Climate Investment Funds

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March 15, 2010

CLEAN TECHNOLOGY FUND
INVESTMENT PLAN FOR COLOMBIA

Clean Technology Fund (CTF)

Colombia Investment Plan

TABLE OF CONTENTS

ACRONYMS

ANDI	*Asociación Nacional de Empresarios de Colombia* (National Association of Entrepreneurs)
Asobancaria	*Asociación Bancaria y de Entidades Financieras de Colombia* (Colombian Association of Banks and Financial Institutions)
Bancoldex	*Banco de Comercio Exterior de Colombia* (Foreign Trade Bank of Colombia)
BAU	business as usual
BRT	bus rapid transit
CCI	Clinton Climate Initiative
CDM	Clean Development Mechanism
CIURE	*Comisión Intersectorial para el Uso Racional Eficiente de la Energía y Fuentes No Convencionales de Energía* (Inter-sectoral Commission for the Rational and Efficient Use of Energy and for Non-conventional Energy Sources)
CNG	compressed natural gas
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent (A unit used to measure the climate effects of all GHG; it is calculated by multiplying the quantity of a GHG by its global warming potential)
CONFIS	*Consejo Superior de Política Fiscal* (National Fiscal Policy Council)
CONPES	*Consejo Nacional de Política Económica y Social* (National Council for Economic and Social Policy)
CPLP	IFC's Cleaner Production Lending Program
CREG	*Comisión Reguladora de Energía y Gas* (Energy and Gas Regulatory Commission)
CTF	Clean Technology Fund
CTIMCC	*Comité Técnico Intersectorial de Mitigación de Cambio Climático* (Inter-sectoral Technical Committee on Climate Change Mitigation)
DC	Distrito Capital
DNP	*Departamento Nacional de Planeación* (National Planning Department)
ECOPETROL	*Empresa Colombiana de Petróleos* (National Oil Company)
EEB	*Empresa de Energía de Bogotá S.A. E.S.P.* (Bogotá Energy Utility)
EPM	*Empresas Públicas de Medellín* (Medellín Utilities)
FEN	*Financiera Energética Nacional* (National Energy Fund)
FNG	*Fondo Nacional de Garantía* (National Guarantee Facility)
GDP	gross domestic product
GEF	Global Environment Facility
GHG	greenhouse gases
GoC	Government of Colombia
IBRD	International Bank for Reconstruction and Development (World Bank)
ICONTEC	*Instituto Colombiano de Normas Técnicas y Certificación* (Colombian Institute for Technical Standards and Certification)
IDB	Inter-American Development Bank
IDEAM	*Instituto de Hidrología, Meteorología y Estudios Ambientales* (Institute of Hydrology, Meteorology, and Environmental Studies)
IFC	International Finance Corporation
IFI	*Instituto de Fomento Industrial (*Industrial Promotion Institute)
IIC	Inter-American Investment Corporation
IP	Investment Plan
ISA	*Interconexión Eléctrica S.A. E.S.P.*
kgoe	kilogram of oil equivalent
LAC	Latin America and the Caribbean
LULUCF	land-use, land-use change and forestry
MAVDT	*Ministerio de Ambiente, Vivienda y Desarrollo Territorial* (Ministry of Environment, Housing and Territorial Development)
MDB	multilateral development banks
MEM	*Ministerio de Energía y Minas* (Ministry of Energy and Mining)
MHCP	*Ministerio de Hacienda y Crédito Público* (Ministry of Finance)
MIF	IDB's Multilateral Investment Fund
Mt	million tons
PJ	Petajoule
PM	particulate matter
PNTU	*Política Nacional de Transporte Urbano y Masivo* (National Urban Transport Policy)
POT	*Plan de Ordenamiento Territorial* (land-use plan)
PPA	power purchase agreement
PPP	purchasing power parity
SETP	*Sistemas Estratégicos de Transporte Público* (Strategic Public Transport Systems for medium-sized cities)
SGI&C-FNCE	*Sistema de Gestión de Información y Conocimiento en Fuentes No Convencionales de Energía* (Information and Knowledge Management System on Non-conventional Energy Sources)
SITM	*Sistemas Integrados de Transporte Masivo* (Integrated Mass Transit Systems for large cities)
SITP	*Sistema Integrado de Transporte Público de Bogotá* (Bogotá's Integrated Public Transport System)
SMEs	small and medium-sized enterprises
t	ton
TDM	travel demand management
UNFCCC	United Nations Framework Convention on Climate Change
Uniandes	Universidad de los Andes
UPME	*Unidad de Planeación Minero-Energética* (Mining and Energy Planning Unit)
URE	*uso racional de energía* (rational energy use)

EXECUTIVE SUMMARY

1. The Clean Technology Fund (CTF) Colombia Investment Plan (IP) is presented as a two-phase process, with the first phase described herein. The first phase of this process proposes abatement measures in two key sectors – urban transport and energy efficiency - which have been identified as ready for scaling-up of investment and where CTF can have a transformational impact. The Government is also focusing on improving the environment for renewable energy, which would be included in the possible second phase of the IP if resources become available. The two Programs presented in the annexes comprise the first phase, and will be elaborated upon in more detail during the Program design and project preparation phase, for further consideration by the CTF Trust Fund Committee.

Country and Sector Contexts

2. Colombia emitted 180 million tons of carbon dioxide equivalent gasses (Mt CO_2e) in 2004, including agriculture (38%), energy (37%), land-use, land-use change and forestry (LULUCF) (14%), waste (6%), and industrial processes (5%). In terms of energy sector emissions, Colombia ranked 48th in the world and fifth in Latin America in 2005, with 56 Mt (or 31% of total emissions) from fossil-fuel combustion, and a further 10 Mt from fugitive emissions and biomass combustion. The country's annual per capita GHG emissions from the energy sector are about 1.6 t CO_2e.

3. Colombia's energy mix is mostly based on oil, natural gas, coal, and hydropower with final energy consumption divided as follows: transport 39% (higher than the world average of 31%), industries 27%, households 22%, agriculture and mining 5%, and the commercial and public sector 5%. The remaining 1% is made up by the construction sector and other unidentified uses. Oil and oil products provide 45% of final energy consumption (mostly for the transport sector); natural gas 19% (mostly for the industrial sector); bioenergy 16% (mostly firewood and charcoal for the residential sector, but also bagasse and waste for industries, and biofuels for transport); electricity 16% (mostly in the residential and industrial sectors), and coal and coke the remaining 5%.

4. The transport sector represents 12% of the country's total CO_2e emissions in 2004, without considering the corresponding upstream emissions in the oil industry. Road transport (passenger and freight) accounts for about 90% of the sector's CO_2e emissions. Due to continued urbanization, and, more importantly, an accelerated rate of motorization, Colombia's vehicle fleet has nearly tripled in the last 15 years (1994-2009), increasing from 2 million to 5.9 million vehicles. While current motorization rate (130 vehicles per 1,000 people) in Colombia is low compared to similar middle-income countries in the region, trends indicate that the country's energy use in the transport sector will be approximately 80% higher in 2030, and that under a BAU scenario emissions would increase from 21.8 Mt CO_2e in 2004 to 39.2 Mt CO_2e in 2030.

5. Colombia's electricity sector is today relatively clean in terms of emissions: during the last decade an average of 78% of electricity generation was based on hydropower. Despite the sector's low average emission factor, a reduction in the total amount of energy demanded from the existing system (through efficiency measures, or through the generation of electricity from renewable energy sources) can have a significant emission reduction impact because the last marginal units of power utilized are often fossil-fuelled and have the highest emission factor. At the same time, this reduction in consumption can prevent or delay building new generation capacity which is currently slated to include a 150% increase in coal-fired capacity over the next 12 years, from the current 700 MW coal-fired generation capacity to 1,750 MW.

6. Therefore, while the economy of Colombia has become less carbon intensive during the last two decades, and currently stands at 0.43 kg CO_2 per US$ (compared to a Latin American average of 0.52 and a global average of 0.73) current socioeconomic and resource factors indicate the this trend is set to be reversed under a BAU scenario of increasing investment in transport and electricity generation characterized by higher carbon intensities. Given these challenges, the Government is developing a National Climate Change Policy, which it expects to launch for public consultation around March 8th, 2010. This policy document will include: (i) the conceptual policy framework and guidelines; (ii) strategies for sectoral, territorial, information and economic studies; (iii) institutional strengthening, including negotiating capacities plan, and (iv) general strategies of mitigation and adaptation. It will also include a policy implementation plan and the creation of a National Climate Change System, led by the National Planning Department and the Environmental Ministry, and which will include public regional and local levels, as well as community-based organizations, NGOs and private sector.

Rationale for Selected Sectors for CTF Co-financing

7. The proposed programs for CTF focus on scaling-up investment in low-carbon technologies that are readily available to Colombia today yet face primarily knowledge and financial as well as institutional barriers that must be overcome for scaled-up investment. They are selected for their potential to have a transformational impact on the sector, as well as, particularly in the case of transport, very strong demonstration and replication effects for other countries in the region.

8. *Sustainable Transport Systems*. In 2002 the GoC adopted the National Urban Transport Policy (PNTU) as a national policy for introduction of Integrated Mass Transit Systems (SITMs) and Strategic Public Transport Systems (SETPs) respectively for large cities (more than 600,000 inhabitants) and medium-sized cities (between 250,000 and 500,000 inhabitants). The goal of the PNTU is supporting the implementation of these systems as a means to provide competitive, efficient, affordable and safe mobility options for the urban population which, coordinated with a comprehensive land-use and regional planning strategy, can have the greatest development impacts. While the inherent nature and goals of such investments would help reduce GHG emissions, availability of CTF resources would allow the Government to include additional measures targeted at reduction of GHG emissions within these plans, so incorporating low-carbon technology options from the outset.

9. Utilizing CTF resources for integrating low-carbon technologies and measures into the Government's national urban transport policy, and accelerating these investments, presents a major opportunity for Colombia to demonstrate what it means to transform the transport sector onto a lower-carbon path. The CTF Transport Program will leverage and build upon existing loans and technical assistance from the MDBs, including IDB support for development of an integrated land-use and transport planning strategy for the city of Bogotá (with a focus on regulation of financial management of land-based instruments for the city and complementary land-use and zoning regulations that are required to induce transit-oriented development), and IBRD support to local authorities in the design and implementation of adequate policy and regulatory measures (e.g., TDM) in the other cities.

10. With the proposed CTF-financed activities to reduce costs and risks of investments that lead to fuller integration and optimization of the transport system, alongside scrapping programs and introduction of low-carbon buses, Bogotá will be the first city to adopt such measures at scale. As the TransMilenio has proved, this can provide a replicable model for other large cities in Colombia so accelerating a shift towards an integrated approach throughout Colombia's urban areas over time, and in particular in the other SITMs.

11. The GoC also wants to move forward now with measures for further reducing the emissions of investments associated with implementation of SETPs for seven medium-sized cities, as a model for a further five cities. As in the case of Bogotá's SITM (called Integrated Public Transport System, SITP), CTF-financed activities will be used to reduce the upfront costs and risks of infrastructure investments

that can have a significant impact on modal shift toward low-carbon modes of transport, as well as to support scrapping programs and the introduction of low-carbon bus technologies over time.

12. The transformative impact of the CTF Transport Program will be achieved through combining policy reform and institutional capacity development packages, alongside CTF co-financing aimed at reducing the cost of measures for reducing GHG emissions within urban transport investment plans. As the success of these approaches is demonstrated, there should be a further integration of low-carbon investments within the PNTU, ensuring that future plans and investments support low-carbon development of the sector. Over the 20-year lifetime of the Program investments, the cumulative reductions of the CTF investment program could be around 56 Mt CO_2e. Cost effectiveness of reductions is estimated at US$38.8/ton for the entire financing, or about US$1.8 of CTF resources/ton.

Indicators	Baseline	Investment Program Results
Implementation of integrated public transit systems	3 SITMs implemented	Bogotá's SITP fully implemented targeting a population of 7 million. SETPs implemented in seven cities, targeting a population of 2.4 million
Annual GHG emissions from the transport sector in target areas	21.8 Mt CO_2 per year	Annual emission at 19.0 Mt CO_2 per year, reflecting a 2.8 Mt CO_2e reduction per year. Cumulative (avoided) reductions of 56 Mt CO_2e by 2030 (112 Mt CO_2e by 2050) • Bogotá's SITP annual emission reductions of 2.0 Mt CO_2e • Seven SETPs annual emission reductions of 0.3 Mt CO_2e • Initial implementation of low-carbon bus technology in the SITP and SETPs contributing to additional reductions of 0.2 to 0.5 Mt CO_2 per year Additional reduction of 1.5 Mt CO2e per year is expected from replication and scale-up in SITMs (seven cities) and SETPs (12 cities)
Introduction of low-carbon bus technologies in the transit systems	Standard diesel buses	Bogotá's SITP and SETPs start initial implementation of an advanced hybrid fleet, or other low-carbon bus technologies
Modal shift from private vehicles to public transit systems	Increased ownership and use of private vehicles	Modal share of public transport grows or remains stable

13. *Energy efficiency*. According to recent studies, addressing efficiency potentials in electricity and thermal end-uses across all sectors of the economy would lead to combined emission reductions of 228 Mt CO_2e in a 20 year period, at an average net cost of negative 3.4 US$/t CO_2e, considering energy savings. The proposed CTF Efficiency Program will focus on certain relevant sectors chosen for their readiness, potential and adherence to CTF requirements.

14. Recognizing this potential, the Colombian government has implemented a variety of policy and regulatory measures to help set the stage for energy efficiency investments throughout the economy. These include creating a legal framework for efficiency and standard setting mechanisms, establishing a national efficiency commission, developing appliance efficiency standards, carrying out extensive studies on carbon abatement, and developing a national plan for energy efficiency. Now, the Colombian government is considering the establishment of a fund that will specifically target efficiency barriers in the residential sector, and as part of the CTF Efficiency Program, will also study regulatory changes to create better market incentives for energy savings. Important momentum and awareness amongst private industry stakeholders has been created through incipient programs, such as lending initiatives and training programs, but so far these have been unsuccessful in reaching the scale and depth necessary to create an efficient and self-sustaining market for efficiency.

15. Despite this existing platform, substantial barriers exist in the Colombian market that impede the potential for scaled-up implementation of energy efficiency technologies and processes. Due to the minimal energy efficiency investment undertaken to date there is a lack of experience across the economy, scant information about models in other countries, and also poor information flow between market players. Inexperience in the financial sector has led to difficulty in assessing and structuring investments, and an inflated risk perception, leading to a reticence in providing new efficiency finance. In addition to this lack of credit, end-users face informational barriers that prevent them from making an informed efficiency investment decision including being unaware of the benefits, technological components and steps required to execute relevant measures. Adequate availability of trained technicians, cohesive national programs and optimal regulation are also lacking in the market.

16. The CTF Efficiency Program will mobilize the private sector and complement public sector actions already taken and planned. CTF resources, through both private and public sector activities, will help overcome knowledge, financial, and regulatory barriers by providing advisory assistance, investment support, and performance-based incentives. Efforts will focus on the key stakeholders in this market: financial intermediaries, distribution companies, end-users in the industrial, commercial and residential sectors, technician-agents, and government. Financial sector programs will focus on technical assistance and training, targeted to include capacity building and knowledge sharing with other institutions that have developed efficiency lending programs, as well as support in creating appropriate financial models and lending tools for these investments. The financing barrier will also be addressed with direct financial assistance and guarantees to banks, helping mitigate their risk perceptions, and allowing them to build a track record in the sector. The knowledge barrier amongst end-users (who create demand for the efficiency investments) can be addressed by scaled-up efficiency training programs that educate consumers directly regarding the benefits and criteria of efficiency investments. Program components would include efficiency walkthroughs and audits, and performance-based incentive programs for consumers. The program will also train the technicians that implement equipment measures, and industry groups, which will in turn educate consumers. CTF or other resources will also be used to support the government planning and help it create the market conditions whereby a robust energy efficiency industry can take root. Such resources can assist in strengthening the institutional frameworks of public entities, impart best practices in efficiency regulation, and help the government examine options for aligning regulatory incentives with efficiency objectives.

17. Existing programs have been successful in demonstrating the potential of certain similar initiatives, but are currently too small and balkanized to catalyze a robust and sustainable efficiency market. CTF resources are needed to launch a coordinated effort which will require significant financial resources and know-how that are not currently mobilized in the market. These resources will be executed through public and private sector financial and other intermediaries, in order to enable these entities to gain practical experience and jump-start the development and deployment of appropriate financial instruments. This methodology will unlock latent financial resources which are currently constrained by risk perceptions.

18. Based on the mitigation costs in the sectors targeted, this program would save 31.9 Mt CO_2e over a 20 year period, out of a national potential of at least 67.1 Mt in those sectors, and with a total program cost of US$670 million, leveraging US$50 million of CTF funding. The cost of abatement through this program is therefore US$21.0/Mt CO_2e. This figure includes the investment required for these measures as well as corresponding programmatic and transaction costs. Besides the abatement of carbon, Colombian stakeholders can also be expected to experience significant cobenefits including cost savings and greater economic efficiency.

Indicators	Baseline	CTF Efficiency Program Results
National electricity consumption	117,000 GWh per year (2030)	112,000 GWh per year (2030)
GHG emissions from electricity generation	36 Mton CO_2e per year (2030)	34.4 Mton CO_2e per year (2030)

Financing Plan and Instruments

19. This IP aims at developing an adequate financial package from various available sources, including multilateral, public and private financial institutions as well as carbon finance, to leverage enough resources to achieve the plan's ambitious objective. While the current uncertainty toward a post-2012 framework over the shape of carbon market mechanisms and carbon prices adds significant risks for carbon revenues in the long term, it is nonetheless important that Colombia focus attention on where carbon financing opportunities may exist.

20. It must be noted that carbon revenues, if obtained, would only be made available to the project annually, starting after the first year of project implementation, and only once actual GHG emission reductions have been measured and verified (huge verification bottlenecks are currently delaying annual payments and affecting the financing structure of other large-scale transactions). These risks mean that project developers may, and often do, discount carbon revenues when making investment decisions. As a result CTF funding, structured appropriately, would still be required for projects that are expected to receive carbon revenues, both in situations when (i) carbon revenues are not sufficient to make the project feasible, and (ii) when the risks of receiving such revenues is perceived to be excessively high so as to prevent a project from taking place.

Indicative Financial Plan (US$ million)

Financing Source	Sustainable transport systems (annex 1)	Energy efficiency (annex 2)	TOTAL
CTF executed by IDB	60.0	32.5	**92.5**
CTF executed by IBRD	40.0	--	**40.0**
CTF executed by IFC	--	17.5	**17.5**
CTF total	**100.0**	**50.0**	**150.0**
IDB loans	400.0	130.0	**530.0**
IBRD loans	100.0	--	**100.0**
IFC loans	--	90.0	**90.0**
IDB grants	5.8	--	**5.8**
IBRD grants	--	--	**--**
KfW	--	70.0	**70.0**
Carbon finance	30.0	--	**30.0**
Other	--	--	**--**
GoC	340.0	40.0	**380.0**
Bogotá DC	150.0	--	**150.0**
Municipalities	240.0	--	**240.0**
Private sector	960.0	290.0	**1060.0**
TOTAL	***2325.8***	***670.0***	***2995.8***

INTRODUCTION

21. The Clean Technology Fund (CTF) Colombia Investment Plan (IP) is a "business plan" owned by the Government of Colombia (GoC), and prepared in cooperation with the International Bank for Reconstruction and Development (IBRD), the Inter-American Development Bank (IDB) and the International Finance Corporation (IFC), in order to provide support for the low-carbon objectives contained in Colombia's National Development Plan. This business plan identifies the programs that are proposed to be co-financed by the CTF jointly with the IBRD, IDB and IFC. The IP will be presented to the CTF Trust Fund Committee in March, 2010.

22. The IP is presented as a two-phase process. The first phase addresses the implementation of abatement measures in two key sectors - energy efficiency and urban transport -, which have been identified as ready for the scaling-up of investment through use of CTF resources, and as exhibiting high potential for transformational change in terms of shifting investment patterns onto a lower carbon path. It is proposed that, as the Government takes further steps toward creating an enabling environment for renewable energy, there would be opportunities for investing in this sector as part of a possible second phase of the IP, which could include as well further programs on energy efficiency and transport.

23. The IP is considered a dynamic document, with the flexibility to accommodate changing circumstances and new opportunities. Such flexibility is particularly important during the current period of uncertainty associated with a severe global economic and financial context. It is expected that the programs presented in the annexes will be described in further detail in the coming months.

COUNTRY AND SECTOR CONTEXTS

24. Colombia emitted 180 million tons (or Teragrams) of carbon dioxide equivalent (Mt CO_2e) in 2004, including all sectors. Colombia's CO_2 emissions have been growing steadily over the past 14 years (see Figure 1). The sources of Colombia's total GHG emissions are agriculture (38%), energy (37%), land-use, land-use change and forestry (LULUCF) (14%), waste (6%), and industrial processes (5%). Colombia ranked as the 48th country in the world, and fifth in Latin America in 2005, in terms of its energy sector emissions (66 Mt CO_2e).[1] A disaggregation of these emissions shows that 56 Mt (or 31% of total emissions) come from fossil-fuel combustion, and the other 10 Mt from fugitive emissions and biomass combustion. Fossil fuel emissions can be further disaggregated into transport (12.1% of total emissions), energy industries (8.5%), manufacturing and construction (7.3%), and other sectors (3.4%) (see Figure 2). The country's annual per capita GHG emissions from the energy sector are about 1.6 t CO_2e.

25. Colombia's energy mix is mostly based on oil, natural gas, coal, and hydropower (see Figure 3), with a relatively small share of other renewable energy sources (mostly bagasse, firewood, and biofuels). Final energy consumption (see Figure 4) is divided as follows: transport 39% (higher than the world average of 31%), industries 27%, households 22%, agriculture and mining 5%, and the commercial and public sector 5%. The remaining 1% is made up by the construction sector and other unidentified uses.[2]

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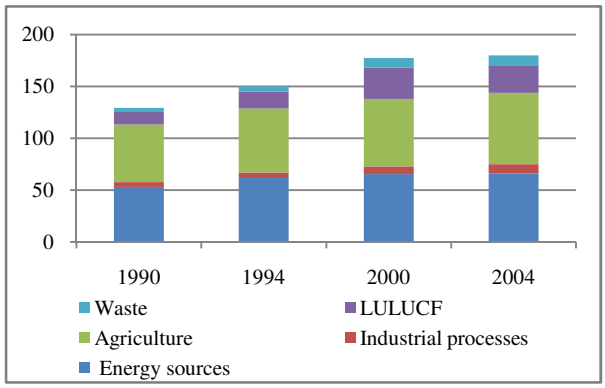
[1] The first four countries are Mexico, Brazil, Venezuela, and Argentina. Colombia ranks 40th in the world, and 6th in Latin America in terms of total emissions. Total annual per capita emissions are 4.2 t CO_2e. Sources: emission data from Colombia's 2004 GHG Inventory. Rankings from the Climate Analysis Indicators Tool (cait.wri.org) for 2005.

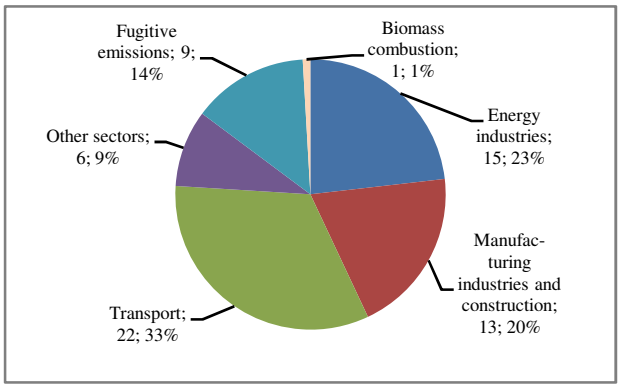
[2] 2008 data from UPME, Energy balances, tiny.cc/BalEnCol.

Figure 1: Colombia's CO_2e emissions 1990-2004 by source (Mt)



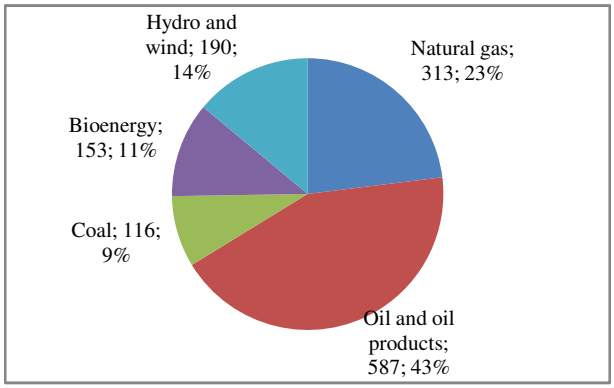
Source: Cabrera, M., *et al.*, 2009. *Visión general del inventario nacional de emisiones de gases de efecto invernadero*. IDEAM.

Figure 2: Colombia's CO_2e emissions from energy sources, 2004 (Mt)



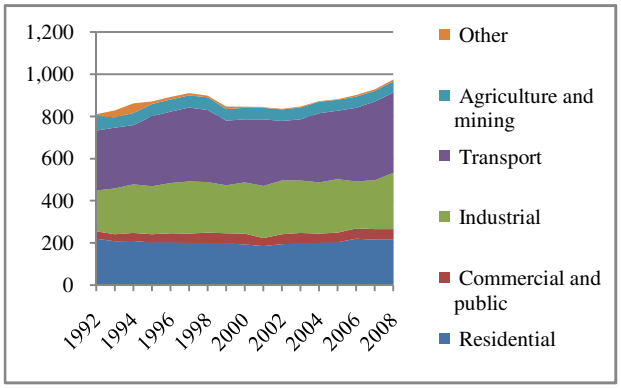
Source: Cabrera *et al.*, 2009.

Figure 3: Colombia's primary energy supply by energy source, 2008 (PJ)



Source: Adapted from UPME, Energy balances, tiny.cc/BalEnCol

Figure 4: Colombia's final energy consumption sectors, 1992-2008 (PJ)



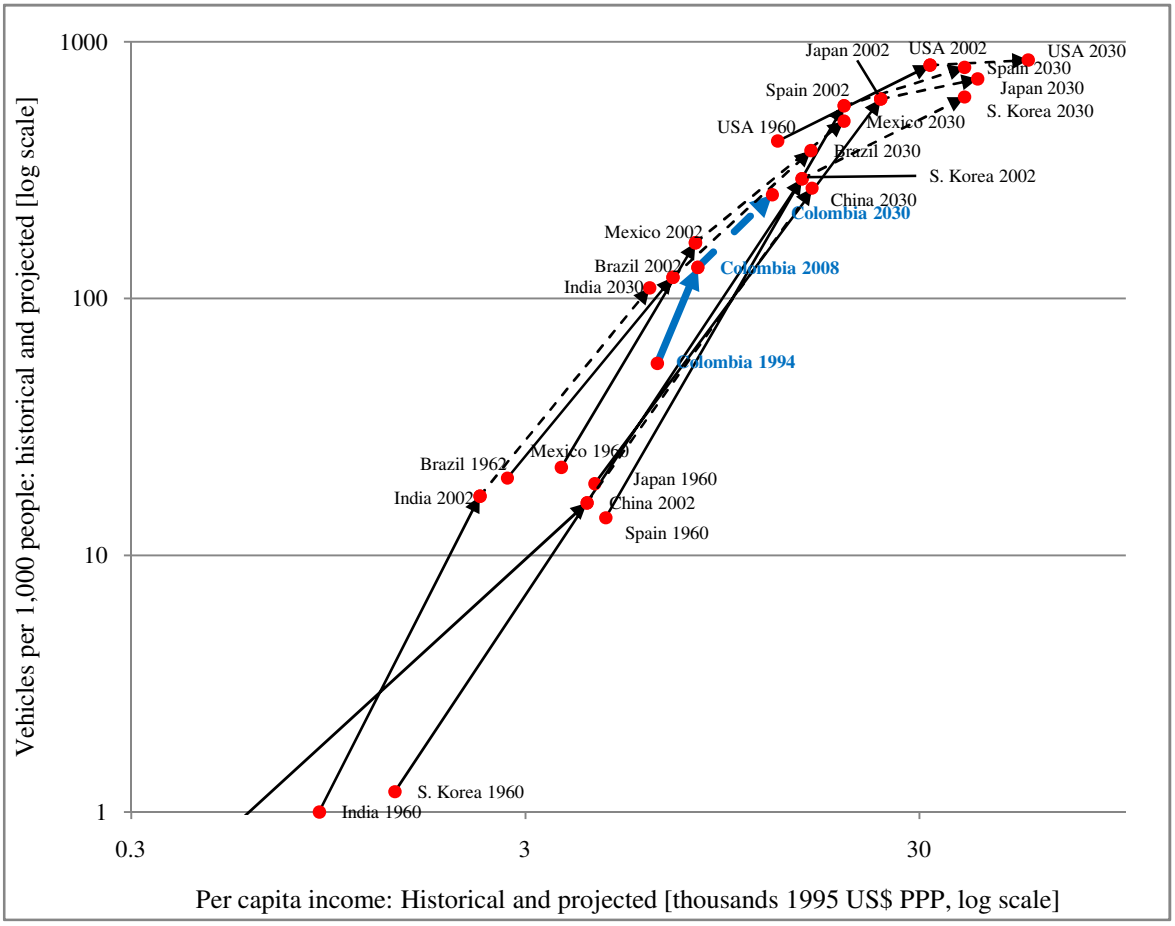
Source: UPME, Energy balances, tiny.cc/BalEnCol.

26. Oil and oil products provide 45% of final energy consumption (mostly for the transport sector); natural gas 19% (mostly for the industrial sector); bioenergy 16% (mostly firewood and charcoal for the residential sector, but also bagasse and waste for industries, and biofuels for transport); electricity 16% (mostly in the residential and industrial sectors), and coal and coke the remaining 5% (for the industrial sector) (see Figure 6).

27. The transport sector represents 12% of the country's total CO_2e emissions, without considering the corresponding upstream emissions in the oil industry. Road transport (passenger and freight) accounts for about 90% of the sector's CO_2e emissions. Energy use in the transport sector diminished at the turn of the millennium (see Figure 4) due to the implementation in Bogotá in 1998 of the *Pico y Placa* license plate-based vehicle restriction system, whereby each day 40% of the cars were banned to circulate within the city during rush hours. Since 2009 the ban is applied for the whole day. In the last decade other six large cities in Colombia have implemented similar restrictions (Medellín, Bucaramanga, Cali, Barranquilla, Cartagena, and Pasto). Since, 2005, however, as an increasing number of households get additional vehicles, the effect of *Pico y Placa* has diminished. As a result, transport has become again the fastest-growing sector in terms of both its energy consumption (see Figure 4) and the corresponding emissions.

The main drivers for this growth are continued urbanization,[3] and, most importantly, an accelerated motorization rate. Colombia's vehicle fleet has nearly tripled in the last 15 years (1994-2009), increasing from 2 million to 5.9 million vehicles.[4] The current motorization rate (130 vehicles per 1,000 people) in Colombia is low compared to similar middle-income countries in the region. Bogotá's vehicle fleet increased 14% in 2008, while in small and medium-size cities there is a particular concern regarding the growth of motorcycles (25% increased nationwide in 2008 alone). This has led to a substantial reduction in the transit ridership share in some cities. Over the next 20 years, Colombia's motorization rate is expected to continue to increase, consistent with the worldwide trend in vehicle ownership and use (see Figure 5), which is highly correlated with increases in per capita income, declines in the inflation-adjusted cost of vehicles, and easier access to credit.

Figure 5: Motor vehicle ownership trends in selected countries



Source: Adapted from Dargay, J., D. Gately, and M. Sommer. 2007. *Vehicle Ownership and Income Growth, Worldwide: 1960–2030*. tinyurl.com/voigww.

28. Colombia's electricity sector is today relatively clean in terms of emissions: during the last decade an average of 78% of electricity generation was based on hydropower (see Figure 7). Despite the sector's low average emission factor, a reduction in the total amount of energy demanded from the existing system

[3] It is estimated that 36 million (78.5% of total population) live in urban centers in 2010, and this number is forecasted to climb to 48 million (83.5% of the total) in 2030 (ECLAC, 2009. *Statistical Yearbook for Latin America and the Caribbean 2009*, tiny.cc/sylac9. See also: Ideam, *Indicadores socio-económicos*, www.ideam.gov.co.

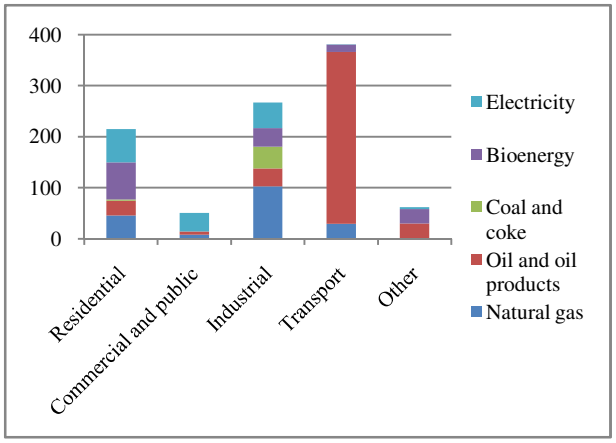
[4] Data from Ministerio de Transporte, 2009, *Estadísticas del parque automotor* (http://tiny.cc/esttr).

(through efficiency measures, or through the generation of electricity from renewable energy sources) can have a significant emission reduction impact because of the following two reasons.

a) In the Colombian power matrix, the last MWh dispatched (marginal unit of power) is often fossil-fuel powered and has the highest emission factor. By consuming less power, these emissions are avoided. The average emission factor of the last unit dispatched, or the 'operating margin', is approximately 0.33 tCO_2e/MWh,[5] and

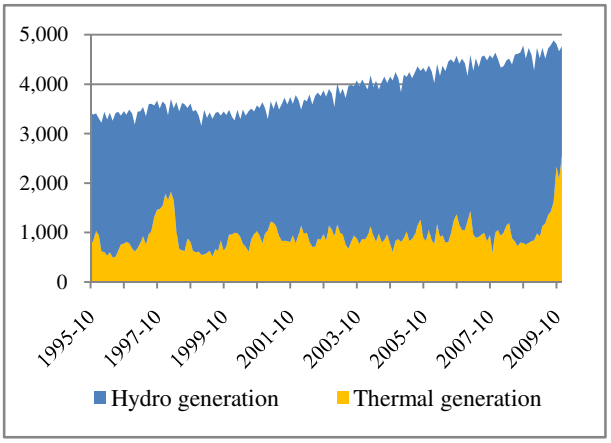
b) Reducing demand also prevents or delays building new generation capacity. In the case of Colombia, the current official power sector expansion plan foresees that 25% of the new capacity planned for the period 2009 to 2023 will be fossil fuel-fired, including a 150% increase in coal-fired capacity over the next 12 years, from the current 700 MW coal-fired generation capacity to 1,750 MW. The average emission factor for the new plants, or the 'build margin', is approximately 0.33 tCO_2e/MWh.[6]

Figure 6: Colombia's final energy consumption by sector and fuel, 2008 (PJ)



Source: UPME, Energy balances, tiny.cc/BalEnCol.

Figure 7: Colombia's electricity generation by source, 1995-2009 (GWh per month)



Source: UPME. *Sistema de Información Minero Energético Colombiano.* tiny.cc/simec.

29. Because the country is expected to continue to grow robustly after the current financial crisis, significant new power generation capacity will be needed. The GoC has stated the risk that the future revisions of the expansion plan will lead to an increasing share of coal-fired generation capacity, for two reasons: firstly, Colombia has abundant reserves of coal,[7] and secondly, the country must diversify away from hydropower due to its high vulnerability to water shortages linked to El Niño events.[8] These events

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5 This figure corresponds to the period of August to December 2006. Source; Empresas Públicas de Medellín, 2008, *Jepirachi Wind Power Project. Monitoring Report Number 2*. tiny.cc/Jepir2. Coto (2005) suggests a much higher value of 0.66 tCO_2e/MWh in the period 1995-2003. Source: Coto, O. 2005. *Metodologías y Proyectos de Pequeña Escala en el MDL*. CATIE. tiny.cc/Coto2005.

6 *Ibid.*

7 Colombia is the sixth largest coal producer in the world, and the fourth exporter. At the current production rate, coal reserves would last 120 years.

8 With a view to save water in hydropower dams and face the 2009-2010 El Niño during the first quarter of 2010, the share of thermal generation has reached a record level of 60% in the last days of 2009, as compared to its normal share of 30%. See XM, 2009. *Boletín Energético del 21 al 27 de Diciembre.* tinyurl.com/BolEnXM. See also the press release of December 23rd in: tinyurl.com/Bol091223. The impact of El Niño Southern Oscillation events on the Colombian power system is shown by the peaks in thermal generation in 1997/98 and 2009/10 in Figure 7, which are due to El Nino-caused droughts in those years.

are expected to increase in strength and frequency in coming years due to climate change.[9] Thus, without efforts now to promote low-carbon electricity generation or end-use energy efficiency investments that can either defer or substitute new investment in coal-fired electricity generation capacity, Colombia's future development will be characterized by a higher carbon growth path than it currently has.

30. Therefore, under a business as usual (BAU) scenario (following Colombia's historical trend and consistent with the pattern of motorization growth worldwide), the country's transport energy use in 2030 will be approximately 80% higher than in 2004, increasing at a rate of about 3% per year.[10] In terms of total GHG emissions from the transport sector, the BAU scenario might represent an increase from 21.8 Mt CO_2e in 2004 to 39.2 Mt CO_2e in 2030.

31. While the economy of Colombia has become less carbon intensive during the last two decades, and currently stands at 0.43 kg CO_2 per US$ (including only energy sector emissions), as compared to a Latin American average of 0.52 and a global average of 0.73,[11] current socioeconomic and resource factors indicate that this trend is set to be reversed, as Colombia embarks on a higher carbon development path with higher carbon intensities characterizing future investment in the transport and electricity generation sectors.

32. In consideration of these challenges, the Government is developing a National Climate Change Policy, which it expects to launch for public consultation around March 8th, 2010. In this context, this CTF IP, and resources that it will leverage for the implementation of programs for scaling-up investment in sustainable transport within the context of the national urban transport plan, and for stimulating scaled-up investment in energy efficiency measures, are particularly timely. In a context of impending higher carbon emissions, this IP proposes a proactive strategy for accelerating investments that can prevent a move onto a higher-carbon path of development.

PRIORITY SECTORS FOR GHG ABATEMENT MEASURES

33. Analyses carried out by the Energy and Mining Planning Unit (UPME), as well as several studies carried out by consultancies or academic institutions, provide a preliminary indication of the mitigation opportunities and cost-effective abatement measures that exist in the most relevant sectors. These include the following:

- The recent study[12] carried out by *Universidad de los Andes* (Uniandes) for EMGESA (a public-private utility), which identified a set of 16 mitigation interventions in different sectors of the economy (see Figure 8). This study carries out an economic analysis of these interventions, without factoring in the costs for implementing the programs.
- The consultancy for the strategic definition of the plan for energy efficiency and non-conventional energy sources, carried out by *Fundación Bariloche* and *BRP Ingenieros* for UPME.[13]

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[9] Ashok, K. and T. Yamagata, 2009. Climate change: The El Niño with a difference. In: *Nature 461*, 481-484 (24 September 2009) | doi:10.1038/461481a.

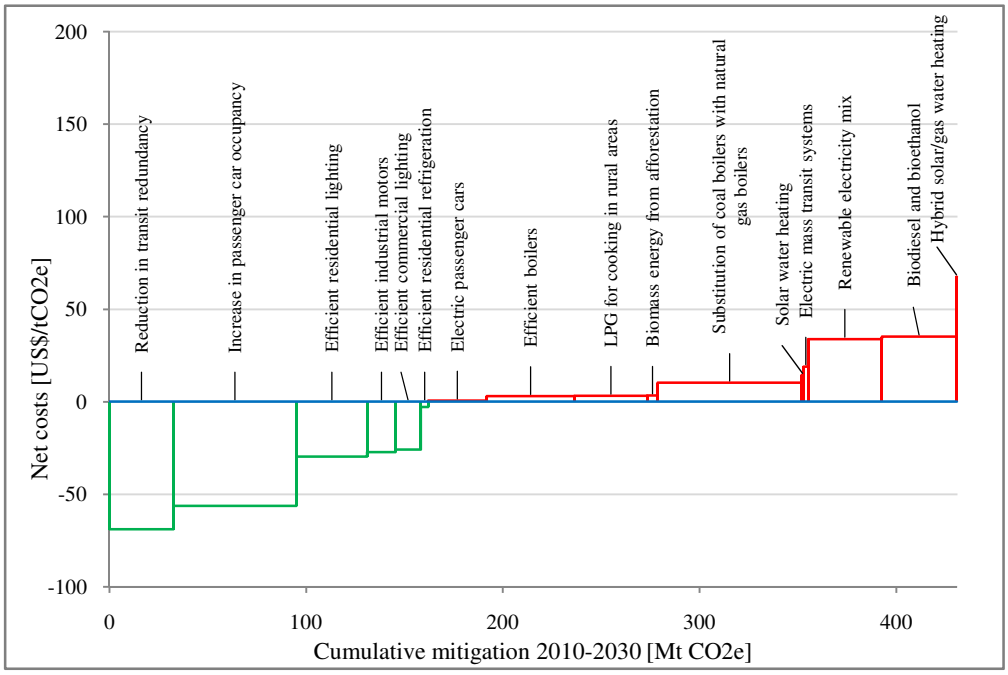
[10] Worldwide, it is estimated that around 75% of the projected increase in oil demand by 2030 will come from the transport sector (IEA, *2008 World Energy Outlook*).

[11] US$ of year 2000, exchange rate parities. Using power purchase parities, the figures are 0.14, 0.27 and 0.47, respectively. Data from: IEA, 2009, *Key World Energy Statistics*.

[12] Cadena, A.I., *et al.*, 2008. Colombia: *Diagnóstico, perspectivas y lineamientos para definir estrategias posibles ante el Cambio Climático*. Emgesa, Codensa, Universidad de los Andes.

[13] Consorcio Bariloche – BRP Ingenieros. 2007. Consultoría para la formulación estratégica del Plan de Uso Racional de Energía y de Fuentes No Convencionales de Energía 2007 – 2025. tiny.cc/urefb.

Figure 8: Marginal abatement cost curve from the Uniandes study



Source: Based on data from Uniandes (Cadena *et al.*, 2008).

34. These studies, as well as other studies carried out with a global scope or in countries with similar circumstances,[14] consistently identify the main areas of opportunity for GHG mitigation:

35. *Transport* stands out as one of the main areas of opportunity for emission reductions. The Uniandes study (see Figure 8 above) suggests that interventions that seek to develop *sustainable transport systems* have the lowest costs and the highest mitigation potentials: a reduction in transit redundancy (oversupply of bus fleet), along with the optimization and rationalization of transit routes and services and a higher vehicle occupation in transit and cars (or by modal shift from cars to public transit), could reduce 95 Mt CO_2e of emissions in the course of a 20 year period, at an average cost of negative 61 US$/t CO_2e (net costs appear as negative because program costs are not accounted for). Additional mitigation opportunities (32 Mt CO_2e of cumulative emission reductions) are identified by this study in the area of technological change (electric vehicles), albeit at higher mitigation costs.

36. Relevant opportunities for the introduction of *energy efficiency* technologies and processes exist in all sectors of the economy. The Uniandes study identified opportunities in residential and commercial lighting, residential refrigeration, residential cooking in rural areas, solar water heating, industrial motors, and industrial boilers, that would lead to combined emission reductions of 228 Mt CO_2e in the course of a 20 year period, at an average net cost of negative 3.4 US$/t CO_2e (see Figure 8 above).

37. *Renewable energy* development is a third main abatement category in Colombia, with significant potential. According to the Uniandes study, 37.5 Mt CO_2e of emission reductions could be achieved during a 20 year period by the implementation of a renewable electricity mix (see Figure 8 above), at an average cost of 34 US$/t$CO_2$e. The proposed mix includes both low-cost and high-cost technologies (35% wind, 25% geothermal, 30% small hydro, 5% photovoltaic and 5% sugarcane bagasse-fired generation), which means that in this study's results the more expensive renewable energy technologies, and in particular photovoltaic electricity, "pull" other cheaper technologies to higher abatement costs when seen

[14] See for example Johnson, T.M. *et al.*, 2009. *Low-Carbon Development for Mexico*. World Bank. http://tiny.cc/lcdmex.

as a mix. Thus, a disaggregation of this mix would show lower mitigation cost figures for lower-cost technologies. Despite the high potential and the economic feasibility of renewable energy, the current regulatory environment makes its viability difficult. The GoC has stated its willingness to remove the relevant barriers, and the MDBs are providing technical assistance to this end. A renewable energy program may be included in a potential future second phase of the CTF investment plan to be submitted to the Trust Fund Committee[15] when the requisite reforms in the sector have taken place that would make it more investment-ready.

38. Finally, there are important low-carbon opportunities in the *agriculture, forestry and land-use change sectors* in Colombia, which include reducing deforestation and forest degradation; implementing afforestation, reforestation and restoration activities; improving agriculture and livestock raising techniques, and producing liquid, solid and gaseous biofuels. Despite their relevance in the Colombian context, the abatement opportunities in the agriculture and LULUCF sectors currently fall outside the scope of the CTF and are therefore not considered further in this IP.

39. Further efforts are under way to conduct a systematic assessment of the cost-effectiveness of mitigation opportunities across various economic sectors of Colombia, which will be used in the detailed design of priority programs. Of note are the IDB-supported GoC's Economics of Climate Change Study, an IDB Policy-Based Loan to support the preparation of the National Climate Change Policy, and a GEF financed Technology Needs Assessment, based on guidelines defined by UNFCCC,[16] and currently being prepared by the National Planning Department (DNP) with IDB's support. For the transport sector, the IDB is also financing a number of specific technical cooperation studies to assess the mitigation potential and the cost-effectiveness of sustainable, low-carbon transport interventions. These will become available in the coming months and will provide necessary data for the detailed preparation of the Investment Program and the specific investment projects outlined in Annex 1.

RATIONALE FOR SELECTED SECTORS FOR CTF CO-FINANCING

40. This section of the IP outlines the reasons for selecting the emission reduction opportunities presented to the CTF in the two priority sectors that have been chosen for this IP, namely sustainable transport systems and energy efficiency.[17] These two sectors have been chosen for their carbon abatement cost-effectiveness, as demonstrated by current data, as well as sectoral readiness, implementation potential, and eligibility for CTF funding.

41. The selected opportunities for CTF co-financing presented here are the result of several months of discussions between the GoC and the IDB, IBRD and IFC, and build on years of development experience and policy dialogue among these institutions. The choice of programs within this IP reflects a combination of the GoC's priorities and sector implementation readiness, alongside the areas where the Government is seeking to strengthen engagement with the MDBs in line with priorities established by the CTF.

42. The programs proposed for CTF financing focus on scaling-up investment in low-carbon technologies that are readily available to Colombia today yet face primarily knowledge and financial as well as regulatory barriers that must be overcome for scaled-up investment. Programs envisaged here are designed to maximize the use of concessional finance from the CTF, by leveraging both co-financing and technical cooperation from the MDBs and other domestic, bilateral and multilateral sources. They are

[15] Subject to availability of resources.

[16] UNFCCC. 2009. *Handbook for Conducting Technology Needs Assessment for Climate Change*. tinyurl.com/hbTNACC.

[17] The opportunities in renewable energy, as well as in agriculture and in LULUCF are not included in this IP. See §37 and 38.

selected for their potential to have a transformational impact on the sector and shift future investment trends towards a low-carbon path in the priority sectors.

Sustainable Transport Systems

43. The Uniandes study produced 'negative mitigation costs' for sustainable transport interventions (see Figure 8 above). These apparently negative mitigation costs do not indicate that such measures are cost-free or that they could be implemented without external resources. In reality the most effective low-carbon interventions in the transport sector - i.e. those implying modal shifts - face a number of cultural, institutional, policy and financial barriers that can only be overcome through well-designed sectoral strategies and availability of public sector resources.

44. The GoC and local governments know these barriers well. Despite their exemplary track record in the last decade with innovative solutions aimed at keeping public transport modes competitive and affordable, transport is the fastest-growing sector in terms of its GHG emissions produced by the combustion of fossil fuels. Urban transport systems are also generating significant negative externalities in terms of congestion, air quality and safety. A truly low-carbon path towards sustainable transport systems in Colombia will ultimately depend on the rate of investment in sustainable urban transport (and freight logistics) investments *vis-à-vis* the current trend of increasing motorization rates and declining share of public transport use. It will require a rapid scaling-up of investments to reinforce and replicate the type of actions that GoC and the cities have been undertaking in the last decade. One of the country's most valuable assets for sustainable transport, which is worthwhile preserving, is the existing high modal share of public and non-motorized transport in most cities.[18]

45. Seeking to improve and modernize the urban transport systems, and provide tailor-made solutions for the most important urban centers, the GoC created the National Urban Transport Policy (PNTU)[19]. Through this national policy, large cities (more than 600,000 inhabitants) and medium-sized cities (between 250,000 and 500,000 inhabitants) are proposed to benefit from the implementation of Integrated Mass Transit Systems (SITMs) and Strategic Public Transport Systems (SETPs), respectively. The goal of the PNTU consists of supporting the implementation of these systems as a means to provide competitive, efficient, affordable and safe mobility options for the urban population, coordinated with a comprehensive land-use and regional planning strategy. Under this policy framework, the GoC signals intention to provide financial and institutional capacity building incentives to implement integrated urban transport systems, which are prioritized to have the greatest development impacts. The nature and goals of such investments, as identified within the current GoC's National Development Plan (PND 2006-2010)[20] would help reduce GHG emissions while also improving air-quality.

46. For the SITMs the GoC has so far invested about US$ 1 billion since the program began in 2000, and expects to invest more than US$ 1.7 billion by 2016. The goal of the GoC for the SITMs, stated in the PND 2006-2010, is to capture between 50% and 90% of the total trips in public transport, maintaining or increasing the total mode share of public transport in these cities.[21] The main focus of SITMs has been on implementing Bus Rapid Transit (BRT) corridors.

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[18] In large and medium-sized cities the average mode share of public and non motorized transport is 65% of the total trips (IDB's estimation based on CONPES documents).

[19] National Policy for Improving the Urban Public Transport Service (CONPES 3167, May 2002) and the National Urban Transport Policy (CONPES 3260, December 2003). Departamento Nacional de Planeación (www.dnp.gov.co)

[20] The PND goal for 2016 is to implement eight SITMs (in large cities) and twelve SETPs (in medium-sized cities). DNP. *Plan Nacional de Desarrollo 2006-2010. Estado comunitario: desarrollo para todos*. p. 206. tiny.cc/pnd2010.

[21] There are eight SITMs in operation and under construction. Bogotá (SITP), Pereira and Cali are operating, and Barranquilla, Bucaramanga, Cartagena, Cucuta and Medellín (Valle de Aburra) are under construction.

47. Generally, BRT projects usually lead to improvements in the public transport system by encouraging investment in transit-dedicated infrastructure such as segregated busways, boarding stations, interchange terminals, fare collection systems and high-capacity buses. Such infrastructure investments have tended to also be accompanied by improvements in public sector organizational and regulatory structures for further modernization of the transport sector. As a result, transit users benefit from a better transport service, manifested in shorter travel times, safer environments and cleaner air. The most successful and heralded of these initiatives is Bogotá's TransMilenio system, which has been able to abate 0.25 Mt CO_2e per year (certified emissions), being one of four CDM transport-related projects in Colombia, but currently the only one that has been certified.[22] These four CDM transport-related projects are expected to abate a total of 0.55 Mt CO_2e per year.[23] Despite the relative success of the initial implementation of TransMilenio in 2000[24] (25 years after Curitiba's pioneer system was inaugurated), Bogotá has only managed to extend its BRT network to 84km, serving just 26% of the public transport trips within the city.[25]

48. BRT corridors have not necessarily included investments for integration and optimization of the whole transit network in these cities. However, the SITM for Bogotá, called Integrated Public Transport System (SITP), has been identified as the first transport system that could become a fully-integrated transit system. To achieve implementation of the SITP, financial barriers will need to be overcome through support for new public investment in infrastructure. This can provide a replicable model for the SITMs in other large cities.

49. In medium-size cities, investment in SETPs has been identified as a priority in the PNTU (2003) and PND 2006-2010, however these have been delayed.[26] This delay has come at a cost. Even though the share of public transit and non-motorized transport still represents the majority of the total trips in medium-sized cities,[27] the motorization rate is growing rapidly, particularly for motorcycles (25% increased nationwide in 2008). The public transit systems in these cities are becoming less competitive compared to private motorization, and there is already evidence of substantial reductions in transit ridership for some of the medium-sized cities (e.g., Sincelejo). In view of the population growth and rapid motorization rates in the medium-sized cities, the GoC recognizes the need to accelerate the PND's commitment towards investment for implementation of the SETPs, which are still at the planning stage.[28] SETPs are expected to address the public transport challenges of medium-sized cities by providing the necessary investments in infrastructure, technology, and regulatory incentives, anticipating the transport-related problems for future growth.

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[22] The other CDM projects are for the SITMs in operation (BRT systems): Cali's MIO and Pereira's Megabus, and a project that involves an aerial cable car in Medellín integrated to the Metro system (Metrocable).

[23] UNEP/Risø, 2009.

[24] After TransMilenio's experience, several cities in the world started to replicate this BRT model: 48 BRT systems were operating by 2007 while at least 27 systems were in the planning and construction stages (Wright and Hook, 2007. *Bus Rapid Transit Planning Guide*, Institute for Transport and Development Policy, New York.)

[25] After completion of TransMilenio's third phase (20 kms, 2011), it is expected the system will capture 31% of the trips made by public transport.

[26] *Vision Colombia II Centenario 2019* (DNP, 2006) featured seven SETPs being implemented by 2010.

[27] Public transit (bus) represents around 30% of daily trips on average for the selected seven medium-sized cities. The mode share of cars and taxis is less relevant, 15% and 5% respectively. However, motorcycles and mototaxis are becoming much more prevalent in some cities. Non-motorized transport is still fundamental, with walking accounting for 20% to 50% of daily trips and biking between 6% and 18%.

[28] The SETPs include: Pasto, Neiva, Popayán, Valledupar, Manizales, Armenia, Sincelejo, Montería, Santa Marta, Villavicencio, Buenaventura and Ibague. Four of these cities already received initial support from the GoC, as stated in CONPES documents: Pasto (CONPES 3549, November 2008), Santa Marta (CONPES 3548, November 2008), Armenia (CONPES 3572, March 2008), Popayán (CONPES 3602, August 2009). CONPES documents for Sincelejo and Montería are expected to be approved in February, 2010. The CONPES document provides a formal approval of the GoC to assist and provide financial support to the projects.

50. Even though Colombia has been able to pioneer the development of urban transport projects within the CDM, the scope of this mechanism is limited. This limitation has to do in particular with the difficulties and high costs involved in turning carbon revenues into up-front financing, in addition to other drawbacks of the CDM (high transaction costs, lack of methodologies, volatility of carbon prices, etc.). Considering the relatively small value of the TransMilenio's CERs sold in the Kyoto market (about US$2 million in the 2006-2008 period, or US$0.7 million per year), even when a transit project is able to secure CDM resources, these play a marginal role in its financing needs.

51. In this framework, the GoC suggests utilizing CTF resources for including measures within these plans that will increase GHG reductions, as an opportunity for making these systems more sustainable and for incorporating low-carbon options from the outset.

52. *Priority Activities.* There is a major opportunity for Colombia to demonstrate to other countries how to deliver a scaled-up national sustainable transport system that results in lower GHG emissions. The policy framework is in place, and political commitment is strong. Yet, in order to achieve this at the national level, a number of identified barriers need to be overcome to avoid letting the existing rates of motorization outstrip current sustainability efforts. Key actions of the national sustainable transport strategy over the next years, with a transformational effect for moving the sector onto a low-carbon growth path, include:

a) Accelerating investment in integration and optimization of the Bogotá SITP (with the largest potential for GHG emissions reduction), which can be replicated in the SITMs of other large cities, and

b) Accelerating government investments in SETPs for at least seven (of the twelve) medium-sized cities, and prioritizing specific low-carbon technologies and measures into the SETP investment plans, so that these develop along a more sustainable path as they grow.

53. The CTF Transport Program will leverage loans and technical assistance from the IDB and IBRD, including support to local authorities in the design and implementation of adequate policy and regulatory measures (e.g., TDM) in the cities.[29] The CTF finance will be used to support measures for increasing GHG reductions within a wider package of support for maximizing modal shifts towards greater proportion of public and non-motorized transport. As such, CTF resources will increase the low carbon elements within the investment plans of the SITP and SETPs, making these systems more sustainable through the incorporation of low-carbon measures from the outset. Components to be integrated into these investment plans through the CTF Transport Program may include: investment in infrastructure for facilitating the physical integration among different transit modes in both types of systems to optimize public and non-motorized transport; support for transfer stations, improved public and bicycle lanes, and more accessible and integrated public spaces; consolidation of a scrapping program to eliminate the bus fleet displaced by these more optimized transit systems, and support for introduction of low-carbon bus technologies in the SITP[30] and SETPs structure over time.

54. Bogotá's SITP is the first project of its kind in Colombia, which, with use of CTF resources, will integrate the TransMilenio BRT system with the conventional bus system (municipal and inter-municipal), the bike network and, in the future, the first subway line and the commuter train.[31] This will

[29] The IDB and IBRD will continue to support local authorities through technical assistance (i.e., non-reimbursable technical cooperation operations) in the design and implementation of TDM and other support measures for the investment components.

[30] Although the tendering process for the SITP bus operation contracts is underway, and no low-carbon bus technologies were required in the technical specifications of the bidding documents, specific clauses were placed in the bidding documents to allow the introduction of low-carbon bus technologies in the future for the SITP.

[31] Both the subway and the commuter train are under planning stages, and their implementation is being studied by the GoC.

take place under a centralized fare collection system with hierarchical and streamlined routes and services, elimination of oversupply through scrapping of almost 9,000 old buses, at a cost estimated at US$300M, and promotion of the early retirement of vehicles. The Bogotá SITP investment plan includes additional BRT corridors, priority bus-lane corridors, transfer and interchange stations, access and parking areas, and depots. The SITP concept moves from a corridor approach (BRT corridors) to a holistic programmatic approach that is expected to transform the urban transport sector in the country, representing one of the most ambitious transit system restructuring challenges in the region.[32]

55. With the proposed CTF-financed activities, Bogotá will be the first city in Colombia to embark on this described path of integration and optimization. As the TransMilenio proved to be a model which was then replicated throughout the large cities in Colombia, so it is expected that Bogotá's experience will be a model for accelerating a shift towards an integrated approach throughout Colombia's urban areas over time, and in particular in the other SITMs.

56. The CTF Program will leverage Government and IDB finance for moving forward with a package of seven out of the 12 cities, which account for 5.4% of the total country's population (2.4 million inhabitants). Investments plans for SETPs have been drafted and included in the approved CONPES documents. However, the focus on GHG reductions in these CONPES is secondary to other priorities, and so the financing allocated to this purpose. The proposed CTF finance will be used to factor in low-carbon technologies and measures into the investment plans from the outset, ensuring GHG reductions are prioritized and that the rate of emissions growth typically associated with urban development is significantly reduced. IDB technical assistance will support policy and regulatory packages, alongside the investments in transit and urban infrastructure systems. CTF funding will therefore play a critical role in accelerating low-carbon investments both directly through implementation of SETPs for seven cities, and indirectly in a further five cities.

57. As these investments and technical assistance activities are rolled out, they will promote the further integration of low-carbon investments within the PNTU. Use of CTF resources for a Colombia Sustainable Transport Program, mainly through interventions in the urban transport systems (while recognizing complimentary MDB supported activities, for example in logistics) can therefore achieve large direct reductions of GHG emissions while also leading to much larger indirect reductions of emissions as a result of the transformational impact on the sector at the national level.

58. *Replication and scalability potential.* The implementation of Bogotá's SITP at the proposed scale can stimulate a second generation of urban transport systems in Colombia, both in the SITMs (of seven large cities) and in the SETPs (of 12 medium-sized cities). The proposed CTF co-financing for the Bogotá SITP and SETPs in seven cities will leverage local public funding and multilateral debt financing. The impact of the CTF investments will therefore have a replication effect on the SITMs of other large cities, as well as the SETPs of five other medium-sized cities. Successful integration of low-carbon measures into the initial implementation of these seven SETPs will positively influence the PNTU and encourage the Government to introduce similar measures into all urban investment plans in the future. The implementation of these measures will have a transformation effect on all new urban areas within Colombia expected to grow over the coming decades and subject to implement a sustainable urban transport system under the PNTU.

59. The CTF Transport Program would accelerate the current positive trends in investment in urban transport systems, and take this to the next level of sustainability through investment in low-carbon technologies that increase abatement of GHG emissions while maintain affordability, particularly for the

[32] Other comparable processes in Santiago, Chile, and São Paulo, Brazil have shown that citywide integrated transit systems require substantial infrastructure investments in order to provide an adequate level of service.

poor.[33] As the SITP and SETPs investments get underway, alongside the Government's national policy and plan, they would have a strong replication effect and so scalability of investment for all other large and medium-sized cities in the country. At the same time, the successful implementation of such a national program, whereby all current large cities, and the next generation of large cities are simultaneously shifting onto a low-carbon investment path, would demonstrate what it means to transform the transport sector at a national level. This would have wider replication impacts regionally within LAC[34] and internationally. Moreover, the introduction of low-carbon bus technologies in the SITP and SETPs has the potential of bringing down the costs of alternative technologies by providing incentives for manufacturers to produce and accelerate the introduction of clean and energy efficient transport technologies. The replication and scalability of these interventions will be enhanced with an additional and complementary IDB-financed program focusing on testing low-carbon bus technologies.

60. *Cumulative emission reductions*. According to available data, by 2030 sustainable, low-carbon transport strategies in Colombia could result in about 6 Mt CO_2e per year of abatement. Investments in mass transport (e.g., BRT) could reduce up to 0.3 Mt CO_2e per year per every million passengers carried per day, as shown by CDM methodologies implemented for Bogotá's BRT.[35] Just in Bogotá, the emissions reductions that would result from the SITP are estimated at 2 Mt CO_2e per year.[36] This project would serve a demand of 3.6 million passengers in the BRT network, in addition to modal shift expectations, by virtue of the optimized bus transit services, fare integration, and transport and land-use coordinated policies. Moreover, the seven SETPs are expected to abate up to 0.3 Mt CO_2e per year, serving an aggregate of one million passengers per day. [37] Emission reductions brought by the SITP and SETPs will come in part by optimizing and rationalizing bus transit services (with better technology), removing redundant vehicles (oversupply), and enabling fare and operational integration among different transit modes. However, a significant proportion of the total projected emission reductions in the long run (approximately 80%) will come from the avoided motorized trips (car and motorcycle) that would occur under a BAU scenario (projected motorization rate increase), but will have the potential to shift to low-carbon modes of transport if the SITP and SETPs are implemented. Optimizing mode shift towards low-carbon modes of transport has the largest potential to reduce GHG emissions in these urban areas. Along with the initial implementation of low-carbon technologies (e.g., hybrid or CNG buses), this financing is anticipated to result in a reduction of 2.5 to 2.8 Mt CO_2e per year. An additional reduction of 1.5 Mt CO_2e per year is expected from replication and scale-up in SITMs (seven cities) and SETPs (12 cities). Over the

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[33] The regional experience of Santiago (Transantiago) demonstrated that integrated transit systems require significant investments in infrastructure. Although several elements in the design and implementation strategy of Transantiago failed, the lack of adequate transit-dedicated infrastructure stands out as the main aspect for the suboptimal service operation and the large operational subsidies the Government of Chile has provided to the system.

[34] Only two cities in the region (Santiago and São Paulo) have built fully-integrated transit networks, and efforts were met with mixed results.

[35] Adjusted according to actual CDM results, and Grutter Consulting on behalf of CAF and TransMilenio S.A. Project Design Document (PDD CDM) BRT Bogotá, Colombia: TransMilenio Phase II to IV, Version 4.1, September 6th 2006 (approved).

[36] Preliminary results from modeling scenarios (40% reduction of CO_2e by 2020). Ongoing technical cooperation studies financed by the IDB: (i) SITP's detailed operational, financial and legal design (Logit-Logitrans); and (ii) integrated environmental strategies for a sustainable mobility of Bogotá (Uniandes).

[37] The estimate for GHG emission reductions in seven SETPs, applying the proxy of 0.6 Mt CO2e per year per every million passengers carried per day (CDM methodologies for BRT) can be overestimated since SETPs are not full BRT systems. However, that overestimation is corrected by assuming a 0.3 Mt CO_2e per year per every million passengers carried per day adjusting the CDM methodologies for BRT. Additionally, a large mode share for SETPs is projected to be achieved with respect to the current, relatively low, mode share of public transit in these medium-sized cities. The IDB is financing a technical assistance to estimate more rigorously the potential GHG emission reductions in the SETPs.

20-year lifetime of the investment the cumulative reductions of the CTF investment program could be around 56 Mt CO_2e.

61. *Development impact and other co-benefits*. Promoting more sustainable transport systems, such as those envisioned in the SITMs and SETPs, can provide substantial co-benefits in addition to climate change mitigation, including reductions in traffic congestion (from reduced travel time) and improvements in public health (from reduced air pollution, noise, accidents, sedentarism, and stress). Bogotá and other large cities that have implemented SITMs (Pereira and Cali) have demonstrated the potential to reduce exposure to airborne pollutants.[38] In Bogotá, the operation of TransMilenio has resulted in an 80% reduction in accidents along the BRT corridors, and a 3-10 decibels reduction in noise levels, as well as other development benefits.[39] The support for additional activities such as the scrapping of old buses prevents transferring these costs to the passengers, a critical aspect in a very elastic market, where any small change to the fares turns a number of passengers away from public transit. Low-income passengers are particularly vulnerable, since they risk turning to more polluting and dangerous modes of transport: motorcycles and old used private cars.

62. These sustainable urban transport systems have also provided additional social inclusion benefits as a result of more accessible transit services, more and better-used public spaces, and associated urban renewal. These factors bring benefits to both passengers and urban dwellers in the area of influence of the transit systems, as reflected by the consistent increase in the value of residential properties located near the stations of Bogotá's TransMilenio.[40] The development impact of these urban improvements is significant given that the target population is usually in the low and middle-income groups.

63. *Implementation potential.* In the larger cities, there is a strong and long track record of implementing SITMs among the national and local governments. Since 2005, the IBRD and the IDB have supported the implementation of SITMs by providing almost one billion dollars of investment loans.[41] While there will no doubt be significant implementation challenges in implementing SETPs in medium-size cities, the capacity already built in Colombia to address these challenges is significant. Technical and feasibility studies for Bogotá's SITP are almost completed and have been financed, in part, through IDB technical cooperation operations. The IDB is also supporting the development of an integrated land-use and transport planning strategy for the city, including the reformulation of the regulation that establishes the financial and management land-based instruments. Furthermore, design and feasibility studies for seven SETPs are under execution with IDB support.

64. *Additional costs/risks*. The additional upfront capital costs of incorporating low-carbon technologies within urban transport plans, which already require major capital outlays for the Government, pose a significant cost barrier to inclusion of such measures. A further key barrier for scaled-up investment relates to regulatory authorities that are typically weak and resistant to changes in existing practices, and even sometimes co-opted by the incumbent private operators. Such regulatory uncertainty poses considerable risks for private investors that may invest in low-carbon transport technologies. Overcoming these cost and institutional barriers will be the focus of the CTF Transport Program. CTF resources will be used to cover the incremental cost of measures that will optimize the SITP and SETPs. Furthermore, continued institutional strengthening will be provided to ensure implementation of well-designed policies

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[38] Reduction of 2.5 tPM/million pax; 18.1 tNO_X/million pax; and 0.3 tSO_2/million pax. (Grutter Consulting, 2006).

[39] See Chaparro, I., 2002. *Evaluación del impacto socioeconómico del transporte urbano en la ciudad de Bogotá. El caso del sistema de transporte masivo Transmilenio*. ECLAC. tiny.cc/LCL1786

[40] Rodriguez, D.A. and Targa, F. 2004. "Value of Accessibility to Bogotá's Bus Rapid Transit System," *Transport Reviews, Vol. 24*, Issue 5, pp. 587-610. Rodríguez, D.A. and Mojica, C.H. 2009. Capitalization of BRT network expansions effects into prices of non-expansion areas, *Transport Research Part A, Vol. 43*, Issue 5, pp. 561-575.

[41] The IBRD is supporting the SITMs through the *Integrated Mass Transit Project* which amounts to US$757 million for the cities of Bogotá, Bucaramanga, Barranquilla, Pereira, Cartagena and Medellín. Likewise, the IDB supports the BRT system in Cali through the *Cali Integrated Transport System Project,* which amounts to US$200 million.

for infrastructure investments, for optimizing the transport system, and for implementing an integrated land-use and transport.

65. The proposed CTF co-financing package is aimed at accelerating the adoption of sustainable, low-carbon investments in the sector in order to maximize modal shift towards public and non-motorized transport. The proposed investments are outside the scope of existing budgeted costs for the SITP and SETPs programs. At the same time, costs associated with scrapping programs and with the introduction of low-carbon bus technologies in the systems cannot be fully transferred to transit fares without adversely reducing the affordability of the transport system, particularly for the poor, making public transit far less attractive. Blending CTF resources with IDB and IBRD loans and other financing sources would make available investment capital in infrastructure, which may otherwise not be readily available for facilitating the integration of low-carbon technologies within the roll-out of the SITP and SETPs in cities nationwide. Thus, CTF financing would be instrumental in fostering the introduction of low-carbon bus technologies, scrapping programs, and related measures for optimizing and promoting an integrated land-use and transport system. The recent tender by the city Government for Bogotá's SITP indicates that low-carbon measures are currently not a priority due to the high costs of such investments.[42]

66. *Indicators*. Program results indicators are as follows: Cost effectiveness of reductions is estimated at US$38.8/ton for the entire financing, or about US$1.8 of CTF resources/ton. The following table further details key tracking indicators for the program.

Indicators	Baseline	Investment Program Results
Implementation of integrated public transit systems	3 SITMs implemented	Bogotá's SITP fully implemented targeting a population of 7 million. SETPs implemented in seven cities, targeting a population of 2.4 million
Annual GHG emissions from the transport sector in target areas	21.8 Mt CO_2 per year	Annual emission at 19.0 Mt CO_2 per year, reflecting a 2.8 Mt CO_2e reduction per year. Cumulative (avoided) reductions of 56 Mt CO_2e by 2030 (112 Mt CO_2e by 2050) • Bogotá's SITP annual emission reductions of 2.0 Mt CO_2e • Seven SETPs annual emission reductions of 0.3 Mt CO_2e • Initial implementation of low-carbon bus technology in the SITP and SETPs contributing to additional reductions of 0.2 to 0.5 Mt CO_2 per year Additional reduction of 1.5 Mt CO2e per year is expected from replication and scale-up in SITMs (seven cities) and SETPs (12 cities)
Introduction of low-carbon bus technologies in the transit systems	Standard diesel buses	Bogotá's SITP and SETPs start initial implementation of an advanced hybrid fleet, or other low-carbon bus technologies
Modal shift from private vehicles to public transit systems	Increased ownership and use of private vehicles	Modal share of public transport grows or remains stable

67. The changes in Colombia's urban transport sector due to the investment plan and vis-à-vis the BAU scenario include:

- The acceleration of seven SETPs and Bogotá's SITP. (In the BAU scenario the investments would instead be scaled-down and delayed over time with significant opportunity costs related to delaying emissions reductions, as well as significant co-benefits such as reduced congestion, public health benefits, etc.);
- The physical integration and optimization of public transport systems, seeking an optimization of modal shift toward low-carbon modes of transport. This will be possible through ancillary

[42] See footnote 30.

expenditures, including transfer stations to other modes of transport, sidewalks, bicycle lanes and parking facilities at stations, accessible and integrated public spaces, etc.;

- The introduction of hybrid buses, CNG buses, or other low-carbon technologies, which would further reduce the emissions of standard diesel buses, and which is not included in the current fare structure of these systems. These measures would not be achieved under BAU, as the differential on the investment, operational and maintenance cost of these buses represent an additional financial commitment;
- The consolidation of a scrapping policy to eliminate old buses displaced by Bogotá's SITP and the SETPs, which otherwise would just be moved to other areas of the cities involved or other urban areas. This program would cement the emission reductions achieved through the introduction of new vehicles, and
- The rapid adoption of TDM measures geared to maximize modal shift (integrated land-use and transport planning, fuel taxes, time- and zone-based restrictions for private vehicle circulation, high-occupancy vehicle lanes, parking charging management, etc.) that would not be undertaken under a BAU scenario's transit-oriented investment package.

Energy Efficiency

68. Significant opportunities for the scaled-up implementation of energy efficiency technologies and processes in electricity and thermal end-uses exist across all sectors of the economy. This can include the introduction of efficient technologies and processes, end-use renewable energy technologies (in particular solar water heating), and cogeneration systems. According to the Uniandes study, addressing the main opportunities in residential and commercial lighting, residential refrigeration, residential cooking in rural areas, solar water heating, industrial motors, and industrial boilers, would lead to combined emission reductions of 228 Mt CO_2e in a 20 year period, at an average net cost of negative 3.4 US$/t CO_2e (see Figure 8 above) considering energy savings during the lifetime of the investment. A CTF-funded effort would focus on the three main energy consuming sectors, namely industrial, commercial and residential.

69. The fact that the mitigation cost in energy efficiency is "negative" means that, from an economy-wide perspective, energy efficiency interventions, rather than having a cost, yield positive *net* benefits to the economy - in this case a benefit of 3.4 US$ per ton of CO_2e abated (this 'negative cost' is typical for energy efficiency). These results, however, only consider the costs of the investments themselves against the energy savings. They exclude the costs of removing the financial, regulatory and knowledge barriers that are unique to energy efficiency opportunities. A recent study by the consulting firm McKinsey[43] found that while efficiency investments across an entire economy offer tremendous potential for reducing energy emissions, these savings are dispersed across millions of relatively small and diverse measures, in every sector of the economy. Therefore, transactional costs are relatively high per unit of savings, and form a barrier to emissions reduction. For instance, an industrial plant may require 12 different technology upgrades, which are difficult for both banks and companies to assess and process without technical expertise. The knowledge and transactional costs involved in researching each technology are often perceived to outweigh possible energy savings benefits, and no action is taken. However it is known from experiences in other economies that these are worthwhile investments - both from a competitiveness and climate change standpoints. In this environment, efficiency programs that reduce knowledge and transactional costs for both financial institutions and consumers in a programmatic manner are crucial. As programs are established and consumers and financiers gain experience in the sector, the transaction costs are reduced and more of the financial benefits associated with implementing energy efficiency investments can be realized.

[43] Choi-Granade, H., et. al., 2009. *Unlocking Energy Efficiency in the US Economy*. McKinsey and Company. tiny.cc/USEE.

70. Recognizing this potential, the Colombian government has demonstrated its commitment to reducing the energy intensity of its economy by taking important first steps to create an enabling environment for energy efficiency. In 2001, Colombia passed Law 697, which set out the framework for the development of efficiency policies and regulations.[44] In 2004, the government established the Inter-sectoral Commission for the Rational and Efficient Use of Energy and for Non-conventional Energy Sources (CIURE). The energy and gas regulatory commission (CREG) has published efficiency standards for appliances and systems. UPME carried out extensive studies on carbon abatement and developed a national plan for energy efficiency in 2007. Now, the Colombian government is considering the establishment of a fund that will specifically target efficiency barriers in the residential sector. It is also interested in studying how to create a more comprehensive enabling environment for energy efficiency, which may include, for example, incentives through a rate setting mechanism, or targeted regulatory incentives for distribution companies that invest in their clients' energy efficiency. The government strongly supports the proposed CTF Efficiency Program for its ability to mobilize the private sector which would complement the public sector actions already taken and planned.

71. Increasing energy efficiency in the Colombian economy will be faced with a number of interrelated knowledge, financial and regulatory barriers. These pertain to three main market actors: financial institutions, energy end-users, and government. Amongst these barriers the following are the most important.

General

a) A lack of experience in efficiency across the economy and lack of information about existing efficiency experiences in other countries as well as poor information flow between market players. This has impeded the growth of strong efficiency institutions and programs, and the proper alignment of incentives.

Financial institutions

b) A dearth of domestic efficiency finance availability, which is due to insufficient familiarity in the banking sector. The lack of relevant expertise and capacity amongst financial intermediaries in terms of how to market, analyze and appropriately structure energy efficiency deals typically results in relatively high transaction costs for the bank and high interest rates for the consumer. This in turn discourages potential borrowers by deteriorating the cost effectiveness of the energy-efficient project. The high initial investment cost of these products can also be a significant financial hurdle in itself. For individuals the high upfront costs and a lack of access to credit can make these investments impossible even if they have attractive returns.

c) This same lack of knowledge expresses itself as an inflated perception of risk. Financial institutions are uncertain about the returns and loss expectations for energy efficient projects because such loans have not been systematically made and monitored in their markets to date. This discourages them from developing new and unproven lines of business/products. Inflated risk perceptions due to lack of familiarity also puts additional stress on the often weak credit profiles of customers. This is currently a significant barrier given that most energy-efficient equipment has weak collateral value, which focuses the risk analysis even more strongly on a company's or person's financial position and not on the merits of the energy efficient project/investment.

Energy end-users

d) A lack of end-user knowledge of the economic benefits of more efficient equipment and processes forms a barrier on the demand side of the market. While companies and people may understand conceptually that more efficient equipment can save them money, many - especially

[44] *Ley mediante la cual se fomenta el uso racional y eficiente de la energía, se promueve la utilización de energías alternativas y se dictan otras disposiciones*; October 3rd, 2001. Available at: tiny.cc/Ley697.

those in charge of making investment decisions - do not know the scale of those savings or how to execute the right measures, and have insufficient information to make reasonable investment decisions.

e) The knowledge barrier amongst end-users also manifests itself as perceptions of a high opportunity cost for initial investments. When choosing amongst investments in fixed capital, managers may prefer to invest in larger projects which have a lower project return but a larger absolute impact on the company's financials because benefits appear greater in the short term. This barrier for companies disappears consistently with better education.

f) There is also a lack of experienced technical service providers in the economy, who could otherwise contact clients and facilitate and implement energy efficiency measures. These agents normally operate in tandem with efficiency programs, but because there is not enough information on the benefits of such programs, the private sector has not sufficiently developed them.

Government

g) Under the current regulatory framework, distribution companies have a disincentive to foster energy efficiency among their clients, because the resulting reduction in total energy consumption (and reduction in sales) would cause them to forego earnings.

h) On the public side, insufficient coordinated national programs that manage the informational and technical aspects of efficiency investments and connect the consumer with financing.

72. As evident above, most of these barriers are intertwined knowledge and financial-based and can be addressed with scaled informational and financial programs directed at the private sector, though policy-making support will also be useful. Colombia's market structure also offers a unique opportunity to "fast-track" behavioral change across many sectors simultaneously because the country's private sector is led by seven major conglomerate groups or affiliations. Each economic group has historically included affiliations with financial institutions, as well as major industrial and commercial companies. As a result, the opportunity exists for the MDBs, through the CTF Efficiency Program, to obtain the "buy-in" from one or two of these groups for efficiency programs (if only as a competitive advantage) to further catalyze the "up-take" of efficiency programs across many sectors at the same time. The following actions are envisaged as key elements of the CTF Efficiency Program in order to directly address the above barriers.

Financial institutions

a) Barriers amongst financial intermediaries can be addressed in two ways. Firstly a technical assistance program is required to educate institutions about the risks, benefits and characteristics of efficiency finance. Technical assistance resources can be targeted to include capacity building and knowledge sharing from other global or regional financial institutions, which have developed energy efficient lending programs, as well as support in creating appropriate financial models for these investments, and structure for efficiency lending tools. As banks are better able to assess and incorporate the financial benefits of energy-efficient projects into their credit decisions, and as interest rates decline for these products, the client base for efficiency financing products is expected to grow.

b) Secondly, the financial intermediary barrier can be addressed with direct financial assistance and guarantees to banks, which help mitigate their overall risk perceptions regarding these investments that results from inadequate experience on the part of domestic lenders. CTF finance is more suited to accept these risks and catalyze financial institutions to enter into this new market. CTF funds can be used to provide financial institutions with "risk cushions" or "first loss" coverage while a track record is being established for the new portfolio.

Energy end-users

c) The knowledge barrier amongst end-users (who create demand for and implement the efficiency investments) can be addressed by scaled-up efficiency programs that educate consumers directly, or train the technicians and industry groups that will in turn educate consumers and execute efficiency measures. This knowledge dissemination is necessary to create capacity and demand, thereby catalyzing the adoption of energy-efficiency technology. The programs should provide the education and assessments to consumers regarding measures, and facilitate the execution of their intervention programs by connecting them to the trained technicians that can execute the measures, and the financing programs that can finance them.

d) One specific and indispensable tool for educating consumers and initiating the process of equipment upgrades is energy audits. These help companies understand the level of savings that can be achieved through technology improvements, and the payoffs of making the high initial equipment expenditures.

e) Another envisaged tool that is both knowledge-based and financial would be the establishment of private sector performance-based incentives programs, whereby stakeholders would be educated and rewarded for their actions conducive to efficiency improvements. Such a program would also serve to create awareness of efficiency programs and assistance, improve the penetration rates of these programs, and serve to facilitate the involvement of industry partners and government.

f) Even given the dissemination of knowledge about the potential savings to be achieved by energy efficient equipment, financial barriers can remain for the consumer, which may simply not have enough cash to cover the high initial investment cost of these products. Increasing access to capital for individuals and SMEs through the banking programs described above, and utilizing programmatic intermediaries, could help to enable investment in these sectors.

Government

g) CTF or other resources can and should also be used to support government planning and help it create the market conditions whereby a robust energy efficiency industry can take root. Such resources can assist in strengthening the institutional frameworks of public entities, impart best practices in efficiency regulation, and help the government examine options for aligning regulatory incentives with efficiency objectives.

73. In sum, CTF resources, through both private and public sector operations, can play a key role in overcoming knowledge, financial, and regulatory barriers to the adoption of low-carbon technologies by providing advisory assistance, investment support, and performance-based incentives. Existing programs offering some of these tools have been successful in demonstrating the potential of certain components of an efficiency market in Colombia but are currently too small to catalyze scaled-up energy efficiency investments. Additional resources are required to scale up these efforts and utilize international best practices to build strong national efficiency programs. If market components are aligned and scaled up in a coordinated and strategic fashion, the connection between supply and demand for efficiency services can be established.

74. CTF resources will be combined with leveraged IDB and IFC investments, as well as other public and private sources. They will be executed through public and private sector financial and other intermediaries, in order to enable these entities to gain practical experience and jump-start the development and deployment of appropriate financial instruments. This is planned with the expectation that, in the future, financial intermediaries will be able to offer adequate financial packages at scale and in a sustainable way.

75. *Financial sector.* The Colombian financial sector is led by 5 large private banks. The proposed CTF Efficiency Program is expected to work with two to three of the top banks to enable them to develop new lines of business for financing energy efficiency investments. Each of the participating banks would benefit from a combination of technical assistance and financing to address the knowledge barriers that

have prevented them from independently developing such financial products. By targeting the leaders in the banking sector, the CTF Efficiency Program will not only create competition among banks to provide the financing products, but could reach nearly all of the industrial and commercial companies that could benefit from financing for energy efficiency investments. For example, one of the largest banks in Colombia, which has expressed strong interest in participating in the CTF Efficiency Program, has among its current customers approximately 90,000 small and medium sized companies and the top 10,000 corporations. Capitalizing on its strong liquidity, a guarantee supported jointly by the CTF and the MDBs would allow this bank to finance its clients' energy efficiency investments. Once this bank becomes comfortable with the risks associated with energy efficiency investments (both through guarantees and capacity building), it would be in a position to actively market its new product to its existing client base, which would in turn not only create competition among the banks, but also among the businesses. This competition among the banks and its clients provides the catalyst for scaled-up investments.

76. These banks have shown a high degree of interest in participating in efficiency lending as long as certain risks and costs can be addressed. It is expected that, deployed effectively, CTF resources can be heavily leveraged as most domestic institutions have a high degree of liquidity. This lending has not developed much so far because they lack experience in efficiency lending and are uncertain about the return and loss performance of energy efficiency portfolios. As conservative institutions they therefore assess them as having an inflated risk component and are reticent to make efficiency loans. Guarantees from the MDBs and CTF can directly address the financial institutions' heightened risk perception and catalyze the flow of funds into this sector. The use of concessional rates for guarantees and financing would be used to address the first few financial institutions' hesitation to incur the expense of developing lines of business in new sectors, so that a track record can be established. The focus on institutional capacity building will be key in helping them structure financing and assess risk properly in this new sector, and ensure that the banks continue this line of business after the CTF funding is exhausted. Catalyzing investment in this manner can foster the development of a robust and financially sustainable energy efficiency lending market, as other financial institutions capitalize on the experiences of the early entrants and enter the market.

77. It is important to note that energy efficiency investments cannot be scaled up by addressing the barriers for financial institutions alone, but must be accompanied by capacity building and technical tools designed to educate end-users regarding the benefits and opportunities of efficiency investments, therefore creating demand for efficiency finance. For example, the experience of a financing program with Bancoldex-URE showed that although Bancoldex offered price-competitive lines of credit for energy efficiency investments to the Colombian financial sector, these lines of credit were not utilized by the financial intermediaries, due to unfamiliarity of financial institutions with how to process and market them appropriately, and lack of demand from end-users.

78. The CTF program described above would seek to increase end-user demand by targeting equipment upgrades in three main energy-consuming sectors outlined below, with specific outreach efforts and technical advisory for each one. These are the industrial, commercial, and residential sectors. As demonstrated earlier in Figure 6, these three sectors are the source of almost all Colombian energy consumption, after transport (which is addressed by the other component of this IP).

79. *Industrial sector*. Colombia's industrial sector is responsible for a third of the final energy consumption in the country, and most of this energy use is in thermal applications fired by fossil fuels (see Figure 6). According to *Fundación Bariloche*, the energy consumption of the industrial sector will grow by 2.3% annually during 2006-2025 under a business as usual scenario. This rate can be reduced by improving the efficiency of certain equipment. Thermal measures include improving boilers, kilns and ovens, introducing solar water pre-heating, or substituting boilers with cogeneration schemes are probable emission abatement measures. There is also a significant mitigation potential in improving the efficiency of electrical devices, particularly motors. The Uniandes study shows that the installation of efficient industrial motors could produce over a 20 year period savings of approximately 14 Mt CO_2e.

80. The Colombian industrial sector is dominated by 7 large conglomerates, which have significant operations in the main industrial sectors. Two of these conglomerates also own two of the five largest Colombian financial institutions and therefore important opportunities for cooperation are envisaged. The industrial component of the program would revolve around encouraging a critical mass of strategic industrial players to adopt energy-efficient technologies, thereby encouraging competitive upgrades amongst smaller players (who would also have access to support). Through partnerships with financial institutions and industrial associations, a few of these conglomerates can be targeted to benefit from the CTF Efficiency Program, thus generating significant demonstration value and catalyzing other actors within a given sector to pursue energy efficiency investments. The principal industrial association in Colombia, *Asociación Nacional de Empresarios de Colombia* (ANDI), has expressed interest in supporting such an efficiency program, and would be a key ally in reaching end-users. The composition of ANDI's membership – where 50 of 1,100 companies account for 33% of the members' total energy consumption – reflects the concentrated nature of the Colombian economy and the value of focusing the program on Colombia's top industrial and financial institutions to maximize the demonstration value of each investment and to catalyze other market players to follow suit. This structure represents an opportunity to reach companies efficiently.

81. The CTF Efficiency Program outlined here would furthermore be complemented by direct investments to large corporations by IDB and through IFC's cleaner production lending program (CPLP)[45].

82. *Commercial sector*. The commercial sector provides a significant potential for GHG emission reduction. Most opportunities exist in refrigeration, which accounts for 70% of the energy consumption in small businesses, according to a study by UPME. According to this study, the replacement of 294,000 inefficient refrigerators in small businesses would save 529 GWh/year and have a potential GHG emission reduction of 0.23 Mton/year. The estimated costs of the associated measures are US$294 million. A market transformation approach may be applied in the commercial sector similar to the one proposed in the industrial sector, yet the importance of using audits and other sorts of market outreach will be more important as this sector is more disaggregated. A targeted performance incentives program will also be useful to reach these end-users and encourage technology adoption in a few strategic and influential players in the market, coupled with access to finance programs for all players in the market. In the commercial sector, there may be a bigger role for market associations to disseminate knowledge and influence behaviors.

83. The program component targeting the commercial sector will leverage the early success of the Inter-American Investment Corporation's (IIC) GreenPYME program in Colombia, which trained over 400 managers in its inaugural energy efficiency workshops in 2009 and is now implementing energy walkthroughs and audits. In September 2009, BBVA Colombia supported IIC's GreenPYME workshops in Colombia by identifying workshop attendees from its SME client base, as well as contributing logistical support. IIC and BBVA Colombia are now engaging SMEs for energy efficiency audits. While results in terms of efficiency investments are still too early to be seen, the GreenPYME program demonstrates the receptiveness of financial institutions to explore energy efficiency initiatives under the right conditions, as well as the market's receptiveness to proactive and targeted outreach, all of which sets the stage for future engagements. The CTF Efficiency Program will also leverage and influence the existing Bancoldex program, which, because of the CTF program will channel a percent of its funds into efficiency.

84. *Residential sector.* The Colombian residential sector is divided into six end-user strata. Eighty-nine percent of the population belongs to the lower-income strata 1, 2 and 3, which receive subsidies

[45] IFC's CPLP is a global program, which will target companies in Colombia. On its own it is not enough to spur the catalytic change envisioned through the CTF program, but is expected to support and help speed up the impact of the CTF program.

amounting to US$ 750 million, 40% of which are provided by the government budget, and by cross-subsidies from industrial and commercial consumers, as well as from higher-income strata.

85. This sector faces certain challenges including a lack of credit through formal financing services needed to purchase new, more efficient appliances, a subsidy to low income residential cons*umers which reduces* the incentive to save energy, and a lack of incentives for utilities to encourage them to reduce power sales. According to the Colombian Association of Banks and Financial Institutions (Asobancaria), approximately 43% of the Colombian adult population has no access to any formal financial services and are considered "unbanked" with no access to formal financial services, while 84% have no access to credit cards or consumer loans.[46]

86. Several existing efforts have been launched to address these barriers, including appliance replacement schemes which address the financing and subsidy issue. For instance, a new credit card program by Colombia's biggest utility CODENSA offered financing to customers for home appliances, micro-insurance and home improvement products. The loan payments are billed and collected through monthly CODENSA electricity bills. Ninety-seven percent of the credit card program's participants belonged to the lower-income strata 1, 2 and 3, out of which two thirds were previously unbanked.[47] Although the CODENSA program has significantly increased the use of new, energy efficient appliances, its objective is not energy efficiency, and in fact energy consumption per household with an outstanding loan has increased on average by 4.7%. The CODENSA financing approach shows nevertheless the potential that could be achieved by similar programs, with the specific aim of substituting old appliances (and thus including their removal and disposal). *Empresas Públicas de Medellín*'s (EPM) more recently launched appliance program includes removal and disposal services to ensure energy demand reductions. These programs have been met with good participation, which demonstrates that energy consumption reductions are possible in the residential sector despite their subsidized rates.

87. In the longer term, utilities would ideally also be enlisted to help effect reductions in this sector. The rate setting mechanisms for distribution companies which are agreed among the Colombian government and the distribution companies is on a five-year cycle, and was most recently set in 2008. In order to create direct incentives for distribution companies to foster energy efficiency investments, the Colombian government - as part of the CTF Efficiency Program - is interested in studying alternative structures over the next three years that could be effected for the cycle beginning in 2013.

88. The Colombian government is also considering the creation of a national energy efficiency fund aimed in particular at developing a large-scale energy efficiency transformational program that establishes appropriate financial structures and supports knowledge and capacity building activities for the residential sector. In addition, the CTF Efficiency Program will seek to address efficiency in the residential sector through scaled-up versions of an appliance replacement program like EPM's.

89. *Emission reductions*. Based on data from the Uniandes study, and information by UPME, a cumulative emission reduction of 32 Mt CO_2e could be achieved with an investment of US$ 670M, including US$50M from CTF.[48]

90. The study by *Fundación Bariloche* assesses a potential of 12 Mt CO_2e in cumulative emission reductions during a 17-year period, by means of the implementation of a set of energy efficiency measures, leading to a reduction of between 3.9% and 4.2% in electricity consumption. According to

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[46] Asobancaria, 2009. Reporte de Bancarización. March. Available at: tiny.cc/abefc.

[47] Arbelaez, M.A. *et al.*, 2007. *El Crédito Fácil para Todos de Codensa: Un Programa de Impacto Social para Bogotá*, Fedesarrollo.

[48] These figures were calculated for industrial motors, residential lighting, residential refrigeration, commercial lighting, and commercial refrigeration. Investment costs for the first four interventions were derived from Johnson *et al.*, 2009 (tiny.cc/lcdmex), by making adjustments to the Colombian power sector. The investment costs for commercial refrigeration were based on data from UPME. Program costs were estimated at 20% of investment costs.

UPME, the emission reductions could reach 10% of the national electricity consumption, or 7,500 GWh per year in 2025, and would involve annual emission reductions of more than 2 Mt CO_2e.

91. *Replication and scalability potential*. In the commercial and industrial sectors, energy efficiency investments could be scaled up through mobilizing existing local financial resources, through the provision of appropriate capacity building in the Colombian financial sector and market, and through innovative risk mitigation instruments. The existence of large conglomerate economic groups in Colombia's private sector also facilitates replication or, more importantly, adoption of efficiency investments across many sectors simultaneously. In the residential sector, replication and scaling up would be achieved by leveraging carbon finance and private sector participation in conjunction with the government's coordination strategy and policy measures. Different delivery alternatives would be considered during the design phase of the program to ensure a successful implementation and market uptake/transformation of these particular sub-sectors. The Colombian financial market shows a high liquidity and interest in financing energy efficient investment and developing energy efficiency product lines, with the appropriate assistance.

92. Many low-carbon technologies which are relevant in one high GHG emitting sector (such as chillers and variable-speed drive motors) are also applicable in other sectors. Therefore, once a technology has been proven and successfully implemented in one industry, it would be feasible to replicate that approach to technology adoption in other similar industries. Furthermore, since energy efficiency investments generate energy - and thus cost - savings, companies that implement them become more competitive and push their competitors to follow suit.

93. *Environmental co-benefits*. Energy efficiency reduces energy demand, avoiding burning of fossil fuels for thermal uses and power generation and postponing the building of new fossil fuel power plants and other energy sector infrastructure. This has a range of global and local air quality benefits. Air pollution from the energy sector includes not only GHG emissions, but also SO_2, NO_X, Hg, and PM emissions.

94. *Development impact*. The energy efficiency investments in the residential sector, such as appliance replacements, would be addressed particularly in low-income dwellings, yielding therefore a positive distributive impact. Reductions in customer utility bills could also be expected with the introduction of higher-efficiency appliances and lighting. The Colombian government will experience fiscal benefits from reduced government subsidies to low-income residential customers, as well as a more competitive economy. National benefits also include increased energy security, lower exposure to fuel price volatility risks, and deferred investments in generation capacity and other energy infrastructure.

95. *Indicators*. Program results indicators are as follows: Cost effectiveness of reductions is estimated at US$21.0/ton for the entire financing, or about US$1.6 of CTF resources/ton. The following table further details key tracking indicators for the program.

Indicators	Baseline	CTF Efficiency Program Results
National electricity consumption	117,000 GWh per year (2030)	112,000 GWh per year (2030)
GHG emissions from electricity generation	36 Mton CO_2e per year (2030)	34.4 Mton CO_2e per year (2030)

ENABLING POLICY AND REGULATORY ENVIRONMENT

Sustainable Transport Systems

96. The current policy and institutional framework for the transport sector has been established by the GoC through a series of CONPES (National Economic and Social Policy Council) documents.

97. The PNTU is built upon a premise of collaboration between the GoC and local authorities to improve the quality of life and increase urban productivity in the supported cities. The policy framework is aimed at:

a) improving the efficiency and safety of public urban transport services;
b) providing reliable transport accessibility for the poor;
c) enhancing private sector involvement in service provision;
d) reducing air pollution and GHG emissions;
e) fostering comprehensive sustainable urban development processes, and
f) promoting inter-municipal coordination within the metropolitan areas, interagency coordination within the municipalities, and knowledge sharing between the central and local governments.

98. Under this framework the GoC seeks to provide the necessary financial and technical incentives to implement the national policy for improving urban transport. Generally, cities participating in the SITM and SETP programs sign subsidiary agreements with the GoC laying out financial and technical commitments to carry out the program. Under these agreements, the GoC usually contributes up to 70% of the total cost of the program, with financial contributions in each city depending on specific project characteristics and their financial/fiscal situation. The rule for financing up to 70% of the total cost of the program is dictated by law and only applies to the SITM[49]. Nonetheless, the GoC has committed financial resources on similar proportions for the SETP programs. GoC funding is committed through a flow of earmarked yearly fiscal transfers (*vigencias futuras*), previously approved by the National Fiscal Policy Council (CONFIS). Since 2005, the IBRD and the IDB have supported the PNTU by providing almost one billion dollars in investment loans to finance the development of SITMs. These resources finance the annual contributions (*vigencias futuras*) of the GoC to the local projects. In the case of the local authorities, their main source of funding in the SITM and SETP programs is the gasoline surtax, mostly paid by automobile users. In SITM cities, this surtax provides approximately 34% of total investment costs of the program and, most importantly, provides the municipalities with a source of funding that can be matched against GoC contributions for the implementation of the projects.

99. Recently, the city of Bogotá enacted the Decree Law 0309 of 2009 adopting the SITP. The Decree Law establishes the institutional, regulatory and legal framework for the implementation and operation of the SITP. In particular, it defines the general characteristics of the public transport system with the structure and requirements for the service provision, operational scheme, ancillary services (e.g., fare collection, control and information), and integration requirements. The Decree has played a pioneering role in the country's urban transport sector, and the Ministry of Transport is seeking to replicate this framework through a National Decree for the eight large cities with SITMs. For the SETPs, the Ministry of Transport enacted the Decree Law 3422 of 2009, setting the specifications for these systems.

100. The National Logistics Policy is adopted by the CONPES document 3602, August 2009.

Energy Efficiency

101. The Colombian government has demonstrated its commitment to reducing the energy intensity of its economy by taking important steps to create an enabling environment for energy efficiency. Resolution 097, published in year 2000, mandated UPME to propose energy efficiency standards, and CREG to establish the standards. To date several standards have been published. Other steps include the following.

[49] The SITP legislation refers to Law No.86 dated December 29, 1989 as amended by Law No.310 dated August 6, 1996 and published in the Government's Official Gazette No.42853 dated August 12,1996, providing for the joint financing (between MHCP and the participating cities) of infrastructure works required for the SITP, through the provisions of transfers.

102. UPME has started a labeling program for establishing the benchmark for energy efficiency standards. It is working directly with different financial entities, jointly with the IDB, to develop an energy efficiency portfolio within the SMEs in large cities in Colombia.

103. In coordination with the Colombian Institute for Technical Standards and Certification (ICONTEC), energy guides and technical specifications have been developed to complement the existing ones. This will set the basis for future knowledge-based activities and programs amongst different stakeholders.

104. Law 697 for the promotion of energy efficiency and renewable energy was passed in 2001 and sets the general legal framework for the development of policies and regulations by the national government.[50] Under this framework, the Intersectoral Commission CIURE was established in May 2004. CIURE's key mandates include the formulation and coordination of national energy-related policies and strategies to be incorporated in a sectoral approach.

105. Despite the favorable general framework set by Law 697, the regulatory framework lacks structural incentives for energy efficiency investments and presents the following challenges.

- The subsidies towards electricity tariffs, which reduce the incentive of low-income households to adopt low-carbon technologies.
- The lack of incentives for electricity distribution companies to foster energy efficiency investments among their customers.
- The lack of institutional continuity: CIURE does not have a permanent nature, and general sessions are held only when requested by a member in order to address a particular issue.
- The weak enforcement of new standards, due to institutional barriers and lack of resources.[51]

106. While this regulatory environment has not been effective at catalyzing systematic and scaled up adoption of efficiency technologies, it will not necessarily prevent their adoption. The Colombian economy is very private sector oriented and private actors have the ability to, and do indeed pursue efficiency for competitive reasons without government assistance. To date this has occurred on a small scale. In the context of the CTF Efficiency Program, the government will study alternative incentive structures to better align the interest of the distribution companies with its commitment to reducing energy demand during the next regulatory cycle. The current power pricing regime came into effect in 2008 and will remain in effect for a five-year period.

107. Despite subsidized residential tariffs meaningful reductions in residential energy consumption are attainable. The CODENSA and EPM appliance programs demonstrate that low income consumers have an interest in purchasing new energy-efficient appliances, even though they enjoy a subsidized tariff.

108. Meanwhile, the consumers in the commercial and industrial sectors need to pay a premium on their tariffs, used to cross-subsidize low-income residential consumers. These higher tariffs create an incentive for savings. Price-competitive financing, access to audits, technical training, and other capacity building measures are being provided (albeit on a piece-meal basis) by other market actors, and can be, when strategically combined, adequate tools to yield meaningful energy savings in the sector.

109. As part of the CTF Efficiency Program, CTF or other resources would assist in strengthening the institutional framework of public entities such as CIURE, address the knowledge barriers for energy efficiency with regards to best practices in efficiency regulation. The CTF Efficiency Program would also help the government examine options for aligning regulatory incentives with efficiency objectives, including the removal of regulatory barriers that distribution companies face to invest in their clients' energy efficiency.

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[50] See footnote 44.

[51] Consorcio Bariloche - BRP Ingenieros, 2007.

IMPLEMENTATION POTENTIAL

110. This section addresses the capacity in place to implement the proposed investments, as well as some of the constraints and key risks that could impede implementation.

111. A generic risk for all investments designed to reduce GHG emissions of key sectors of Colombia's economy, and indeed of most other countries, is the volatility of oil and gas prices. Generally speaking, an increase in oil prices tends to make a transition to a low-carbon economy more financially attractive. Conversely, a downward trend in oil prices might make the necessary investments less financially attractive. This holds true in Colombia, where the pricing of oil derivatives has been flexible.

Sustainable Transport Systems

112. The GoC and local authorities have shown successful results in initiating the implementation of SITMs (BRT systems). The time is ripe for building on existing momentum and Government commitment for scaling-up investments that can transform the Colombian urban transport sector. The CTF Transport Program in Annex 1 will directly lead to the implementation of the SETPs in seven medium-sized cities, which account for 5.4% of the total country's population (2.4 million inhabitants) and accelerate a further five cities identified within the PNTU. There is also a window of opportunity to initiate a second generation of sustainable, low-carbon urban transport systems, through the integration of the BRT systems with the rest of the transit network. The implementation of Bogotá's SITP, expected to start in late 2010 and to be fully implemented by late 2011, will have the potential to stimulate this second generation (low-carbon) of urban transport systems in Colombia, both in SITMs and SETPs.

113. The IDB is supporting the Clinton Climate Initiative's Hybrid Bus Test Program in Latin America (Bogotá, São Paulo, Rio de Janeiro and Curitiba), with the objective of providing data and analysis to municipalities regarding the reliability of hybrid buses, estimated emissions reduction and life-cycle costs, and other benefits and risks associated with the adoption of the hybrid bus technology. This study will also contribute to the reduction of barriers for technology deployment and will assist local and national institutions in its implementation.

114. A number of multilateral and bilateral agencies have engaged with the local authorities and the Colombian policy, technical, financial and environmental agencies in the design and implementation of SITMs and SETPs. The IBRD has supported the implementation of eight SITMs in large cities through three loans, the most recent approved in July, 2009. The IDB has an operation in its project "pipeline" (planned for 2011) aimed to support the implementation of seven SETPs. In 2009, the IDB approved a technical cooperation loan to support the design and implementation of Bogotá's SITP. The execution of this loan is being complemented with two non-reimbursable technical cooperation operations: (i) development of an integrated environmental strategy (IES) for a sustainable urban mobility in Bogotá and (ii) a regional program to test hybrid buses in four Latin American cities, including Bogotá. The IDB has also a policy-based loan operation in its project pipeline (planned for 2010) to support the GoC in the implementation of the National Logistics Policy, providing a comprehensive framework for the freight transport in the country.

115. *Risk assessment*. Overall risk for the transport investment is moderate based on the fact that institutional, regulatory and policy requirements are in place, while the technologies and systems to be deployed have shown that they can successfully implemented in Colombia's SITM and will be tested in the country and other cities. In the case of low-carbon technologies, such as hybrid or CNG buses, a pilot activity is being supported by the IDB as noted above. However, the implementation capacity for Bogotá's SITP poses greater risks as the program is quite ambitious and requires coordination with other modes of transport and operators. The table below summarizes the main risks and risk mitigation measures associated with this investment.

Risk	Mitigation	Residual risk
Policy and regulatory framework	The PNTU define cities participating in the SITM and SETP programs, and the subsidiary agreements lay out the financial and technical specifications for the design and implementation of these programs. The IDB is supporting the development of an integrated land-use and transport planning strategy for the city of Bogotá, including the reformulation of the regulation that establishes the financial and management land-based instruments for the city (*Plan de Ordenamiento Territorial* – POT). Some of these instruments include land value capture mechanisms to finance transit infrastructure in the SITP projects, and complementary land-use and zoning regulations that are required to induce transit-oriented development.	L
Implementation capacity: Limited institutional capacity to implement SETPs Integration with other modes in the Bogotá's SITP is not effectively achieved	In the model adopted for the implementation of SITMs, the GoC: (i) created an incentive for the cities to implement the program by securing future budget support and eliminated the risk of a potential change in Government or municipal policy; (ii) transferred program implementation to local authorities, promoting local ownership and knowledge creation, and (iii) provided an incentive for local governments to focus on sound and longer-term policy and related investments. The main characteristics of this model will remain relevant for the implementation of SETPs, adjusted based on the lessons learnt from the SITMs. For the SETPs, the IDB will review the demand estimates, business models and financial results, and agree on an Implementation Program in order to assure that technical capacity and financial resources are available and consistent with an optimized work schedule. The technical cooperation loan that the IDB is executing to support the design and implementation of the SITP will help strengthen local capacities to manage the whole integration of the transit system with other transit modes and in coordination with air quality, urban development and transport sector plans.	M
Technology: Financial analysis shows that it is not feasible for cities to integrate low-carbon technologies given investment, operation and maintenance costs, and tariff structures, among other factors. New bus technology presents operational and maintenance problems	While there are no elements in the current institutional, legal and regulatory framework ensuring low-carbon (e.g. hybrid) technologies would be introduced in the foreseeable future, the SITP and SETPs will have a window of opportunity to allow for their gradual introduction over time as their use becomes more ubiquitous. Although the hybrid bus technology is not new, a Test Program (CCI-IDB) will be conducted in Bogotá, and other regional cities. The expected benefits of the program are: (i) reduction in upfront testing costs for the cities participating in the initial bus tests and for the cities seeking to purchase hybrid buses based on the results of initial bus tests; (ii) long-term market benefits for the acceleration of the energy efficient transport industry in the region, lowering costs; (iii) development of new production lines, specialized services, and markets in Latin America, and (iv) identification of strategic actions to (1) remove possible legal and economic barriers for this technology in Latin America and (2) help multilateral, national and local institutions to use market mechanisms to reduce GHG emissions by transforming the urban transport sector.	M
Finance: Lack of local (municipal) financial resources to implement the SETP programs and the Bogotá's SITP	Cities participating in the SITM and SETP programs sign subsidiary agreements with the GoC laying out financial commitments. GoC funding is committed through a flow of earmarked yearly fiscal transfers (*vigencias futuras*). SETP and Bogotá's SITP will receive multilateral loan resources and will be complemented with carbon finance and other grant resources, thereby reducing risk. An adjustment in implementation schedule will reflect available resources including commitments from participating cities.	L - M

Risk	Mitigation	Residual risk
Environmental and social safeguards: While addressing greenhouse gas emissions, local airborne pollutants and air quality concerns may be ignored Stakeholder opposition in view of the varied and complex issues involved in implementing changes of the SITP and SETPs	Project design will follow GoC, local and multi-lateral bank safeguards. Appropriate environmental management measures will be incorporated into project design. The options to be supported will render both global and local benefits and promote improvements in air quality, while reducing emission of greenhouse gases and air toxics. The PNTU addresses these global environmental objectives. This strategy will be also reinforced through the IDB technical cooperation to develop an integrated environmental strategy (IES) for a sustainable urban mobility in Bogotá, which could then be replicated in other Colombian cities. Stakeholder support will be enhanced through project design components and IDB technical cooperation to provide advisory support and training to the incumbent bus transit operators for the transition and industry transformation that will be required for the new SITP and SETPs.	M
Development potential: Operators and other stakeholders oppose the implementation of the systems The experience in the SITM is not used as a basis for replication in other cities	A comprehensive consultation process will take place to ensure commitment and ownership by all involved. Dissemination and training actions are being taken to ensure that lessons from Colombia are considered in the development of similar activities in the entire region. Lessons from MDB-financed projects throughout LAC will be used for training to ensure that lessons learned are considered in the development of similar activities in the entire region.	M
Procurement	This has not been an issue in the SITM program. The IDB loans will provide further support where necessary.	L
Overall		***Moderate***

Energy Efficiency

116. Because the current regulatory environment does not effectively catalyze energy efficiency technology adoption, the GoC has recognized that, in order to scale-up energy efficiency measures across all sectors, a further mix of private and public sector activities is required. The private sector requires knowledge, capacity building and financial support to scale up investment. The government is seeking to strengthen the trend towards a reduction in the energy intensity of the economy by implementing a comprehensive national energy efficiency program in several sectors.

117. UPME's efficiency standard labeling, and the ICONTEC energy guides and technical specifications have set important technical groundwork for efficiency program technician training.

118. Interest and momentum among key players in the energy efficiency market already exists. There is growing interest from the financial sector in providing financing and new product lines for energy efficiency services if initial risks can be mitigated and know-how can be acquired. Local financial institutions have expressed strong interest in participating in the CTF Efficiency Program and developing new lines of business in the energy efficiency sector. More companies are showing interest in conducting energy audits and investing in energy efficiency projects. End users across each of the sectors are demonstrating an increased interest in energy efficiency investments, by participating in the currently available pilot programs. Local distribution companies are already working with the MDBs on programs that can be scaled up and key domestic industrial associations are keen to work with the program to catalyze the implementation of efficiency measures amongst their membership. The government has established a supporting regulatory environment and continues to create incentives for energy-efficient investments. In addition, pilot programs such as GreenPYME have been successful and have started to create awareness, data and momentum in the sector, and industry allies are keen to participate in upcoming programs.

119. To date the isolated efforts to catalyze energy-efficient investments *at scale* have not been effective, since these efforts were incomplete and have addressed some barriers without addressing others. Through

the programmatic and strategic deployment of CTF resources, Colombia can now address each of the barriers in an integrated manner to catalyze technology adoption at scale, including increasing access to finance (through financial incentives and capacity building), training market participants including technicians, and facilitating the flow of information throughout the market.

120. The proposed CTF Efficiency Program will include capacity building components, programmatic linking of banks to clients, the necessary measures to enhance the relevant policy and regulatory frameworks, and the provision of appropriate risk mitigation and risk sharing instruments, to foster and realize investments in energy efficiency activities.

121. The Industrial Promotion Institute (IFI) and the Foreign Trade Bank of Colombia (Bancoldex), financial entities that support SMEs, are interested in moving forward with a successful national energy efficiency program and welcome the support of the proposed CTF Efficiency Program in order to avoid repeating the failures of previous efforts. Moreover the National Guarantee Facility (FNG) is currently developing an energy efficiency facility focused on SMEs, but open as well to larger clients. Lastly, the National Energy Fund (FEN) is interested in establishing a national energy efficiency facility.

122. *Risk assessment*. The table below summarizes the main risks and risk mitigation measures associated with these energy efficiency investments.

Risk	Mitigation	Residual risk
Implementation capacity: Limited institutional capacity to coordinate the implementation of the proposed activities in the public sector Limited implementation capacity by financial institutions	Technical, organizational and financial assistance to strengthen the relevant agencies will be provided. A significant part of the CTF Efficiency Program is focused on mechanisms to foster financial institution and technical expert capacity building. Once a base of technical expertise is developed within Colombia to provide training for financial institutions capacity building can be provided to similar institutions on an ongoing basis in a sustainable manner without CTF support.	L
Knowledge barriers: Limited demand for efficiency investments due to knowledge and technical expertise barriers	As noted above the CTF Efficiency Program will provide technical assistance to companies and include activities aimed at disseminating knowledge among all relevant stakeholders. It will also include programs aimed at strengthening the technical expertise base in Colombia. It is expected that once there are sufficient examples of the cost benefits of technology adoption with key companies within a sector, competitive forces will step in to drive demand, both for knowledge (companies will begin to seek audits) and investment.	M
Regulatory: Distribution companies do not have an incentive to encourage end users to invest in energy efficiency	As mentioned, the government will begin evaluating new mechanisms for aligning the incentives of distribution companies to pursue energy efficiency investments for the 2013 regulatory cycle. In the short term, programs such as EPM's offer potential for scale-up in the residential sector, even in the absence of a regulatory change. The industrial and commercial sectors do not rely on distribution companies to facilitate energy efficiency investments, and instead are driven by market forces to pursue such investments.	L

Risk	Mitigation	Residual risk
Market uptake: Market uptake does not occur at the expected rate	This is likely the most significant risk in the program and can occur for many reasons, including lack of management attention within the financial institutions and/or the end user companies. To mitigate this, the CTF Efficiency Program will seek to work only with financial institutions that have fully "bought in" to the process and are willing to dedicate the time necessary, at the senior level, to influence institutional uptake at the operational level. On the end user side, the MDBs will focus energy efficiency audits on companies that have both influence in the market (can ignite competition), have management buy in, and are willing to share information on their experiences.	M
Technology risks: New more efficient technologies present operational and maintenance problems	Only well proven technology would be supported.	L
Overall		***Low***

FINANCING PLAN AND INSTRUMENTS

123. This IP aims at developing an adequate financial package from various available sources, including multilateral, public and private financial institutions as well as carbon finance, to leverage enough resources to achieve the plan's ambitious objective. While the current uncertainty toward a post-2012 framework over the shape of carbon market mechanisms and carbon prices add significant risks for carbon revenues in the long term, it is nonetheless important that Colombia focus attention on where carbon financing opportunities may exist.

124. It must be noted that carbon revenues, if obtained, would only be made available to the project annually, starting after the first year of project implementation, and only once actual GHG emission reductions have been measured and verified (huge verification bottlenecks are currently delaying annual payments and affecting the financing structure of other large-scale transactions). These risks mean that project developers may, and often do, discount carbon revenues when making investment decisions. As a result CTF funding, structured appropriately, would still be required for projects that are expected to receive carbon revenues, both in situations when (i) carbon revenues are not sufficient to make the project feasible, and (ii) when the risks of receiving such revenues is perceived to be excessively high so as to prevent a project from taking place.

Timeline

125. Based on current assessments - notably on implementation readiness - the MDBs suggest as priorities for phase I of this IP the lines of action on energy efficiency and sustainable transport systems mentioned above. Once an enabling framework for the development of renewable energy is set in place, phase II would provide investments in this line of action, as well as, potentially, further work on energy efficiency and transport.

Summary

126. The table below summarizes the investment needs and proposed allocations across the various proposed sources of financing (in US$ million). It must be noted that these are notional amounts, revisable according to Government plans.

Indicative Financial Plan (US$ million)

Financing Source	Sustainable transport systems (annex 1)	Energy efficiency (annex 2)	TOTAL
CTF executed by IDB	60.0	32.5	**92.5**
CTF executed by IBRD	40.0	--	**40.0**
CTF executed by IFC	--	17.5	**17.5**
CTF total	**100.0**	**50.0**	**150.0**
IDB loans	400.0	130.0	**530.0**
IBRD loans	100.0	--	**100.0**
IFC loans	--	90.0	**90.0**
IDB grants	5.8	--	**5.8**
IBRD grants		--	--
KfW	--	70.0	**70.0**
Carbon finance	30.0	--	**30.0**
Other	--	--	--
GoC	340.0	40.0	**380.0**
Bogotá DC	150.0	--	**150.0**
Municipalities	240.0	--	**240.0**
Private sector	960.0	290.0	**1060.0**
TOTAL	***2325.8***	***670.0***	***2995.8***

Annex 1. CTF Sustainable Transport Systems Program (IDB, IBRD)

Transport Problem Statement

1. The transport sector in Colombia currently accounts for 12% of the country's total GHG emissions, and 22% of its energy-related emissions, without considering the corresponding upstream emissions in the oil industry. Transport is the largest and one of the fastest-growing sectors in terms of increasing contributions to the country's total emissions. Moreover, the transport sector tends to pose some specific challenges in terms of scaling-up of investments with a transformative impact in the abatement of GHG emissions overtime.

2. Energy use and emissions by the transport sector will increase as a result of the interrelated processes of economic development, urbanization, rapid motorization and growth in both domestic and international trade of goods and services. Under a BAU scenario, transport emissions would increase from 21.8 Mt CO_2e in 2004 to 39.2 Mt CO_2e in 2030.

Proposed Transformation in Transport

3. The most cost-effective low-carbon interventions with the largest potential for reduction of GHG emissions are those that aim to increase (or maintain) the modal share of public transport while improving the efficiency of the system (services and fleet). This is the main strategy behind the PNTU and the priority for the sector that national and local authorities in Colombia have agreed upon.

4. By supporting the adoption of an integrated approach to land-use and transport planning, combined with a range of specific investments such as optimization of transit services and logistics, travel demand management and introduction of regulatory standards and measures, the CTF has considerable potential for assisting Colombia in altering its current and projected carbon path in the transport sector in a way that can have a truly transformative impact at the national level. At the same time, by effectively scaling-up investment in a way that demonstrates that countries can move towards sustainable transport systems from a national policy, the program can have a strong demonstrative impact for other countries in the region, as well as globally.

5. Use of CTF resources for transformational investments will therefore build on the Government's current efforts and leverage further resources for investment in the implementation of a number of targeted interventions in a programmatic way that combines national and local level policies and investments. These interventions include the following.

a) Integrated land-use and transport planning, promoting high densities and mixed land uses, while recovering the urban landscape, coupled with smart infrastructure planning and design, enabling and facilitating both public transport and non-motorized modes such as cycling and walking;

b) Optimizing and rationalizing bus transit services, by restructuring routes, removing redundant vehicles (oversupply), and enabling fare and operational integration among different transit modes (with infrastructure and information technology);

c) Applying economic instruments through a comprehensive design of travel demand management (TDM) strategies (e.g., fuel taxes, time- and zone-based restrictions for private vehicle circulation, high-occupancy vehicle lanes, parking charging management, etc.);

d) Adopting regulatory and technological measures, such as fuel economy standards for new vehicles, improvements in the enforcement of inspection and maintenance programs, introduction of low-carbon technologies for buses, and fuel quality improvements, and

e) Promoting sustainable freight transport logistics, by optimizing the operation of heavy-duty vehicles, building specialized freight transfer terminals, improving information and communication systems, and expanding the use of more sustainable, efficient modes such as railroads and waterways.

Proposed CTF Transport Program Scope

6. The proposed CTF co-financing will support Colombia in transitioning to the next generation of urban transport investments, by scaling up its hitherto successful efforts in promoting investments in BRTs and preventing a reversal in the strong gains in modal share of public transport. The GoC is proposing to use CTF co-financing for two discreet activities to:

a) accelerate low-carbon-related investments in Bogotá's SITP, with the largest potential for GHG emissions reduction; and

b) accelerate low-carbon-related investments in SETPs for at least seven (of the twelve) medium-sized cities, and increase measures for reduction of GHGs within these plans, as well as indirectly leading to similar investments in a further five cities.

7. A number of targeted investments will be promoted through CTF leverage of loans and technical assistance from the IDB and IBRD, including appropriate support to local authorities in the design and implementation of adequate policy and regulatory measures (e.g. TDM) in the cities. These investments aim at increasing the GHG reductions within a wider package of support for maximizing modal shifts towards greater proportion of public and non-motorized transport.

8. The proposed CTF investments will include several components, which will enhance the existing Government and municipality plans for Bogotá's SITP and SETPs in seven cities. These CTF supported components are all aimed at increasing (or maintaining) the modal share of public and non-motorized transport and improving the efficiency of the system (services and fleet) in order to maximize the reduction of GHG emissions associated with the plans for the SITP and SETPs. The components, which will be elaborated upon during the detailed program design and project development, include:

- Investments and measures for modal shift toward low-carbon transport alternatives. The CTF Transport Program will support interventions required to facilitate physical integration and optimization of the SITP and SETPs infrastructure, seeking an optimization of modal shift toward low-carbon modes of transport. These interventions include the development or accelerated expansion of the current investment plans, including BRT corridors, priority bus-lane corridors (pre-BRT), transfer and interchange stations (terminals), depots, information and technology systems, etc. The supported interventions will also include smart infrastructure planning and design (and financing), enabling and facilitating public and non-motorized transport through transfer stations, sidewalks, bike lanes and parking at stations, accessible and integrated public spaces, etc. The CTF Transport Program will also leverage and complement the investments with a comprehensive design of TDM strategies specific to the context and needs of each city, including integrated land-use and transport planning, time- and zone-based restrictions for private vehicle circulation, high-occupancy vehicle lanes, parking charging management, congestion or road pricing, traffic management optimization, eco-driving programs, etc.
- Scrapping displaced vehicles. The CTF will support the consolidation of a scrapping policy in Bogotá to eliminate the bus fleet displaced by the SITP (estimated at 9,000 old buses) and for the SETPs in seven medium-sized cities, which otherwise would just be moved to other urban areas. This component would assure the emission reductions achieved through the introduction of new vehicles.
- Setting the stage for the introduction of new low-carbon bus technology. To support an integrated and affordable fare, SITMs, SETPs and the next generation of integrated transit

systems will only be able to cover capital investment and O&M costs of standard diesel buses, limiting the potential of significant GHG emissions if low-carbon technology buses are in place (estimated at 40%-50% compared to standard diesel technology). While there is no elements in the current institutional, legal and regulatory framework ensuring low-carbon (e.g. hybrid) technologies would be introduced in the foreseeable future, the SITP and SETPs will have a window of opportunity to allow for their gradual introduction over time as their use becomes more ubiquitous. The CTF Transport Program will support part of the incremental cost (in comparison to the standard diesel buses) for the introduction of hybrid, CNG or other low-carbon technologies in the SITP and SETPs bus fleet if there is a potential for its introduction, thus making it possible to initiate operation at a commercial scale and providing an experience of global value while reducing its cost. In that case, CTF would provide funding to cover procurement of a limited number of hybrid, CNG or other low-carbon technology buses.

9. According to available data, by 2030 sustainable, low-carbon transport strategies in Colombia could result in about 6 Mt CO_2e per year of abatement. Investments in mass transport (e.g., BRT) can reduce up to 0.3 Mt CO_2e per year per every million passengers carried per day, adjusting the CDM methodologies implemented for Bogotá's BRT. In Bogotá alone, the emissions reductions that would result from the SITP are estimated at 2 Mt CO_2e per year as this project would serve a demand of 3.6 million passengers in the BRT network, in addition to an expected modal shift impact, by virtue of the optimized bus services, fare integration, and transport and land use coordinated policies. Moreover, the seven SETPs are expected to abate up to 0.3 Mt CO_2e per year, serving an aggregate of one million passengers per day. Along with a full deployment of low-carbon technologies (e.g., hybrid or CNG buses) in the long term, this financing is anticipated to result in a reduction of 2.5 to 2.8 Mt CO_2e per year. An additional reduction of 1.5 Mt CO_2e per year is expected from replication and scale-up in SITMs (seven cities) and SETPs (12 cities). Over the 20-year lifetime of the investment the cumulative reductions of the CTF Transport Program could be around 56 Mt CO_2e.

Transport Implementation Readiness

10. In the larger cities, there is a strong and long track record of implementing SITMs among the national and local governments. Since 2005, the IBRD and the IDB have supported the implementation of SITMs by providing almost one billion dollars of investment loans. While the capacity existing in Colombia to address many of these challenges is significant, there will be some specific barriers that will need to be overcome in the implementation of the CTF Transport Program, particularly for the SETPs in medium-sized cities. Technical and feasibility studies for Bogotá's SITP are almost completed and have been financed, in part, through IDB technical cooperation operations. Design and feasibility studies for seven SETPs are also under execution, with IDB support. Through the implementation of TransMilenio, Bogotá adopted a scrapping policy, which has yielded mixed results due to lack of enforcement and technical capacity.

11. The IDB is supporting the Clinton's Climate Initiative Hybrid Bus Test Program in Latin America (Bogotá, São Paulo, Rio de Janeiro, and Curitiba), with the objective of providing data and analysis to municipalities regarding the reliability of hybrid buses, estimated emissions reduction and life-cycle costs, and other benefits and risks associated with the adoption of the hybrid bus technology. This study will also contribute to the reduction of barriers for technology deployment and will assist local and national institutions in its implementation.

12. The IDB is supporting the development of an integrated land-use and transport planning strategy for the city of Bogotá, including the reformulation of the regulation that establishes the financial and management land-based instruments for the city (*Plan de Ordenamiento Territorial* – POT). Some of these instruments include land value capture mechanisms to finance transit infrastructure in the SITP

projects, and complementary land-use and zoning regulations that are required to induce transit-oriented development.

Rationale for CTF Financing of the Transport Program

13. CTF resources can help to overcome cost and institutional barriers to the realization of modal shift towards sustainable, low-carbon urban transport systems. These barriers include the following.

- City-wide transport systems, such as the SITP, require massive public sector investment from the local and national government, which may not readily available given the multiple demands for public funds in social sectors and the high cost of transit infrastructure.[52] The availability of CTF financing would lead to integration of low-carbon technologies within urban transport systems and so scaling-up of investment. Blending CTF resources with IDB and IBRD loans and other financing sources would therefore facilitate integration of low-carbon technologies within the SITP and SETPs.
- Institutional barriers are also present, with regulatory authorities that are weak, resistant to change existing conditions, and sometimes co-opted by the incumbent private operators. The MDBs will continue providing technical assistance to ensure successful implementation of the CTF Transport Program, as well as for introduction of TDM measures, while representing significant reductions in carbon intensity over the long run, also face strong institutional and political economy barriers, requiring fiscal measures that may not prove popular in the absence of financial and regulatory incentives;
- Scrapping programs are also capital intensive, involving the purchase of many old vehicles, large transaction costs and institutional capacity for management and enforcement, and
- Adoption of low-carbon technologies, such as hybrid or CNG drives, which are more capital intensive than conventional diesel buses (approximately 50%), even though it is thought their use would typically reduce maintenance expenditures by a similar margin. These upfront capital costs constitute a significant barrier which CTF concessional finance could overcome.

CTF Transport Program Financial Plan

14. The following is a conceptual financing plan for the CTF Transport Program. The specific allocations between technical assistance, and investments, as well as actual contributions of individual MDBs and stakeholders will be outlined at the proposal stage.

[52] Infrastructure costs for BRTs (US$4-15 million/km) are often too high to be financed entirely by local governments, making almost necessary the availability of additional financial support from central governments and other sources such as CDM and CTF financing.

Indicative CTF Transport Program Financial Plan (US$ million)

Source	Bogotá's SITP	SETPs	TOTAL
CTF executed by IDB	40.0	20.0	**60.0**
CTF executed by IBRD	40.0	--	**40.0**
CTF total	**80.0**	**20.0**	**100.0**
IDB loans	150.0	250.0	**400.0**
IBRD loans[53]	100.0	--	**100.0**
IDB grants	4.8	1.0	**5.8**
Carbon finance	30.0	--	**30.0**
GoC	--	340.0	**340.0**
Bogotá, DC	150.0	--	**150.0**
Municipalities[54]	--	240.0	**240.0**
Private sector	700.0	260.0	**960.0**
Total	***1214.8***	***1111.0***	***2375.8***

CTF Transport Program Preparation Timetable

15. Based on the assumption that the Colombia Country Investment Plan is approved by the CTF Trust Fund Committee in March 2010, the program is expected to be prepared along the following timetable:

Milestones	Date
Program preparation and design	September 2010
Program approval	November 2010
Individual project appraisal/negotiations	January 2011+
Individual project implementation start	April 2011+

[53] Indicative and contingent upon capital availability and exposure management issues.

[54] Pasto, Popayán, Armenia, Santa Marta, Sincelejo, Montería and Valledupar.

Annex 2. CTF Public/Private Sector Energy Efficiency Program (IDB, IFC)

Efficiency Problem Statement

1. Colombia possesses significant potential for energy efficiency savings throughout its economy in the industrial, commercial and residential sectors. The potential reduction in energy demand from energy efficiency investments corresponds to a reduction in current and future fossil fuel combustion for both electricity generation and direct use for heat. The study by *Fundación Bariloche* assesses a potential of 12 Mt CO_2e in cumulative emission reductions during a 17 year period, by means of the implementation of a set of energy efficiency measures, leading to a reduction of between 3.9% and 4.2% in electricity consumption. According to UPME, the emission reductions could reach 10% of the national electricity consumption, or 7,500 GWh per year in 2025, and would involve annual emission reductions of more than 2 Mt CO_2e. The Uniandes study assess a potential of 67.1 Mt CO_2e of cumulative emission reductions on a 20 year period.

2. Not only will significant reductions in energy demand allow the development of new fossil fuel generation to be postponed while other renewable sources are explored, but the Colombian government will benefit from reduced government subsidies to low-income residential customers and a more competitive economy. Colombia's end users are eager to pursue the opportunities presented by energy efficiency investments, such as lower costs and greater competitiveness, as well as a lower carbon footprint. In order to realize these benefits and unlock the latent demand of energy efficiency investments, knowledge, financial and regulatory barriers need to be addressed in a programmatic manner.

3. The Colombian government has demonstrated its commitment to energy efficiency through a variety of policy and regulatory measures. These include creating a legal framework for efficiency and standard setting mechanisms, establishing a national efficiency commission, causing the national energy regulator to set efficiency standards, through UPME carrying out extensive studies on carbon abatement, and developing a national plan for energy efficiency in 2007. Now, the Colombian government is considering the establishment of a fund that will specifically target efficiency barriers in the residential sector.

4. However, these institutions and policies are still early stage and further steps toward amplifying and making them more effective are necessary. The government is aware in particular of the value of creating an enabling regulatory environment that would allow utilities to reduce power sales, as this is a key component to both scaling-up investments and rendering such investments financially sustainable over the long term. As part of the CTF Efficiency Program, the government will study possible regulatory changes to create direct incentives for distribution companies to encourage energy efficiency investments among its clients for implementation when the current methodology for the remuneration of distribution companies is revised in 2013.

5. Despite the government's commitment and businesses' interest, knowledge and financial barriers in the Colombian context are particularly high given the lack of significant energy efficiency investment undertaken to date. These barriers are outlined in detail in §71 of the body of this document and include firstly a general lack of experience and information about existing efficiency experiences in Colombia and other countries and also poor information flow between market players, which has impeded the growth of strong efficiency institutions and programs. The lack of familiarity amongst the financial sector has led to difficulty in assessing and structuring investments, and an inflated risk perception that results in reticence in adopting efficiency tools. Local private financial institutions do not have the experience or technical expertise to perform due diligence and assess the risks associated with financing energy efficiency and are inclined to over-estimate risk and over-price financial products, thus reducing the attractiveness of the investments to the end-user.

6. Furthermore, there is a lack of information about the benefits and technical aspects of efficiency investments amongst end users, resulting in low demand and a perception of higher opportunity costs for upfront efficiency investments. There is also a lack of experienced technical service providers in the economy, and a lack of extensive efficiency programs for them to operate in cooperation with. End-users are often also excluded from these investments because they simply do not have adequate access to credit, or there is a tenor or other mismatch in the sorts of financing available.

7. Barriers are also regulatory. Utilities currently lack incentives to reduce energy consumption, and certain end-users have subsidized rates, which reduce the incentive to consume less. Finally, the current efforts of public efficiency entities have so far been insufficient to transform the market. While these barriers do not prohibit efficiency investments, they do not provide a driver for end user investments; as a result, the program will focus on developing and promoting other incentives for end users (i.e. making it easier to become more economically competitive by reducing the time, cost and knowledge barriers that exist for implementing efficiency investments today).

8. Although early initiatives to develop an energy efficiency market in Colombia have emerged, no significant scale-up of investments has been seen to date. UPME's technically valuable energy efficiency investment guidebooks alone cannot bridge the knowledge gap. The Bancoldex-URE program to provide price-competitive lines of credit for energy efficiency investments to local financial institutions was not utilized since the availability of financing alone does not create the demand for the financing. The creation of an energy efficiency market must be composed of coordinated efforts between end-users and financial institutions.

Proposed Transformations in Efficiency

9. The proposed CTF Efficiency Program seeks to strategically deploy CTF financing through a series of private and public sector interventions, using technical assistance, investment financing, and performance-based incentives to systematically reduce the barriers that stand in the way of scaling-up energy efficiency investments throughout the economy.

10. Based on the mitigation potential presented in the Uniandes study and in UPME's data, as well as specific intervention opportunities in the targeted three consuming sectors (industrial, commercial and residential), it is estimated that the CTF Efficiency Program would save 31.9 Mt CO_2e over a 20 year period (out of a national potential of 67.1 Mt in the sectors that this IP will target) with a total program cost of US$670 million. The cost of abatement is therefore US$21.0/Mt CO_2e.[55] This figure includes the investment required for these measures as well as corresponding programmatic and transaction costs.

11. *Financial sector programs.* The measures required to attain these savings imply substantial implementation costs and will require that price-competitive financing is readily available in the market. Therefore one of the primary foci of the CTF Efficiency Program is on the banking sector. Through the program, IFC and IDB would work with two to three of Colombia's more influential financial institutions to increase their capacity to develop, assess and monitor a portfolio of suitable energy efficiency projects. This would include combining targeted financial support, training for bank staff, investment screening tools, and transaction-level support in order to facilitate the development of new lines of business within local financial institutions. Only if internal capacity is developed will financial institutions have the ability to continue energy efficiency lending beyond the life of the CTF Efficiency Program. By working with local consulting firms to deliver the capacity building in these initial interventions, the CTF program will strengthen local technical capacity, which can then support other financial institutions as they develop efficiency programs to stay competitive in the market. The supply of finance would be, importantly, developed in coordination with capacity building activities in the public sector and private

[55] See footnote 48.

sector, to promote the connection of supply with demand, adequate flow of information, and proper alignment of incentives.

12. Debt and/or guarantees and risk sharing products would be used as necessary to mitigate financial institutions' perceived risks regarding energy efficiency projects until a track record can be developed and help leverage significant private sector financing flows. The specific instrument to be used would depend on the liquidity and funding profile of each financial institution. Banks would be offered a financing package that includes a combination of CTF funds with IDB and/or IFC funds. The concessional nature of the CTF funds would allow some of the initial product line development costs to be offset and to mitigate risks for financial institutions during the early stages of their heightened risk perceptions. Once financial institutions develop their internal capacity as well as a track record and experience in the industry, they will be able to scale-up financing on their own without the need for further subsidies. In addition, once other financial institutions see that some banks are creating "market share" in this space, experience in other markets show that other banks are likely to follow suit without further support. While these initiatives are expected to release access to financing for energy-efficient investments, in order for these tools to be successful, demand must also be generated amongst end-users.

13. *Industrial and commercial programs*. Specific ways of surmounting knowledge barriers and creating demand are well-proven in myriad contexts around the world. The first step in an efficiency program, once it has identified an interested consumer, is typically to provide an energy efficiency walkthrough, or audit. This has several purposes. Energy efficiency audits provide end-users with concrete analysis on the financial and operational benefits of specific energy efficiency investments. Audits also allow a qualified engineer to assess the technological and operational feasibility of investments, make specific recommendations for efficiency measures, and gather data that a financial institution will need in order to process the efficiency loan. The experience of audit providers demonstrates that once a company has gone through the audit process and therefore received adequate information regarding the benefits of efficiency investments, it is highly likely to implement recommended measures - particularly if the company's senior management is involved in the process. (The reluctance of line managers to prioritize investments that yield energy savings over those that generate revenue is often only overcome through the direct engagement of a company's leadership). Uptake in the industrial sector is also be likely to be stronger and more rapid once example projects can be implemented with key strategic companies in one or two of Colombia's economic groups. Similar programs already exist such as IIC's GreenPYME program, which could be replicated or scaled up.

14. Equipment technicians and service providers are crucial agents in the efficiency market. The CTF Efficiency Program would also include training programs that capacitate technicians to perform walkthroughs or audits, educate and make recommendations to clients, assist them in accessing and applying for financing, and implement the efficiency measures. Such a program already exists and could be replicated or scaled. Another envisaged tool that is both knowledge-based and financial would be the establishment of private sector performance-based incentives programs, whereby end-users would be educated and rewarded for their energy savings. Such a tool can create an opportunity to generate the interest of company managers and executives to pursue energy efficiency investments, as well as constructive competition among companies within and across industries.

15. Scaling up energy efficiency in the industrial sector will also be supported by direct lending from IDB and through IFC's Cleaner Production Lending Program (CPLP), a program of combined technical assistance and lending which directly targets the largest industrials in the country. The CPLP is a global program that will be actively working in Colombia.

16. *Residential programs.* Just as local financial institutions provide the greatest opportunity for scaling-up industrial and commercial investment due to their extensive client base of local businesses, local electricity distribution companies are uniquely situated to serve the lower stratum of residential customers, in particular as many of these customers have no access to formal financial markets. As seen

in the CODENSA case, distribution companies have the proven ability to successfully catalyze investment in new, more energy-efficient appliances. The inclusion of removal/disposal requirements in such programs would orient its objectives to energy efficiency and make it effective in unlocking efficiency potential within the residential sector, as seen in the EPM case.

17. The Colombian government is planning to address financial barriers to the residential sector through the implementation of a national energy efficiency fund whose purpose is to develop a large-scale energy efficiency program with appropriate financial structures and capacity building activities. The development of such a fund would provide complementary financing options to those made available through the local distribution companies and financial institutions. Within the context of the CTF Efficiency Program, the government is seeking the support in the design and start-up of such a fund from the MDBs.

18. Together, the various financial and non-financial products of the MDBs and the CTF, each leveraging funding from bilateral cooperation agencies, the government, and the private sector, provide a programmatic response to the specific challenges posed by the Colombian economy.

Rationale for CTF Financing of the Efficiency Program

19. CTF financing is necessary to address capacity, cost and risk barriers among financial institutions, increase end user demand, and build local technical expertise among key stakeholders in order to scale up energy-efficient investments in a systematic and sustainable way in Colombia. The CTF program would coordinate existing small, balkanized policies programs and actors in energy efficiency, as well as unlock latent financial resources which are currently constrained by risk perceptions. Because the benefits of efficiency technologies have not been demonstrated in this market sufficiently, and because the technical capacity required does not exist sufficiently in the market, scaled investment in an efficiency market under current conditions will not take place. Launching such a coordinated effort will require significant financial resources and know-how, which are not currently being mobilized in the market. CTF resources could grow, and serve as a center of gravity and coordinating mechanism for all of the individual players within the sector. Previous attempts to solve only a single barrier have been unsuccessful. It is only through this programmatic approach for addressing regulatory, knowledge and financial barriers that the market can be transformed and that the 228 Mt CO_2e potential can thus be realized.

20. The net abatement cost for energy efficiency investments in Colombia is estimated at -3.4 US$/t CO_2e, including the consideration of energy savings. This calculation does not capture, however, the complexity and cost of gathering and delivering information on potential energy savings, changing risk perceptions, changing engrained behavior, reducing transaction costs, or implementing an energy efficiency program. Many energy efficiency investments generate a positive return, but until the financiers and end-users understand – through the experience of their competitors or their own firsthand experience – that energy efficiency investments are good business, those returns will not be generated. The use of CTF funds for technical assistance and concessionary finance, such as loans and guarantees, or seed capital for the national energy efficiency fund, provides the necessary catalyst to engage the stakeholders to implement energy efficiency investments. In the absence of such a source of funds, Colombia - as well as many other countries - is expected to remain as it has been: a country of significant, but untapped, energy efficiency potential. In addition CTF funds can make possible a set of programs that will build a comprehensive and coordinated efficiency market, allowing Colombia to adopt best-of-industry practices and avoid wasting valuable resources through the trial and error of isolated pilot programs.

21. The role of the CTF as a catalyst extends further to re-directing existing funding sources and generating new funding sources for this energy efficiency program. As a result of the CTF Efficiency Program, a portion of the already approved US$200 million line of credit from IDB to Bancoldex for SME competitiveness, which is matched by US$200 million of government funds, will become available for SME energy efficiency investments. Funding available from bilateral agencies, such as KfW, which

has earmarked €50 million for the program, will also be directed most likely toward energy efficiency investments. CTF funding will also directly leverage financing from the IDB and the IFC, as well as private sector funding.

Efficiency Implementation Readiness

22. The GoC is committed to reducing the country's carbon footprint through the implementation of a comprehensive CTF Efficiency Program.

23. The IDB and IFC have already begun exploring partnerships with key market actors and have several programs already in place that can be scaled-up. Several local financial institutions have expressed strong interest in participating in the program and developing new lines of business in the energy efficiency sector under the right conditions. Local distribution companies are already working with the MDBs on programs that can be scaled up. For example, IDB is financing EPM's new appliance replacement program, which, through the use of technical assistance support, includes removal and disposal programs to ensure energy demand reductions. The recently piloted GreenPYME program, which has already trained 400 SME managers and is currently initiating a program to conduct energy efficiency walkthroughs and audits, demonstrates the receptiveness of the market to proactive and targeted outreach and sets the stage for future such engagements. The existing MIF program for training service providers also provides critical groundwork for the success of the CTF Efficiency Program. The Colombian government is furthermore planning to address financial barriers to the residential sector through the implementation of a national energy efficiency fund and is seeking the MDBs' support in the structuring of an appropriate financial structure and in the start-up phase of this fund. ANDI, the key domestic industrial association, is very interested in working cooperatively to catalyze its membership and implement energy efficiency investments.

CTF Efficiency Program Financial Plan

24. The following is a conceptual financing plan for indicative purposes to address the knowledge and financial barriers through the use of technical assistance and financial instruments. The specific allocations between technical assistance, performance-based incentives, and investments, as well as actual contributions of individual MDBs and stakeholders will be outlined at the program proposal stage.

Indicative CTF Efficiency Program Financial Plan

Source	Amount
CTF executed by IDB	32.5
CTF executed by IFC	17.5
CTF total	**50.0**
IDB loans[56]	130.0
IFC loans	90.0
KfW[57]	70.0
Other[58]	--
GoC	40.0
Private sector	290.0
Total	***670.0***

CTF Efficiency Program Preparation Timetable

25. Based on the assumption that the Colombia Country Investment Plan is approved by the CTF Trust Fund Committee in March 2010, the program is expected to be prepared along the following timetable:

Milestones	Date
Program preparation and design	September 2010
Program approval	November 2010
Individual project appraisal/negotiations	January 2011+
Individual project implementation start	April 2011+

[56] Includes a portion of the US$200 million conditional line of credit to Bancoldex, which is matched by US$200 million from the government. As a result of the CTF program and as reflected in the indicative financial plan, it is estimated that 20% of the funds would be available for energy efficiency investments for SMEs

[57] KfW's anticipated contribution is €50M, equivalent to approximately US$70M.

[58] Additional funding sources will be pursued on an individual project basis, from other bilateral agencies, carbon finance, etc.