

# Oil products production and Distributionm in Brazil

**Prof. Edmar de Almeida<sup>1</sup>**

**Prof. Marcelo Colomer<sup>2</sup>**

**Patrícia Oliveira<sup>3</sup>**

## Introduction<sup>4</sup>

This chapter is dedicated to the overview of the downstream of the oil industry in Brazil, focusing the production, distribution and marketing of oil products.

We present the main characteristics and trends for the downstream of the oil industry in Brazil. The first section of the chapter is dedicated to the description of the oil products chain in Brazil. In the second session, we analyze the existing market and its structure, the recent evolution of the fuels demand and production. The third section describes the regulatory framework of the downstream of the oil chain in Brazil. This section is divided in five subsections. In the first one, the main institutions responsible for regulating the fuel market and their roles is introduced. In the second, the pricing process in Brazil is shown. The third analyzes the process of granting the permissions and authorizations in relation to the sale of fuels. Fourth, the role of inspection and quality control of fuels by the National Petroleum Agency (ANP) is described. Finally, we highlight the joint activity

---

<sup>1</sup> Professor at Energy Economic Group, Institute of Economics, Federal University of Rio de Janeiro – GEE-IE-UFRJ

<sup>2</sup> Professor at Energy Economic Group, Institute of Economics, Federal University of Rio de Janeiro – GEE-IE-UFRJ

<sup>3</sup> Researcher at Energy Economic Group, Institute of Economics, Federal University of Rio de Janeiro – GEE-IE-UFRJ

<sup>4</sup> The authors would like to thank the help of Mayara Mota in the research for this chapter.

of ANP and the Administrative Council for Economic Defense (CADE) to hinder anti-competitive practices for controlling prices. Finally, the last section of this chapter presents some trends for the next ten years for the fuels demand in Brazil.

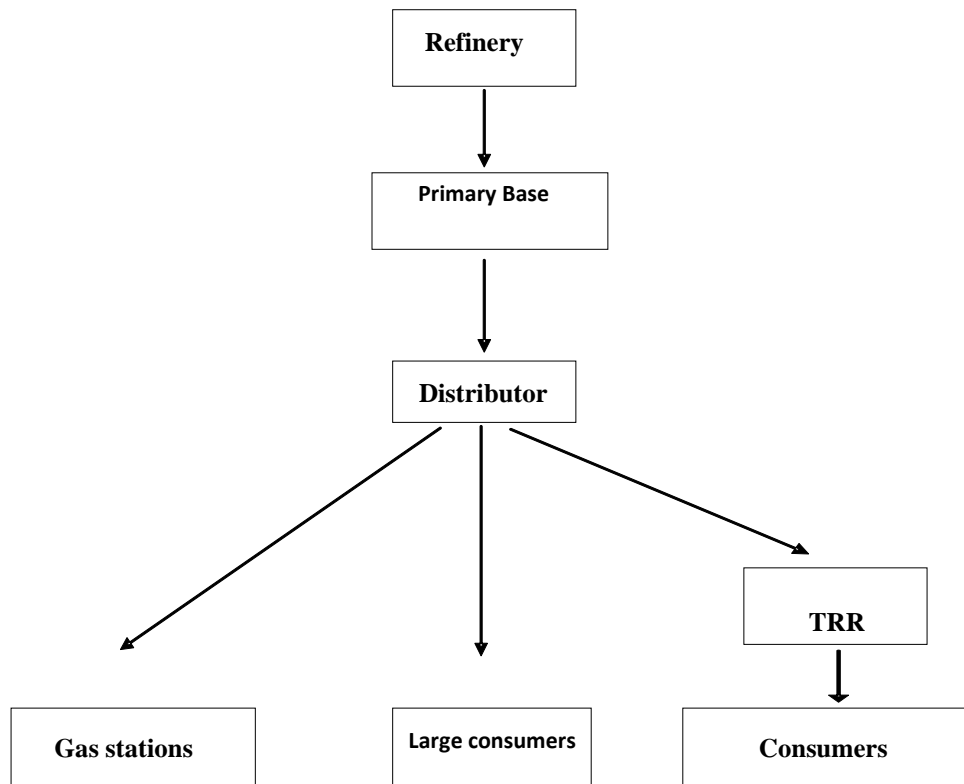
## 1 – The Oil products chain

The oil industry includes economic activities related to the exploration, development, production, refining, transportation, import, and export of oil, natural gas, and other fluid hydrocarbons and their products. It is defined as Upstream the oil exploration and production. The Downstream consists the transportation, refining, fuel distribution and resale of oil products. The downstream sector includes segments such as refining, distribution, gas stations, and retailer transporters (TRR).

Oil products are produced by refineries that store them in so-called primary bases. Distributors are responsible for the logistics of oil products for the consumer market, being the link between the producer and retail. They take the products from the main distribution terminals and transfer them to own terminals or terminals shared with third parties, called secondary distribution terminals. In other words, they purchase and sell oil products in bulk (wholesale) to retail sector or large consumers. Transportation to market is via pipelines, railroads, trucks, waterways, or by sea.

The consumer market assisted by the distributors consists of the following segments: gas stations, where gasoline, ethanol, diesel, and CNG are primarily marketed; large consumers, who directly purchase products from distributors; retailer transporters (TRR), who purchase fuel (except automotive gasoline, LPG, aviation fuel, and ethanol) from distributors and deliver it to small consumers (usually in rural areas). Figure 1 simply shows the distribution and trading of oil products.

**Figure 1 - Distribution and Trading Structure**



**Source:** Own Elaboration

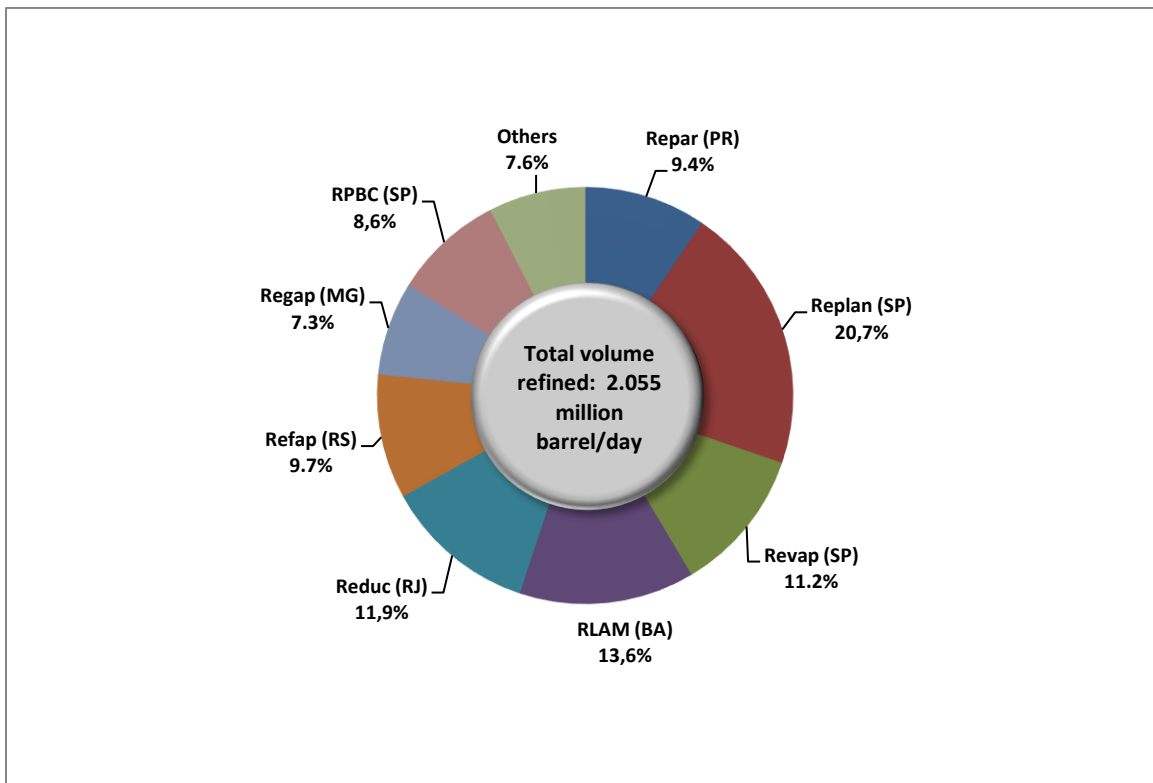
Most of the oil products used in the automotive transportation (ethanol, gasoline, diesel, and lubricating oils) are sold in gas stations. Gas stations are the most visible part in the whole oil supply chain and they sell most of the oil products. The marketing of these products is associated with other services, such as cleaning, lubrication, restaurants, cash machines, and convenience stores. The revenue associated with such services has assumed an important role in the sector. In Brazil, there is a growing trend in the convenience market, which is betting mainly on food service.

Gas stations are identified and ranked by brand and property. Brand gas stations belong to the distributors or franchisees. They can exclusively purchase fuel from the corresponding distributor. Off-brand gas stations are not bound to distributors and purchase from whoever offers the best price or best payment term. There are also groups owning gas stations with different brands.

## 1.1 Refinery

In 2013, 16 refineries were active in Brazil with a total refining capacity of 2.2 million barrels per day. The rate of utilization of these refineries was 98.2% in 2013. Most of oil processed in Brazil were domestic produced. The imported oil processed came from Africa (63%) and Middle East (26%). Petrobras holds most of refineries (12) and refining capacity (98%). Private refineries (Manguinhos, Riograndense, Univen e Dax Oil) represent only 2% of the capacity (ANP, 2013).

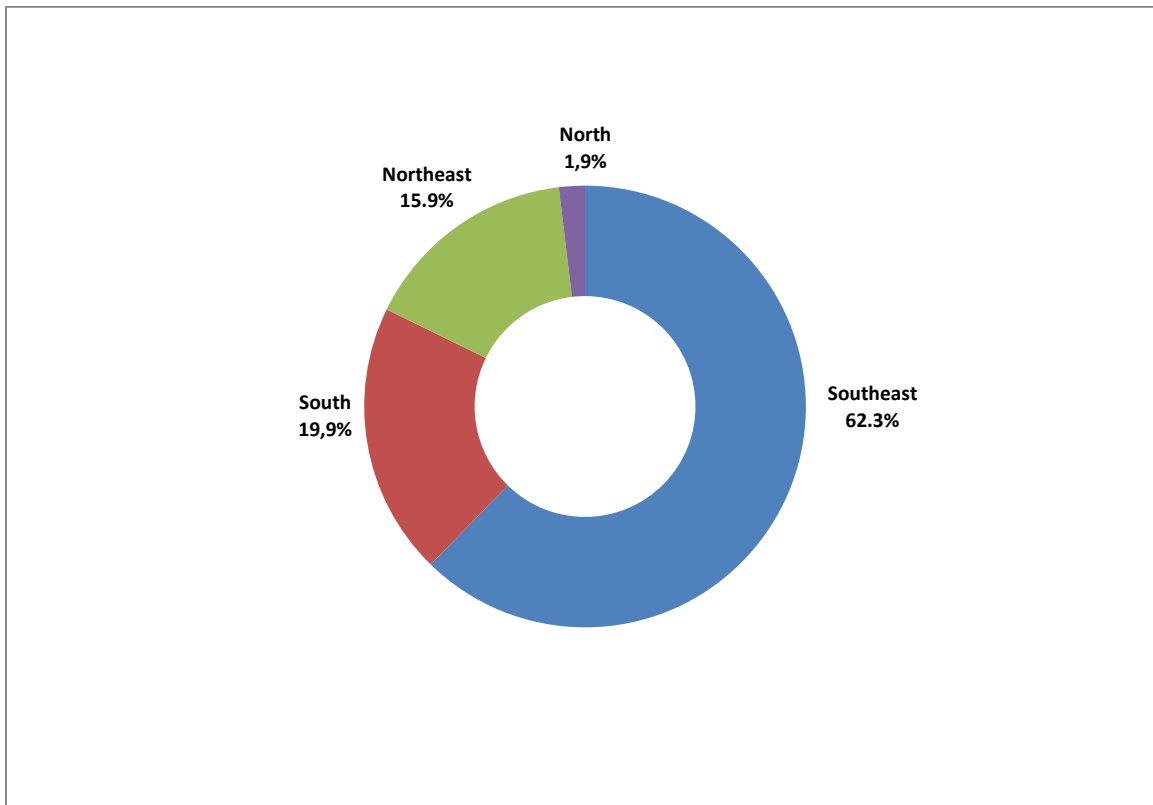
**Figure 2 – Share in oil refining Capacity According to Refineries – 2013**



Source: ANP, 2014

The geographic distribution of the refineries in Brazil is very unbalanced, as we can see in Figure 3.

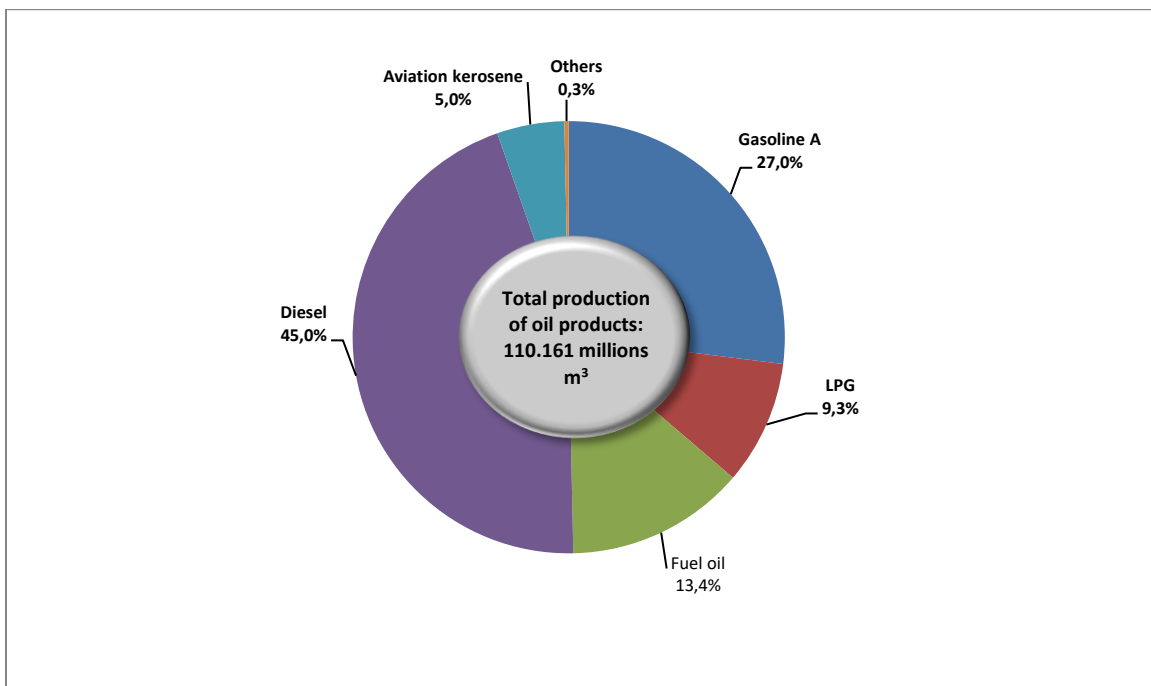
**Figure 3 – Refining capacity by region - 2013**



Source: ANP, 2013.

The total production of oil product was 127.3 million m<sup>3</sup>, of which 97.3% was produced in refineries and in the remainder in petrochemical plants. Of total products produced, 86.5% (or 110.2 million m<sup>3</sup>) were for energy use. The diesel oil was most important type of product followed of gasoline and fuel oil (Figure 4).

**Figure 4 – Oil products by energy product – 2013**



Source: ANP, 2013.

## 1.2 – Distribution

Oil refineries or biodiesel and ethanol plants are not allowed to directly trade with gas stations. Oil products must be sent to a distributor, who is a part in the supply chain and delivers it to the gas stations or retailer transporters (TRR), before being purchased by the end user.

In this last stage, which is heavily based on vectors of logistics and marketing, the oil products are delivered to the end user. Only gas stations and TRR's are authorized by ANP to retail fuel.

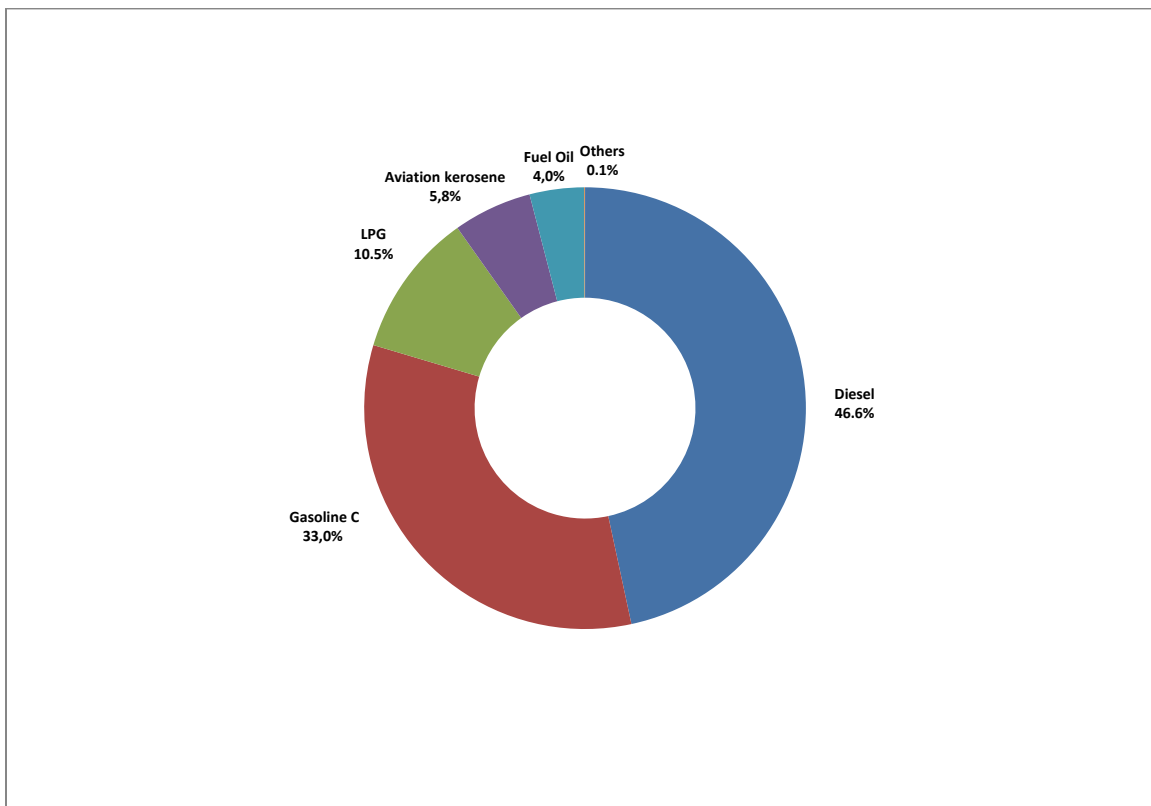
The distribution of different fuels is arranged according to the location of refineries and consumer markets, in addition to the logistical characteristics of each type of product. Distribution depends on the facilities of terminals, pipelines, and distribution terminals.

Brazil is provided with 329 liquid fuels distribution terminals authorized by ANP, whose storage capacity is 3.8 million m<sup>3</sup>. Most of the terminals (77.1%) were allocated to oil products (excluding LPG). In the case of ethanol, the distribution terminals are able to

store 717,300 m<sup>3</sup>. The LPG storage terminals have capacity equivalent to 147,700 m<sup>3</sup> (ANP, 2013).

Regarding the sales of the distributors, we clearly note the importance of diesel, gasoline, and LPG. In 2012, for example, sales of diesel accounted for 46% of total sales, while the gasoline C (with anhydrous ethanol added and sold at gas stations) and LPG accounted for 33% and 10% of sales respectively.

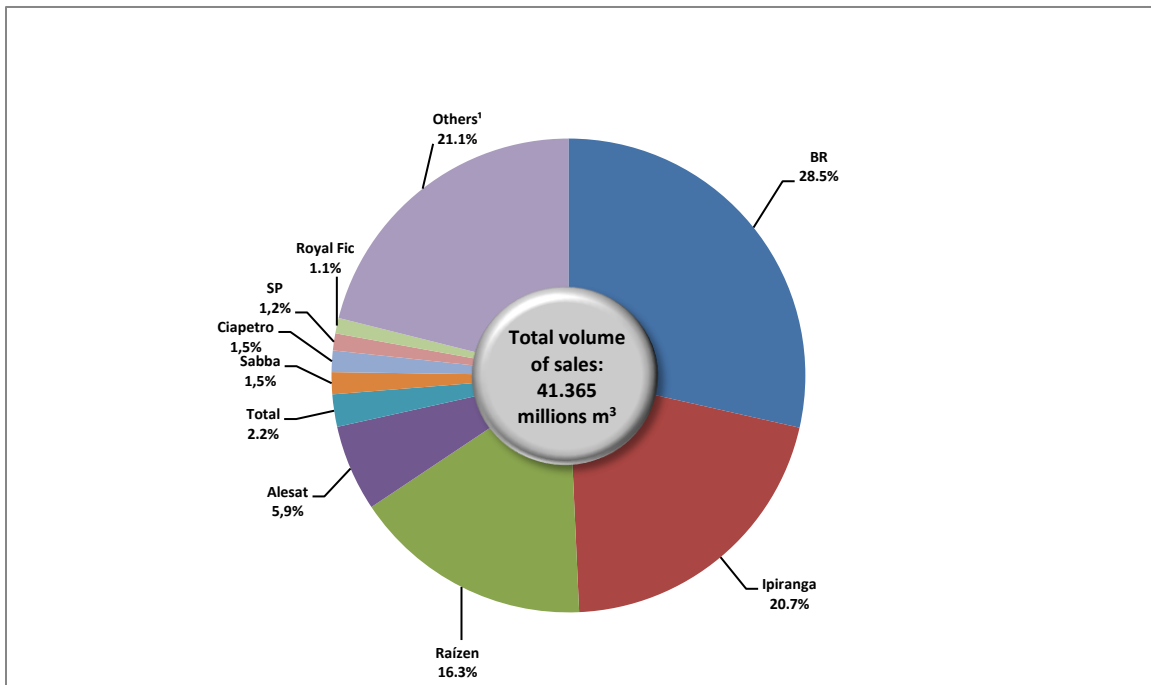
**Figure 6 - Domestic sales according to distributors of major oil products, in 2013**



Source: ANP, 2013

Gasoline C is obtained from the mixture of automotive gasoline and anhydrous ethanol fuel (distributor shall mix according to provisions set forth by ANP). Sales of gasoline C increased in recent years and recorded higher sales in all regions of the country. In the market of gasoline C, BR is in the first place, followed by Ipiranga and Raízen.

**Figure 7 – Distributors according to domestic sales of gasoline C, in 2013**



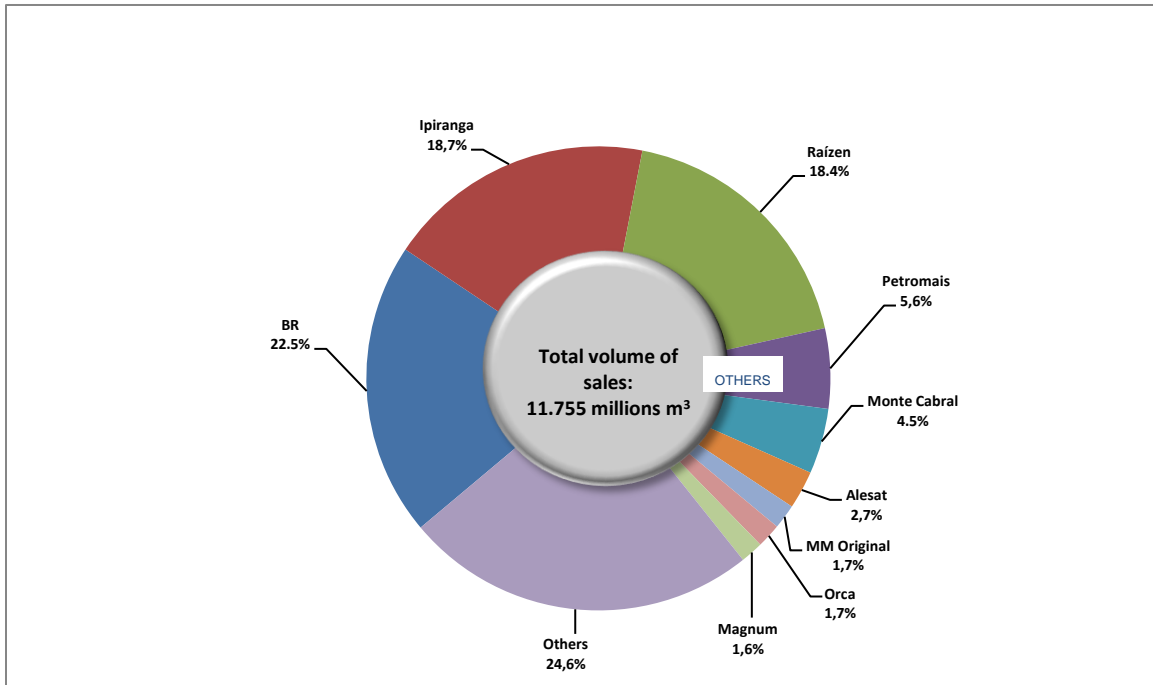
Source: ANP, 2013

The hydrated<sup>5</sup> ethanol is still affected by 2008 crisis, which has restricted financing sources to increase production of plants. At the same time, sales of hydrous ethanol faces competition from its main substitute (gasoline), whose price has recently been set below the international benchmarks. Nevertheless, this fuel still has an important role in the Brazilian energy matrix. BR, Raízen, and Ipiranga are the major distributors of hydrous ethanol, and they are responsible for most of the sales of fuel in 2013.

<sup>5</sup> The anhydrous Ethanol is blended in gasoline while hydrated ethanol is consumed in flexfuel cars.



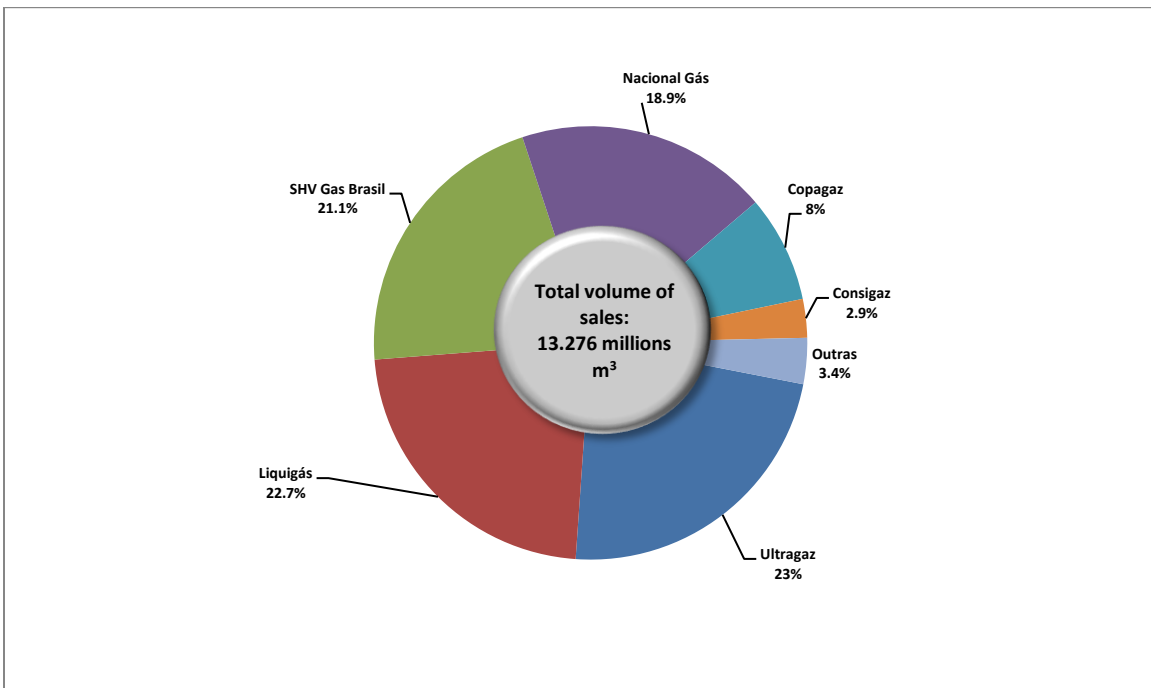
**Figure 8** - Distributors according to domestic sales of hydrated ethanol, in 2013



Source: ANP, 2013

In 2013, sales of LPG are mainly in the Southeast (45.5%) and Northeast (22.9%) regions, followed by the South (17.5%), Midwest (8.1%), and North (6%) regions. Distribution is made by 18 companies, 4 of them accounted for 85.7% of sales: Ultragaz, Liquigás, SHV Gás Brasil and Nacional Gás.

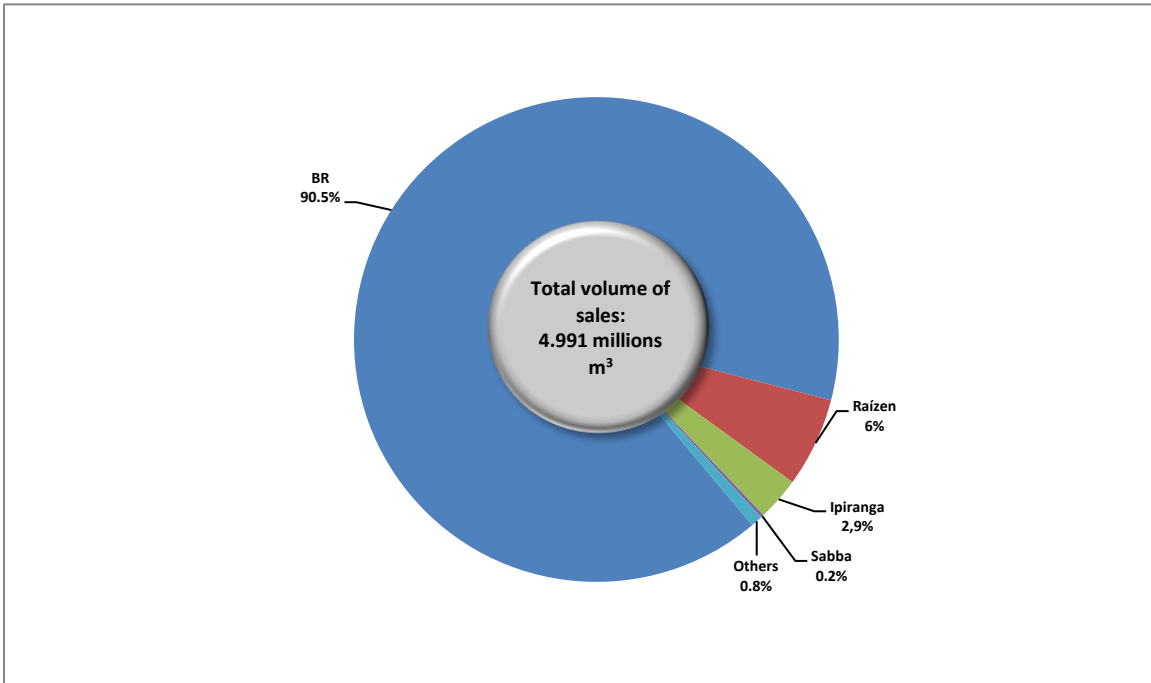
**Figure 9** - Distributors according to domestic sales of LPG, in 2013



Source: ANP, 2013

Regarding the marketing of fuel oil in 2013, domestic sales are mainly in the North (22.9%), Northeast (40.7%), and Southeast (21.4%) regions. The South (6.7%) and Midwest (8.3%) regions are not considerable. Three companies distribute 99% of fuel oil in the country; particularly BR, which was responsible for over 85% of the distribution.

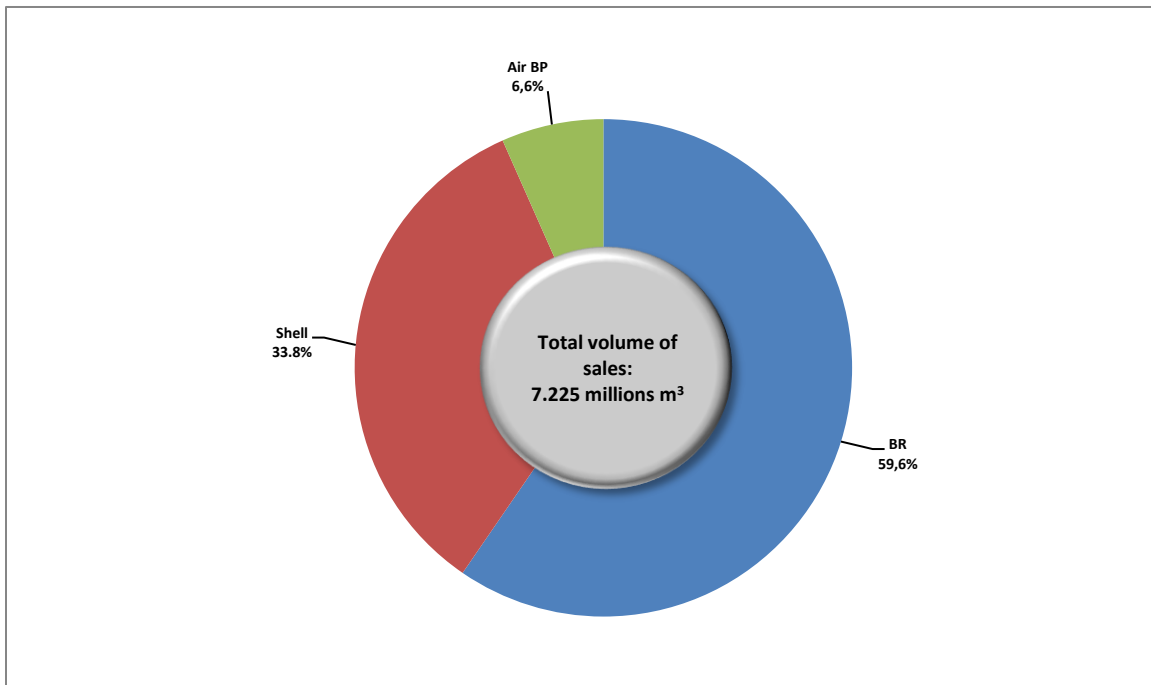
**Figure 10** - Distributors according to domestic sales of fuel oil, in 2013



**Source:** ANP, 2013

The Aviation Kerosene market is greatly expanding in recent years. In 2013, the consumption of aviation kerosene was mainly in the Southeast (63%), due to the heavy air traffic flow in this region. Following the Southeast region, we have the Northeast (14.9%), Midwest (9.3%), South (7.3%), and North (5.5%) regions. Three companies were responsible for the aviation kerosene market: BR, Shell, and Air BP.

**Figure 11** - Distributors according to domestic sales of aviation kerosene, in 2013



Source: ANP, 2014

### 1.3 – Resale

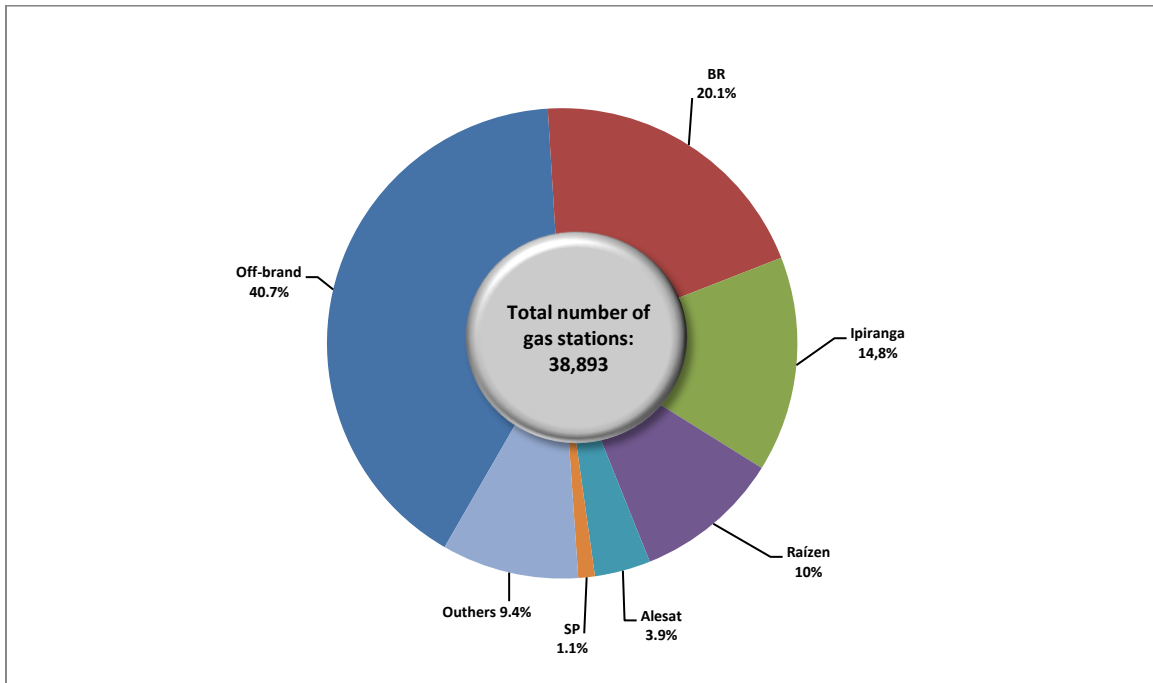
The resale market in Brazil consists of 38,893 gas stations (ANP, 2014). This figure is based on CONAMA (National Environmental Council) Resolution No. 273 that sets forth retail gas station as:

*"Facility where retail of oil products, ethanol, and other automotive fuels are operated, and provided with equipment, automotive fuel storage systems, and meters." (CONAMA Resolution No. 273, of November 29, 2000).*

About 40.7% (15,826) out of total number of gas stations are off-brand, and 59.3% (23,067) are brand gas stations, which are required to purchase the products only from their distributors. In 2013, brand gas stations were responsible for retailing 48.7% of the

fuel. In 2013, the resale occurred mainly in 4 out of 97 brands operating in Brazil: BR, Ipiranga, Raízen, and Alesat (ANP, 2013).

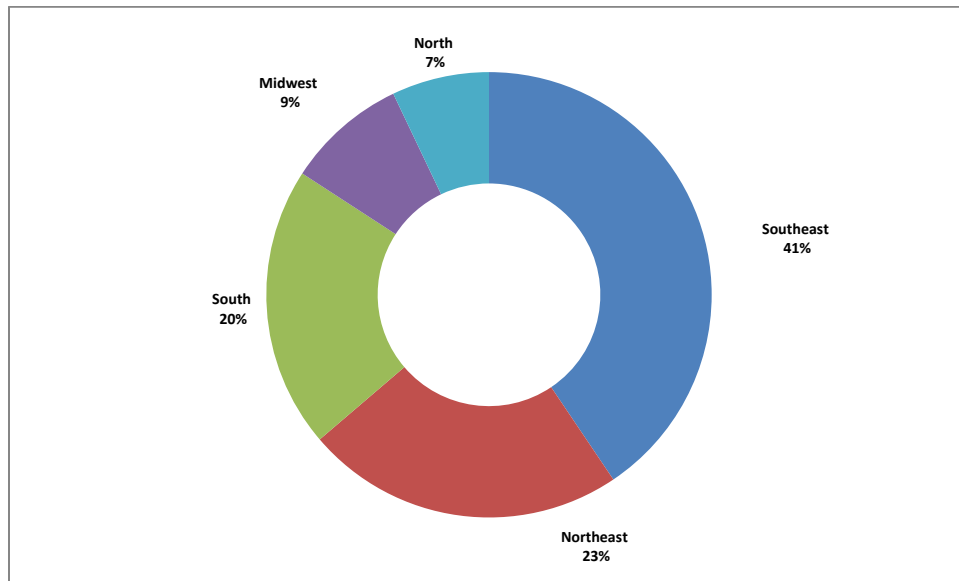
**Figure 12 - Percentage of Brands in Gas Stations -2013**



Source: ANP, 2014

We can also observe the regional concentration of resale service. In 2013, most of the gas stations in the country were located in the Southeast (40.6%) and Northeast (23.2%) regions. Other regions comprise 36.3% of gas stations in the country.

**Figure 13 - Gas stations by region, 2013**



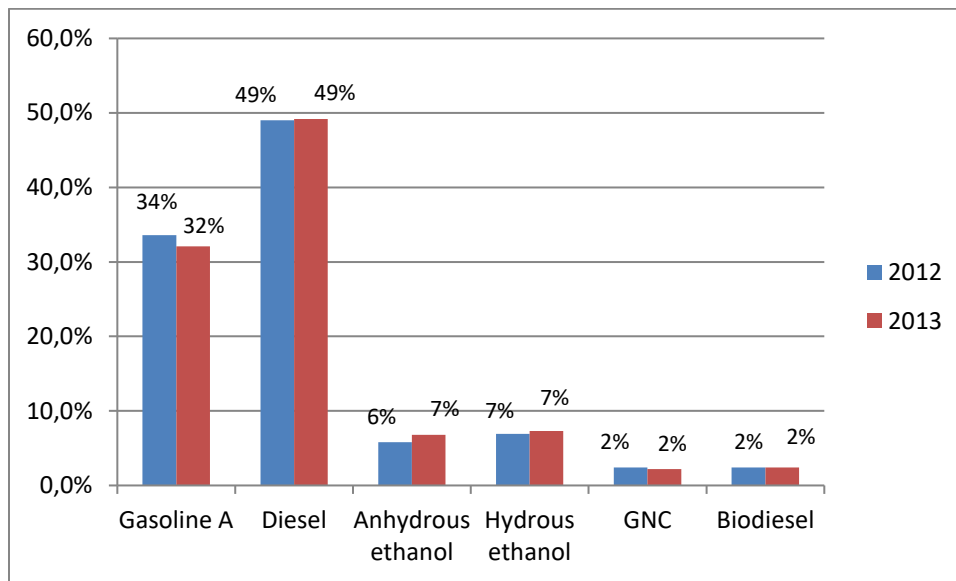
Source: ANP, 2014

## 2 - Existing Market

The liquid fuel (gasoline, ethanol, and diesel) market accounts for over 5% of GDP and it has been recently growing robustly at higher rates than the growth of the economy. This can be particularly explained by the increased demand for diesel oil and gasoline C, due to the increase in the number of vehicles per capita and growth of freight transport.

It is interesting to note that the vehicle consumption matrix in Brazil has a high market share of renewable fuels, such as ethanol and biodiesel. Gasoline, however, has recently increased its market share substituting for hydrous ethanol, due to the increase in the relative price of ethanol in relation to gasoline.

**Figure 14 – 2012/2013 Brazilian vehicle consumption matrix**



**Source:** Fecombustíveis (2014)

## 2.2 – Market Structure

Petrobras is undoubtedly the main player in the Brazilian oil and natural gas sector. It operates at all stages of the production chain, most of time as a major player. After 17 years of the opening of the Brazilian market with the Petroleum Act (Act 9,478/97), the refining activity is still concentrated in Petrobras, and for years and the segment does not receive significant private investment. Distribution segment is less concentrated with a significant participation of private companies. However, it was observed in the last decade a movement of concentration from mergers, acquisitions and joint ventures between major distributors in the market<sup>6</sup>. The activity of oil products resale is the most competitive segment.

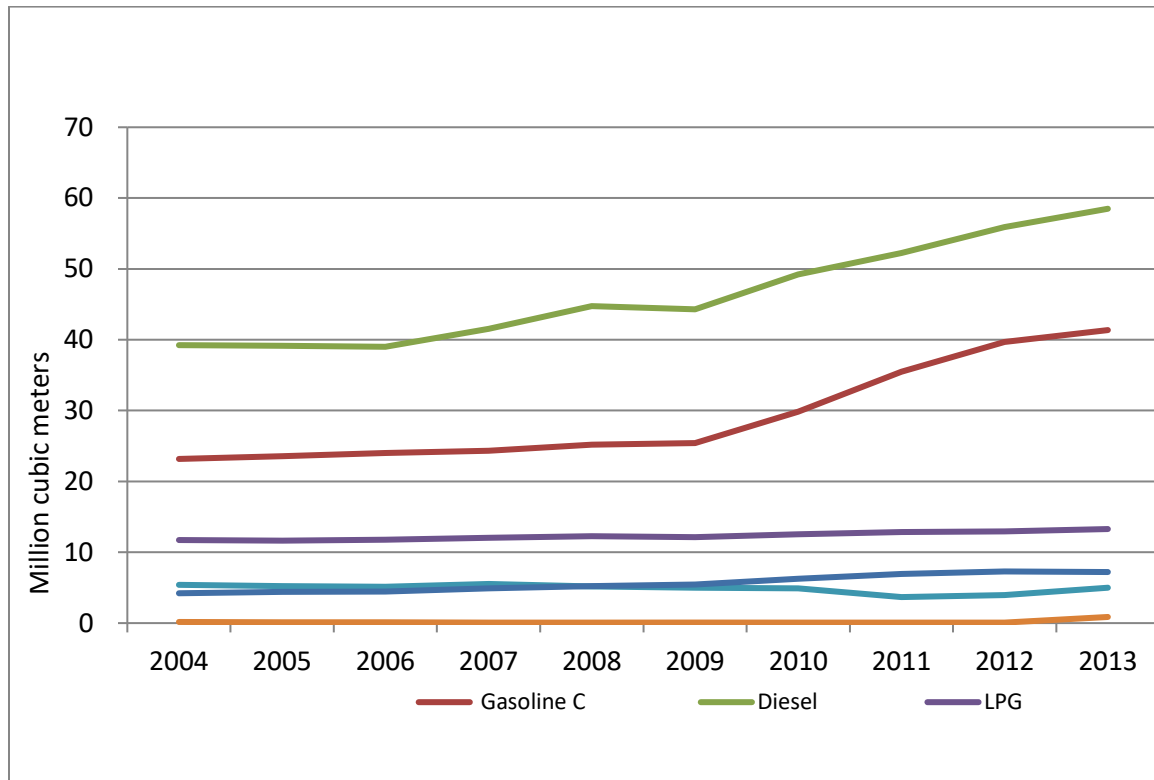
## 2.3 - Recent Evolution of fuel market in Brazil

In recent years, distributors are showing a strong growth in sales of oil products. This trend of sales growth, mainly diesel and gasoline C, has been occurring since 2003. In the

<sup>6</sup> Fusion Alesat in 2006; acquisition of the Ipiranga by Petrobras and the Ultra Group in 2007; the purchase of ExxonMobil in the domestic market by Cosan in 2008; acquisition of Texaco in 2009 by Ultra Group and the joint venture between Shell and Cosan in 2010.

same period, sales of LPG, aviation fuel, and other products remained stable, while sales of fuel oil recently fell (since 2010).

**Figure 15** - Development of domestic sales according to distributors of major oil products, from 2003 to 2013

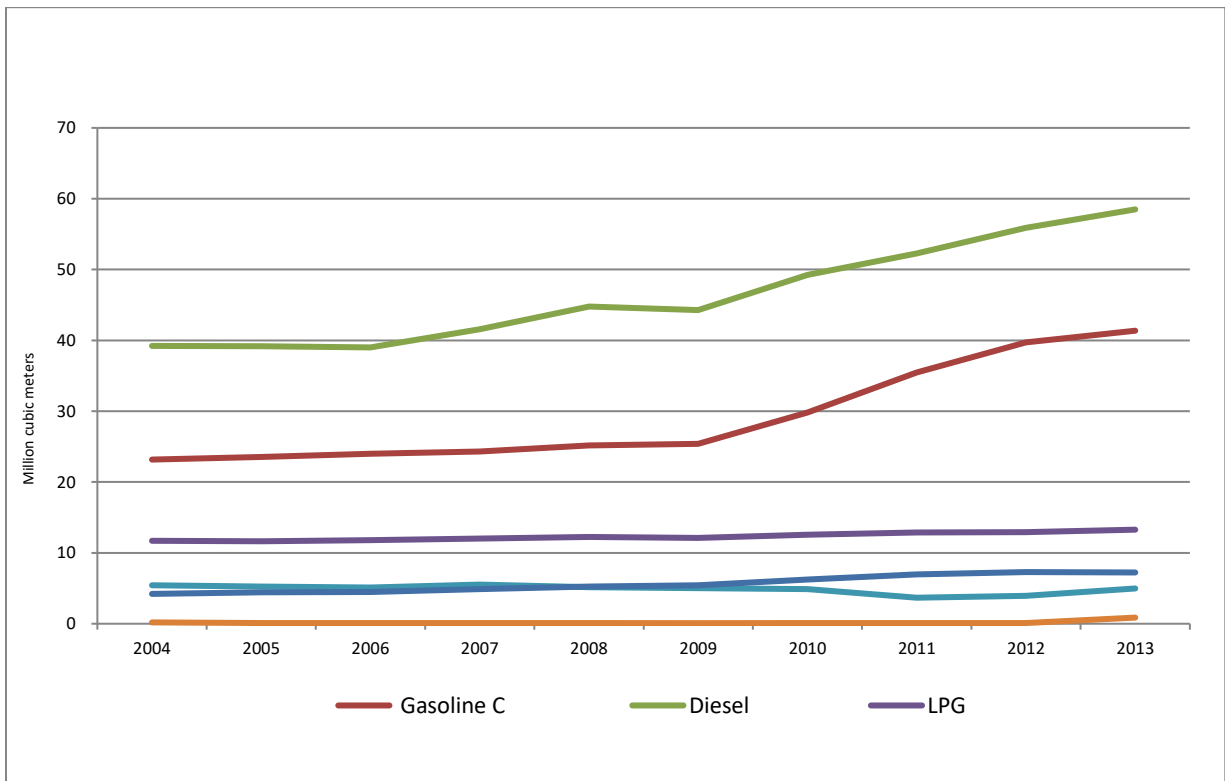


**Source:** ANP (2014)

However, the strong growth in demand seen especially for diesel and gasoline, has not been accompanied by increased in domestic production at the refineries (Figure 15), leading since 2009 greater external dependence on these fuels (ANP, 2013B).

**Figure 16** - Evolution of fuel production from 2000 to 2011



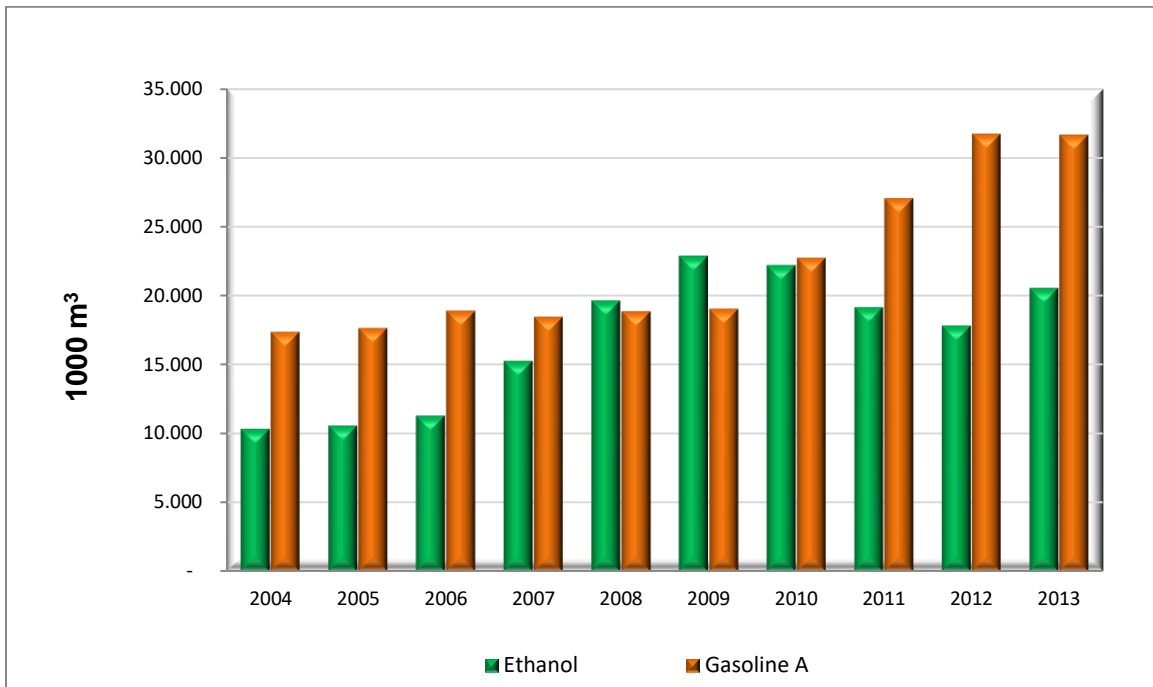


Source: ANP, 2013b

In Brazil, gasoline sold at gas stations (gasoline C) shall have a portion of anhydrous ethanol (18% - 25%). In this context, apart from the consumption of hydrous ethanol, (ethanol sold at gas stations) sales of anhydrous ethanol follow the increasing consumption of gasoline C. On the other hand, sales of hydrous ethanol mostly depend on prices of gasoline, because it is the primary substitute.

As the price of gasoline remained relatively controlled, with small adjustments recently, oil products have been replacing the ethanol hydrate in recent years, particularly in the Northeast region (with sales falling 18.6% since 2009). In addition, the mixture of anhydrous increasing to 25%, since early 2013 the production of hydrous ethanol began to compete even more with the production of anhydrous ethanol.

**Figure 17 – Sales of automotive gasoline and ethanol in Brazil - 2003-2012**



Source: ANP (2014)

### 3 - Regulation of the Fuel market in Brazil

Brazil started in the 90s a deregulation and liberalization process in the oil industry. In 1995, Constitutional Amendment No. 9 amended the article 177 of the Federal Constitution, thus ending the monopoly of Petrobras in the oil and gas industry. Now, the Federal Government has the right to contract the state and private companies to be provided with exploration and prospecting activities in mineral deposits; refining of petroleum; import and export of oil, oil products, and natural gas; and transportation of oil, oil products, and natural gas.

In 1997, the Act. 9,478 regulated the Constitutional Amendment No. 9. In addition, the government decided to sell part of Petrobras' shares to private players promoting private participation in the oil sector. In this context, the regulatory State was replacing the historical role played by the Brazilian State, whose interventionism of public policies prevailed. Thus, following the global trend, competition and productivity gains in the Brazilian oil industry were prioritized.

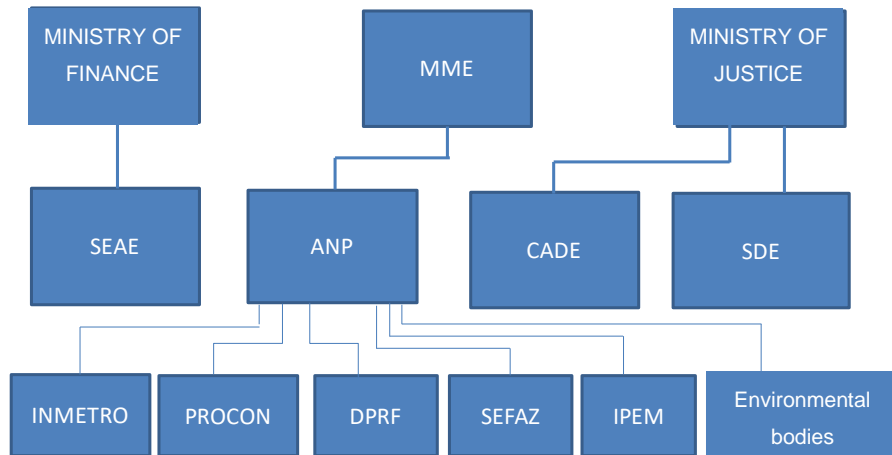
### **3.1 - Regulatory authorities and related powers**

Due to the liberalization in the 90s and the transition to a deregulated economy, the regulatory body was required to inspect efficiently. Therefore, its role became more important not only in quality control, but also in factors such as environment, safety, repression to illegal tax practices, and security of supply in the domestic market. Currently, some bodies stand out: National Petroleum Agency (ANP), Economic Law Department (SDE), Administrative Council for Economic Defense (CADE), and Secretariat for Economic Monitoring of the Ministry of Finance (SEAE/MF).

ANP is responsible for regulating, contracting, and inspecting the economic activities in the gas, oil, and oil product sector, and specify the quality of products being produced. In order to increase the efficiency of the inspection process, ANP has signed a series of agreements with various bodies at federal, state, and local level, such as INMETRO (National Institute of Metrology, Normalization and Industrial Quality), PROCON (Consumer Protection Agency), DPRF (Federal Highway Police Department), SEFAZ (Tax Authority Department), and IPEM (Office of Weights and Measures). We can notice, however, that the inspection is still focused on the ANP inspection agents.

In the case of SDE and SEAE, the bodies are responsible for filing administrative proceeding by issuing an economic opinion on possible anticompetitive practices. Once the SDE or SEAE have considered sufficient elements for a lawsuit, it shall suggest to CADE that judges the case. CADE conclusively judges the SDE proceedings at the administrative level and thus individually sentences or not and it requests ANP to apply the appropriate sanctions, if applicable. Both SDE and CADE are supported by the Ministry of Justice and their duty is to control the market concentration and punish offenses against the Economic Order.

**Figure 17 – Bodies Regulating and Inspecting Fuel Market in Brazil**



**Source:** Own Elaboration

### **3.2 – Oil Product Pricing**

With regard to the oil products pricing, Act 9,478/97 set forth a period of 36 months for the total liberation and deregulation of prices of fuel at refineries and gas stations.

It was established initially a selling price for each type of oil product, reflecting the company's operating costs and a profit margin. Thus, from 1998 products' prices began to vary monthly according to international prices. This price increased by the transportation and internalization costs, were supposed to cover refining costs. The price charged by distributors, continued to be established by MME in conjunction with the Ministry of Finance. A deadline for its liberalization of the distribution price was set for 2002 (COLOMER e TAVARES, 2012).

### **3.2 - Permission and Authorization**

In the same period of price liberalization, private companies were allowed to import to participate in the refining activity. With regard to the gas stations, licence to operate takes into account several aspects, both bureaucratic and environmental. Licenses from different government bodies are required to obtain permission and authorization to establish gas stations. To perform activities related to the retail distribution,

authorizations from the local, state, and federal bodies, as well as ABNT (Brazilian Association of Technical Standards), INMETRO (National Institute of Metrology, Normalization and Industrial Quality), and relevant environmental bodies, are required.

These authorizations may only be exercised by a legal entity provided with the retail authorization granted by ANP. Therefore, an application on the ANP website is required, as well as local permits, several operating and environmental licenses, inspection certificate issued by the Fire Department, and national certificate of freeboard for floating retailer.

According to the current law, retailer shall entry into operation after the publication of the registration in the Official Daily Gazette (DOU). Should this activity be exercised without the prior registration provided by the ANP, retailer may receive Infraction Notice and fine and its gas station may be forbidden to operate.

ANP analyzes the documentation required to be submitted. Should procedures required by ANP be not met, legal sanctions may be applied. Retailer granted by ANP shall purchase the fuel from authorized distributors and previously registered by ANP. The registration of a gas station shall always be updated on the ANP website. If changes are made, it is important to inform ANP within 30 days.

### **3.3 – Fuel Quality Inspection**

Since prices were liberalized in 2002, a more active inspection was required, and ANP is responsible for this activity. The ANP inspection acts on two fronts: prices and quality of fuel and lubricants.

Inspection of fuels is essential to protect the rights of consumers. ANP monitors the fuel quality by checking the documentation of the gas stations, compliance tests, fuel quality tests, and safety and environmental protection.

The National Monitoring Program on Fuel Quality, established in 1998 and regulated by ANP Resolution no. 8/2011, is supported by laboratories from 22 institutions contracted by bidding process in all regions of the country. By this program, ANP systematically assess the quality of fuels sold. The results analyzed are made available to general public and

can be found on the ANP website. In 2012, about 22,000 inspections were carried out in Brazil (ANP, 2013).

If there are irregularities, according to Act 9,847/1999, ANP has the authority to issue Infraction Notice, interrupt gas pumps to operate at gas stations, and cancel registrations of products. Inspectors are empowered to indict and/or interdict the gas station showing irregularities. The Act 9,847/1999 establishes the cases of interdiction, proper procedure to operate, and fines to be applied.

The Act also allows ANP to celebrate agreements with public administration bodies, in order to improve the inspection activities. In addition to directly inspect the gas stations, preventive measures are also taken, such as the mandatory addition of orange dye to anhydrous ethanol, in order to avoid tampering of hydrous ethanol.

Due to the large size of Brazil and the large number of gas stations, the number of ANP inspectors is not adequate to cover all the municipalities and spots. Remote areas are more affected due to insignificant number of inspectors. Threats and bribes are the other problems that hinder the proper inspection activities. The current system relies primarily on accusations made by consumers, government bodies, contracted or not, and the industry's economic agents.

**Table 1 - History of ANP Inspection**

Year	Inspection	Interdiction	Infraction	Infraction (quality)
1999	7.335	449	2.099	424
2000	12.470	561	4.208	745
2001	15.685	692	5.280	1.230
2002	22.631	1.132	7.249	1.949
2003	26.364	1.311	8.702	1.653
2004	25.181	1.668	7.893	1.320
2005	15.370	649	4.331	1.109
2006	24.930	1.008	6.408	1.686
2007	24.980	931	6.114	1.621
2008	19.669	719	4.566	827
2009	28.603	1.213	6.665	825
2010	27.880	1.108	5.354	665
2011	24.972	1.061	4.510	551
2012	21.141	820	4.154	486
2013	11.723	523	2.201	344
<b>Total</b>	<b>308.934</b>	<b>12.534</b>	<b>79.734</b>	<b>15.435</b>

Source: ANP, 2013

### 3.4 - The Role of ANP, CADE, and SDE in the Antitrust Policy

Fighting cartels, tacit collusion, and price controls in the fuel market, especially gas stations, are the main focuses of the Brazilian Antitrust System. Under the legal

framework to investigate actions that can hurt the economic order process, ANP, SDE, and CADE are the bodies that stand out to control these actions.

ANP is responsible for ensuring the protection of consumer rights in relation to price, quality, and availability of products. Concerning the inspection of anticompetitive practices, ANP monitors the prices charged by distributors and retailers gas stations by conducting a weekly price survey.

This survey and the margins for marketing fuel cover the common gasoline, hydrous ethanol, diesel fuel (no additives), compressed natural gas (CNG), and liquefied petroleum gas (LPG). Results are made available weekly to the general public.

Based on the survey, if there is evidence of violations to the economic order, such as cartelization, CADE and SDE are notified. In this process, SDE is responsible for investigating and filing the administrative proceeding, by issuing an economic opinion. Importantly, SDE may initiate an investigation, in order to ascertain practice of violations to the economic order. No notification from others are required. Should there be evidence of violation, an administrative proceeding shall be filed against companies/people investigated. Following the legal procedure for the case, companies will be notified to submit their defense and SDE shall file the case.

After evidentiary stage, SDE shall submit the case to CADE. Once the SDE has considered sufficient elements for a lawsuit, it shall suggest to CADE that judges the case. CADE conclusively judges the SDE proceedings at the administrative level and thus individually sentences or not and applies the appropriate sanctions, if applicable.

There is a technical cooperation agreement in force between SDE and ANP which provides that the Agency shall notify SDE on indications of practices harmful to the economic order in the gas, oil, and oil product sector. It shall also notify CADE on facts and procedures taken. ANP has also the duty to make a statement within 30 days from the date of notification by SDE, upon filing the administrative proceedings against the fuel sector players. This term also applies to the issuance of technical opinions from market concentration requested by SDE, based on Article 36 of Act 8,884/94. ANP shall apply penalties to those involved when CADE considers violation to the economic order or by court order.



Violations to the rules relating to the oil industry activities, domestic supply of fuel, National Fuel Stock System, and Annual Fuel Stocks Strategic Plan may be penalized. The main administrative sanctions are: fine; seizure of goods and products; forfeiture of seized goods; cancellation of product registration at ANP; suspension of supply of products; temporary, permanent or partial suspension of establishment or facility; cancellation of establishment or facility registration; and revocation of authorization to operate.

Over the past few years, CADE has played a fundamental role in restraining agreements and cartels in the oil and gas sector, by imposing heavy fines and various restrictions to participants in these agreements detrimental to the economic order.

#### **Example of CADE activity**

Among the several cases judged by CADE, the most emblematic one took place in Florianópolis, in 2002, when CADE sentence a retail of fuel for the first time ever. The Retail Union was found guilty of anti-competitive practices, thus receiving a fine of R\$ 400,000.00. Its chairman was also ordered to pay a fine in the amount of 15% over the fine applied to the Union. Concerning the gas stations, they were required to pay 10% of revenues in 1999 and the owners 10% over the amount of the fine applied to their companies.

#### **4 - Trends for the next 10 years**

The growth of sales of fuels in Brazil depends on a number of economic, political, and social factors. Regarding the economic variables, we have the evolution of per capita income, growing number of vehicle fleet, evolution of the interest rate and consumer

credit, regional and social improvement in income distribution, and evolution of energy prices as factors that may influence the sales of fuel in Brazil.

Concerning the social and political conditions, the profile of population growth and the policies to improve urban mobility and reduce CO<sub>2</sub> emissions can positively and negatively influence the growing demand for services provided by gas stations.

Development of new technologies may also contribute to the change in sales of fuel segment. They can increase the efficiency of combustion engines or even change the current technological paradigm, as the dissemination of electric motors

By recognizing the variables that affect the sales of fuel, the Energy Research Company (2013) identifies possible trajectories for the sector in Brazil. According to the assumptions made by EPE (2013), Brazilian economy is expected to grow from 2013 to 2022 at an average annual rate ranging from 4.5 to 5.0%, driven primarily by world economy, which is estimated to grow at around 4.0%/year.

In this context of moderate growth in the global economy, it is estimated a stability of high prices of oil in the first half of the period. With the resumption of investment in exploration and production (disrupted by the economic crisis) rearrangement is expected in prices of oil, in the second half of the period analyzed, at lower levels than those observed today.

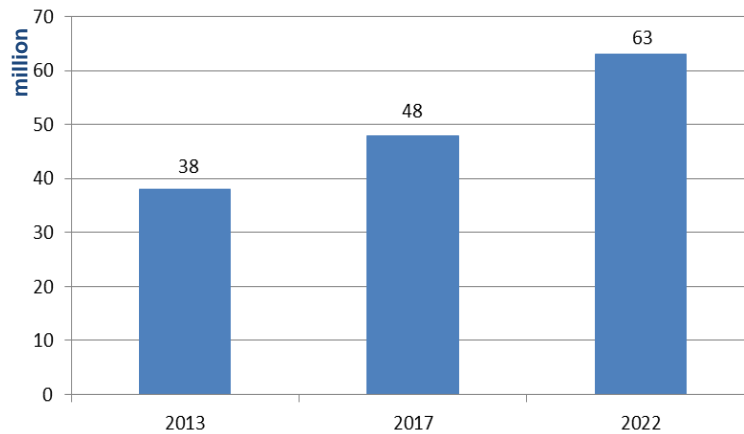
In terms of demographic variables, the most visible change is the aging population. The regional distribution of the population will remain concentrated in the urban areas of the Southeast (41.9%) and Northeast (27.7%) regions (EPE, 2013).

In the transportation sector, we consider that the expansion observed in the Brazilian automotive industry in the last decade will maintain its pace in the coming years. Brazil secures 4th place, in 2011, in numbers of vehicle licensing (ACEA, 2012).

It is expected that over the next decade, the increase in household income and greater competitiveness in the domestic market for light vehicles will contribute to the sustained growth in sales of vehicles. The growing need for mobility of people and goods will also

imply the growth in number of heavy vehicles (buses and trucks), as we can see in Figure 18.

**Figure 18 – Number of Vehicles**



**Source:** EPE, 2013

In relation to the public transportation, road transport will prevail, with a significant increase by 2022, due to the relative reduction in vehicle transporting only one person, in the same time horizon.

In the freight transport, the distribution of activity also remains focused on road transport by 2022, but rail and waterway transportation should prevail. The growth of waterway transportation is explained by the cabotage transportation of oil and oil products, due to the distance of oil fields (including the Pre-salt) to the new refineries in the Northeast region. This creates an increasing need for displacement of feedstock (oil), as well as the effect on smaller scale in relation to the increasing displacement of products to the consumer center.

## **4.1 - Evolution of Fuel Market in Brazil**

### ***Diesel***

The main component that explains the growing diesel consumption in Brazil is the transport sector, mainly in the public transportation and freight transportation (Bus, Truck, Rail, and Waterway).

The road system requires great demand for diesel. To forecast the diesel consumption for road segment, EPE (2013) used key variables, such as number of vehicles, specific fuel consumption (l/km), average annual mileage, and occupancy factor. To forecast the number of vehicles, scraping curves for buses, trucks, and light commercial vehicles were made.

In relation to estimation of sales of light and heavy vehicles, EPE (2013) considered the historical growth rate, income elasticity of demand, and forecasting for growing road activity within the domestic matrix. An increase of 1.0% average annual yield for new vehicles has been considered since 2012.

In the Waterway transportation, the increase in diesel consumption comes from the growth of GDP plus a gain due to the location of new refineries (cabotage to refineries and oil products to markets) and logistics associated with exploration and production activities in the Pre-salt.

For the railroad transportation, railway projects that potentially affect the sector in coming years were considered. Forecasted figures are in accordance with the National Plan for Logistics and Transport (PNLT) (Ministry of Transport, 2012). Thus, in 2022, the rail freight network will reach 42,000 kilometers, due to the greater use of railway system.

The assumption to change from road transportation, especially in the freight segment (ton / km), to rail, waterway, and air transportation, results in a proportional reduction of diesel consumption, for road transportation requires more energy than the others. Gains of intermodal efficiency (structure effect), as well as the increasing efficiency of the modality (intensity effect), are captured by EPE's model.

Concerning the demand for biodiesel, calculated on the final demand for diesel, EPE (2013) considered the obligation provided for in Act 11,097/2005 and CNPE Resolution 06, of

09/16/2009, which anticipated the addition of 5% biodiesel into diesel oil from January 2010. The percentage of 5% was maintained throughout the forecast horizon. Based on the assumptions made, the demand for diesel will be slightly more than 77 billion liters by 2022 (EPE, 2013).

**Figure 19 – Demand for Diesel**

Year	North	Northeast	South	Southeast	Midwest	Brazil
	Million liters					
2013	6,287	8,339	10,378	22,394	7,245	54,643
2017	6,867	10,298	12,338	26,171	8,656	64,330
2022	8,480	12,670	15,137	30,317	10,604	77,208
Period	Variation in the period (Million Liters)					
2013-2022	1,686	4,788	5,295	8,930	3,781	24,479
Period	Variation (% per annum)					
2013-2017	0.2	5.5	4.6	4.1	4.9	4.1
2018-2022	4.3	4.2	4.2	3.0	4.1	3.7
2013-2022	2.2	4.9	4.4	3.6	4.5	3.9

**Note:** Biodiesel, bunker for export and self-production of electricity, and consumption of the energy sector are not included. Consumption related to the expected thermal generation is included.

**Source:** EPE, 2013

## ***Gasoline***

The estimate for consumption of gasoline can be prepared from the economic scenario adopted, the estimation of the number of light vehicle licensing, the domestic supply of ethanol, and consumer preference between gasoline and ethanol for flex-fuel vehicles.

Thus, EPE (2013) estimates a growth in the number of vehicle licensing about 3.6%/year between 2012 and 2022. As an assumption, sales of car (mostly internal combustion and flex-fuel) are adopted by the end of the period.

By taking into account the maintenance of technological and economic barriers and the lack of government incentives, we assume that hybrid cars should be available in the Brazilian market only from 2015. From that time, the market share for these vehicles will gradually increase to reach 3% of domestic sales in 2020, remaining stable until the end of the decade (EPE 2013). Moreover, no significant entry of other technologies (plug-in hybrid and electric) is considered over the next decade.

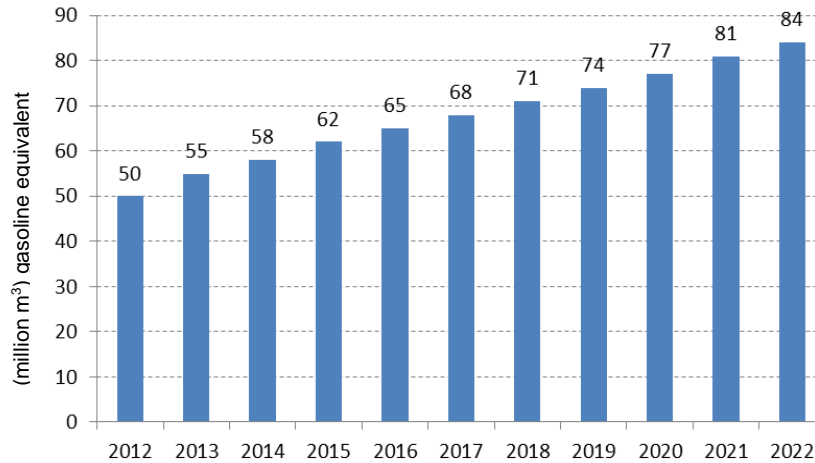
The domestic total number of light vehicles, growing at a rate of 5.9% per annum, is expected to be 59 million units in 2022. The internal combustion flex-fuel vehicles will account for approximately 76% of this total number, corresponding to 45 million units (EPE, 2013).

In Brazil, the estimated demand for gasoline should consider the mandatory content of anhydrous alcohol added to gasoline A. In this case, it is estimated that this percentage is 25% anhydrous ethanol (EPE, 2013) for the period considered.

Based on these assumptions, the consumption of automotive gasoline A shall grow at an average of 3.1% per annum, due to the loss of competitiveness of hydrous ethanol in relation to gasoline C (gasoline A plus anhydrous ethanol), from 34 billion liters in 2013 to 43 billion liters in 2022 (EPE, 2013). Thus, the growth of demand for gasoline C in the decennial period reaches 3.8% per annum, from 44.3 billion liters in 2013 to 57.5 billion

liters by the end of the period (EPE, 2013). The global demand for fuel for the total number of light vehicles is shown in Figure 24.

**Figure 20 – Final Energy Demand for Light Vehicles (Otto Cycle)**



Source: EPE, 2013

### ***Hydrous ethanol***

Since the demand for anhydrous ethanol will depend on the mandatory content of blending and demand for gasoline C, the demand behavior para o hydrous ethanol can be determined by consumer preference to fuel the flex-fuel vehicle.

By assuming that in the early years of the decade the ethanol supply will be subject to restraints (restrictions to sugarcane production and expansion of external demand for sugar), hydrous ethanol will remain low competitive in relation to gasoline C. In this context, it is estimated that the demand for hydrous ethanol changes from 11.6 billion liters in 2013 to 32.8 billion liters in 2022 (growth of 11.2% per annum) (EPE 2013) as shown in Figure 25.



**Figure 21 - Energy demand for hydrous ethanol**

Year	North	Northeast	South	Southeast	Midwest	Brazil
Million liters						
2013	197	984	1,429	7,604	1,374	11,588
2017	480	2,542	2,070	18,125	3,357	26,574
2022	655	3,373	2,457	21,865	4,462	32,811
Period	Variation in the period (Million Liters)					
2013-2022	478	2,479	1,158	14,218	3,140	21,471
Period	Variation (% per annum)					
2013-2017	22	23.2	9.8	18.8	20.5	18.6
2018-2022	6.4	5.8	3.5	3.8	5.9	4.3
2013-2022	13.9	14.2	6.6	11.1	12.9	11.2

**Source:** EPE, 2013

It can be concluded that over the next 10 years the dynamics of the sales of fuel in Brazil will remain driven by the increasing demand for oil products, especially gasoline and diesel. This is explained by the predominance of combustion engines and the slow diffusion of new technological paradigms for engines, which will not require significant

changes in sales of fuel. It is also estimated that growth in fuel consumption and consequently the gas stations will remain in the Southeast region.

An interesting change to be observed in the sale of fuel is the trend of adding new services at the gas stations (laundry, drugstore, clothing & shoes repair, and even restaurants) , In addition to the traditional convenience stores. ).

## **5 – Final Remarks**

This chapter presented an overview of the oil products market in Brazil. It has been shown that Brazilian fuels markets are experiencing an important transformation as the demand for oil products and renewable fuels (ethanol and biodiesel) is growing very rapidly. An important feature of the Brazilian fuel market is the important market share of renewable fuels and CNG (compressed natural gas). CNG and sugarcane based ethanol competes with gasoline to supply a very large fleet of flexfuel fleet (currently estimated at 18 million vehicles). This interfuel competition is an important distinctive characteristic of the Brazilian fuels market.

The renewable fuels and CNG have experienced very rapid demand growth in the first part of the 2000 decade. Nevertheless, after the economic crisis of 2008, oil products demand growth became more important because of the government control of the price of gasoline and diesel.

This paper has also shown that it is expected an increase in household income and light vehicles sales over the next decade. It is also expected a growing need for mobility of people and goods that will also imply the growth in number of heavy vehicles (buses and trucks). As shown in session 4 , fuel demand for the next 10 years will continue to grow at a rapid pace. Nevertheless, still persists important uncertainties for this market. Given the strong competition between different types of fuels in Brazilian market, different demand growth scenarios can be traced for interfuels competitiveness assumptions.

## **6 – References**

Ministry of Transport and Ministry of Defense [MD], 2012. Plano Nacional de Logística e Transportes. Relatório Executivo. Available at <<http://www.transportes.gov.br/>>..

ACEA, 2012 European Automobile Manufacturers Association. The Automobile Industry Pocket Guide 2012. Belgium, September 2012.

EPE, 2013 Plano Decenal de Expansão de Energia 2022.

ANP, 2013 Boletim de Fiscalização. July 2013.

ANP, 2013b. Estudo Temático: Evolução do Mercado de combustíveis e derivados: 2000-2012. Available at: <http://www.anp.gov.br>. FECOMBUSTÍVEIS, 2013 Statistical Yearbook.

ANP, 2011. Cartilha do Posto Revendedor de Combustíveis. Available at [www.anp.gov.br](http://www.anp.gov.br)

ANP/SDE, 2004. A Defesa da Concorrência no Mercado de Combustíveis – ANP/SDE.

Available at

[http://www.mpba.mp.br/atuacao/ceacon/doutrina/a\\_defesa\\_concorrncia\\_mercado\\_ombustiveis\\_ANP\\_SDE.pdf](http://www.mpba.mp.br/atuacao/ceacon/doutrina/a_defesa_concorrncia_mercado_combustiveis_ANP_SDE.pdf)

SDE, 2009. COMBATE A CARTÉIS NA REVENDA DE COMBUSTÍVEIS.

<http://www.mpsp.mp.br/portal/page/portal/Cartilhas/CarteisRevendaCombustiveis.pdf>