

INTERNATIONAL SUPPORT FOR DOMESTIC CLIMATE POLICIES

Options for International Support for Low-Carbon Transportation Policies in Brazil

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* The ideas contained in this paper do not necessarily reflect the official position of Brazil on these issues.

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Abstract

This paper analyses the Brazilian transportation sector, with specific focus on two recently adopted policies: The National Plan on Logistics and Transport, a policy that can promote a significant change in the modal split in the country; and the Pro-Transport programme, which aims to fund public transportation in urban areas. Although these policies have been adopted for reasons other than climate change, they will help to lower the curve of GHG emissions in Brazil. Moreover, taking into account that the transportation sector has many inter-linkages with other actors and economic activities, additional environmental, social and economic co-benefits have been identified. The analysis of these policies led to the conclusion that while it is relatively easy to mobilise investment in transport logistics infrastructure at the national level, given the impacts on economic competitiveness for the country as a whole, it is more challenging to leverage funds to provide more efficient and integrated public transport systems and their related infrastructure at the local level. Taking into consideration these challenges within the Brazilian transportation sector, international cooperation can play a significant role in supporting domestic policies, especially to complement and accelerate domestic efforts.

1. Introduction

This paper, like the others within the scope of this study, aims to link potential international financial support to increased scale, scope and time-frames for implementation of domestic policies with climate co-benefits in developing countries. The focus of this study is the transportation sector in Brazil. As a country-specific case study, this paper will discuss the Brazilian transportation sector, with reference to specific examples from two recently adopted policies: The National Plan on Logistics and Transport, a policy that can promote a significant change in the modal split in the country; and the Pro-Transport programme, which aims to fund public transportation in urban areas.

The growing mobility of goods and people is one of the main features of globalisation. Transportation is a basic enabler of economic activity and people interaction, and an effective transportation infrastructure is recognised as being closely linked to economic growth. However, one of the negative aspects of this growing mobility is that motorised forms of transport are strongly associated to the increase of greenhouse gases (GHG) in the atmosphere.

The 2007 Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) highlighted that CO₂ emissions increased 80% from 1970 to 2004, representing 77% of the emissions in 2004¹. One of the largest increases in GHG emissions during this period, in an assessment of end-user sectors, was the transportation sector², with an increase of 120%. This sector accounts for 23% of world energy-related CO₂ emissions, with 74% coming from road vehicles³.

¹ Intergovernmental Panel on Climate Change - IPCC, “Climate Change 2007: Synthesis Report”, WMO/UNEP, 2007 (un-edited copy prepared for COP 13), p. 1 (Topic 2).

² The transport sector encompasses passenger and freight movements by road vehicles, railways, aircraft and both inland and maritime vessels. Moreover, pipelines can also be considered in the broad concept of transportation.

³ IPCC, “Climate Change 2007: Mitigation of Climate Change”, Working Group III Report, WMO/UNEP, 2007, p. 325.

Moreover, GHG emissions from the transportation sector are expected to continue to sharply increase in the near future, given that each year a growing number of people are gaining access to motorised forms of transport. Although the vast majority of the world's population still does not have access to personal vehicles, this situation is changing fast, especially in emerging economies. Despite the growing pressure on all countries to significantly mitigate GHG, it is a challenge to curb emissions without preventing new consumers in developing countries from enjoying the benefits and luxuries of modern technology.

If greenhouse gas emissions are to be curbed, the transportation sector cannot pursue its development along the same lines as in the past or under the "business-as-usual" scenario, given that it depends heavily on burning fossil fuels. In fact, according to the IPCC, 95% of the total energy used by world transport relies on petroleum⁴.

Nevertheless, to shift from "business as usual" scenarios to more climate-friendly pathways is challenging. Vehicle efficiency, alternative fuels, and adequate transportation infrastructure combined with effective transportation system management, are essential to reduce GHG emissions from the transportation sector. All these options will require new "environmentally sound technologies" - EST⁵ and a considerable amount of investment.

These challenges also offer significant opportunities and it must be highlighted that implementation of these options has several co-benefits of economic, environmental, and social order.

GHG emission reduction will be only one of several key issues related to the transportation sector during coming decades and it is extremely naïve to believe it will be the foremost related concern in developing countries, given the need of these countries to promote improvements in their transportation systems as an enabling factor for economic development.

However, even if concern for the accumulation of GHGs in the atmosphere is not considered the main issue, it is important to consider the primary source of emissions: unsustainable burning of fossil fuels. Unsustainable use of energy sources invites reflection, especially considering the steady rise in oil prices in the international market in the last months. How to reduce dependence on oil, in the transportation sector and elsewhere, is a question related to energy security, especially for oil importing countries, and this issue draws more political attention than environmental reasons. Although it is unrealistic to think that the dependence on oil will be overcome in a short space of time, it is certainly valid to discuss alternative energy sources related to the transportation sector.

⁴ *Ibidem*.

⁵ According to Agenda 21, Chapter 34, entitled "Transfer of Environmentally Sound Technology, Cooperation and Capacity-Building", environmentally sound technologies - EST are those that "protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products, and handle residual wastes in a more acceptable manner than the technologies for which they were substitutes." Moreover, Agenda 21 draws attention to the fact that EST are "not just individual technologies, but total systems which include know-how, procedures, goods and services, and equipment as well as organizational and managerial procedures." Cf. paragraphs 34.1 and 34.3 of Agenda 21, Chapter 34, contained in UN. Doc. A/Conf.151/4, 12th August, 1992.

Motorised traffic is the common source for both local air pollutants and GHGs, and a systematic approach to address these problems has the potential to reduce costs in the health system (including traffic fatalities) and in measures related to ecosystem management. For instance, a study points out that in China the costs of reducing carbon dioxide emissions by 5-10% would be compensated by increased health benefits from the accompanying reduction in particulate matter⁶.

One of the main nightmares of people who live in big cities is the number of vehicles in the streets, resulting in congestion, noise and accidents. The increasing demand for private vehicles, especially in developing countries, is outpacing the supply of transport infrastructure, both in terms of road networks and public transport systems⁷. The measurement of the costs of traffic jams is complex, but it is evident that they result in losses of billions of dollars each year⁸.

The main difficulty faced by developing countries in relation to their transportation sectors is how to ensure an adequate level of public and private investment to promote transportation infrastructure, both in terms of freight and passenger transportation. Infrastructure investment is required to cope with the increasing number of vehicles and the need for a high performing transportation system, which is essential to the country's economic vitality.

Moreover, co-benefits to jointly address climate change and development can be identified, especially for the urban transportation system. Although it has been recognised that transportation policies are, in the vast majority of cases, undertaken for reasons other than climate change, highlighting the co-benefits of these domestic transportation policies is extremely important to show that they are compatible with the long-term objective of large-scale emissions reductions. These linkages should be explored in a way that could facilitate promoting South-North cooperation and attractiveness of foreign investments.

2. Brief Characterisation of Brazil and its Transportation System

In order to allow the reader to fully understand the impact of the selected transportation policies in Brazil and the need for investment, it is important to provide some information regarding the country's territory and government structure, as well as details on the transportation system.

Brazil is a Federative State; therefore, the exercise of power is attributed to distinct and independent entities, each with its own particular function, with further provision for a control system among them under the 1988 Federal Constitution. The political and administrative organisation comprises three main Branches of Power: the Judiciary, the Executive and the Legislative⁹, and the principle of autonomy among the Union, the Federal District (where the

⁶ Aunan, K., G. Patzay, H.A. Aaheim, and H.M. Seip, 1998: Health and environmental benefits from air pollution reduction in Hungary. *Science of the Total Environment*, 212, pp. 245-268.

⁷ IPCC, *supra* note 3, p. 326.

⁸ National Cooperative Highway Research Program, *Economic Implication of Congestion*, NCHRP Report 463, Washington, D.C., 2003.

⁹ In addition to the Union, the structure of the Branches of power is applied in the 26 states, the Federal District and 5,563 towns and cities.

Capital of the Republic, Brasília, is located), 26 states and 5,563 municipalities (according to 2003 data)¹⁰.

With an area of 8,514,876.6 km², Brazil is the largest country in South America. It is the fourth biggest country in the world in terms of contiguous lands and fifth if non-contiguous lands are considered. The size of its territory makes it a country of continental dimensions, since its land area occupies 1.6% of the globe, 5.7% of the planet's land area and 20.8% of the surface of the American continent.

The characteristics of Brazilian territory, and the diversity of its biomes, have over time determined the various forms of occupation and use by the population, distributed over five large geographic regions. The table below shows the regional disparities in terms of territory, population and contribution to national GDP.

Region	% of Territory	% of Population	% of GDP
North ¹¹	45	7.9	5
Northeast ¹²	18	27.7	13
Southeast ¹³	11	42.65	56.4
South ¹⁴	7	14.65	16.6
Midwest ¹⁵	19	7.1	9

Table 1. Regional disparities in terms of size of territory, population and GDP.

The historic occupation of Brazil led to a major concentration of economic activities and population within a small portion of its territory, usually close to the coast. This resulted in a situation of geographic inequality; with immense areas of empty and underdeveloped land on one side, and areas with a high concentration of population on the other. Economic inequality has been observed in both cases, although determined by different drivers.

Data from the Demographic Census for 2005 estimated Brazil's population at 184,184,170¹⁶, with a population density of 19.95 persons per km². Average population growth was 1.67% per year from 2001 to 2005. In 2005, most of the population (82.82%) lived in urban centres. In the most urbanised region of the country, the Southeast, the urban population is over 90%. Although the greatest concentration of population is in cities of more than 1 million inhabitants, the greatest growth occurs in cities with populations of between 250,000 and one million.

¹⁰ See the homepage for the Brazilian Government, available at http://www.brasil.gov.br/ingles/about_brazil/government_structure/

¹¹ This region consists of the following states: Acre (AC), Amapá (AP), Amazonas (AM), Pará (PA), Rondônia (RO), Roraima (RR), and Tocantins (TO).

¹² This region has the largest number of states: Alagoas (AL), Bahia (BA), Ceará (CE), Maranhão (MA), Paraíba (PB), Pernambuco (PE), Piauí (PI), Rio Grande do Norte (RN), and Sergipe (SE).

¹³ This region consists of four states: Espírito Santo (ES), Minas Gerais (MG), Rio de Janeiro (RJ), and São Paulo (SP).

¹⁴ This region includes the following states: Paraná (PR), Santa Catarina (SC), and Rio Grande do Sul (RS).

¹⁵ This region consists of the following states and districts: Goiás (GO), Mato Grosso (MT), Mato Grosso do Sul (MS), and the Federal District (DF).

¹⁶ Brazilian Institute for Geography and Statistics (Fundação Instituto Brasileiro de Geografia Estatística) - IBGE, 2005.

From an economic point of view, Brazil is a developing country with a very complex and dynamic economy, one of the ten largest economies in the world. The country is a large agricultural producer (it has about 200 million heads of cattle and is a major world exporter of a number of agricultural products). It is also one of the world's largest producers of several manufactured products, including cement, aluminium, chemical products, petrochemical feedstock and oil¹⁷. In 2007, Brazil's GDP was around US\$ 1.5 trillion and GDP per capita was US\$ 7,605.

Given these characteristics, Brazil's transportation system faces two different challenges, both at different scales. The first challenge is to improve the infrastructure of the transportation system throughout the country. This could ease the integration, expansion and improvement of the production system in order to facilitate a cooperative development effort among regions. In this regard, all transportation systems must be significantly improved and articulated in light of this need.

Road transportation is the main transport system in Brazil. In the 20th century, Brazilian transportation policy overemphasised the importance of roads, which resulted in 2005 in 58% of freight transportation being pursued on roads (measured in t/km). The predominance of this mode of transport is the result of a development model implemented in the country since the 1950's, during the government of President Juscelino Kubitschek (known as JK), who famously said: "to govern is to open roads". However, comparative to the size of the territory, the Brazilian road network is considerably small. In 2000, Brazil's total roadway network was 1,071,821 miles (1,724,929 km), 9.6 % of which were paved.

Although roads represent a fast means of moving comparatively small amounts of cargo and passengers over short distances, they are often more expensive than other modes of transport and are usually less energy efficient. The lack of consistency in infrastructure investment results in poor conservation of the road network, which leads to a considerable increase in transportation costs and number of accidents.

Prioritisation of roadways was implemented at the expense of railway investments. Although, railways represent the second most important transportation system in Brazil, in 2000, the country's total railway network was only 28,500 km – half of which was concentrated in the states of São Paulo, Minas Gerais and Rio Grande do Sul. This is an insignificant number taking into account the size of the territory. The existing network is largely used for freight transport of iron ore, grains and steel. The situation is even worse when passenger services are considered: long distance passenger railway services are practically nonexistent in Brazil and passenger lines are limited to the suburbs of great urban centres. It is worth mentioning that the government sold off its controlling shares of railways in 1997, although many states and municipalities retained control of local lines.

Brazil has been blessed by abundant water resources and possesses a vast and dense hydrological network. Many of its rivers are noted for their length, width, and depth. Due to the nature of the continental relief, there is a predominance of plateau rivers, which are characterized by sudden drops in altitude, deep narrow valleys, and other features that give them a high potential for electric energy generation. However, the same characteristics

¹⁷ See Federal Government of Brazil, "Brazil's Contribution to Prevent Climate Change: White Paper", MRE/MCT/MMA/MME/MDIC, Brasília, 2007, p. 13. Available at http://www.mct.gov.br/upd_blob/0018/18294.pdf

jeopardise navigability. Of the great Brazilian rivers, only the Amazon and the Paraguay are predominantly flatland rivers and are used for navigation. Nevertheless, studies have indicated that vast waterways in most of the hinterland have not been fully exploited for waterborne transport.

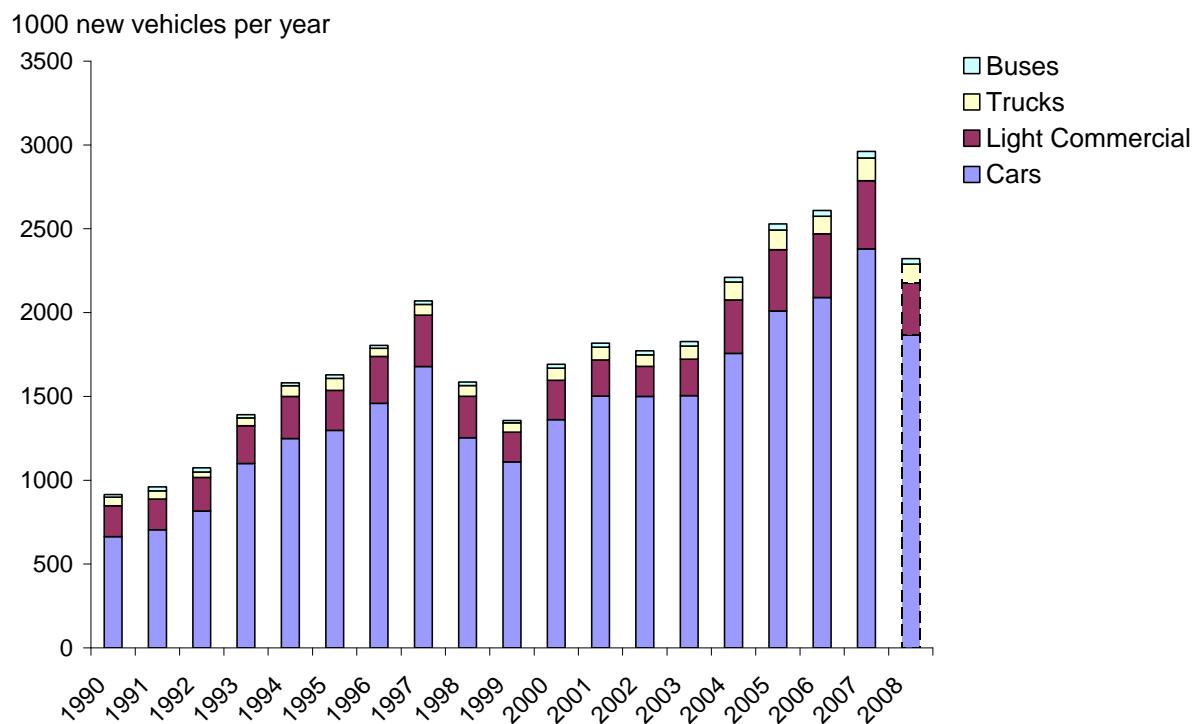
Brazil's long coastline has also not been exploited to a desirable extent. Brazil has 46 organized ports, 24 of which are ocean ports. Only since the late 1990's have there been attempts, mainly through privatisation, to improve the country's major port facilities and overcome the obsolescence of equipments and lack of storage structure.

Given the vastness of Brazilian territory, both in terms of latitude and longitude, it would be natural to think that air transportation is largely used in the country. However, this is not the case, mainly due to the higher costs. In 2005, air transport accounted for only 3.6% of the country's transportation system. However, the fast economic growth Brazil has experienced in recent years, accompanied by an increase in income, has led to a sharp growth in this sector. In the biennium 2002-2003, it saw annual growth of 8%, twice the world average. In 2001, total passenger movement was calculated at 75 million passengers per year. Although Brazilian air transportation still faces considerable bottlenecks, as there is enormous demand for new terminals and airport construction, recent years have witnessed extraordinary progress, with the renovation of major airports and the inauguration of new ones. Nevertheless, it has been acknowledged that this sector will require a significant level of investment in coming years.

Actually, this observation can be extended to all transportation systems in Brazil. However, the main challenge is not to deal with each transportation system separately, but how to promote the integration of road, rail, water and air transportation systems in order to reinforce the trend toward inter-modality.

Although the government has sought a systematic approach to plan and implement a national system of integrated surface transport since the 1940s, coordinated investment recognising the importance of air transport has only been pursued since the 1990s. However, funds have not been provided at the scale necessary to accompany economic development and this can be a serious barrier for the country's growth. Therefore, it is fundamental to promote multi-modal investment alternatives.

The second main challenge related to the transportation sector is to ensure an effective transportation system in urban areas, especially in big cities. The country has 10 cities with more than 2 million inhabitants, and two of them, Sao Paulo and Rio de Janeiro, are among the biggest cities in the world, with more than 10 million people. These cities, as with any other big city in the world, suffer from air pollution, congestion, noise and accidents caused by intense traffic. Governments have difficulties providing the necessary road network infrastructure for the incredibly fast increase in the number of both light and heavy vehicles. The table below shows the total output for the Brazilian automobile industry by type of vehicle. This provides an idea of the country's rapid motorisation and the number of new vehicles in the streets and roads every year, an annual average of more than 2 million over the last 5 years.



Year	Cars	Light Commercial	Trucks	Buses	Total
	10^3	10^3	10^3	10^3	10^3
1990	663.1	184.8	51.6	15.0	914.5
1991	705.3	182.6	49.3	23.0	960.2
1992	816.0	201.6	32.0	24.3	1,074
1993	1,10	224.4	47.9	18.9	1,391
1994	1,249	251.0	64.1	17.4	1,581
1995	1,297	239.4	70.5	21.6	1,629
1996	1,459	279.7	48.7	17.3	1,804
1997	1,678	306.5	63.7	21.6	2,07
1998	1,254	247.0	63.8	21.5	1,586
1999	1,11	177.0	55.3	14.9	1,357
2000	1,362	235.2	71.7	22.7	1,691
2001	1,502	214.9	77.4	23.2	1,817
2002	1,5	179.9	68.6	22.8	1,792
2003	1,505	216.7	79.0	27.0	1,828
2004	1,757	318.4	107.0	28.8	2,211
2005	2,01	365.7	118.0	35.4	2,530
2006	2,09	379.2	106.0	33.8	2,611
2007	2,38	406.2	137.0	39.0	2,970
2008*	1,869	309.6	111.4	31.7	2,321

Figure 1. Total Output for the Automotive Industry by Type of Vehicle: 1990 to August 2008
 (Source: ANFAVEA 2008).

Nevertheless, the poor are usually not included in the rapid growth of private mobility and have to count on public means of transportation, which usually are far from adequate. As an

emerging developing country, Brazilian local governments have difficulties in finding the right balance between the level of funds needed to invest in public transportation with the need to meet their pressing social and economic needs, such as eradicating poverty, improving health conditions, combating hunger, creating decent living conditions, among others. Therefore, it is essential to find alternatives to support public transportation infrastructure.

3. Description of Policies

The two main challenges facing Brazil's transportation sector identified above are shared with many other developing countries. To highlight the Brazilian transportation sector, this paper will focus on two policies that have just been adopted: the National Plan on Logistics and Transport and Pro-Transport.

Both policies are intended to facilitate investments in the transportation sector. The choice of these policies is motivated by the fact that – although they have different scopes and scales, are at different stages of implementation, and have different levels of implementation and identification of means – each of them addresses one of the two challenges identified in the previous section. Whilst the first policy addresses the challenge of how to promote a multi-modal system and identify the scale of investment necessary, the second addresses the issue of how to ensure alternative investments to improve the public transportation system. Another reason that justifies their choice, despite of the fact they have mainly been conceived for reasons other than climate change, is that they have been included in the draft version of the Brazilian National Plan on Climate Change. This indicates they have been perceived as instruments that can also contribute to the long-term objective of large-scale emissions reductions.

National Plan on Logistics and Transport (Programa Nacional de Logística e Transporte: PNLT)¹⁸

The PNLT is a framework policy that aims to provide a strategic planning system for the transportation sector, for the mid and long term, based on concepts of territoriality, national security and occupation of the territory by means of sustainable development with equity and social justice. It is a multimodal plan, based on comprehensive studies, which indicates the need for actions and investments, and is associated with the country's social and economic development. The plan involves the whole logistic chain associated with transportation, including all costs and not just direct sector costs.

Nevertheless, the PNLT intends to be more than a mere list of projects and actions by becoming a national plan involving the whole Federation. The policy will expand beyond the mandate of a government, extending to overall policies for the Brazilian State. Thus, it calls for an efficient and effective process of institutionalisation, organisation and management, in order to involve all government structures, as well as the various public and private organisations and institutions related to the transportation sector.

¹⁸ Ministry of Transport & Ministry of Defence, National Plan on Logistics and Transport, Executive Summary, 2007. This section has been based on the available version of the PNLT. The Plan was subjected to public consultation and has been reviewed by the ministries involved.

The first and fundamental objective¹⁹ of the PNLT is to re-establish an integrated planning process within the transportation sector, offering a permanent management structure, based on a Geographic Information System, which intends to be participative, integrated and inter-institutional. The second objective, which is equally important in order to prioritise actions and investments, is to consider all logistic chain costs, involving the real prices of moving flows from origin to destination. This is fundamental to the effectiveness and competitiveness of the national economy, both for domestic and international markets (exports).

The third objective of the policy is to achieve an effective change in the existing freight transportation mix of the country, given that optimisation and rationalisation of freight is associated with the more intensive and adequate use of railways and waterways. This objective takes into account energy efficiency and productivity of flows, in order to consider volume and transportation distances. It is worth highlighting this objective in the scope of this paper, given that the PNLT can induce a change in the modal shares of trucking, rail and inland waterways transport, which can curb the GHG emissions curve in the country. Moreover, regarding passenger transportation, it defines instruments that may offer standards of potential demand evaluation for projects related to passenger flows in major cities based on an analysis of the evolution of both air and highway modes. If the projects and actions identified in the plan are implemented, railway and waterway modes will significantly increase, as can be seen in the figure below.

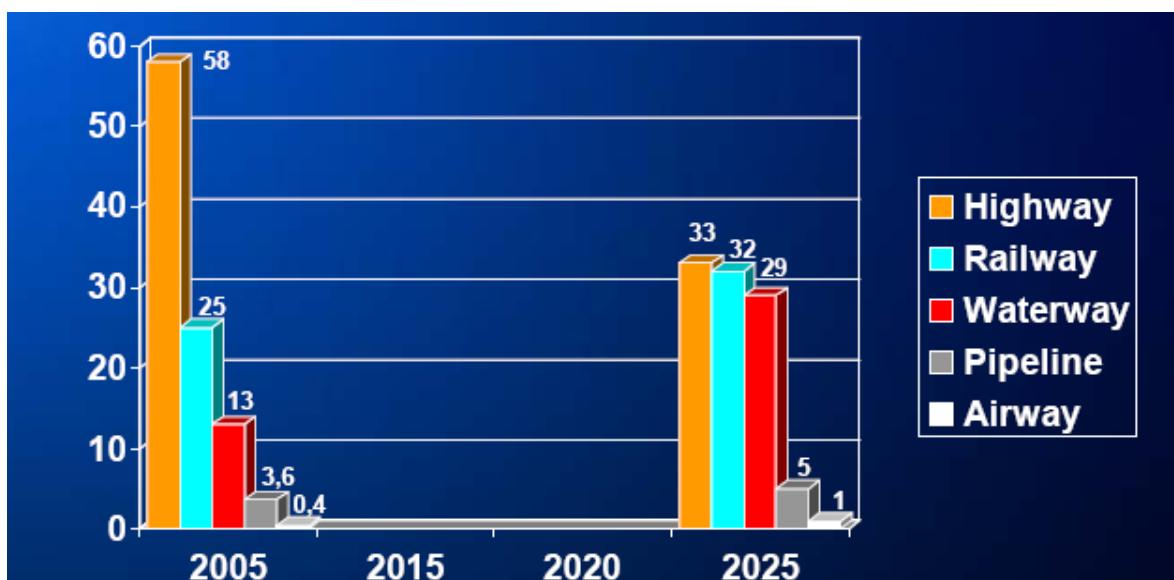


Figure 2. Current and Future Freight Transportation Mix²⁰ (Source: PNLT).

The fourth objective is environmental protection, which takes Brazilian environmental legislation into consideration, especially with regard to the use of land and soil, both in production of goods and in infrastructure construction. Although there is no reference to GHG emissions regarding the implementation of the plan, the PNLT is strongly committed to the respect of environment impact assessments and Ecological & Economical Zoning, as well as to technological evolution and energy rationalisation. In this matter, the PNLT is connected to

¹⁹ A more detailed description of the scope and objectives of the PNLT is given in the Executive Report of the plan, available in Portuguese at:

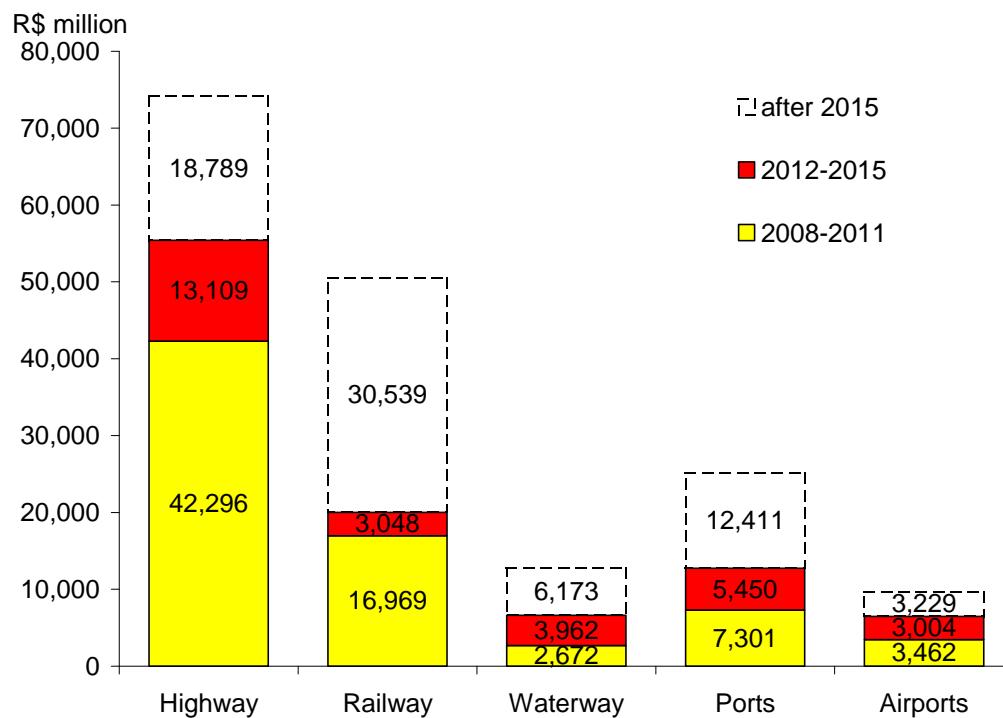
http://www.centrabeb.br/docs/proj_estrutura/logistica/relatorio_executivo_junho2007.pdf

²⁰ In terms of t/km, by mode.

the studies being carried out by the Ministry of Planning. The fifth objective of the PNLT is the creation of a new framework classification of structural projects for the country's social and economic development. These projects can be divided into four categories, projects to: increase productive efficiency in consolidated areas; induce development in areas of agriculture and mining expansion; reduce regional disparities in depressed areas; and promote South America regional integration.

Period	Mode of Transport	Extension (km) Quantity (un)	Investment (R\$ million)	Modal Total Participation in Investments
2008-2011	Highway	19.743	42.296,00	Total in Period 72.700,00
	Railway	4.099	16.969,00	
	Waterway	3.363	2.672,00	
	Ports	56	7.301,00	
	Airports	13	3.462,00	
2012-2015	Highway	3.769	13.109,00	Total in Period 28.573,00
	Railway	2.183	3.048,00	
	Waterway	3.244	3.962,00	
	Ports	58	5.450,00	
	Airports	13	3.004,00	
After 2015	Highway	19.691	18.789,00	Total in Period 71.141,00
	Railway	13.974	30.539,00	
	Waterway	7.882	6.173,00	
	Ports	55	12.411,00	
	Airports	14	3.229,00	
Total Period	Highway	43.203	74.194,00	43,0
	Railway	20.256	50.556,00	29,4
	Waterway	14.489	12.806,00	7,4
	Ports	169	25.085,00	14,6
	Airports	40	9.695,00	5,6
Total Brasil			172.414,00	100,0

Source: PNLT

Figure 3. Recommended Investments in Transportation Infrastructure by 2023**Figure 4. Recommended Investments in Transportation Infrastructure by 2023 (by modes)**

In order to implement its objectives, the PNLT indicates the amount of investment recommended until 2023. These figures have been aggregated by modes and by periods of implementation, as can be seen in the table and graph above. Costs related to the maintenance of existing roadway networks have not been included in the table. The recommended investments that have been presented, which correspond to around 7% of the country's annual GDP (2007)²¹, certainly do not cover the totality of investments required by the transportation sector in Brazil.

Pro-Transport²²

Public transportation, not just in Brazil but also in several developing countries, is undergoing a serious crisis resulting in high tariffs, institutional difficulties, loss of quality, loss of commercial speed due to traffic jams and a reduction in urban mobility rates. This has caused a real reduction in the number of trips made by urban populations. In order to reverse this scenario, a significant level of investment in infrastructure is necessary, for a variety of reasons, to create exclusive corridors for public passenger transportation, terminals, stops, shelters and to ensure accessibility. Given the amount of investment needed, and the difficulties that local governments face allocating the adequate amount of financial resources to these measures, Pro-Transport has been created as a way to offer an alternative channel to raise such funds.

Pro-Transport is a programme established using resources from the Government Severance Indemnity Fund for Employees - FGTS²³ and was approved by the Funds' Curator Council through Resolution n. 409, of 26th November 2002. The objective of the programme is to finance infrastructure geared towards the public transportation of passengers, with priority given to low-income classes. It also aims at promoting physical, economic and social development, as well as improving quality of life and preservation of the urban environment in cities.

Several actions can be financed under Pro-Transport:

- segregated streets, exclusive streets and lanes for public urban passenger transportation traffic (see text box);
- large and small public urban passenger transportation terminals for all modalities of bus, subway, urban train and barge;
- public urban passenger transportation line connection points for the same or different modality;

²¹ Using the exchange rate US\$1= R\$1.64 provided by the Central Bank of Brazil, on 1st September 2008, when the first draft of this paper was concluded. Given the international financial crisis that affected global markets at the end of 2008, the exchange rate on 19th November 2008 was US\$1= R\$2.37. Certainly, an adjustment in the amount of recommended investments will be necessary to reflect the recent depreciation of the Brazilian Real.

²² This section has been based on the information available at the Ministry of Cities' website. Available only in Portuguese at:

<http://www.cidades.gov.br/secretarias-nacionais/transporte-e-mobilidade/programas-e-acoes/pro-transporte/>

²³ The Government Severance Indemnity Fund for Employees (FGTS) was created in 1967, by the Federal Government, to protect workers dismissed without just cause by opening an account linked to the work contract. Every month, companies deposit an amount that corresponds to 8% of each employee's salary in accounts opened in their names. The FGTS is comprised of the total sum of these monthly deposits. The Fund sums belong exclusively to the employees who can make use of the total amount deposited in their names in specific situations. With the FGTS, the worker has the chance to create wealth as well as purchase a home using the funds in the account. Besides that, the FGTS finances popular housing, basic sanitation and urban infrastructure programmes.

- shelters at public urban passenger transportation stops; accessibility works for pedestrians, cyclists and the physically handicapped to streets, stations, terminals, connection points, shelters; and
- conception studies and projects, basic projects, executives for implementing the enterprise, so long as they are included in the program proposal.

Curitiba is the state capital of Parana, in the south of Brazil, with a population around 1.8 million people. Since the 1960's Curitiba has been at the forefront of urban planning and transportation in Brazil and its public transportation system has been quoted as an example of best practice in cities of rapid urbanisation and urban sprawl. The Curitiba Master Plan of 1968 set out a revolution in urban planning and transport including dedicated lanes for a bus rapid transport system. Bi-articulated buses now serve 75% of all weekday commuters, with routes branching out from five key radial routes. The "surface subway" system was achieved at the relatively low cost of US\$3 million/km compared to a typical tram system that costs US\$8-12 million/km or a subway at US\$50-100 million/km²⁴. The system has been estimated to reduce fuel consumption by 25-30%²⁵ in comparison with eight comparable Brazilian cities. Rabinovitch (1993)²⁶ estimated a saving of 27 million litres of fuel a year, equating to approximately 62,505 tonnes of CO₂. The Curitiba system is managed by a state-run company (URBS) who licenses private companies to operate the system, which is completely financed by bus fares, set by the URBS. In addition, there are regulations ensuring that the bus fleet is less than ten years old. Despite the perceived success of the Curitiba Plan, it has not been adopted in other Brazilian cities, highlighting the barriers, both political and economic, that need to be overcome in establishing successful urban public transport systems, with their associated emission reductions.

Figure 5. Public Transportation System in Curitiba²⁷

Given that Pro-Transport is a programme to facilitate fund-raising to be used in public passenger transportation, it does not have a specific cost, although related projected resources have limitations. Pro-Transport's target audience is City Halls, State Governments, managing bodies and public urban transportation service concessionaires or permissionaires.

Although the scale of the programme has not been clearly identified, there are some requirements that the target audience must satisfy so they can apply for funding. These requirements include the existence of an updated Director Plan or one that is being updated/elaborated; existence of a Transportation and Circulation Plan; measures that meet programme and finance action objectives; and the service's concessionaires or permissionaires that are candidates for financing must have been chosen through a bidding process. Those entities interested in obtaining financing resources through Pro-Transport (Applicants for Credit) shall go to a Financing Agent (banks and financial institutions) accredited by the Operating Agent to obtain information about the necessary requirements and complete a Consultation Letter. The National Secretary of Transportation and Urban Mobility

²⁴ Data from <http://www.epa.gov/NCEI/international/transportation.htm>

²⁵ Data from http://www.enpc.fr/fr/formations/dea_masters/tradd/site/documents/curitiba.pdf

and Roseland, M., *Toward Sustainable Communities: resources for citizens and their governments*, New Society Publishers, Gabriola Island, BC, 1998.

²⁶ Rabonivitch, J., "Urban Public Transport Management in Curitiba, Brazil", *UNEP Industry and Environment*, 16 (1-2), 1993, pp. 17-20.

²⁷ Text box by Tim Laing, to whom I express my deep gratitude.

(SeMOB) of the Ministry of Cities (MCidades), as Application Manager, shall provide information on the analysis, framework and selection phases of the Consultation Letters previously qualified by the Financing Agent and sent to SeMOB, in addition to solving any doubts related to the technical aspects of the Consultation Letter presented by the applicants for credit.

Thus, Pro-Transport constitutes an alternative channel for funds to promote infrastructure investments in the public passenger transportation system.

4. Benefits

Efforts to develop transportation policies in Brazil have largely been undertaken for reasons other than climate change, as is the case in the two policies presented in the last section. The PNLT's Executive Report, a comprehensive publication of more than 400 pages, does not even mention greenhouse gases, addressing at most local pollutants. The need to reduce atmospheric pollutants and greenhouse gases has only recently been mentioned in the justification of a Resolution on Pro-Transport, recommended by the Council of Cities of the Ministry of Cities²⁸.

It is certainly challenging to quantify the short-term and long-term climate change benefits of the described policies. Given the complexity of Brazil's fuel supply market (availability of "gasohol"²⁹, hydrated ethanol³⁰, VNG, diesel and biodiesel), it would be extremely complex to quantitatively estimate the mitigation potential of modal shifts as a result of implementing the National Plan on Logistics and Transports, which also presents the difficulty of being an indicative plan. In the case of Pro-Transport, the task is even more difficult, given that it is a programme through which developers can apply for funds to facilitate financing infrastructure geared towards investing in the public passenger transportation system. There is no publicly available information on the amount of funds raised through this programme, or on the measures implemented under such a programme. Nevertheless, as an effort to roughly estimate the impact of such policies in terms of GHG mitigation potential, a comparative exercise can be undertaken based on "business as usual" and projected scenarios borrowed from a recent study developed in Brazil.

In 2006, the Center for Clean Air Policy - CCAP conducted a comprehensive study entitled "Greenhouse Gas Mitigation in Brazil, China and India: Scenarios and Opportunities Through 2025"³¹. The study aimed at analysing the costs and implications of policies to reduce GHG emissions in these countries.

The methodology applied to the GHG mitigation analysis was based on the use of country-specific scenarios for annual population and gross domestic product (GDP). Two alternative

²⁸ Council of Cities, Ministry of Cities, recommended Resolution of 9 July 2008.

²⁹ In Brazil, ethanol is blended with petrol, with a current content of 25% of anhydrous alcohol, forming a "gasohol" mixture.

³⁰ In Brazil, the vehicle industry developed engines capable of running on a 100% ethanol blend. During the 1980's around 70% of the entire fleet of light vehicles in Brazil ran on hydrated ethanol. This Brazilian situation has changed significantly since then, and in recent years the availability of flex-fuel vehicles has stimulated the consumption of hydrated ethanol. See footnote 37.

³¹ CCAP, "Greenhouse Gas Mitigation in Brazil, China and India: Scenarios and Opportunities through 2025", Washington, D.C., 2006. http://www.ccap.org/docs/resources/62/CCAP_Developing_Country_Project-Synthesis_Report_Nov_2006_.pdf In the study's integrated report there is reference only to the B2 scenario data.

GHG reference case scenarios for each sector were developed, partly based on the A2 and B2 scenarios in the IPCC “Special Report on Emissions Scenarios”. Three different scenarios were developed for each country and each specific sector analysed. A “pre-2000 policy” scenario, which considered only policies and programs adopted prior to 2000, was used as the “business as usual” (BAU) scenario. A “recent policy” scenario (also called “unilateral actions”), which considered the impact of the implementation of all policies announced before 2006, was also developed. Moreover, where appropriate, each country analysis conducted up to four variations of “advanced option” scenarios, based on potential cost effectiveness (measured in \$/metric ton CO₂e reduced) of the mitigation measures analysed.

When considering only policies adopted before year 2000 (BAU scenario), emissions from the electricity, industrial, transportation, residential and commercial sectors are projected to increase over the next two decades in all three countries due to increases in economic activity, population, and urbanisation. Although GHG emissions are projected to continue to grow in many sectors in the near term, the impact of fully implemented³² government policies and programs adopted since 2000 in these countries (“unilateral” efforts) – which have already been undertaken or are underway – will slow this trend and reduce emissions below projected levels. It is worth pointing out that these actions have been taken for reasons other than climate-related considerations.

Specifically in the case of the transportation sector in Brazil, according to the BAU scenario, GHG emissions would grow at such a fast pace that by 2020 (245 MMTCO₂) they would have increased more than 130% compared to 2000 levels (106 MMTCO₂). However, taking into consideration the “recent policy” scenario, the study indicates that emissions will fall by almost one-fifth (18%) in 2020 (202 MMTCO₂), meaning 44 MMTCO₂ less than the BAU scenario, which is equivalent to almost 1.5 times the total emissions from light-duty vehicles in 2000³³)³⁴.

The Figure below illustrates the scale of these reductions, emission reduction savings are from the recent policy scenario relative to the “pre-2000 policy” scenario. The Advanced option savings are shown for both the reference case studies; A2 scenario suggesting a “dirtier” society and B2 a “cleaner” society. The figures displayed for transport emissions are those discussed above for 2000 and 2020. The “recent policy” scenario encompasses only policies adopted between 2000³⁵ and 2005 and, therefore, only two were considered: deployment of flex fuel technology³⁶, which has been quite successful in Brazil³⁷, and the

³² It has been recognised that these policies are not necessarily guaranteed to achieve the expected levels of reduction, which will require full enforcement of existing policies and programmes.

³³ Estimated light-duty vehicles in Brazil corresponded to a total of 31.9 MMTCO₂ in 2000.

³⁴ CCAP, footnote *supra* 31, pp. 12-14.

³⁵ The most important pre-2000 transportation policy in Brazil is the National Ethanol Programme. Although the creation of this programme did not have the direct objective of reducing GHG emissions, it has been currently recognised as extremely successful in promoting such reductions. The average annual avoided CO₂ emissions from ethanol consumption contribution in Brazil since 1990 has been estimated at around 13 million tonnes of CO₂. Avoided CO₂ emissions from ethanol consumption were estimated by applying a factor of 0.7 to simulate the differences between ethanol and petrol engine performance and the CO₂ emission factor for petrol. See footnote *supra* 17, p. 13.

³⁶ Flex-fuel vehicles allow their owners to select the fuel used each time they fill the tank, based on price, availability, performance and consumption. Accordingly, they can decide to use any addition of hydrated ethanol to petrol in the blend, from 0 to 100%, with no need to change the vehicle's operation. This technology offers energy alternatives to consumers, enabling them to contribute by saving oil and lowering GHG emissions. Currently, in most of country's petrol stations, the price of ethanol (it is worth observing there are currently no subsidies for ethanol production in Brazil) is highly competitive with petrol.

National Programme for the Rational Use of Natural Gas and Oil Products, known as “Conpet”, an energy efficiency programme for the use of oil and natural gas³⁸. In the “advanced option” scenario, savings come from a near complete conversion of passenger vehicles to flex-fuel, fuel switching from diesel to CNG in Heavy Duty Vehicles (HDVs) and further expansions of other HDV policies from the recent policy scenario. It is clear that there is significant scope for additional policies similar to the PNLT and Pro-Transport to further reduce emissions in this sector.

Given that the PNLT and Pro-Transport were not considered either under the “recent policy” or “advanced option” scenarios, it can be deduced that their implementation will imply a GHG mitigation far beyond minus 18% of the BAU scenario³⁹, greater than the savings illustrated in the graph above. Certainly, where data is available, there is a need to develop further research to assess the impacts of the implementation of these policies in terms of the likely carbon emission reductions.

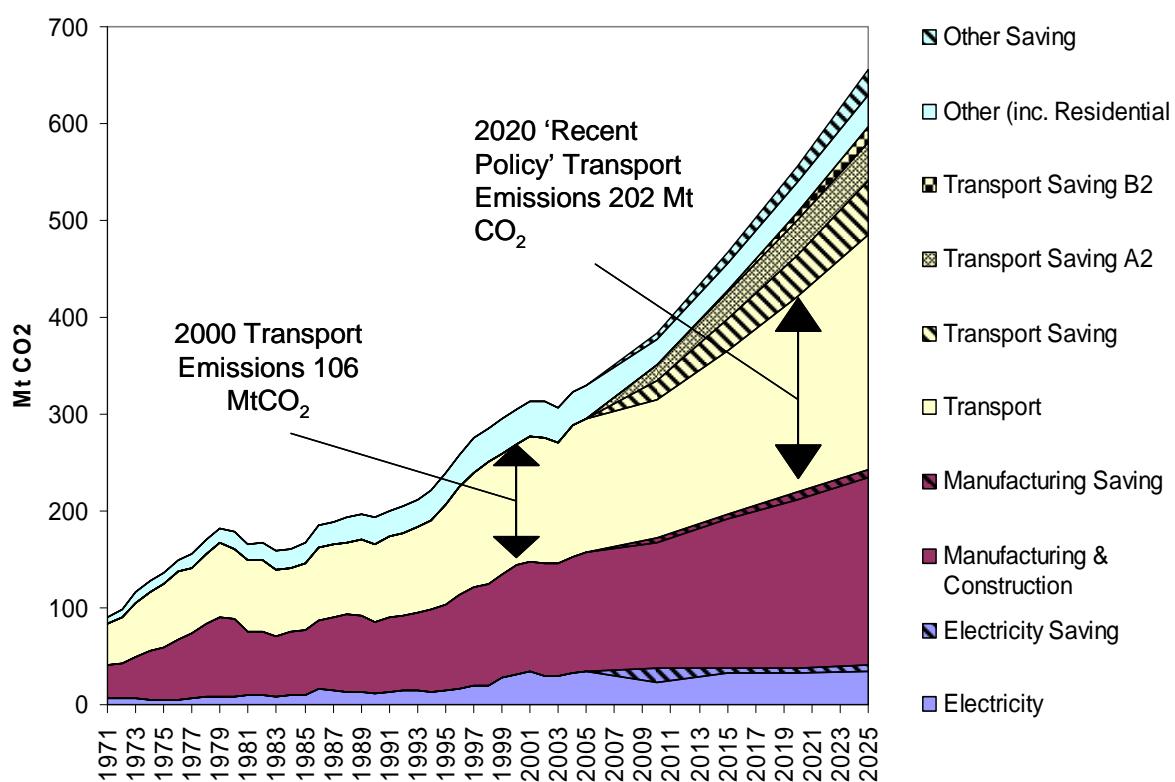


Figure 6. Sectoral emissions reductions (Source: Historical Data IEA, Projected Data CCAP).

³⁷ The production and sale of flex-fuel vehicles (petrol-ethanol) have been very successful since their launch in March 2003. The production of flex vehicles, according to the Brazilian Automotive Industry Yearbook published by the National Vehicle Manufacturers Association (Anfavea), has grown from 49,200 units in 2003 to 332,500 in 2004, 857,900 in 2005 and 1.4 million in 2006, with a total of 3.86 million flex-fuel vehicles in 2007, accounting for 16% of Brazil's fleet.

³⁸ Conpet's goal is to gain 25% energy efficiency in the use of oil and natural gas products, without affecting the activities in the diverse sectors of the national economy.

³⁹ A linear extrapolation based on the BAU scenario is not possible, mainly due to the complexity of Brazil's fuel supply market, as mentioned previously. For a more precise quantitative estimate a computational model should be run, which goes beyond the scope of this study.

Railway and waterway modes are usually more cost effective than roadway modes in terms of energy consumption per tonne of freight, especially regarding mining, raw materials and basic agricultural products, due to far greater load capacity. In a study on the energy use and carbon emissions from freight in 10 industrialised countries⁴⁰, data suggest that modal mix has a large impact on freight energy use, as the energy intensity of road freight (in MJ/t-km) is as much as ten times that for shipping or rail⁴¹.

Furthermore, measures to promote public passenger transportation usually reduce GHG emissions. From a climate change perspective, the IPCC recognises that personal motor vehicles consume much more energy and result in far more GHG emissions per passenger-km than other surface passenger modes⁴², although the experience of some countries also suggests that isolated measures to ensure an efficient transportation system do not necessarily reduce the number of private vehicles in the streets.

The impact of such policies in terms of GHG mitigation potential can be catalysed when other options are considered, given that carbon emissions are dependent on the mix of fuels used for transport. Brazil has a very ambitious biodiesel programme and the government is strongly committed to avoiding GHG leakage in production of the fuel. The addition of 2% of biodiesel to the mineral diesel blend (known as B2) has been mandatory nationwide since 2008. The addition to the blend will increase to 5% as of 2013, and it is expected that this target could be met by 2010⁴³.

Moreover, if new train and underground systems powered by electricity are implemented, as is the case in Europe and Japan, an increase in electricity's participation in total energy demand in the transport sector is expected. This will have a positive impact on the GHG emissions, taking into account that the Brazilian electrical mix is very clean due to the high share of hydroelectricity power (88.7% in 2007).

It must also be pointed out that these policies will have other co-benefits. In the case of the PNLT, if successfully implemented, the plan might increase productivity and distribution of goods with significant economic gains, avoiding losses from the bottlenecks found in the current transportation system. This point also applies to the urban environment and the Pro-Transport programme; the plan also delivers additional direct co-benefits in terms of health, noise and congestion, as indicated in the previous sections.

5. Domestic Drivers and Barriers

In 2003, the Ministry of Transportation recaptured the process of mid and long-term transportation planning on a national scale, which was consolidated in 2006, setting up the basis for elaborating the National Plan for Logistics & Transportation – PNLT. The plan was

⁴⁰ Schipper, L.; Scholl, L.; Price, L.; "Energy use and carbon emissions from freight in 10 industrialized countries: An analysis of trends from 1973 to 1992, Transportation Research Part D", *Transport and Environment*, vol. 2, issue 1, March 1997, pp. 57-76.

⁴¹ *Ibidem*, p. 67.

⁴² IPCC, footnote *supra* 3, p. 348.

⁴³ The share of renewable sources in Brazil's fuel market for roadway transport stood at 16.9% in 2005, including the use of anhydrous and hydrous ethanol. The 2% (B2) and 5% (B5) biodiesel-diesel blend should increase the share of renewable fuels in the automotive mix to 17.9% and 19.6% respectively, without considering the expected increase in ethanol use resulting from the growing popularity of flex-fuel engines. See White Paper, footnote *supra* 17, p. 27.

supported by CENTRAN (Excellence Center for Transportation Engineering), in a collaboration between the Ministry of Transport and the Ministry of Defence. The PNLT is the result of a broad participative and transparent process, involving state governments, the manufacturing and service sectors (agriculture, industry, commerce and tourism), transport operators, contractors and users.

The PNLT served as input for formulating the Federal Government Pluriannual Plan of Actions (PPA) 2008-2011 and for the first indication of investments for the PPA 2012-2015. It will also serve as input for organising of the following PPAs until 2023, which is the horizon of the socio-economic studies on which the PNLT has been based. Moreover, the PNLT has been integrated in the Growth Acceleration Programme (*Plano de Aceleração do Crescimento - PAC*), launched by the Federal Government on 22nd January 2007, which aims at offering better credit conditions for infrastructure.

Investments in logistics (modals) to the order of more than R\$58 billion have been estimated under the PAC for the period of 2007-2010: around R\$33 billion from the Federal Budget and around R\$17 billion from public financing, mainly through the Brazilian Social and Economic Development Bank (*Banco Nacional de Desenvolvimento Econômico e Social - BNDES*)⁴⁴.

The BNDES, as a component of the PAC, approved on 25th January 2007, an interest rate reduction for segments related to infrastructure, including roadways, railways, ports, airports, roadways and urban transportation. Therefore, the interest rates will be, on average, 60% lower than in 2005, with the objective of stimulating investments in the Brazilian economy. The interest rate for BNDES loans is comprised of the Long-Term Interest Rate (*Taxa de Juros de Longo Prazo - TJLP*) plus a basic fee, as in the table below, plus a credit risk rate, of up to 3.57% p.a.⁴⁵, pursuant to the beneficiary's risk.

Financial resources under the PAC are considerable and can be an important element for achieving PNLT objectives, especially regarding the change in modal split. Given that the time horizon for the PNLT is 2023, if the PAC could provide a third of the funds necessary, as expected by 2010, financial resources constraint will be a minimal issue. The availability of financial resources for investments in logistics is considered strategically important, given that the country's competitiveness could be at risk. The projects incorporated under these plans aim to accelerate Brazil's growth, which would bring benefits to the population as a whole in terms of income and better living conditions. Although financial barriers certainly exist, they are reduced in light of such major considerations. Unfortunately, the same perception does not exist in the case of urban public transportation, given that the benefits are on a smaller scale, and are largely perceived only by the local population or visitors and tourists.

⁴⁴ PAC, Press Release, p. 17. Available in Portuguese at http://www.brasil.gov.br/pac/conheca/infra_estrutura/logistica/pac_no1

⁴⁵ It is worth pointing out that this interest rate is considerably low if compared to commercially available Brazilian interest rates. Brazil has one of highest interest rates in the world: 13.75% (October 2008, determined by Brazilian Monetary Policy Committee).

Logistic	2005	2006	2007	% Variance (07/05)
1. Railway Modal				
North and Northeast regions and bottleneck reduction	2.5%	0.0%	0.0%	-100%
Other Investments	2.5%	1.5%	1.0%	-60%
2. Roadway, airway, port and terminal modals	2.5%	1.5%	1.0%	-60%
3. Roadway concessions	3.0%	3.0%	2.0%	-33%

Table 2. BNDES Basic interest rates applied for public infrastructure investment (Source: BNDES, 2007).

Pro-Transport is led by the Ministry of Cities in collaboration with the Curator Council for the Government Severance Indemnity Fund for Employees. However, as previously mentioned, policy makers for Pro-Transport are governance officials from City Halls, state governments, managing bodies or public urban transportation service concessionaires or permissionaires, who will decide if it is worth participating in the programme and executing the projects, given that they will also assume the risk of the investments.

Monthly interest will be charged for interventions within the scope of Pro-Transport, on the date established in the contract, in the grace and amortisation phases, at the nominal rate of 6% (six percent) per year for the public sector and 20% (twenty percent) for the private sector. There will be a 48 (forty-eight) month grace period, starting from the date the financing contract is signed, which may be extended for up to half the originally agreed upon grace period. The amortisation period is up to 240 (two hundred and forty) months starting from the month following the end of the grace period.

Moreover, there is the minimum percent counterpart contribution that the borrower is responsible for that has been fixed over investment value. This is 5% for the public sector and 20% for the private sector. Thus, Pro-Transport involves a considerable number of conditionalities (see also section 3) and investment risks. The rate of return for many urban transportation projects can only be verified on a long-term basis and, therefore, many projects are not attractive for private investors. The counterpart contribution can also represent a significant barrier both for public and private entities.

Another significant barrier is the fact that the projected resources for Pro-Transport are quite limited, especially considering sector needs and the number of municipalities in Brazil. In its Operational Budget and Pluriannual Plan for Contracting, the Curator Council for the Government Severance Indemnity Fund for Employees approved, through Resolution n. 554,

of 20th December 2007, resources of R\$1 billion for the fiscal year 2008. With these financial resources, the programme would not be able to finance more expensive interventions, such as underground systems or tram lines.

In the case of underground systems, it is worth mentioning that the PAC estimates there will be R\$3.1 billion worth of investments in the period 2007-2010 (R\$1.5 billion from the Federal Budget and R\$1.6 billion through financing). However, only 5 cities⁴⁶ would receive such investments for expanding their systems. Under the BNDES, basic fees for integrated urban transportation were 1.5% in 2007, 50% less than in 2005 (3%).

Given the analysis of domestic drivers and barriers of these two policies, it may be the case that financial barriers related to urban transportation projects are higher than those for logistic projects (modals). This takes into account that the latter usually involves issues related to economic competitiveness and, therefore, logistic projects are more attractive both from the political and economic point of view.

6. International Cooperation

Given the challenges facing transportation sectors in developing countries, technical and financial support, at any level, is necessary, if not to guarantee the feasibility of the implementation of domestic efforts, then at least to accelerate them. International cooperation can play a significant role in this process. Cooperation obviously raises the challenging question of how to define the scale, scope and timing of what can be done domestically and what requires international support. Moreover, it also raises the question of the attractiveness of the investment, both from a political and an economic point of view.

As far as climate change is concerned, the main issue is whether these policies are seen as instruments that can also contribute to the long-term objective of large-scale emissions reductions. In order to facilitate this perception, the relation between global warming and the transportation section will have to be addressed in the context of the broader goal of sustainable development. In this context, a clear understanding of the level of domestic support for transportation policies is essential, given that international support in these cases might be complementary. It is important to identify the main bottlenecks in implementing domestic policies and to explore how international funding could play a catalytic role in solving them.

As previously discussed, governments are usually the primary investors in domestic logistics infrastructure, such as roads, airports and ports. However, it is important to assess where governments have difficulties in investing or in raising the adequate amount of financial resources.

In the case of the PNLT, one of its failures in terms of promoting modal change split is the absence of coordinated efforts to significantly extend the network of long-distance passenger railway running on electricity, which is almost nonexistent in the country. Electrification of the transport sector would result in the mitigation of GHG emissions due to the high share of hydro electricity in the Brazilian power generation mix. This is certainly an area where international technical and financial support would be welcome.

⁴⁶ Fortaleza, Recife, Salvador, Belo Horizonte and Sao Paulo.

Another window through which international flows could enter in Brazil and play a complementary or catalytic role is through concession and privatisation. As previously mentioned, railway system operations have been almost entirely privatised through concessions. In the port system, a strong opening for the participation of private users has been promoted, with concessions for management and exploitation of small ports and specific terminals in big ports, like containers, vehicles and bulk cargo. In the roadway system, in spite of the fact that in 2007 only 4% of the roads were operated under concession, an important concession programme has been developed, especially where traffic flows and economic development justified the operation and maintenance of roads by private companies under toll payment. This has not been the case for the airway system, although there is a current debate on the concession of certain terminals and airports, given the existing bottlenecks and the need for rapid investments.

A financial flows report issued by the UNFCCC in 2007 affirms it is important to focus on the role of private-sector investments when considering means to enhance investment and financial flows to address climate change⁴⁷, as they constitute the largest share of investment and financial flows (around 86%). Although this idea seems quite interesting, private-sector investments look mainly for profits and the long-term nature of the rate of return, as a result the majority of transportation infrastructure related investment does not seem very attractive to them. If it is already difficult to set up domestic initiatives regarding public transportation sector in urban areas, especially in the case of underground or tram system, it is even more difficult to attract international funds in this case.

This paper has indicated that the probability for the PNLT to be successful is higher than Pro-Transport; as the former involves issues related to the country's competitiveness as a whole, making it easier to raise public funds, while the latter involves issues at the local level and difficulties in mobilising capital in municipalities. This raises another question regarding the level of government to which international funds are willing to support. At the federal or state level, it is easier to find technical expertise or political capability to raise international funds than at the city level; a situation that is also related to the capacity of counterpart contribution and credibility of the borrower.

If international investments in the transportation sector are to be compatible with the long-term objective of large-scale emissions reductions, they must be designed and structured in a complementary way. Therefore, the climate change regime has a fundamental role to play in organising efforts in a coordinated manner, as well as in providing adequate means to measure them. Thus, options within the multilateral climate change regime must be explored.

This regime has already offered innovative ways to fund GHG mitigation measures; the Kyoto Protocol created market mechanisms to finance mitigation measures. Among them the Clean Development Mechanism (CDM), the only one focused on the participation of developing countries, has resulted in significant GHG emission reductions in non-Annex 1 countries.

CDM projects have provided a fruitful environment for the enhancement of technological cooperation among different stakeholders (the private sector, NGOs and government at

⁴⁷ UNFCCC, "Report on the analysis of existing and potential investment and financial flows relevant to the development of an effective and appropriate international response to climate change", Dialogue on long-term cooperative action to address climate change by enhancing implementation of the Convention, Fourth workshop, Vienna, 27-31 August 2007, Dialogue working paper 8, 2007, p. 2.

various levels) and promoted environmentally friendly investments in developing countries' economies. However, so far, the carbon market has had little impact on GHG emissions from the transportation sector, although related projects are eligible under the CDM. Only two project activities under this sectoral scope have been approved by the CDM Executive Board. The first being the Bus Rapid Transit (BRT) system TransMilenio Phase II to IV in Bogotá Colombia⁴⁸, which uses a large scale methodology. The second involves the Installation of Low GHG emitting rolling stock cars in the metro system in Delhi Metro Rail, India⁴⁹, which employs a small scale methodology.

In the view of specialists, the main barrier for a larger number of CDM project activities in the transportation sector, particularly those involving "modal shift", is proving "additionality"; whether or not the project would be feasible without the opportunity of the CDM project activity⁵⁰. It is not yet certain whether the number of CDM projects will increase. There is the potential to do so through the opportunities offered by programmatic CDM, which have not been fully explored due to many existing complexities involved, and new opportunities that might be created in the post-2012 arrangement.

Therefore, other options must be sought beyond the Kyoto Protocol's CDM, and an effective implementation of the United Nations Framework Convention on Climate Change (UNFCCC) may provide some solutions. At the 13th Conference of the Parties to the UNFCCC, held in Bali December 2007, an Action Plan was adopted to launch a comprehensive process to enable full, effective and sustained implementation of the Convention through long-term cooperative action, now, up to and beyond 2012, in order to reach an agreed outcome⁵¹.

The possible adoption of an arrangement, under the auspices of the UNFCCC – providing positive incentives to support voluntary efforts (which may be measurable, reportable and verifiable) undertaken by developing countries to reduce emissions in different sectors within their territories – would be a significant contribution to the ultimate objective of the Convention, as well as to the promotion of sustainable development and equity. Given that GHG emissions from the transportation sector are expected to continue to increase sharply in the near future, particularly in developing countries, such as Brazil, all the options to address such emissions, including funding to support their mitigation, must be seriously taken into consideration at the domestic and international levels.

⁴⁸ The goal of TransMilenio is to establish a sustainable mass urban transport system based on a Bus Rapid Transit (BRT) system. TransMilenio phase II-IV, which is the project presented, is an extension of phase I that is not part of this CDM project. Under TransMilenio the resource efficiency of transporting passengers in Bogotá is improved and emissions per passenger trip are reduced compared to the situation without project activity. The project estimated emission reductions correspond to 246,563 in metric tonnes of CO₂ equivalent per annum (as stated by the project participants; crediting period from 1st January 2006 to 31st December 2012 - renewable). See UNFCCC website.

⁴⁹ The project activity introduces state-of-art rolling stock cars in Delhi Metro Rail Corporation (DMRC) with a regenerative braking system. The project activity replaces the conventional electro-dynamic rheostatic braking technology enabled Rolling stock. This project is intended to reduce CO₂ emissions to the extent of electricity displaced from the Northern regional grid. The project estimated emission reductions correspond to 41,160 in metric tonnes of CO₂ equivalent per annum (as stated by the project participants; crediting period from 29th December 2007 to 28th December 2017 - fixed). See UNFCCC website.

⁵⁰ Lancaster, R., "Caught in the headlines: can something be done to improve the role of carbon finance in tackling road transport's rising greenhouse gas emissions?", in Point Carbon , vol. 2, issue 6, July/August 2008, p. 25.

⁵¹ UNFCCC, Decision 1/CP. 13.

7. Conclusion

This paper aimed to identify funding sources to support domestic climate policies specifically in relation to the transportation sector in Brazil. The two policies identified and analysed were the National Plan on Logistics and Transport, which is a policy that can promote significant change in the modal split in the country; and Pro-Transport, a programme aimed at funding public transportation in urban areas.

Although it has been acknowledged that these policies have been adopted for reasons other than climate change, they will help to lower the curve of GHG emissions in Brazil. Moreover, taking into account that the transportation sector has many inter-linkages with other actors and economic activities, additional environmental, social and economic co-benefits have been identified; suggesting that improvements for the wider economy are compatible with the long-term objective of large-scale emissions reductions.

The analysis of these policies led to the conclusion that while it is relatively easy to mobilise investment in transport logistics infrastructure at the national level, given the impacts on economic competitiveness for the country as a whole, it is more challenging to leverage funds to provide more efficient and integrated public transport systems and their related infrastructure at the local level. Taking into consideration these challenges within the Brazilian transportation sector, international cooperation can play a significant role in supporting domestic policies, especially to complement and accelerate domestic efforts.

This paper recognises that the linkages between global warming and the transportation sector must be addressed in the context of the broader goal of sustainable development. Thus, both public and private investment opportunities must be explored. In any case, international cooperation must be compatible with the voluntary efforts undertaken by developing countries to reduce emissions within their territories, even if this is not the primary objective of the policy adopted. This is the fairest way to ensure developing countries can experience growth to meet their social and economic needs, while at the same time contributing to the full, effective and sustained implementation of the Convention.

However, as far as international cooperation to support domestic policies in developing countries is concerned, it is still uncertain whether the recent financial economic crisis in the U.S.A will have global spill-over effects, reducing the availability of funds to be invested in such countries.

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