BRAZIL GAS MARKET – TOWARDS A LIBERALISATION? AN OVERVIEW OF THE EVOLUTION OF THE MARKET, ITS REGULATION AND THE INDUSTRY ORGANIZATION

AUTHORS:
CYNTHIA SILVEIRA
JORGE DELMONTE

COMPANY: IBP (BRAZILIAN PETROLEUM INSTITUTE)

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Abstract: This paper aims to present an overview of recent developments in the oil and gas industry in Brazil and discuss future trends for the sector. Three areas will be detailed:
. The market, with the expansion of production and import of natural gas, development of infrastructure (transport and distribution) and changes in the consumer market.
. The industry organization, using the evolution of the IBP (Brazilian Petroleum Institute) as an example of such transformations
. The regulation: the impact of recent legislation on the liberalization of transport and marketing of natural gas

1. HISTORY AND INTRODUCTION OF NATURAL GAS IN BRAZIL

Gas Distribution, from its establishment till its privatization in the 90's

As with other major world capitals, gas as an energy source was first introduced in Rio de Janeiro and Sao Paulo in the nineteenth-century for street lighting, which until then used to run on coal.

Rio de Janeiro was the first city in Brazil to use gas, when in 1854, the first gas lamps were installed by Companhia de Iluminação a Gás, as a result of a contract signed in 1851 by Baron de Maua, a top executive of the Empire of Brazil. Produced from coal, gas promoted a great change in the habits and customs of Rio's population, which then started to take advantage of street lighting in homes and theatres.

In 1865, the company was sold to a British company which took over its services through the Rio de Janeiro Gas Company Limited. That same year the distribution of gas in the Empire's capital supplied a total of 10 000 residences, 5 000 public facilities and 6 000 street-light lamps.

In 1876, the concession of gas services went to the Belgian company Societe Anonyme du Gaz - SAG. Later, in 1910, The Rio de Janeiro Traway Light and Power Company Limited acquired the controlling stake of SAG.

In 1911, with the intent of expanding the use of gas, a new factory was built in the neighbourhood of São Cristóvão, with greater supply capacity (about 180 000 m³ per day) allowing to extend the use of gas-stoves and water heating.

In 1967, catalytic cracking of naphtha started, abandoning the use of coal as raw material.

With the deterioration of services and the near bankruptcy of private gas distribution in May 1969, the then called State of Guanabara, took over the operations of piped gas services,

nationalizing the company and creating the Companhia Estadual de Gás da Guanabara - CEG GB.

With the merger of the states of Guanabara and Rio de Janeiro in July 1974, CEG, became the Companhia Estadual de Gás do Rio de Janeiro – CEG (State Gas Company of Rio de Janeiro - CEG).
And later, during the 80's, with the discovery of offshore oil reserves in the Campos Basin in Rio de Janeiro, the production of associated natural gas began, being distributed directly to some large companies by Petrobras. In 1982 CEG replaced naphtha as raw material in the production of manufactured gas, starting to use and distribute directly natural gas.

During the 1990's, the trend of economic liberalism along with its reduction of the state presence in the economy came to Brazil, and through the Privatization Program, CEG was privatized in 1997, changing its controlling stake and its name to Companhia Distribuidora de Gas do Rio de Janeiro, with a 30-year concession contract signed with the State of Rio de Janeiro. Today Gas Natural S.A, a Spanish company is the majority shareholder of the company.

In the Sao Paulo state, the gas industry began the same way it did in Rio de Janeiro. In 1872 the British company San Paulo Gas Company received authorization from the Empire to explore the concession of the operation of public lighting, which began to be installed in 1873. The gas, as in Rio, was produced from coal.

In 1912 the Canadian company Light took over the controlling stake, but in 1959 the company was nationalized, changing its name to Companhia Paulista de Serviços de Gás.

In 1968 the company began to be administered by the municipality and was named COMGAS.
Similar to Rio de Janeiro, in 1999, the State of São Paulo decided to privatize the gas pipeline, having the controlling shareholder of the company snapped up by a consortium formed by British Gas and Shell.

The gas distribution service in São Paulo also went through the same evolution as Rio de Janeiro in terms of distributed gas, being first coal gas, then naphtha-derived gas, and later with the construction of the pipeline GASPAL - Rio - Sao Paulo, natural gas produced in Rio de Janeiro.

In the north eastern states the use of natural gas began in the 70's with the production of natural gas associated with oil in the region, which enabled the construction of a pipeline across several states, from Bahia up to Rio Grande do Norte. Initially Petrobras was responsible for the gas distribution directly to industries, but since the 1988 Brazilian Constitution, the distribution of natural gas became the responsibility of each state, which then formed its own distribution companies.

The Evolution of Natural Gas Supply

The impact of the oil crisis on the Brazilian energy sector

Ever since the first oil shock in 1973, Brazil opted for the development of domestic energy sources with emphasis on import substitution. Large hydroelectric plants such as Itaipu and Tucuruí were then launched, as well as an important nuclear program through the construction of the Angra 1 and 2 nuclear power plants

In 1976 the Proálcool Program was initiated, which consisted in the production of hydrated alcohol from sugar cane, as a substitute for gasoline. The production in 1975 was 1,000 m3

per year, and by 1975 it had increased to 14,000 m3 per year, reaching 20.5 million m3 in 2011.

Petrobras, until the early 70's, before the first oil shock, had most of its exploratory activities on-shore. However, the oil shock gave great impulse to the E&P activities off-shore in the continental shelf, where successive discoveries were made. Petrobras found hydrocarbons in the Garoupa field in 1974, Namorado in 1975, Cherne e Anchova in 1976 and Pampo in 1977.

Turning to produce oil and gas in deeper water depths, the reserves reached 622 million proven-barrels in 1978. Since then the reserves and production of offshore oil and gas grew rapidly and as of 2006 it can be said that Brazil has virtually reached self-sufficiency.

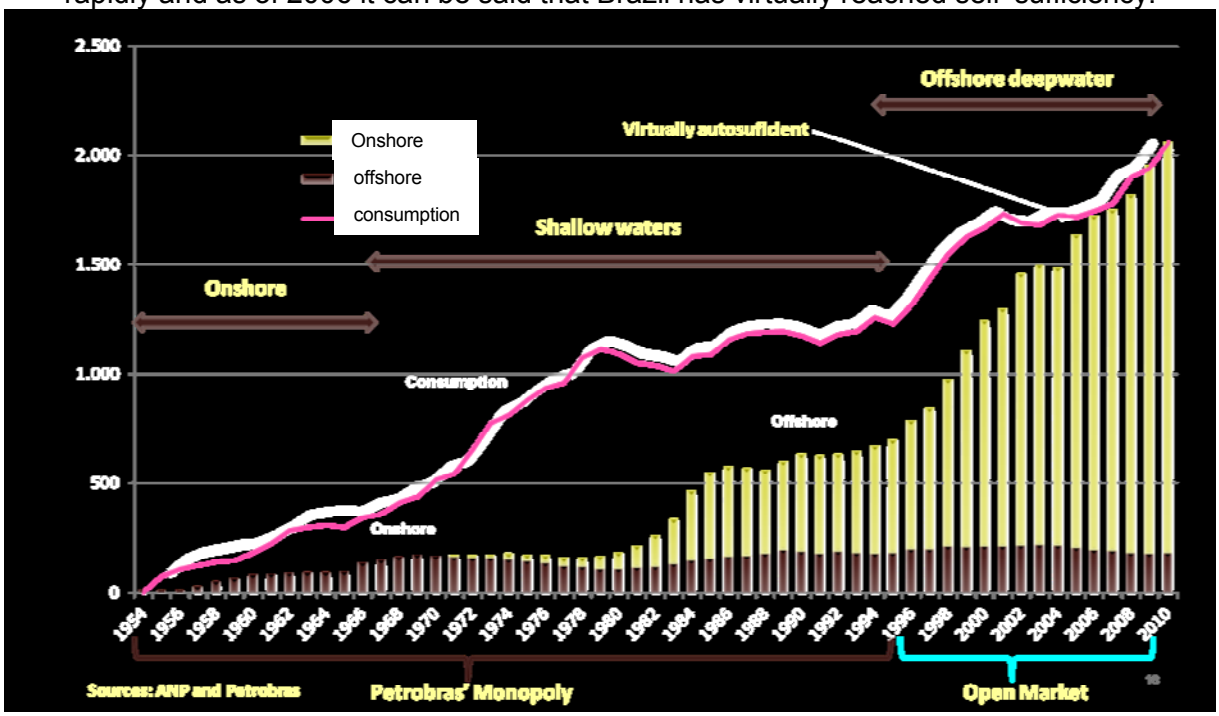

Figure 1: 1954 – 2010 Petroleum Production and Consumption

Opening of the Market in 1998

The production of oil and gas began with a small onshore production in the 50s. Later, due to the development of offshore E&P activities the production reached new levels. There was an initially significant growth from the development of activities in shallow waters in the 70's and 80's and then new subsequent growth in the late 90's when fields in deep and ultra deep waters started to be explored.

All this development however has then been focused on the exploration and production of oil, leaving the associated natural gas to be treated almost as a by-product, and therefore, without a clear policy on development and use, and especially, without a guaranteed supply plan that would allow future industrial development on natural gas.

The internal pressure of the industrial market for an increased supply of natural gas, led the Brazilian government to negotiate imports of Bolivian gas, which started operation in 1999.

A year earlier, in 1998, with the publication of Law 9.478, the Petroleum and Gas sector began opening to both domestic and foreign private companies. This law had as focus and priority the Oil and Natural Gas Exploration and Production sector. E&P activity has, since

then, being held by the signing of concession contracts. Moreover, due to this law, oil started to be paid by international market prices.

There has been, thus, a great effort in recent years by the Brazilian government, and society in general, to expand the supply of oil and natural gas domestically, either through imports or by trying to boost domestic production by attracting private companies.

The auctions conducted by the ANP (National Petroleum Agency) for the exploration and production concession areas, as well as all activities promoted by the Agency, have been and are conducted to date with great transparency.

In return to the concession of these activities the government receives bonuses, royalties and special participations from oil and gas producers, and this activity of exploration and production now has a growing impact on the Brazilian Gross Domestic Product (GDP).

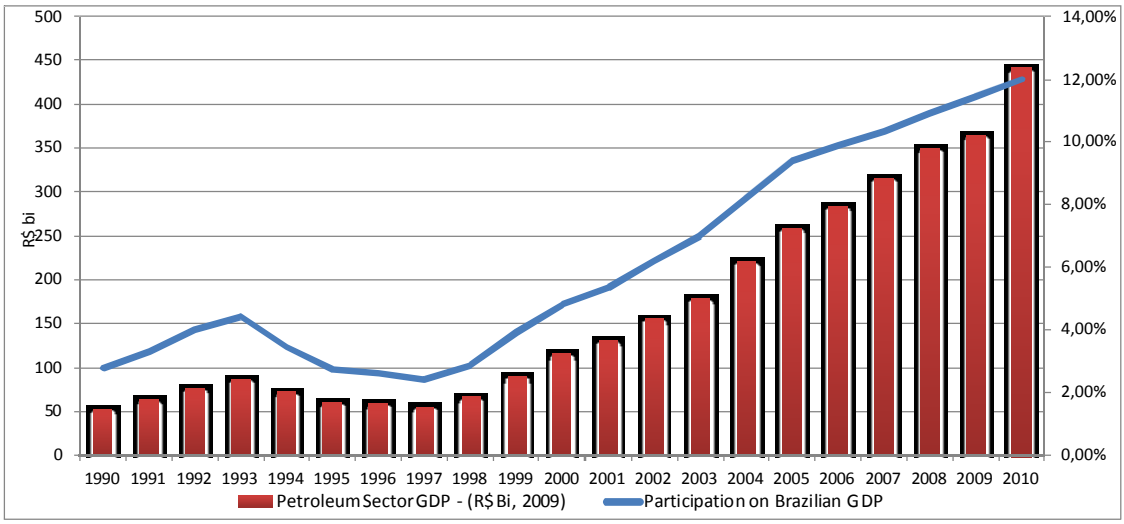

Figure 2: Participation of the Petroleum Sector in GDP
Sources: Andrade Canelas, ANP and IBP

However, the natural gas production and transportation sector was not dealt with great depth by the Law 9.478 (Petroleum Law), due to the low degree of development of the gas industry in Brazil in the 90's.

The impact of the Bolivia Brazil pipeline

Also in the mid 90's the Brazilian Government decided to import natural gas from Bolivia, with the aim of expanding its supply, which in 1995 was less than 2% of the Brazilian energy matrix.

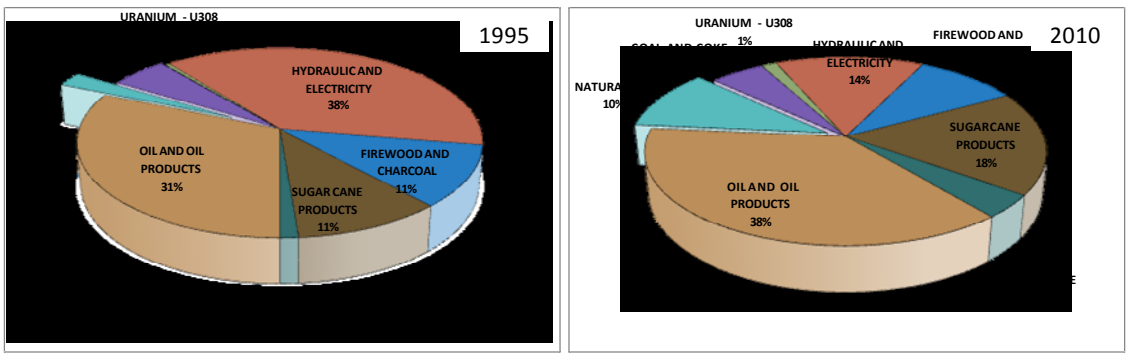

Figure 3: Brazilan Energy Matrix 1995 -2010
Source: MME

After an intense debate about the extent and route of the pipeline, it was decided that it would cross through the middle of the country towards Sao Paulo, Brazil's most industrialized state and consequently the largest consumer of energy, located in the Southwest. It was then later extended towards the South also supplying the states of Parana, Santa Catarina and Rio Grande do Sul.

Figure 4: Bolivia Brazil Gas Pipeline outline
Source: TBG

In July 1999 Gasbol, with its 3,150 km - 557 in Bolivia and 2593 in Brazil - began commercial operations, becoming a milestone for the Brazilian industry because of its firm gas offer at competitive prices, increasing the gas participation at a rapid pace. In 1999 gas participated with 4,1 % of the domestic energy supply reaching, in 2010, 10,3% of the Brazilian energy matrix. Currently the Bolivian gas contributes with about 47% to 50% of the gas offered to the Brazilian consumer.

It is important to high light that the pipeline crosses five states and over 130 municipalities, its area of influence extends through about 80% of Brazilian GDP.

The security of gas supply promoted an unexpected growth in demand with the *ramp up* of the Bolivia Brazil pipeline. Once the maximum capacity was reached there were some

studies to increase its transport capacity, an Open Season has even been studied for Supply Capacity in 2003.

However, to ensure the expansion, significant production investments in the Bolivian E & P would be required, which did not happen because the economic model adopted for Exploration and Production of Oil and Gas in Bolivia failed to attract private capital and the Bolivian government also did not have available resources to support these investments.

The political context in the bordering country led Brazil to abandon the prospect of expanding the supply of Bolivian gas. The company (TBG) that operates the pipeline began to direct their investments to increase the reliability of transportation, and flexibility. The pipeline received investments in compression, increasing the transportation capacity to the South and even with a transportation capacity limited in 30 Mm3/d, the investments to increase the pipeline flexibility, mainly in city gates, increased its delivery capacity to about 45 Mm ³ / d.

The unfinished project to import Argentinean Gas - The Uruguaiana - Porto Alegre. Pipeline

The late 90's and early twentieth century, seemed promising for natural gas and the integration of the continent through this energy similar to the European market, where other projects relying on the gas supply from neighbouring countries were launched.

Thus, private companies built two thermal power plants at the borders of Bolivia and Argentina: the Cuiaba plant in Mato Grosso, and Uruguaiana in Rio Grande do Sul, both with pipelines also built and financed by the private sector. For the project of Rio Grande do Sul, the pipeline would be 565km long, to be interconnected to the Bolivia-Brazil pipeline.

This connection would allow the integration of the gas transportation systems of Argentina, Brazil and Bolivia, allowing indistinct gas transportation between these three countries.

The pipeline had its construction initiated on each end, and today two stretches of 25 km are already in operation, however, the middle section was unable to be completed due to the evolution of the gas market in Argentina.

Unfortunately, the economic-political context of Argentina, along with the freeze on gas prices, followed by an uncontrolled expansion of demand, a reduction of the investment in E & P, and finally, cut in exports, prevented the completion of the pipeline project.

Conceptually the project would bring to the region not only an integration of transport, but would also allow an optimization of supply, flow and even a better price equilibrium.

The LNG solution.

Due to the increase of the Brazilian gas demand, particularly for thermoelectric power generation and considering the difficulties to expand the supply of Bolivian gas, or even the Argentinean one, Petrobras decided to build two floating regasification terminals for LNG to complement the supply of gas produced in Brazil.

These terminals purchase LNG from short-term market (spot), and have as their main objective to guarantee the supply of gas for thermal generation at times of peak consumption. One terminal is located in Rio de Janeiro – where the largest Brazilian thermoelectric gas complex is installed - and the other one in Ceará. A third terminal in Bahia is expected to start operations in 2013.

The country currently has a LNG regasification capacity of 21Mm ³ / d, which will be expanded to 41Mm ³ / d. The two terminals not only increased the reliability of the natural gas system as a whole, but also the country's energy security in general, as it also increased the reliability of the electrical system. These terminals also allowed to achieve several key objectives, such as complementing the supply of associated gas, accommodating the volatility of gas demand, and stabilizing the hydro reservoirs.

The Pre-salt reserves

Due to the discovery of giant petroleum fields underneath the salt layer Brazil has a huge potential to increase the domestic gas supply. Some forecasts project that oil and gas reserves, which are now 14.4 billion, will reach approximately 50 billion Boe by 2020. If such numbers are confirmed, the expectation is that Brazil will then become one of the largest oil and gas producers, as it can be seen in the figures below:

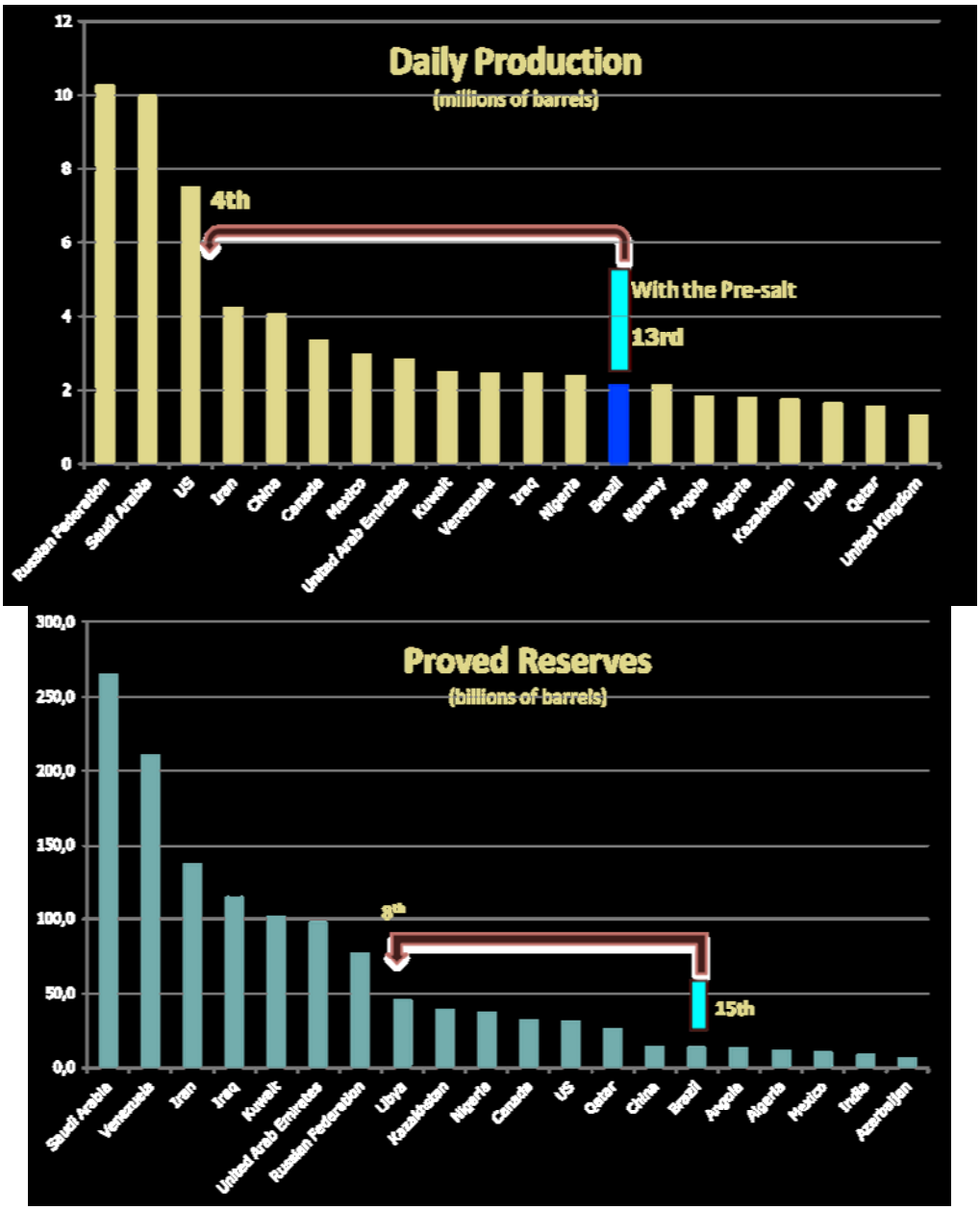

Figure 5: Petroleum Production and Reserves
Source: BP – Statisitical Review – 2011 and IBP

Several agents are now making projections for such gas supply and the most conservative ones estimate a supply of 173 Mm3 /d in 2020, nearly tripling the current supply of 60 M m3/day.

However, many challenges need to be overcome for this scenario to materialize. A significant portion of this gas is associated with oil, and it has not yet been established how much volume of gas will be reinjected. In addition, the gas will be produced about 300 km from the coast, which makes its transport a logistical challenge, bringing an even bigger impact on costs and affecting its competitiveness.

2. NATURAL GAS DEMAND EVOLUTION

The natural gas demand reached around 61 Mm3/d in 2011, from which 46% was supplied by Bolivian Gas, 2.6% by LNG and the major part 51.4% by domestic gas production. The 2011 natural gas balance (figure 6) shows that from the domestic gas production only half becomes available to the market, mainly due to the gas use in reinjection and E&P consumption.

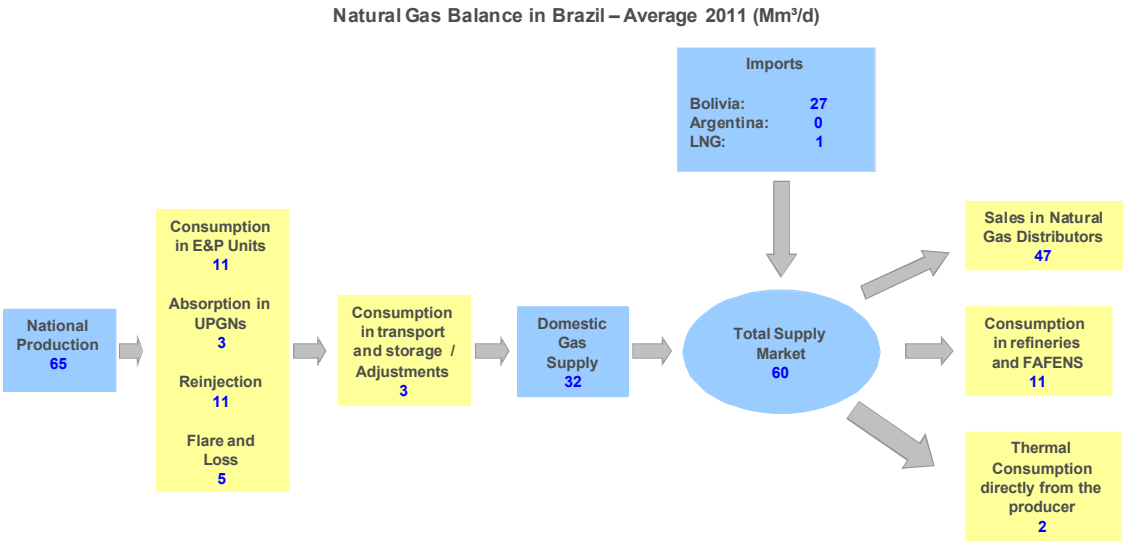

Figure 6: Brazil Natural Gas Balance
Source MME

Gas market in Brazil has always had as an anchor for its development, the industrial demand. Due to the tropical climate, which requires little heating energy consumption, demand in residences and commerce has always been small, standing now at about 2% of the total consumption.

As mentioned earlier, it was only with the arrival of Bolivian gas, being a steady supply of natural gas, that the market was able to develop itself, not only in terms of volume, but also in terms usage profiles.

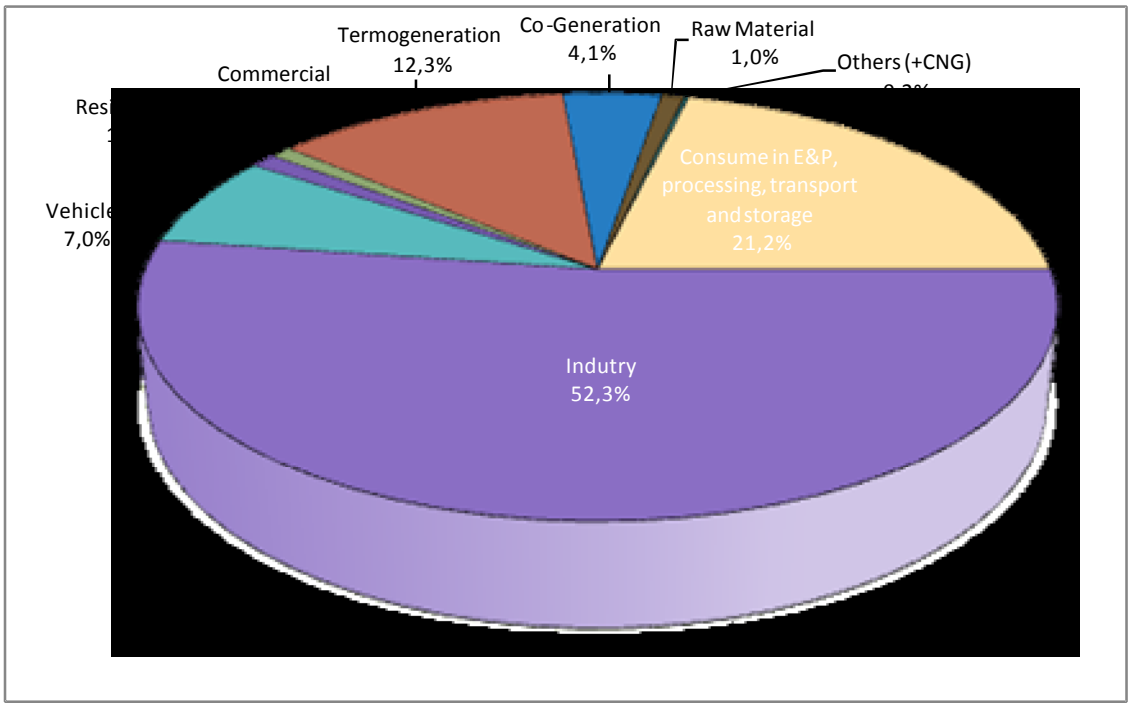

Figure 7: Gas Consumption by sector - 2011
Source – MME

In addition to the industrial market, two demand segments have grown significantly over the past 10 years: thermal demand, with 12% of average annual consumption, as mentioned previously, and the automotive gas demand, representing 7% of the total demand. The use of cogeneration, mainly for air-conditioning also increased, although to a lesser extent.

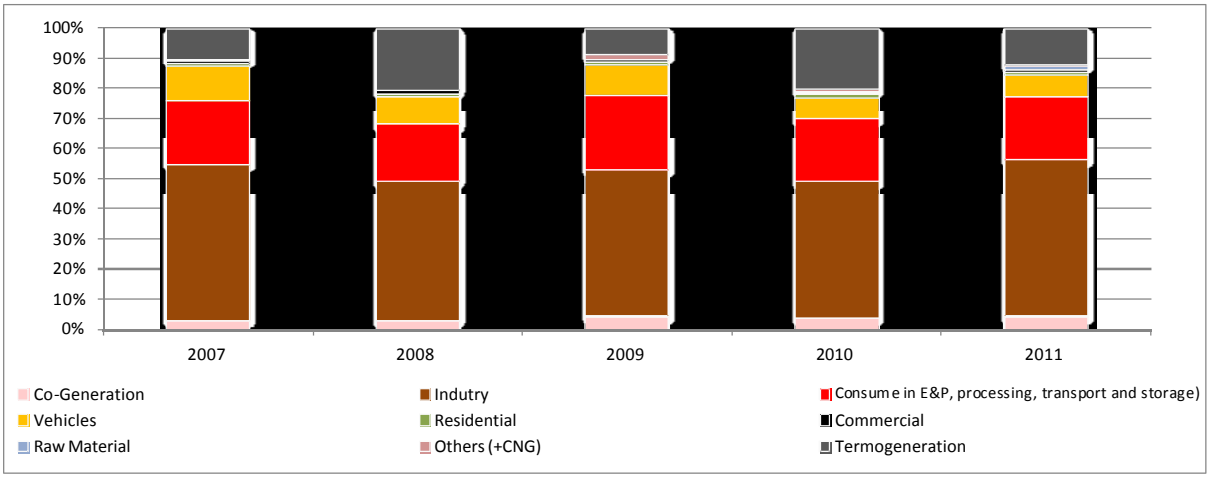

Figure 8: Gas Consumption Evolution
Source MME

Thermal Power Generation

In 2001, around 80% of power generation in Brazil was produced by hydroelectric plants. And due to an unexpected long period without rain, the country suffered an energy rationing, and consequently threatened by a "blackout" in the electricity supply for the following years. To expand the supply of electricity the federal government created an emergency thermo generation program, which added new natural gas fired thermo power plants to Brazil's

power-generation grid. Today the country has 32 844 MW of installed natural gas thermoelectric capacity, representing about 26.7% of Brazil's entire power-generation capacity.

Since then, having to overcome several challenges to diversify its predominantly hydroelectric power generation matrix, the country has increased the participation of other generation sources, aside from thermo-generation from natural gas, such as: bioelectricity - generation from sugar cane bagasse, wind-power and even nuclear with the completion of the Angra 3 plant.

Gas thermoelectric power plants have become the fundamental element of energy security and reliability of the Brazilian electric system. Although they have been designated to serve as a complementary source of electric power, today the long-term planning indicates an increasing use of this source in the supply of the country's electricity. Two important characteristics justify this position: first, these plants do not rely on the hydrological regime, and second the plants are located close to consumption centres, optimizing the transmission system. Moreover all other sources of electricity generation are seasonal: hydroelectric depends on water regime, with a need to supplement supply during the dry season, the bagasse is available only with the harvest of sugarcane and the wind regime is also variable.

However, as mentioned previously, this nature of complementary energy supply added tremendous volatility to the natural gas market, as it can be observed in gas consumption usage-profile for thermoelectric generation, with an aggravating factor that during the very dry years, all thermoelectric plants will have to be employed simultaneously for a few consecutive months.

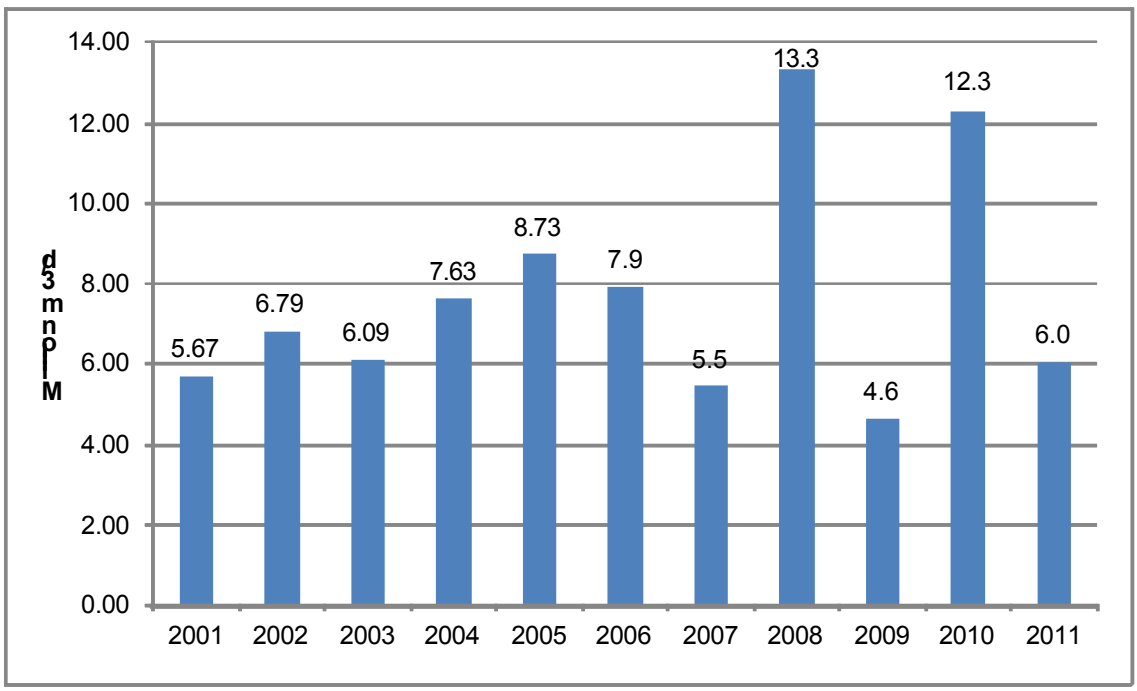

Figure 9: Gas Consumption for Thermal Generation
Source: MME and Abegás

Due to the lack of a practical secondary market for natural gas in the proportions required to absorb large volumes of natural gas, when the electrical system is not generating from gas thermoelectric plants, Petrobras developed the LNG terminals which are supplied with short-term contracts, as previously described.

However, given the challenge to develop gas reserves associated to the pre-salt, and consequently have a market to absorb the volumes from the electrical sector, when thero power plants are not dispatched, Petrobras has included in its 2011-2015 investment plan the construction of three fertilizers (ammonia and urea) production units, an investment of 5.8 billion USD, with an estimated consumption of 13 Mm ³ / d in 2020. Currently the country is an ammonia and urea importer, and as of 2015, it will either become self-sufficient or remain importing only a small quantity of these products.

3. INFRASTRUCTURE – GAS TRANSMISSION AND DISTRIBUTION

Gas Transportation and distribution network

As a consequence of the Bolivian gas firm offer, and even more due to a policy of encouraging the use of natural gas, the transmission and distribution network has increased considerably as it can be seen in the chart below.

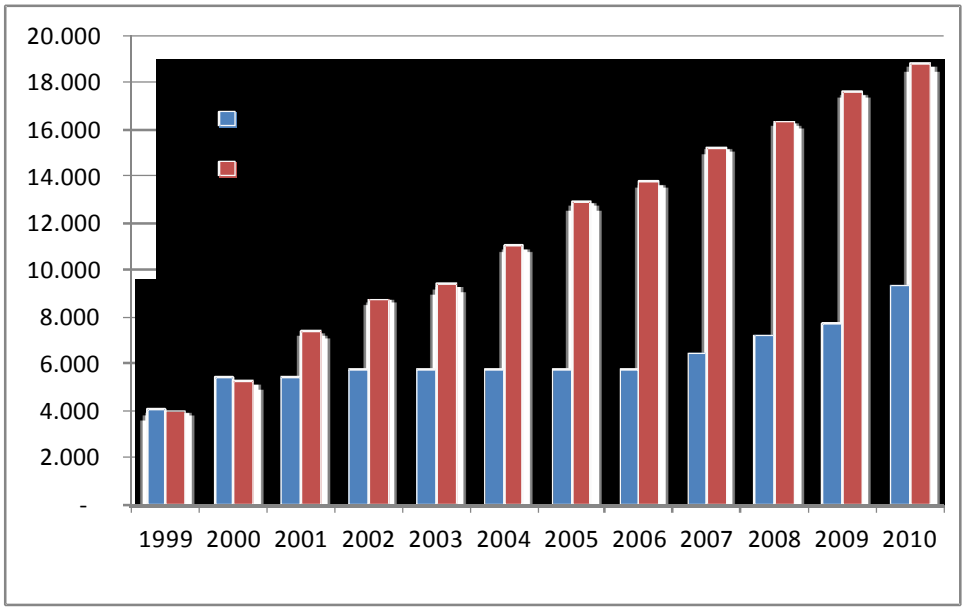

Figure 10: Transportation and Distribution Evolution
Source: MME

In the transportation sector the network increased from 4,000 km in 1999, to approximately 9,300 km in 2010. Note that this growth does not include the Bolivia Brazil pipeline, whose construction was completed in 1999.

The Bolivia-Brazil pipeline as stated previously, was an important milestone for the development of the gas industry in Brazil, not only because it enabled a steady supply of gas, but also because it attracted private companies with international experience to the sector such as: Petrobras, Total, BG, El Paso, Transredes, AEI (originally Shell). The same model was followed for the unfinished Uruguaiana-Porto Alegre pipeline project.

However, the regulation and structuring of the gas sector and the absence of major discoveries of non-associated gas, limited the interest of private companies to participate in the development of gas transportation network, which was then left to Petrobras.

The distribution network has grown even more. It has evolved in the same period from less than 4,000 km to about 20,300 km. It should be noted that the Brazilian gas market is still young, and is currently still concentrated in the southeast and along the coastline. Some of

the initiatives to bring this gas to less-populated areas have been promoted by the transport of LNG and CNG using trucks.

Figure 11: Brazilian Pipeline Network
Source: Abegás

4. SECTOR ORGANIZATION

Initial moves to open up the market

Distribution

Until 1988, Petrobras had a monopoly over the Brazilian oil and gas production and the distribution activity had no specific regulation. Distribution was historically performed by two state-owned companies in the states of Rio de Janeiro and Sao Paulo, or directly by Petrobras in the other states. In 1988 the Brazilian Constitution was revised, and established that "each state had the right to explore directly, or through concession, the local piped gas services...". As a consequence, the north eastern states that were already connected by a pipeline and had a small distribution network for industrial gas, created companies following a state-private owned model, having Petrobras and private companies as partners of local states. About six companies were formed in the northeast with this model and three in the south. In 1997 and in 1999 CEG and COMGAS, the two oldest and largest distributors in the country, were privatized.

In 2000 and 2001, the State of São Paulo offered in a public bid two other areas of the state to be exploited by private distribution services of gas in order to stimulate competition. Additionally, the concession of the gas distribution services anticipated a future opening of the market for direct sales by gas producers.

Today the country has 27 gas distributors, where 7 are still in its early stages due to the lack of a natural gas supply.

Figure 12: Map of the Local Distribution Companies in Brazil
Source: Abegás

Production

In August 1997, the publication of the Petroleum Law (Law 9478) opened the exploration and production sector for private investment and the gas sector began being regulated at two levels: the activities developed from the production/import of gas up to the *city gate* was governed by the ANP (National Petroleum Agency) and distribution became an activity regulated by the states through state agencies.

Today the country has about 79 oil and gas E&P companies. In 2010, there were 48 E&P companies in the production phase.

Transport

The publication of the Petroleum Law, however, gave a superficial treatment to gas transportation due to the low maturity of the gas industry. Brazil, did not have at that time a regulatory framework that would ensure the stability of rules needed to attract investments in this segment.

This was an additional reason for the lack of interest of private enterprises in participating in the transport of natural gas.

The first action to mitigate this was started by the Senate in 2005, with the first of several proposals that eventually merged together as a project for a "Gas Law".

IBP as a formulator of opinions and strategies

The Brazilian Institute of Oil, Gas and Biofuels (IBP) is a civil, non-profit entity whose mission is to promote the development of the Brazilian oil, natural gas and biofuels industry. It is associated to companies from the entire productive chain of the oil sector, consumer goods and services, and other entities with interest in the oil sector.

Founded in 1957 as the Brazilian Petroleum Institute, the Institute was created out of two movements: one from the Instituto Sudamericano Del Petróleo, which stimulated the creation of institutes of oil and gas in various countries of Latin America and the other held by its founders - engineers Leopoldo Miguez de Mello, Plínio Cantanhede and the administrator Helio Beltrao, who saw the need to create an entity that could work in favour of the entire oil industry in Brazil.

Among the 20 founding organizations of the IBP are Petrobras, petrochemical and retail companies. Today, the main oil companies operating in the country and equipment suppliers, among other players of the oil and gas scenario are associated to IBP. There are approximately 220 associated companies, aside from several individual members.

The IBP was founded as a private institute, as a technical agent that carries out studies in the oil sector, under an integrated vision of the industry. Its activities, which were at the time developed in a monopoly environment, were aimed primarily for discussion and dissemination of scientific expertise among professionals in the petroleum industry. In addition to organizing courses, events and publications there were initiatives such as the standardization of equipment and technical standards, which contributed to reducing costs in production processes.

To date, the IBP organizes training courses, events and publications for the industry, but recently the Institute started to develop other activities: the certification, preparation of sectorial studies and scenarios on various topics of the industry's value chain. It also created an information centre to serve the members, and the Institute began offering graduation courses.

The IBP currently has a staff of about 70 employees and their activities are developed with the support of over 1,500 specialists who work as volunteers on committees of the IBP.

In 2000, natural gas reached a new level in the Brazilian energy matrix, presenting itself as an alternative of strategic importance for the country. This changing landscape in the industry, and consequently in IBP's activities, led to the inclusion of the term *gas* to its name, changing its name to the Brazilian Institute of Oil and Gas

Creation of the E&P Regulation Commission

When the Brazilian government began taking its first actions in 1995 towards the opening of the sector, IBP participated actively in the discussions around the theme, and among other activities. In 1996 IBP organized the "New Regulation of Oil" seminar, which was attended by several companies interested in developing oil and gas exploration and production activities in Brazil, given that the sector was undergoing a process of opening, culminating in the publication of the Petroleum Law in 1997. The Institute sent to the government subsidies that were largely used in the preparation of the Petroleum Law, published in 1997, milestone for the opening of the oil and gas market in Brazil.

The Regulatory Committee for Exploration and Production was then created, being the first Sectoral Committee of the Institute, which brought together all the main players in the sector. IBP then went on to serve as a forum to represent the oil and gas industry, addressing with

various segments of the government issues that could directly impact the development of the oil sector activities.

Among others topics addressed at the time and to date are those such as the concession agreements, government involvement (*royalties*, special participations, bonuses, etc.), local content, taxation and environmental issues.

In 2002, IBP was restructured, and that model has been replicated in other areas of the Institute, creating, aside from the Department of Exploration and Production, the Department of Natural Gas and the Department of Downstream.

To coordinate the activities in the Gas area, the Natural Gas Advisory Board was created, which then started to coordinate all of IBP activities in this area.

Gas Advisory Board

The first IBP forum to discuss issues related to natural gas was the Gas Commission, established in 1983. At that time the group had originally intended to discuss technical issues related to Natural Gas and LPG. But by the late 90's natural gas dominated the group's agenda, which also went on to discuss the regulations that the newly created National Petroleum Agency was implementing for the sector.

As mentioned, the segment was growing rapidly and IBP decided to enhance the Natural Gas activities in the Institute. To coordinate the several issues in debate such as access, quality and gas prices that had become part of the industry discussions, the Gas Advisory Board was created in 2004, which also participated actively in the discussions relating to the Gas Law.

In addition to discussions of a regulatory framework representing its members along with the Ministry of Mines and Energy - MME and by the National Petroleum Agency - ANP, the IBP developed with specialists the Supply / Demand Balance of Natural Gas, in order to discuss with entities such as the Energy Planning Company - EPE, the directions of the development of the natural gas industry.

5. REGULATION OF THE NATURAL GAS SECTOR

As mentioned earlier the natural gas industry has two levels of regulation: federal and state. The exploration and production of oil and natural gas are regulated at the federal level, by Law 9478 of August 1997, which established the ANP - National Petroleum Agency, and the general principles to be respected for the development of the activity of E&P and transportation of natural gas, but not clearly defining the regulation for gas transportation activities. The distribution of gas, whose responsibility was given to the states by the 1988 Brazilian Constitution, is regulated in each state by the Concession Agreement signed with the state government.

After the publication of Law 9478, some companies tried to gain access to the transport capacity of the Bolivia-Brazil pipeline, based on open access regulations published by the ANP. The failure of these attempts led the government to verify that there wasn't a comprehensive and appropriate regulation that dealt specifically with the activity of transporting gas.

The Gas Law

History

There were heavy discussions regarding the Gas Law and they had a long maturing period. In June 2005, the first bill was proposed by Senator Rodolpho Tourinho to the Senate. During the second half of that same year the Ministry of Mines and Energy, through the Department of Oil and Gas started preparing a second proposal, with the participation of key industry players. After much debate the document was finalized and forwarded to the Lower House in March 2006. In February of that same year a third proposal was presented for a Gas Law in the Lower House.

The main objective of these three projects was to regulate the activity of gas transmission and the main difference between each one was the speed with which the proposed changes would be implemented.

The three projects were submitted together to the Congress and after a long debate due to the interference by the MME's Department of Oil and Gas a bill was approved by Congress and published in March 2009. That is, five years had passed between the first discussions and the publication of the Gas Law. In December 2010 the decree which regulates the entire law, except for the chapter on Contingency, was published.

Since 2011, the ANP and the MME started to prepare the legal texts that detail all the procedures and proposals brought by the new regulations.

Summary of the evolution of Law 11,909 (Gas Law) on the Law 9478 (Petroleum Law)

New proposals from Law 11,909

The Gas Law project focused its efforts in regulating the transportation of gas, and added other points such as the storage of natural gas. Before the Law was published, transport services were authorized by the Government, with no due date for its expiration, and access to these pipelines were negotiated between the parties, without obligation from the owner of the pipeline or even the company that held the transportation contract, to allow third party access.

With the publication of this Law, new gas pipelines and gas storage facilities will operate under a concession regime, with contracts signed with the MME, for 30-year terms, renewable for the same period. Authorization can be granted in specific cases, such as international pipelines, pipelines that had already been built under the previous regime or even those who that had already obtained environmental permit until Gas Law has been published. However, the pipelines already running under such authorization will need to be auctioned to continue to be operated, but under a concession regime, after 30 years of the Law's publication, ie in 2039.

According to Law 11,909, new transportation contracts are required to be approved in advance by the ANP. Before the Law, the agency received the contracts 15 days after its signing. Just as the transport tariff, that was previously negotiated directly between the parties, with the publication of the new law will have to be submitted for approval by the ANP, even if in case of authorized pipelines.

New pipelines will be proposed by MME - Ministry of Mines and Energy on its own initiative or on the initiative of others, and the MME was made responsible for indicative planning on

how new transport infrastructure will be expanded. Concession auctions will be conducted for construction and operation of pipelines, in the same way that current bidding for electricity transmission lines are held in Brazil, and concession contracts will be signed with the winner based on the price defined during the bidding process and using pre-defined transportation contracts.

Access to new pipelines will be established through public hearing for the construction of new transport capacity. Access will be granted in existing pipelines in operation for at least 10 years, for the capacity not being used in accordance to the market maturity.

The Gas Law also created several new agents, such as *self-producer*, *self-importer* and *free consumer*. The self-producer and self-importer, as its names indicate, produce or import the gas to be consumed in their own facilities, and the *free consumer* or eligible consumer is the agent that may contract the commodity (gas) from another supplier (producer or seller).

In addition, the Gas Law also allows the operational exchange of gas, called *swap*, if the pipeline is not in the exclusivity period.

Some of these issues have already been detailed by the MME and ANP but most of the issues still depend on regulation that details its implementation.

Regulation in Development

The MME and ANP are currently facing the challenges of preparing regulations that will detail all the new rules established by Law 11,909 and Decree 7382. From a long list of issues some have already been established, such as, the guidelines for public hearing for new transport capacity, the procedures for public utility declaration, the terms for the classification of pipelines and LNG terminals, how the registration of self-producers and self-importers will be done and the rules for the authorization of gas commercialization.

During the preparation of this document discussions were held with the market regarding the rules for proposing new pipelines / expanding the transport capacity by a third party.

The list of issues that are still subject to regulation or studies, demanded by the new law is long, and require specific regulations, such as:

- Expansion Plan of the transportation network;
- Rules for the exclusivity period;
- Definition of Referential Gas Pipeline;
- Public Hearing and Third Party Access;
- Regulation of the Bid Process;
- Term of Concession;
- Storage of Natural Gas;
- Review of the criteria for the calculation of transportation tariffs;
- Authorization for Gas Carrying Activity;
- Regulation of Gas Exchange Operations (swap);
- Information about transport volume and capacity of pipelines;

Besides these issues, new questions arise, as the market matures, which will require the establishment of new rules for the sector, such as the supply of gas between distributors, a situation that is not provided for in Law 11,909.

The new institutional environment that the publication of the Gas Law established is creating opportunities for the gas-sector companies. In this new environment, the Law improved the regulation and brought many new opportunities.

Gradually and continuously the gas market is maturing, with no disruption of existing rules.

Alternative mechanisms as the swap are being created for shippers; new agents such as Self-Producers, Self-Importers and Eligible Consumer are opening business opportunities that previously did not exist, and the evolution of processes such as that of Public Hearing for the implementation of new transportation capacity, and use of the concession region for the activity of gas transmission, establishes a stable and transparent environment that brings the best conditions for the development of new infrastructure and the participation of new players in the Brazilian gas market.

The impact of the Gas Law on the regulation of the gas distribution activity.

The modernization brought by the new Gas Law to create new forms for contracting distribution services, such as the Self-producer and Self-importer, aside from the Eligible (free) consumer, shall entail changes in the regulation of gas distribution in each state.

It should be noted that in the case of distributors, the Concession Agreement already sets most of the rules, however only in the State of Rio de Janeiro and São Paulo the concession contracts included the possibility of the consumer buying gas directly from a producer. Nevertheless, it lacked a specific regulation that addressed the issues involving the use of the distribution network by this customer, for example, operating conditions, nomination, tariffs, etc... Aside from having to adapt those concession contracts to enable the existence of the Self-importer and Self-producer.

Remember that theoretically, for example, a self-importer who built his facility in the port for receiving LNG should not pay for gas distribution services since he would not be requiring them. Nevertheless, practice shows that the distributors are insisting on charging a distribution "fee".

Besides the introduction of these new agents, it will also be necessary to regulate the activity of gas supply in each state.

Considering that the level of maturity of the gas markets in each Brazilian region varies greatly, as shown in the following figure, these issues established in a broad sense by law, are being treated quite differently in each state.

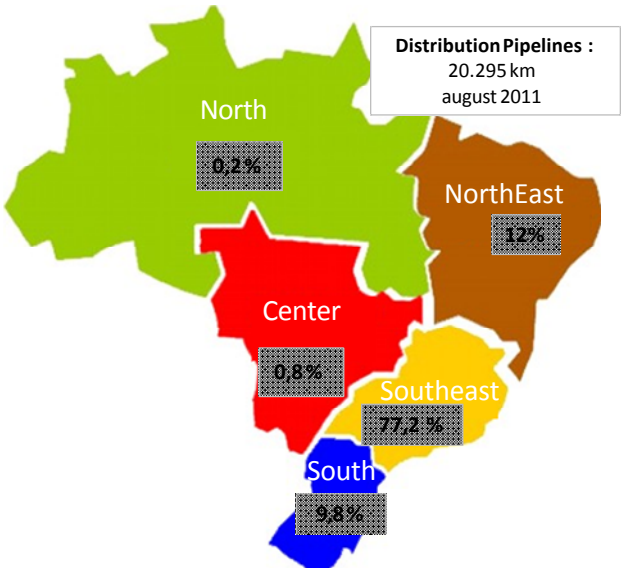

Figure 13 – Distribution Pipelines
Source: Abegas

As an example, we mention the issue of the Free Consumer. In states with a more mature market, the concession contract signed before the publication of the Gas Law, already anticipated the creation of this figure.

In São Paulo the consumer (except residential and commercial) that has an intake greater than 10.000 m3/day will be allowed to buy gas from any producer, and contract with local distributor a delivery service. In the case of the distribution area of Comgás, the market is already open to direct contracts since May/2011. There is currently one consumer in petrochemical segment acting as free consumer, and there are about 185.000 customers who

could potentially buy gas directly direct consumption with the producer, according to estimates from ARSESP - São Paulo State Regulatory Agency. The TUSD - Distribution System Usage Tariff has already been defined for free consumers, establishing a discount of approximately 2% over the full tariff, used for captive consumers of the Concessionaire.

In other areas of the concession, it is expected that the consumer will be able to become an eligible consumer starting in 2014/2015 depending on the date on which the city-gate started operating.

In the case of Rio de Janeiro, despite of being a mature market, the concession already established the minimum consumption of 100,000 m3/day for direct contracts. In the state of Espírito Santo that value was set to 35,000 m3/day, and in the state of Maranhão to 500,000 m3/day.

In the case of Maranhão the discovery of onshore gas reserves (California and Fazenda São José), motivated producers (OGX and Petra) to develop gas power plant projects and participate in the electric-energy auctions, in the quality of an Eligible Consumer according to the new Gas Law framework. It is estimated that these fields will reach a production rate of 5.7 million m3/day already in 2013, which corresponds to a total production of 1.1 Tcf of gas. The natural gas to be produced in the region will be preferably supplied to MPX's future power plants, being another company from the EBX group. The company has already obtained two environmental permits for a total of 3.6 GW, of which 1.2 GW have been sold through electric-power selling auctions.

In the future the governments of each state pressured by industry associations and large consumers will possibly reshape their concession contracts to adapt them to new law.

Production regulation

As widely reported, Brazil discovered at the beginning of the decade, reserves with enormous potential for hydrocarbon production in the pre-salt layers of its offshore basins.
The Brazilian Government, considering that oil production in these fields represent a wide and very promising area, and having a lower uncertainty than exploring the post-salt fields granted under the concession regime, decided, respecting existing contracts, to review the process of exploration and production of the pre-salt reserves. The production sharing regime was then approved for the oil production in these fields and to implement this scheme the PPSA - Présal Petróleo S.A. has been created. And although not yet established, the company will represent the interests of the state in the consortia that will be formed for oil production from the pre-salt reserves.

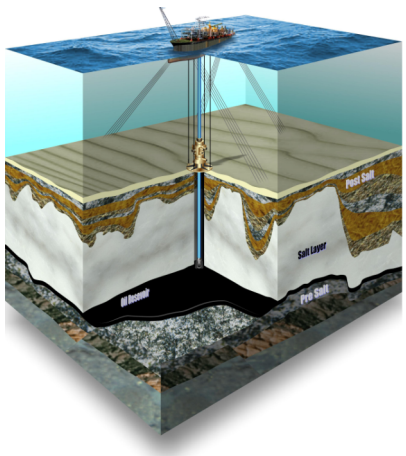

figura pré sal

Figure 14 – Pre Salt simplified description.
Source: Petrobras

As this paper is being written the Brazilian Congress is debating how the Government take adopted Pre-Salt royalties and Special Participations will be distributed.

6. THE PROSPECTS FOR THE GAS INDUSTRY IN BRAZIL

The IBP, through the Gas Advisory Board and other committees, as mentioned earlier, has been actively monitoring the changes in the industry and market developments, proposing improvements to the regulation, overseeing the use of technical standards and operational best practices, promoting ideas for increasing the gas market, supporting the participation of the private sector, and making projections for supply and demand of gas to support discussions with different Government agents.

Considering the recent balance forecast of supply / demand of natural gas, prepared by IBP/GAS ENERGY with contribution of oil companies, in the conservative and aggressive scenarios, presented in the following figure, it may be noted that the natural gas industry has a promising future in the country, but also challenges comparable with the dimension of a continental country.

NG Supply -Assumptions for Each Scenario

SUPPLY	CONSERVATIVE SCENARIO	AGRESSIVE SCENARIO
NATIONAL PRODUCTION (excl. Pré-sal Santos Cluster)		
Traditional Basins	Decline rates per basin for fields in production Production curves for new fields	
Southeast (Ex-Presalt)	Some delay for the fields that should go into production in 2014	
Isolated Systems	For the Solimoes and Parnaíba basins: forecasts of net production related to demand expectations	
New Discoveries / Unproven Reserves	Prod. 5 Mm³/d in 2020	Prod. 6 Mm³/d in 2020
IMPORTS FROM BOLIVIA:	Maintaining current capacity (does not consider Gasbol's expansion)	
LNG IMPORTS:	RJ -expansion of 7 Mm³/d (2015) BA – new terminal 14 Mm³/d (2015) Another non-petrobras 6 Mm³/d terminal (2016)	RJ -expansion of 7 Mm³/d (2014) BA – new 14 Mm³/d terminal (2014) Another 6 Mm³/d new non-petrobras terminal (2015)

*These are recent findings during the initial stage of exploration or evaluation, or unproven reserves in areas already granted or to be granted.

Table 1 – Supply Scenario Assumptions
Source: Gas Energy/IBP Gas Advisory Board

These scenarios were developed considering, from a supply perspective, that imports from Bolivia will continue at least until 2020, that there will be an expansion of the LNG import capacity and that the domestic gas supply will receive different rates of investment, depending if in a conservative or aggressive industrial development.

The difference between the Conservative and Aggressive Scenario is that in the second, it is estimated that a greater number of production platforms will come into operation, as well as a greater Gas Oil Ratio and lower gas reinjection. The aggressive scenario also foresees a higher volume of new discoveries.

On the demand side the aggressive scenario considers a faster economic growth (more than 4% per year), a more competitive price for natural gas and a change in the consumption pattern.

NG Demand Projection Assumptions- Summary

DEMAND	CONSERVATIVE	AGGRESSIVE
INDUSTRIAL / CO-GENERATION:	**MULTIVARIABLE REGRESSION MODEL**	
Industrial GDP	(2011-2020): 4% p.a.	(2011-2015): 5% p.a. (2016-2020): 4% p.a.
Distribution network growth (km)	3% p.a.	(2011-2015): 15% p.a. (2016-2020): 10% p.a.
NG/FO Price Ratio (oil proj. IEA)	Maintaining current ratio (0,8)	More competitive price for gas (0,6)
THERMOELECTRIC:		
2014	Capacity already auctioned (30% average dispatch as for existing)	
2015-2020	+ 0,5 GW/year (50% average dispatch)	+ 1,0 GW/year (50% average dispatch)
REFINARIES / PETROCHEMICAL:	**Based on EPE's Decenal Expansion Plan (PDE)**	
Refinaries	Abreu Lima:2 Mm^3/d (2012) + 1 Mm 3/d (2013) COMPERJ: 2 Mm^3/d (2015) + 2 Mm^3/d (2018) COMPERJ Petroquímica: 2,8 Mm^3/d (2018)	**Conservative + Ref. Premium I: 3,5 Mm^3/d** (2016) + 3,5 Mm^3/d (2019) + Ref. Premium II: 4 Mm^3/d (2017)
Petrochemical	Amonia/Urea: 2 plants (1,5 Mm^3/d each) 2017/2018 Methanol: 1 plant (2 Mm^3/d) 2018	**Conservative +** 1 Urea and Amonia plant (1,5 Mm^3/d) 2018 + Methanol: 1 plant (2 Mm^3/d) 2018
CNG for Vehicles :	**M** aintaining the current consumption of Vehicular CNG	Recovery of light vehicle conversions to V. CNG
OTHER SECTORS:	**3% p.a. growth**	

Table 2 – Demand Scenario Assumptions
Source: Gas Energy/ IBP – Gas Advisory Board

Additionally, more investments in distribution network are being assumed, as well as greater inclusion of thermal generation. The aggressive demand scenario also considers a greater use of natural gas in petrochemical facilities and that all planned refineries will come into operation. The Aggressive Scenario foresees a recovery in the conversion of light vehicles to use natural gas, thereby increasing demand, while the conservative scenario assumes the current vehicular natural gas consumption to remain constant.

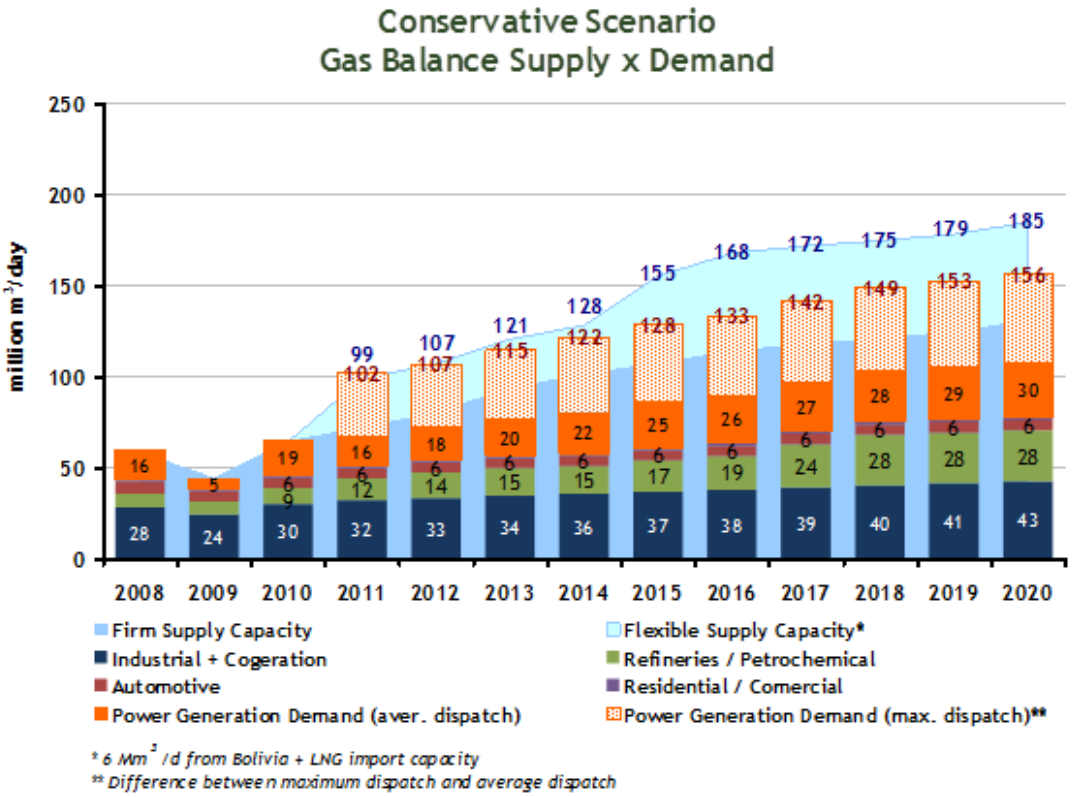

Figure 15 Conservative Scenario
Source: Gas Energy/ IBP – Gas Advisory Board

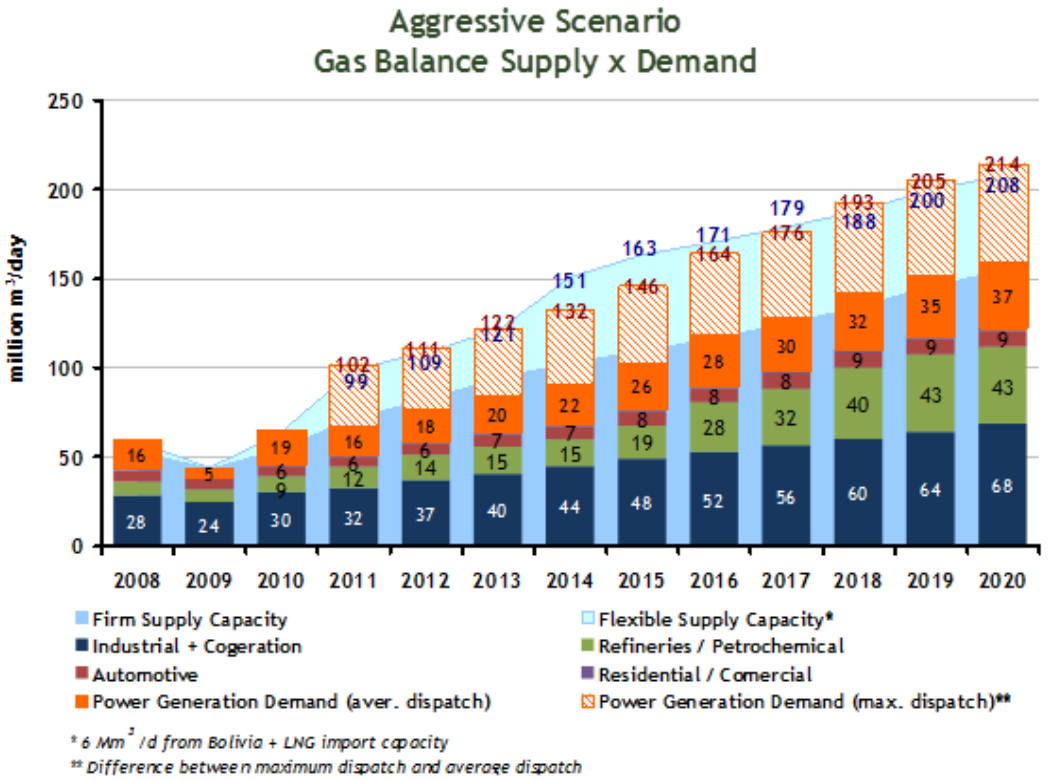

Figure 16 – Aggressive Scenario
Source: Gas Energy/ IBP – Gas Advisory Board

Some future trends in the industry, and issues to be consider:

Comparing with present production levels the firm supply of gas is expected to double, regardless of the scenario, due to an increased domestic production, indicating that natural gas will gain an even larger space in the Brazilian energy matrix. There are still uncertainties associated with the volume and deadlines, especially considering the technological challenges involved with the pre-salt reserves. For instance, the technical limit for gas reinjection needs to be better evaluated.

As the scenarios timeframe stops in 2020, the theme of Bolivian gas imports has not been discussed. Although it is one very important issue as Bolivian gas contract ends in 2019, with one or two years after for make-up gas. This means 24 Mm³/d on firm supply and 6 Mm³/d in flex volumes that could vanish from the market, in 2021 onwards. Will Bolivian E&P have capacity to continue supplying Brazil? How much volume? What about their commitments with Argentina? On the other hand, would Brazil have interest in buying firm gas from Bolivia? Those questions will certainly figurate in the centre of geopolitics discussions together with the assessment of Brazil's own potential to become self-sufficient in gas or even become exporter.

Considering the demand forecast, in both scenarios it is observed that due to the characteristics of the Brazilian electrical system, the expected average thermal dispatch ranges around 30% to 37%, but as the producer has to ensure the availability of gas and infrastructure to ensure the dispatch of nearly 100% of thermal capacity, such condition imposes on the industry a very high cost of investment in production / import and transport infrastructure to ensure the safety and reliability of supply of the electrical system, which will however remain idle during moments of no electric demand. This is undoubtedly one of the biggest challenges in developing the gas market in Brazil.

In other words, how to remunerate the gas producer, and in particular what to do with natural gas coming from associated gas fields? Can the electric sector evolve to a solution where thermoelectric power plants will operate in a base load condition?

The installation of floating LNG terminals with regasification on board and supplied by sport cargos, in short-term contracts, were undoubtedly an interesting solution to try to accommodate this volatility imposed by the electric sector. It can also be seen in the above graphic, that the projected flexible offer capacity, is consistent with the estimates of flexible demand.

However, in the conservative scenario, there will be an excess of firm supply, suggesting that the country will have to promote changes in the industry's market and consumption levels to accommodate these volumes in the domestic market, evolving to the aggressive scenario consumption level. This would require a major shift in the pricing policy making virtually unbearable for a producer to commit to keep the idle capacity needed for supplying power plants.

If the domestic market does not evolve in size and pace expected by the gas producers to lunch their projects, exporting gas via LNG could be the remaining solution.

The solution of exporting LNG, would introduce the complexity of the international LNG market to the Brazilian Market. The high investments and risks associated with the development of the pre-salt reserves will be confronted with the price volatility of LNG in the international market, mainly in Atlantic Basin, where prices are impacted by the Henry-Hub price which is currently at a low level due to the production of shale gas.

Exports to neighbouring countries such as Uruguay and Argentina require prices to pay for the necessary investments in production and transportation infrastructure, and a political-economical stable scenario that mitigates the risks of these investments.

Therefore, the strengthening of the internal gas market seems the best solution for the future development of the reserves of natural gas infrastructure and transport and distribution. Although, a combined solution with a project of LNG export is also under study.

Thus, when designing a new cycle of economic growth for the country, Government should take into account the availability of gas, encouraging increased use of gas in the energy matrix in general, and in particular: considers the industrial market looking to favour the appeal of industries, for which natural gas is essential; in the electricity sector to create conditions for increasing the thermal dispatch; promote greater use of CNG in urban transport, to encourage gas co-generation in the industry and air conditioning segment.

It can be observed that the evolution of the regulation and the prospect of market liberalization has been slow and gradual, but without the breach of contracts, a very important aspect for the private investor. The essential argument being the need to mature the market.

A new market dynamic is expected after the publication of the Gas Law. New producers or importers of gas, mostly private companies, now with clear rules, will compete for already supplied markets, request access to pipelines, promote swaps and provide gas to states that have not yet been supplied. Also expected is the emergence of independent transport agents and traders, companies that although not having gas, will provide services independently and indiscriminately. It is also foreseen that this new dynamic will provoke state distributors to become more aggressive in the development of the market and expanding the distribution network into less populated areas, since certainly the consumer, now being free, will become more demanding concerning the price and supply conditions.

But for this bright future to materialize several elements are important: publication of all the decrees and the rules for the development of the pre-salt reserves; complete the supplementary regulations and decrees related to the Gas Law; publish the Gas Transportation Network Expansion Plan; continue the auctions of exploration and production blocks in the country, and for sure to encourage investment in technological and human resources that will enable these enterprises.

IBP - Brazilian Petroleum Institute, through its several committees will continue to encourage best practices in the industry and promote the exchange of knowledge, experiences and dissemination of ideas, looking for a market with stability of rules and a transparent regulatory framework

References:

- A Catedra do Gás: http://catedradogas.iee.usp.br/gasnatural/historicobrasil.htm
- Portal CEG/CEG Rio: http://portal.gasnatural.com/servlet/ContentServer?gnpage=4-60-2&centralassetname=4-60-2-1-1-0
- Portal da Comgas: http://www.comgas.com.br/conheca_comgas/conheca/historico.asp
- A Energia do Brasil – Antonio Dias Leite
- Balanço Energético Nacional – Edições 2010 e 1996
- Boletim Mensal de Acompanhamento da Indústria de Gás Natural – MME – Edição 53 – Agosto de 2011
- Abegas – Dados Estatísticos Mensais

- Revista Brasil Energia – Especial IBP 50 anos
- Portal TBG – www.tbg.com.br