provides a great flexibility in the levels with desegregation of spaces, particularly for the project evaluation of limited influence (i.e. public railway networks public, etc.), which requires a fine zoning process. ESTRAUS has been used in the modeling of UTS in Santiago with 264 and 535 zones, and also in Valparaíso and Viña del Mar, with 200 zones.

Model ESTRAUS consists of four sub models:

- Socioeconomic: It predicts variables related to the system of activities.
- Generation and attraction: From the previous sub model, for several scenarios of urban development, it predicts the generation and attraction of trips for each one of the zones in which they subdivide the area of study.
- Of simultaneous balance: It jointly solves the distribution, modal partition and allocation of trips to several networks of public and private transport, considering interactions between modes that use a common infrastructure.
- Of economic evaluation: It makes analyses benefit-cost by means of: calculation of the social net benefit, considering the willingness to pay, the benefit of the operators, the investments and the operation costs, the calculation of the benefits through the savings of physical time and resources, and costs like the value of the investments.
Additional GEF Annex 7: Participation Plan
CHILE: Sustainable Transport and Air Quality for Santiago (GEF)

The GEF project aims at supporting the implementation of the PTUS during its 10 years of implementation from 2000 to 2010. Among its major characteristics, participation of stakeholders, public and civil society, has become a fundamental issue since its formulation. The PTUS is a radical and comprehensive initiative aiming at the organization of the Transport Sector in Santiago, in order to complement the service provided by the Metro and looking forward to provide a transportation sector to poor and low income communities on the Metropolitan Region. With this in mind, a participatory plan must be designed to produce deep changes in urban transport and urban development.

PTUS has identified the main institutional and social actors involved in the preparation and implementation of the plan as follows:

- Institutional: Government & Municipalities
- Public transport system: Operators and drivers
- Communities (at the barrio level)
- Municipalities
- NGO’s; and
- Buses and equipment suppliers.

Along with this identification, CGTS is developing a conflict management analysis, based on the following assumptions:

- The public transport is a very sensitive issue for the citizens and for all relevant public opinion-maker actors and sectors.
- Public transport operators tend to be the worse evaluated sector by the citizens.
- Operators are the main source of resistance to change and conflict. Therefore, conflicts between Government and operators tend to solidify an alliance between the Government and the communities, NGOs and municipalities.
- This alliance is strengthened if a real process of participation of the community and of the municipalities is developed for the different stages of policy design and implementation.

At the development stage of the participatory plan there are several action to be implemented based on the category of the sector which will participate on the development of the plan, as it is explained below for every actor previously identified the plan will address its issues as follows:

- At the community level, the plan will include the following:

Work with community organizations at the barrio level to polish up the design of the new system (reach of troncal and feeder services, design & security of bus stop places, interior layout of new buses, type & conditions of night services, information needs, etc) and to check advances at different stages, incorporate some specific sectors (i.e. university students and the like) into some specific tasks at different stages of the modernization process (i.e. Information to users at some critical moments of the process, continued monitoring of performance of the new system, etc); build regular links and contacts between the community, the PT operators and the municipalities; design a web page for information exchange and suggestions gathering, which is currently place for the development of the GEF project; and make available a dedicated telephone line for consultations and suggestions.
At the Municipalities level, the plan will include:

Permanent “Work Table” with majors, heads of the transit and public works departments, head of the District Secretary of Planning, and other local officials. The agenda of subjects should include (i) District urban planning & public transport; (ii) Specific coverage requirements of the local public transport system; (iii) Segregated lanes for public transport; (iv) Modal exchange stations, and transfer stations (metro-bus & bus-bus); (v) Technology of buses; and (vi) Environmental qualities required for specific public places in the district (schools, hospitals). Also, at the municipality level there must be joint contacts with community organizations for the coverage of the agenda of subjects at the barrio level.

At the NGOs level, the plan will include the following:

Creation of a permanent consulting council that will include NGO representatives, to discuss policy design and implementation of the public transport system, community participation, and work with municipalities. Formation of a consultative body with NGOs with expertise and interest in environmental aspects linked to different policy and plan components of the renewed public transport system. Involve NGO’s in the technical work (through tendering), so that they can participate as consultants and provide their experience on community participation processes.

At the Public Transport Operators level, the plan will include the following:

Promotion of a strong participatory process and provision of technical assistance to support the creation of enterprises within the new concession schemes for public transportation, for the existing transport companies. Also, through their participation in the design of the tender process itself (pre-qualification of future companies participating in the 2003 tender process). Promotion of associative processes between current public transport operators with the new operators (both national and foreign), and promotion of continuous dialog between operators, municipalities and local communities.

At the Public Transport Drivers level, the plan will include the following:

A wide informative process amongst drivers’ organizations about policies and plans, and its consequences for workers at the sector. Promotion of an active participatory process, involving the various drivers’ organizations, Installation of a “Work Table” for permanent and periodic discussion around an agreed agenda about workers rights and labor conditions in the future public transport system, about “Professionalization”, re-training of current drivers, permanent training in future concession contracts, and strengthening sector labor organizations.

At the Great Santiago community level, the plan will include the following:

Strong and sustained communications strategy, closely synchronized with the participation strategy, addressed at users as well as non-users of public transport in order not only to inform them but also to prepare them for the oncoming changes, develop among “santiaguinos” a sense of identification with Santiago and with the driving idea “Santiago, world quality city” as well as with the importance of public transport system and users transformation for such objective, and develop a powerful sense of identification for the santiaguinos with their modernized public transport system: “Un transporte como la gente”.
ASIF Methodology

The basic approach to calculate the global environmental impact of the project, measured as reduction of GHG emissions, is based on the so-called ASIF methodology. ASIF is a useful analytical framework for analyzing changes in emissions and for confronting possibilities for the future. It stands for Activity, Structure, Intensity and Fuel Choice. Basically, the methodology principle is the following:

\[ G = \sum_{i,j} A \times S_i \times I_i \times F_{ij} \]

Consider that \( G \) is the carbon emissions from the particular transport sector, \( A \) is the total travel or freight activity (in passengers-km or ton-km), \( S_i \) is a vector of the modal shares, \( I_i \) is the modal energy intensity of each mode, \( F_{ij} \) represents the sum of each of the fuels \( j \) in mode \( I \), using standard coefficients to convert fuel (or electricity) used into carbon emissions. This equation can be used to study changes in energy use or emissions over time.

Throughout the development of the project, ASIF will be used to assess the level of GHG emissions to be attained in a medium-to-long term frame. The project is aimed at spurring the adoption of measures that not only will contribute to abate air pollution, but also to mitigate climate change. However, the measures contemplated involve behavioral and structural changes in the transport system, that will show results slowly and over a relatively long-period of time. The methodology will help build sound scenarios of success, based on data that will be available throughout project implementation.

Estimated Project Impact

At the preparatory stage, and based on the above referred methodology, some estimates on the project global environmental impact can be made. Basically, the approach will calculate emissions reductions resulting from induced changes or measures that affect modal composition, as well as types of technology, as per the following equations:

\[ E_{rk} = (D_{ijk} \times F_{ijkb}) - (D_{ijp} \times F_{ijkp}) \]

Where
- \( E_{rk} \) = Emission Reductions of pollutant \( k \)
- \( D_{ijk} \) = Distance traveled (veh-km) per year for mode \( I \) and technology \( j \) for
- \( F_{ijk} \) = Factor of Emissions for pollutant \( k \) for mode \( I \) and technology \( j \)
- \( p \) = Project scenario
- \( b \) = Baseline scenario

\( D \) already incorporates information on Activity (trips, length, technology, speed), and Efficiency (km/Lt of fuel), while \( F \) includes information on the type of fuel and on the emission effects of the respective technology.
For purposes of estimating the project impact in the reduction of CO2 emissions, a preliminary estimation will be made according to the following methodology. During project preparation not only additional information will be incorporated into the analysis, but also it will be performed for all the other target pollutants (NOx, SOx, CO, NH4, and PM). In addition, scenarios combining measures will also be defined with GoCh; this will enable to estimate more realistic emission reduction scenarios.

A. TRAVEL HARMONIZATION. Emission reductions are obtained, similar to the previous components, from a net decrease in the use of private cars. In this case, it is through education and associated behavioral change that the trips get bundled and reduced. The experience of a travel blending program for Sidney and Adelaide in Australia have shown net reductions of about 20% in the number of car-km. For Santiago, and at this preliminary stage we have assumed a more conservative 10% net reduction in the number of private car-km. This would mean a reduction in emissions of about 340,347 tons CO2 per year, equivalent to 2.9 million tons CO2 in 20 years (discounted at 10%) or an accumulated 6.8 million tons CO2 at no discount.

B. BICYCLE USE. In this case, the emission reductions are obtained from a shift to a non-motorized mode of transport. Previous studies show potential reductions in the trips by private cars of 3-10%, trips which are absorbed by trips by bicycle. To estimate the reductions in emissions for Santiago, we have assumed a 3% increase in the use of bicycles accompanied by a 3% decrease in the number of cars-km, and 3% in the number of taxi-km. This could be considered the long term effect, and would amount to about 126,000 tons CO2 per year, equivalent to 1.072 million tons CO2 in 20 years (discounted at 10%) or an accumulated 2.52 million tons CO2 at no discount. A medium term scenario, better related to the project will take into account the number of trips, modal composition, associated technology, and associated veh-km from Las Condes, from Providencia, and from Ñuñoa to the center of Santiago, as well as the trips within these comunas and amongst them. This estimation will be performed during project preparation.

HYBRID BUSES. The new rules for bidding the routes in Santiago will be stringent enough so that cleaner technologies get promoted. Thus, a bus operator company can have a fleet of vehicles combining old emitting buses with new clean ones (hybrid or CNG), as long as the minimum emission criteria are met. In addition, the potential for emissions resulting from the particular fleet composition will be one of the key criteria to choose operators. It is expected that the participation of hybrid buses will start slowly, peaking up as long as new mandatory fleet replacements are needed. We have calculated the potential of emission reductions of CO2 resulting from the introduction of hybrid, comparing the hybrid buses to the baseline technology which consists in conventional diesel buses (EPA 94 or EURO II). Emission factors have been obtained from previous studies in Manhattan and Mexico, aimed at comparing emissions from hybrids (diesel electric), CNG buses and diesel-powered buses. Results for 561 show potential CO2 yearly emission reductions of 23,516 tons. This is equivalent to 200,597 tons CO2 in 20 years (discounted at 10%) or an accumulated .709 million tons at no discount. No effects from modal shifts or growth are incorporated into the analysis at this stage. Based on the data from MODEM, other factors like growth, and specific bus route information will be incorporated into the analysis to enhance the environmental impact assessment.