

RIO DE JANEIRO OIL INDUSTRY YEARBOOK

OVERVIEW 2016

EXECUTIVE
SUMMARY



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EDITORIAL

The Brazilian oil and gas industry faces significant challenges today due to the national sociopolitical crisis. At the same time, oil prices are dropping, following the global trend. However, many forget that urgency plays a fundamental role in the Brazilian oil industry.

It is necessary to expedite the production of oil from the pre-salt area. This concerns the potential wealth still unexplored beneath the marine soil, which will only become a genuine asset to Brazil when it is exploited.

The world will not wait for Brazil. While we discuss political and bureaucratic issues, the globe rotates and follows new paths pursuing the discovery of other energy sources. Some companies have already announced, for the near future, the replacement of oil as a fuel source. Furthermore, social pressure compels individuals and entities to adapt every day by consuming fewer fossil fuels.

Therefore, what does the Brazilian society need in order to take ownership of this wealth?

We explore the example of Rio de Janeiro State, which concentrates over 60% of the Brazilian oil and gas production, but suffers daily from so many misfortunes.

How much can our State evolve with the benefits that will be generated by exploiting the pre-salt oil?

Even in a crisis scenario, Rio de Janeiro State is the hub of the shipbuilding industry in the country, and 30% of its GDP is linked to the oil, gas, and maritime markets. Here, we concentrate the largest share of the oil and gas industry activity. Moreover, the expectations unveil a volume yet to be explored in the pre-salt area of around 56 billion barrels of oil equivalent (boe).

Considering the current volumes, the Brazilian proven reserves are equivalent to nearly 20 years of production. In addition, we still own the volume of potential reserves. If we do not hurry, there is a risk of seeing this commodity coming at the wrong moment, when the whole world has already turned its attention to other energy sources.

This is the threat of delaying exploiting this source of wealth.

Sistema FIRJAN aims toward a competitive market, with more benefits for society. This Yearbook is one of our contributions to the construction of a free, investor-attractive, and valuable market not only for Rio de Janeiro but also for Brazil.

Let our haste be the fuel that encourages us to move forward, seeking growth and evolution.

Enjoy your reading!

Eduardo Eugenio Gouvêa Vieira

President of Sistema FIRJAN

The Executive Summary of the Rio de Janeiro Oil Industry Yearbook Overview 2016 is a synthesis of the full presentation and the common agenda submitted to the State of Rio de Janeiro based on statistical data.

In a crisis scenario, such as the one we are experiencing today, it is recommended that we focus on developing activities within organizations, the government, or companies based on their estimated output.

The desired regulatory adjustments have the power to improve the business environment. Regarding the oil market, current regulations should attract investments.

In this context, the common agenda to recover this market dynamics should focus on the following points: holding regular bids of exploration blocks; ending the contract with the sole operator in the pre-salt; allowing free competition to establish oil-product prices; and implementing a well-coordinated, convergent, and stable industrial policy.

YEARBOOK PRESENTATION

The oil, gas, and maritime markets and their values and productive chains are the main generators of profit and employment in Brazil, especially in Rio de Janeiro State, where these markets concentrate their activities.

Over 60% of all Brazilian oil and gas production is located in Rio de Janeiro State. To that extent, we are the reference for shipbuilding in the country. Moreover, according to Rio's government data, more than 30% of Rio de Janeiro State's GDP is linked to these markets.

Sistema FIRJAN published the **Rio de Janeiro Oil Industry Yearbook Overview 2016** to present the State's contribution across the country. The yearbook focuses on the oil market, presenting the main data regarding the participation of Rio de Janeiro in several segments of this market, as well as the analysis and prospects of Brazil in the global context.

Currently, available publications in this field only focus on raw data presentation, which does not add much value for readers. Instead, the Yearbook offers access to qualified information, which enables companies to establish their investment decisions and to design their business plans.

The yearbook's content has been carefully selected to drive attention to the most promising market and to guide decisions over the productive chain.

The Yearbook reviews the oil market trends, especially the sharp production growth in the pre-salt area, the demand increase for oil products during the last decade, and the concurrent refinery capacity expansion in Brazil.

The preparation of the Rio de Janeiro Oil Industry Yearbook 2016 was mainly based on data widely published by the **Brazilian National Agency of Petroleum, Natural Gas, and Biofuels (ANP)**. The organization played an important role in the production of the document through the superintendence of technical data, but also supported the initiative from the beginning.

International data were obtained from publications of the **U.S. Energy Information Administration (EIA)** and the oil company **BP**, which operates internationally and provides market information.

The Yearbook production had the collaboration of respected organizations of the oil and gas market, which adds value and validity to its content. The document offers a view on the world oil context, an analysis made by the **Brazilian Petroleum, Gas, and Biofuels Institute (IBP)**, and is divided into chapters covering its value chain and key related issues.

The first chapter presents activities related to Exploration and Production segments. **The National Organization of the Petroleum Industry (ONIP)** prepared an article exposing the necessity for regulation improvements in order to attract investments for these activities.

In the second chapter, downstream data are presented, including refining activities, and the distribution of oil and its products. The **Sistema FIRJAN Oil, Gas, and Maritime Management (GPN)** division evaluated the scenario and prospects for Rio de Janeiro from the perspective of the necessary regulation improvements to make this industry segment more dynamic.

Government views on the oil market, industry, and prospects are presented in the third chapter. The vision of the government of Rio de Janeiro State, through the **Secretariat of Economic Development and Energy (SEDEIS)**, is that these state and municipal collections in the oil market have suffered a significant reduction, affecting the regional economy.

Finally, the fourth chapter highlights employment data across the oil value chain, as well as an analysis of the economic situation, prepared by the **Economic Studies Management (GEE)** of Sistema FIRJAN.

In addition, the Yearbook presents a glossary of oil market-specific terms.

The Rio de Janeiro Oil Industry Yearbook Overview 2016 presents an analysis of the market, revealing the significance of Rio de Janeiro State in the national context, with an analysis presented in the Final Considerations, here available for your reading.

The complete document can be accessed through the Oil, Gas, and Management page at the Sistema FIRJAN website: www.firjan.com.br/oilandgas

We wish you an excellent reading!

YESTERDAY, TODAY, TOMORROW

RIO DE JANEIRO OIL INDUSTRY OVERVIEW

The natural dynamics of the oil market, with all its complexity, are interdependent on and demand the constant monitoring of the global scenario.

When a fundamental variable of the global scenario changes drastically, as for example did the crude oil price, which registered a fall over half its peak value, the need for oil companies to change their business strategies is crucial for survival.

The natural fluctuations in the oil market, with its ups and lows, dictate that renewal is necessary both in performance and positioning.

During the commodities super cycle, after the crisis in 2009 until the middle of 2014, oil companies continued to focus on production growth since their financial return was guaranteed.

Today, following the oil prices reduction, alongside the forecast of a lengthy recovery and not returning to the level of 100 US\$/bbl, companies' strategic plans aim at maximizing the returns to their shareholders.

Investment plans are now meticulously reviewed and replaced by divestment plans and a more rigid monitoring of the companies' activities.

This new scenario does not diminish the importance of oil. On the contrary, according to BP's projection released on February 10, 2016, an additional demand of approximately 850 thousand barrels of oil per day (bpd) is estimated until 2035, as compared to the 2015 demand.

Moreover, the production growth rate is expected to fall in the long term. However, this does not correspond to a lack of growth. In fact, the potential production in Rio de Janeiro is still quite promising.

As can be observed in Chart 1, the main areas of interest in terms of production, which are already being explored or under development, are within the geographic limits of the State, and their contract coverage periods are extensive. The seven fields listed below represent 50% of the total domestic oil production.

Fields at ground zero in 1998, like Roncador, Marlim, Marlim Leste, Marlim Sul, Albacora, and Albacora Leste, had their concession contract durations extended in May 2016 to

reach up to 2052. This extension was associated with the favorable condition of their reservoirs, and according to CNPE Resolution number 2 from 2016, this measure aimed to achieve viability for investments to assure production from these fields.

A considerable portion of the recoverable potential (2 to 3 billion barrels of oil), from areas conducting production individualization agreements, is located in Rio de Janeiro. Among them are Lula, Libra, and all areas from Transfer of Rights, in addition to BM-C-34, 32, and C-M-202 blocks, which are also within Rio's geographical limits.

Since 2010, part of the oil production in Brazil has been migrating from the Campos to the Santos Basin, mainly due to advancement of production in the pre-salt area. This happened also due to non-realization of bidding rounds in the concession model. In technical note published by Sistema FIRJAN in 2015, in addition to the drop in the pace of production development, each year without round are held more than \$ 27 billion in future investments that we fail to attract.

Still, Rio de Janeiro remains the most prominent position as a hub for this commodity in the country, referring to domestic oil production, the national share of the State reached 67% in 2015, as shown in the chart below. In the past decade, Rio represented about 80%. Although the percentage of produced volume decreased, a growth of near 70% is observed in the total production of oil in the State, amounting 1.64 million bpd.

Furthermore, Rio is the main holder, not only of the proven oil reserves in the country (82%) but also of the probable and possible ones. Rio de Janeiro owns 9.2 billion oil barrels in the form of probable and possible reserves; this value corresponds to more than 80% of the total in Brazil.

The still unexplored potential of the pre-salt polygon should be added to this volume, with most part of this area belonging to the State. It is estimated that there are 56 billion oil barrels remaining to be explored. These values highlight the role of Rio de Janeiro in the future of the oil industry in Brazil.

If the amount of reserves by itself is insufficient to illustrate the potential of the State, it should be registered how these numbers can be translated into demands, whether entrepreneurial, governmental, or academic. They are industrial demands for goods and services, labor, rules and appropriate regulation, research, development, and innovation.

The development of an oil field, as each one has its own characteristics, creates demands for new production systems. Furthermore, these require additional goods and services to enable production and product flow.

Among the demanded goods and services, the installation of pipelines, drilling rigs, stationary production unities, logistics, and port infrastructure are the most important. According to a study published by Sistema FIRJAN in 2016, in order to explore and develop an area in the pre-salt

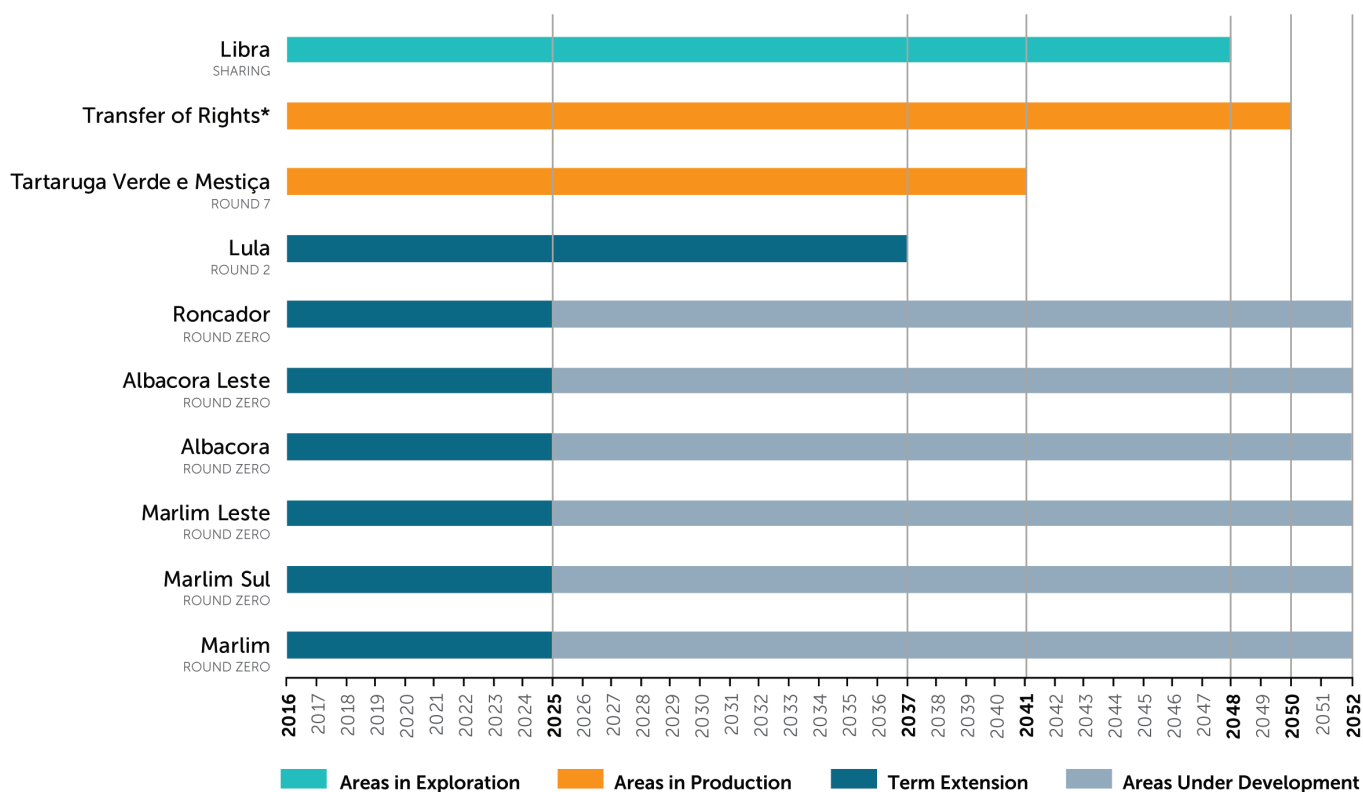
area, for instance, minimum investments of US\$ 9 billion are required for a reservoir equal to 1 billion oil barrels according to recent studies.

Nevertheless, it is important to consider the benefits for the society in terms of new socioeconomic programs, implemented through government taxation and the dynamic exploitation of the oil field, greater employment opportunities, and income increase for the industry workers.

With regard to market trends, a sharp growth of oil production in the pre-salt area is observed. This activity shift should guide investments in the technological field. In order to further explore these new areas, more elaborated and disruptive technologies are required, given the severe geological conditions for hydrocarbon exploitation in this area.

Hydrocarbon exploitation in the pre-salt area involves

CHART 1. DURATION OF CONTRACTS OF THE MAIN AUCTIONED AREAS IN BRAZIL



*Includes Búzios, Sul de Sururu, Norte de Sururu, Norte de Berbigão, Sul de Berbigão, Atapu, Itapu, Sépia, Sul de Lula e Sul de Sapinhoá
Source: Self-elaboration with ANP and Petrobras data

higher environmental and security risks. The increased tectonic activity in geological formations, like those in the pre-salt area, means that exploitation has to take place off-shore, at great depths and distance from the shore. Therefore, compliance to the environmental and labor safety regulations is of utmost importance.

The associated logistical demands, given the long distances to perform the activities and the hostile environment in the work units, also increase the importance of adhering to these precautions. Therefore, it is necessary to adjust and improve job security-related services, such as services that improve the workers' quality of life and services associated with compliance with environmental legislation.

Going further in the value chain, the strategic importance of oil refining should be highlighted. The refining process, which turns oil into by-products, incorporates a long production chain, demanding more goods, more services,

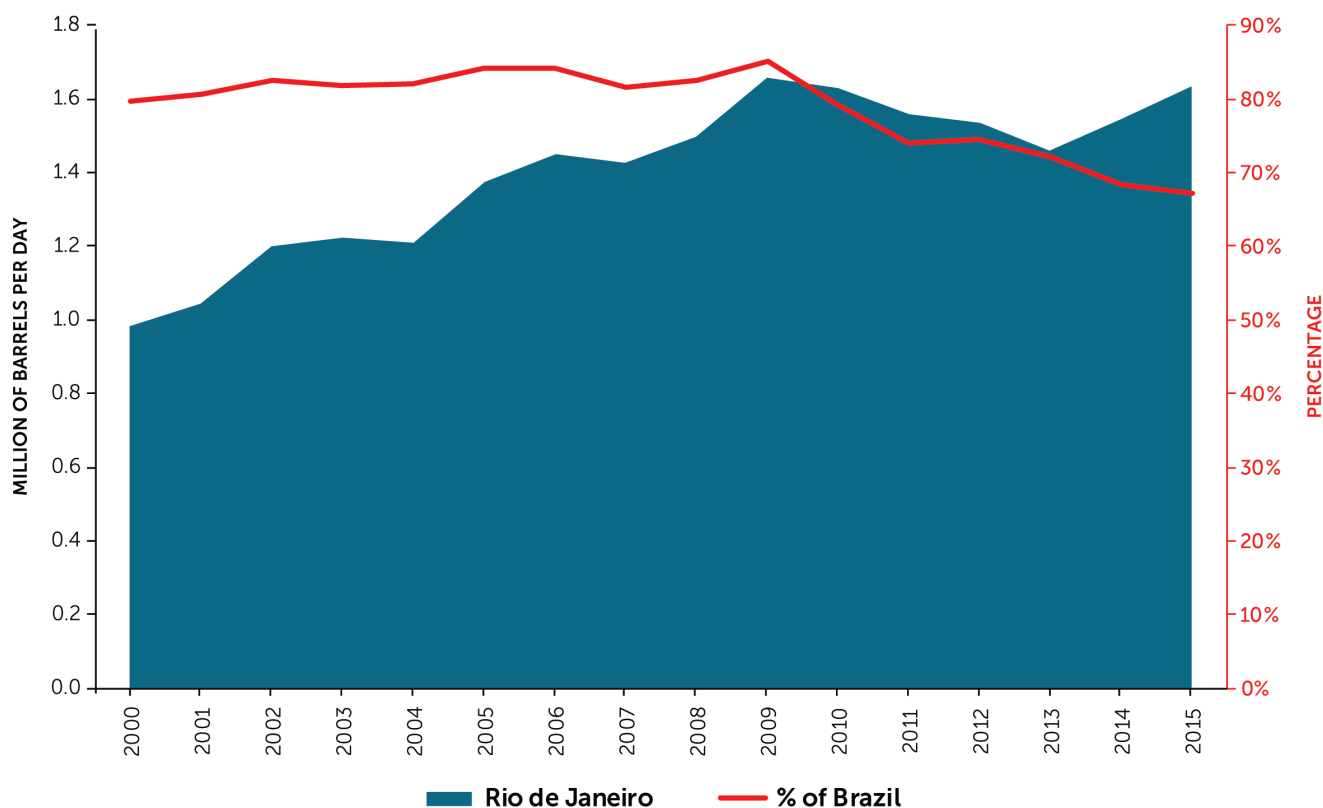
labor, standards, regulations, research and innovation, and therefore, more investment and associated income.

The aggregate refining capacity of Brazil increased only by 15% in the last ten years, despite the fact that the demand for oil products increased by more than 50% in the same period in Brazil.

This is where Rio de Janeiro State still has room for development. According to the data provided by ANP, the State refineries have been maintaining operations in occupancy levels above 80% since 2005, representing the third largest refining facilities in the country.

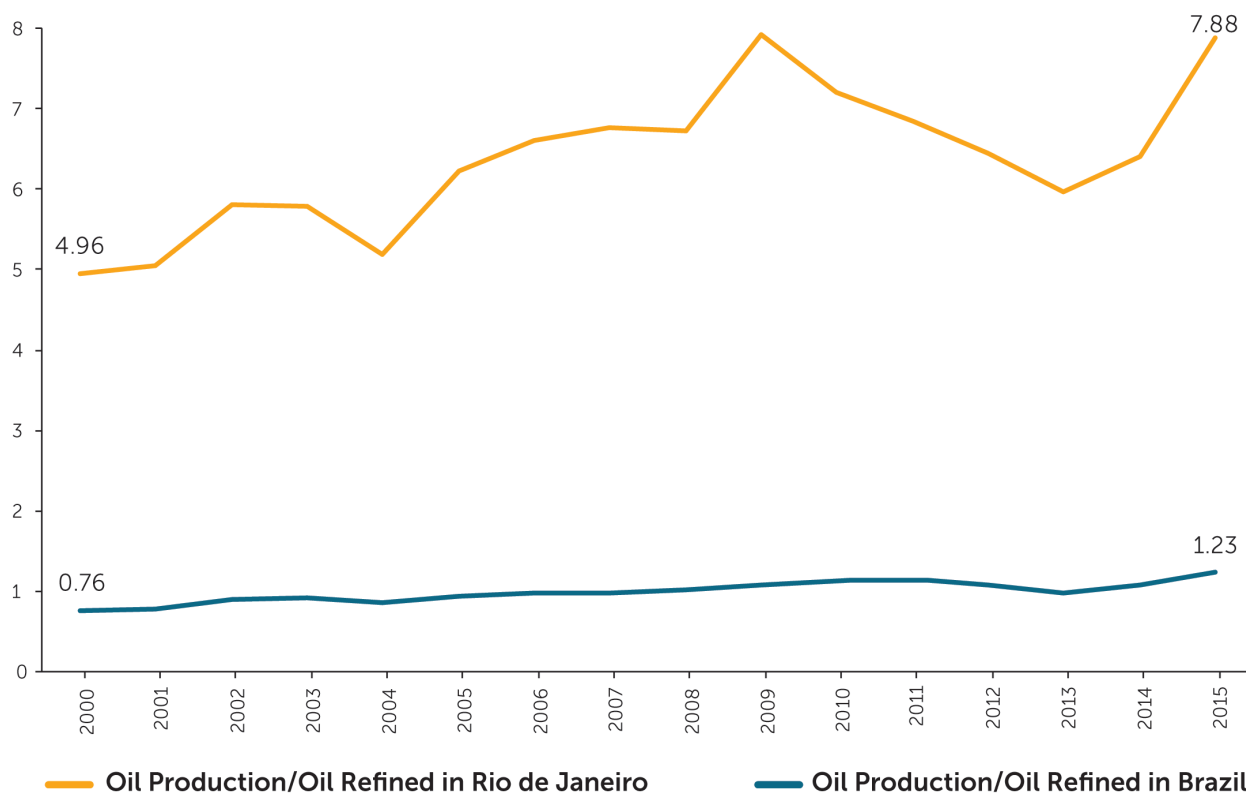
Throughout the years, despite the fact that oil production in the State has increased significantly, this was not accompanied by an equal increase in its refining capacity, which can also be seen in Brazil as a whole. As can be seen in Chart 3, the relationship between the total oil produced in the State and the oil volume refined here increased from 4.96

CHART 2. OIL PRODUCTION IN RIO DE JANEIRO EVOLUTION PARTICIPATION IN BRAZIL'S TOTAL



Source: Self-elaboration from ANP data

CHART 3. RELATION BETWEEN OIL PRODUCTION AND TOTAL CRUDE OIL REFINED IN THE RIO DE JANEIRO STATE



Source: Own calculation from ANP data

times, in 2000, to 7.88, in 2015. That is, the State fails to add value to its main product.

Regarding the opportunity for the development of refining capacity in the State, the self-sufficiency of the domestic market is decreasing. This is indicated by the relationship between the production of oil products and the State demand and highlighted by the drop in the ratios for gasoline, diesel, and aviation fuel. In the case of liquefied petroleum gas (LPG), the establishment of the natural gas processing unit – NGPU in the Petrochemical Complex of Rio de Janeiro – COMPERJ, may improve this relationship.

Chart 4 outlines a situation that requires special attention. Regarding gasoline, it was found that despite the demand increase, Rio de Janeiro State remains self-sufficient, whereas for diesel and aviation fuel, this relationship is paired. Therefore, the State tends to the condition of dependency on imports in the case of these oil products.

Although the future scenario is disquieting, it also sets up an opportunity for the market. According to ANP, a supply shortage of 1.1 million barrels per day of oil products in the country is expected in 2030, pointing toward a strong external dependence. This expectation takes into account the operation of two trains of the Abreu Lima Refinery RNEST, and the COMPERJ.

The incentive for expanding the refining park in Rio de Janeiro State refers to its strategic role within the oil value chain. Increasing the State’s refining capacity will not only create new employment opportunities but will also stimulate the market by increasing the production of oil by-products in the state, and thus, increase the revenue base.

For example, the completion of the refining park in COMPERJ would increase the tax collection on goods and services because these taxes are collected only in the products’ final destination, where the products are consumed.

In order for this expansion to be consolidated, it is essential to ensure that the producing companies are able to set their prices according to the world market.

The oil industry in Brazil has a high potential for growth and positive socioeconomic impact. There are still many challenges to be overcome, in order to achieve their maximum potential return to society.

As a guideline for investments, in professional training, the data show a drastic reduction in the number of workers employed in 2015, with greater emphasis on Rio de Janeiro, as compared to 2014. Conclusively, the oil industry work force in the State suffered a four times higher impact than Brazil as a whole.

It is necessary to provide improved training opportunities for workers in the oil industry, in order to strengthen their skills, as well as to enhance the allocation of

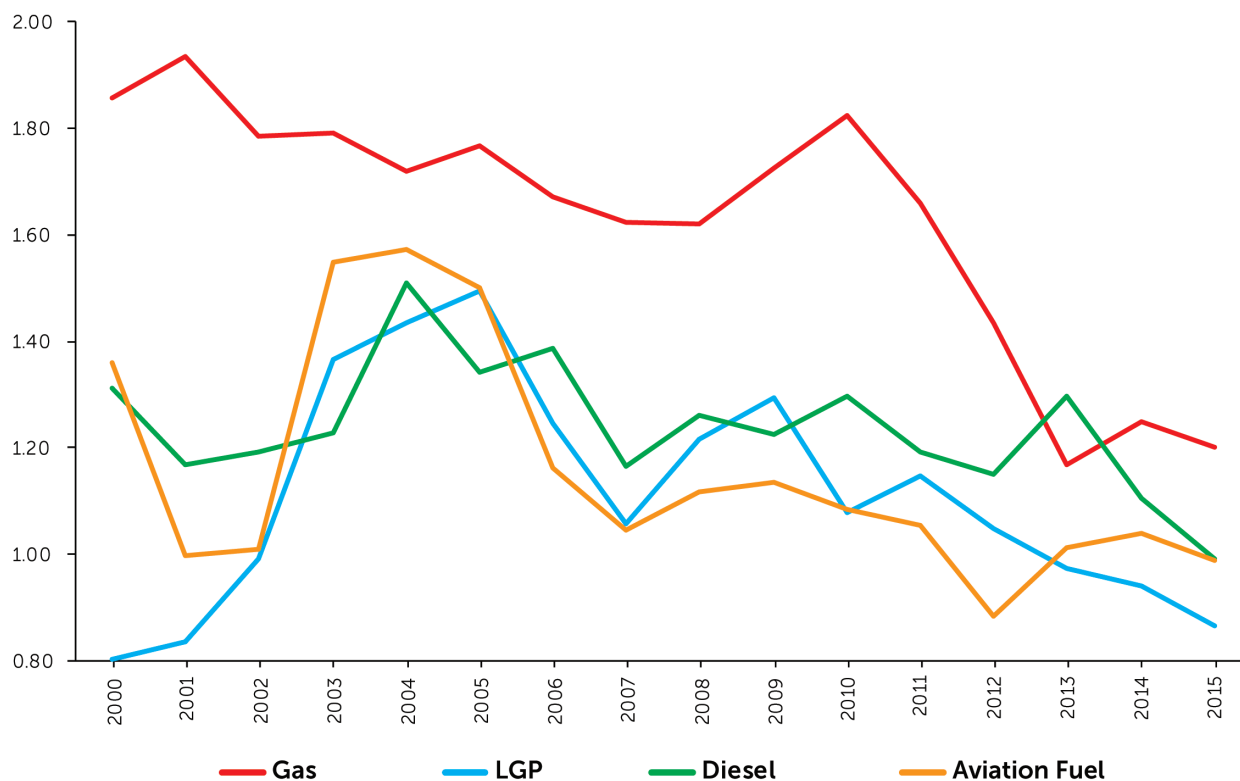
resources, to increase efficiency. On the other hand, the requalification of those outside the labor market their repositioning is also required.

Furthermore, the market environment, affected by the international oil prices reduction, has undergone restructuring worldwide in response to its displacement in the world energy matrix due to the entry of new competitors such as shale gas.

As a result, a reduction in costs is observed, which is associated with the slowdown in demand and the expansion of mergers and acquisitions also transforming this market. Consequently, the present environment in the industry demands high productivity and high efficiency in business management. These shifts should therefore be taken into account in our development strategies.

The challenges presented here affect all market players.

CHART 4. RELATIONSHIP BETWEEN PRODUCTION AND DEMAND IN RIO DE JANEIRO FOR GASOLINE, DIESEL OIL AND AVIATION FUEL



Source: Own calculation from ANP data

These are broad challenges, from technological to social issues. In addition to developing new technologies and training qualified professionals, an open discussion with the current workers of this industry is increasingly demanded and equally important.

Regardless of the chosen scenario, access to information is crucial for making strategic decisions in any business. The Rio de Janeiro Oil Industry Yearbook Overview 2016 is delivered by Sistema FIRJAN to the industry, both national and private, contributing to the increase in its added value.

The oil market has significant potential. Sistema FIRJAN offers specialized support for investors who wish to establish their business in Rio de Janeiro State.

The partnership with Sistema FIRJAN facilitates coordination with:

- government agencies;
- financial institutions;
- municipal governments;
- institutes;
- research centers and more.

With our support, it is much easier and faster to invest in the Rio de Janeiro State.

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