

# THE CONSOLIDATION OF THE NATURAL GAS IN THE BRAZILIAN ENERGY TRIAD, ANALYSIS OF THE CURRENT SITUATION AND PERSPECTIVE

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**Abstract.** *The use of natural gas has shown an marked growth, significant changes have taken place in the Brazilian Energy Sector for the last ten years, in which its role was based on the development of sustainable principles for the society. Brazil has seen the consolidation of future energy three-way sources, oil, electricity and natural gas. However, the political situation that permeates this area currently brings concerns on the foundations to create an assured energy policy. The present paper is developed in this context, in which its main aim is to supply subsidies so that decisions on the use of energy can be made with both higher stability and transparency. This way, the development of its sector is investigated by means of the current presentation of gas natural resources, production, policy and trends. Finally, it is reasonable to infer that in a less turbulent scene and with clearer rules, it is possible to achieve a better use for this gas. However, in the current scene, the volatile situation may increase or decrease the risk to its replacement. It is believed that such view is inherent to the process of development and as soon as the variables find their right values, there will be a more mature industry in our country.*

**Keywords:** *natural gas; energy policy; energy supply.*

## 1. INTRODUCTION

In the last years the growth in the use and production of natural gas has had salient ascension in all the sectors where it acts as combustible, or either, in energy, industrial, commercial, residential the sector and of road transport. The use of the energy one contemplates to each year bigger number of applications, the necessary infrastructure to the increase of the capillarity of the system of transport and distribution grows and handspike some important sectors of the economy. However some obstacles must be loose for the consolidation of Brazilian industry of gas production. There are happened situations of the natural learning and adaptation, so common to new the practical ones of a sector that it needs to be consolidated. During the last decade it had significant changes in the Brazilian energy sector, whose rule was based on the development of sustainable principles for the society, then, the State glimpsed the consolidation of the future, composed energy triad for the oil, electricity and natural gas. However, the currently situation politics of the gas sector brings apprehensions on the beddings that praise one coherent energy politics. The population and economic growth stimulates the energy consumption, of this form has of if becoming more agile the process of increase of the capacity of generation of energy installed in the country. Currently this goal must be preference reached by means of the construction of center thermo-electrics plants, moved the natural gas, and small hydraulic center. In this environment it is that if it develops the present work, whose main objective is to supply subsidies so that decisions concerning the use of the energy one can be taken with bigger stability and clarity.

## 2. CHARACTERISTICS OF THE NATURAL GAS

In the nature, the natural gas generally appears associated to the oil (called associated), where it forms a chamber of high pressure above of the liquid surface, helping the rise of the oil until the surface. In these conditions, the gas leaves together with the oil. Then, it passes for a separator and, or is lead for the consumption, or is re-injected to assist the extraction of the oil. It can, also, occur in deposits without the presence of the oil, being called not-associate. The hydro-carbons gifts in the deposit determine will have or not together oil to the natural gas. The physical form of the hydro-carbon depends on the carbon atom number gifts in the molecular structure. With up to four atoms in each molecule if it presents in the gaseous form constituting the natural gas, that is a methane mixture, ethane, propane and butane. Between five and twenty carbon atoms for molecule, the hydro-carbon if presents in the liquid form constituting the rude oil. Above of this value the state he is solid, forming the diverse types of coal (GUO, 2005).

When it has predominance of the gases propane and butane in the mixture and these are conditioned in gas reservoir, the pressures slightly above of the atmospheric pressure, this mixture is known as liquid gas of oil. With the reduction in the temperature of the natural gas until its point of condensation 111.15 K to a pressure slightly above of the atmospheric pressure, its volume if thermal reduces in 600 times, allowing its storage in great isolated reservoirs for storage and transport. In this situation it is known as liquid natural gas, what he allows the transport in great methane ships, manufactured for this end, possessing coated spherical reservoirs with thermal isolation (PROFESSIONAL ENGINEERING PUBLISHERS, 1996).

Being about one mixture of hydro-carbons, between which the gas prevail methane, the burning of the natural gas becomes with relative easiness, providing one raised degree of exploitation and reduced emission of pollutants

### 3. USES OF THE NATURAL GAS

The natural gas has characteristics extremely favorable techniques under the economic and ambient points of analysis. This allows that the same it plays energy important role as alternative if its price will be competitive, therefore the elasticity of the price of the natural gas is high. In the industry, it is used in the vapor production, in heaters, greenhouses, co-generation and other ends. In the developed countries, the participation in the energy matrix is, average, of 20%, tending to grow. The chemical composition of the natural gas, with the predominance of the methane and with reduced texts of inert gases ( $\text{CO}_2$  and  $\text{N}_2$ ) and of hydro-carbons weighed, makes of same a fuel with being able calorific above of  $37.68 \text{ MJ/Nm}^3$ . Considering its mean density of  $0.77 \text{ kg/Nm}^3$ , can be evaluated its calorific power, for return of  $47.73 \text{ MJ/kg}$ . Of this form, the natural gas is used with raised efficiency in boilers, engines of internal combustion and turbines. When compared with the combustible oil, the burning if makes with more easiness, therefore the control of the relation air and fuel is more necessary and the mixture with air is more uniform, resulting in raised temperatures more (MERCEDÉZ BENZ OF BRAZIL, 1989).

In the petrochemical industry, the natural gas can be used as raw material, but due to small amount of carbon in the gases that participate of its composition its use so including when is not compared with the oil. The natural gas associate has greater amounts of ethane, propane and butane, which constitute a parcel of the basic source of a petrochemical one. Such components are used as raw material in the manufacture of aromatic olefins and. The manufacture of ammonia and methanol also uses the natural gas as raw material. The installations of manufacture of ammonia and methanol if have dislocated from the developed countries more for the countries that possess great natural gas reserves, reducing, of this form, the production costs. In the manufacture of ammonia and methanol, as well as of formaldehydes and fertilizers, the natural gas is considered as the raw material that presents the best technological and economic conditions. The co-generation also is present in the petrochemical industry, in which if they install gas turbines associates with boilers of recovery, using itself the exhaust gases in high temperatures for the vapor production. The gas turbines present the advantage to operate in high temperatures, aiming at to the increase of its thermal efficiency. Consequently, in the exit of the gases the temperature also is raised, making possible its use in the generation of heat for processes of the proper industry. The exhaustion gas can directly be used in exchangers of heat or boilers for the vapor production (BOYCE, 2001).

In the siderurgic industry the gas is used in the reduction of the iron ore and in the substitution of the coke in the processes of direct reduction, raising the productivity of the blast furnaces. Also it contributes to improve the finished product quality, when used to uniform temperatures of the processed parts. By the degree of cleanness of the combustion products, the natural gas can be used in ovens, acting in direct contact with the content of these. The manufactured product better presents quality due to easiness of proportionate control of temperature for the burning of the natural gas. In ovens of thermal treatment, greenhouses of drying, heating of crucibles of casting and in equipment of plate cut, the natural gas is presented as an ideal substitute for other energy ones. In the ovens of it would forge of not ferrous metals, the economy of proportionate energy for the substitution of the combustible oil for the natural gas arrives 16% (COMGÁS, 2001).

Use of the natural gas to propagate is made in the gaseous state and in raised pressure, also calls compressed natural gas. For in such a way, the gas is compressed and stored in steel cylinders without sewing, obtaining reasonable amount that allows a good autonomy for the vehicle. Some problems appear with the conversion of a conventional vehicle for the use of the natural gas, as its useful space that is much reduced due to the size of the cylinders. The weight of these is also a negative factor that can provoke greater costs of maintenance in average stated period. The stops are more frequent, being about two the three times more, compared with the ones of a vehicle moved with conventional fuel. Being a new technology, that requires trained adequate and personal infrastructure, the supplying of the vehicle is restricted the places where it has natural gas availability. It can, however to enumerate some advantages: the use of the after represents a economic alternative for engines of cycles Otto and Diesel, having stated period of return of capital around eighteen months the conversion (for stroll vehicles that they cover, in average, 500 kilometers for month); the emissions of pollutants are lesser due to combustion easiness and the sulphur inexistence and hydro-carbons weighed in the composition of the natural gas; the development of an equipment industry new heats the economy and promotes the generation of new ranks of work; older vehicles are converted with relative easiness, thus operating with the and diminishing the level of emission of pollutants; the high octane index of the natural gas allows to a bigger relation of compression in the engines, raising the energy income (LOURENÇO, 2003).

The use of the natural gas in the electricity generation considers the adoption of turbines the gas, associates with turbines the vapor. This association constitutes the combined cycle, which presents income above of 55%. This type of thermal central office is only possible when it is made use of the natural gas in great amounts. The gas-line is only viable economically when it is constructed for great demands, as in the case of the supplement of power plant. Of this form, the construction of the thermal central office makes possible the natural gas for other sectors of the economy, which would not demand volumes of gas that they justified the construction of the gas-line. The use of the natural gas

for domestic, commercial and industrial ends implies in the construction of an infrastructure of distribution nets that need great investments. When the installation of a power plant central office tied with the construction of a gas-line is considered, the project must also contemplate other sectors of the economy, without yielding the pressures of market and to the lack of concern with the conservation programs and rational use of energy (BOYCE, 2001).

#### 4. IMPACTS PRODUCED IN RESULT OF THE USE OF THE NATURAL GAS

The natural gas is a fuel considered clean in the world all, for presenting basses indices of emission of pollutants in the atmosphere, amongst fossil fuels. The gas methane, for containing 75% of carbon in its mass composition produces 2.77 kilograms of carbonic gas and generates 56 MJ for each burnt kilogram. One kilogram of a liquid hydro-carbon, with ten carbon atoms, produces 3.16 kilograms of carbonic gas and generates 45.8 MJ. For each 4.18 MJ of energy generated in the combustion, the methane produce 0.21 kilogram of 0.29 carbonic gas and the other produces kilogram, that is, 41% more. The natural gas being constituted of raised methane index starts to be the cleanest fuel in terms of emission of carbon monoxide (RITCHIE, 1999).

In case of the thermo-electric generation by the natural gas, the main generated pollutants are: carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), carbon hydro-carbons and dioxide (CO<sub>2</sub>). The presence of these gases in the atmosphere contributes for the formation of photochemistry oxidants and acid rain, as well as for the intensification of global the climatic changes, given that the CO<sub>2</sub> and the hydro-carbons are between the main gases that cause the effect greenhouse. Before following for the consumer, the natural gas passes for a treatment process that consists of the removal of sulphur that if concentrates in the form of H<sub>2</sub>S. The toxicity of this acid one is similar to presented for the acid bigger HCN and two times that of the carbon monoxide (CO). In contact with the water, it forms sulfuric acid that is highly corrosive, what it could damage the equipment. The carbon dioxide (CO<sub>2</sub>) also is removed, mainly to prevent the dry icing in the processes of condensation of the natural gas (LOURENÇO, 2006).

The density of the natural gas is minor who of atmospheric air and therefore dispersed it if quickly for emptying occasion, eliminating the fire risk. It has raised inflammability index, making it difficult its phosphor and needing bigger relation air and fuel, what it makes it still safer. The natural gas when burnt it only liberates the carbonic gas and the water. Its combustion is complete e, therefore it does not have formation of carbon monoxide, that is highly toxic being able until fatal when being breathed in great amounts. The toxicity of a gas is related with the percentage of carbon monoxide contained in the fuel or in the combustion products, when this occurs in incomplete way. The natural gas is flavorless, not detectable for the human directions and highly toxic and explosive when mixed to air (LOURENÇO, 2003). An environment that contains 1% of CO is lethal dose to the human organism; therefore the hemoglobin of the blood absorbs the CO faster than the oxygen (RITCHIE, 1999).

When it substitutes the combustible oil and the oil diesel, the natural gas promotes improvements in the environment, among others factors, because it does not contain sulphur, preventing the oxide production that, in presence of humidity, produces famous rains acid. In relation to the thermo-electric plants, with the use of the natural gas the following advantages are had: the exhaust gas of a turbine goes for the atmosphere, to the step that in the central offices the vapor this must be condensed, requiring great amount of water that is supplied by the environment and returns warm above from the usual conditions; the dimensions and the weight of an installation with turbines the gas are lesser, preventing problems of space and difficulties in the transport; the amount of formed carbonic gas in the combustion of the natural gas is of 2.77 kilograms of CO<sub>2</sub> for each kilogram of natural gas, while in an installation diesel produces 3.77 kilograms for unit of burnt mass. In a thermo-electric installation that functions in combined cycle, the specific consumption is evaluated in 0.16 kilogram for each kilowatt-hour, resulting in the emission of 526 kilograms of CO<sub>2</sub> for each megawatt-hour of produced energy; in an installation the oil diesel, where the specific consumption is 0.23 kilogram for each kilowatt-hour, the CO<sub>2</sub> emission more than increases for 709 kilograms, representing 35% the carbonic gas for the same converted electric power. Burning of gas natural in combustion chamber of turbine gas is made with easiness, with raised income and occupying little space, already generator of vapor, whose operation requires special cares and hand of specialized workmanship, cause great upheavals to environment for amount of heat that loses through its walls, for the space that occupies and the emission of pollutants. When the natural gas substitutes a hydro-electric center prevents great flooding, with displacement of populations, interruption of roads and climatic change provoked by the alteration in the relative humidity of air (BOYCE, 2001).

As in other parts of the world, the natural gas is the primary fuel that more grows in America of the South During the last decade of the last century the gas demand in the region grew 5.1% aa, while the total demand for energy grew to a 3.2% aa (D'APOTE, 2003).

Even so the region counts on industries of oil and hydro-electric sufficiently developed, the natural gas industry meets in its primary phase. This allows to new chances of investments and uses of the natural gas. However, the development of the natural gas market will only occur will have the creation of a favorable environment for the attraction of investors.

## 5. WORLD-WIDE OF RESERVES, PRODUCTION, CONSUMPTION AND TRENDS

Considering the perspectives of short term, the natural gas if shows as the main substitute of the oil. While the consumption of oil in the world increased 1.4% to the year between 1998 and 2003, the natural gas consumption increased 2.5% to the year. With the advent of the liquid natural gas, whose commerce grew 13% between 2002 and 2003, the trend is of significant expansion in the penetration of the natural gas in the energy matrices. In 2003 the natural gas already represented 24% of the total consumption of primary energy, behind only of the oil with 37.3% and the coal with 26.5%. Also it has the possibility of if producing, from the gas, gasoline, diesel and others for the technology gas to liquids. Since 2003 companies as the ExxonMobil, Shell, ConocoPhillips and ChevronTexaco have carried through economic feasibility studies for the development of plants of gas to liquids in the Katar. The intention of the local government is to transform the country into the world-wide capital of the gas to liquids. The Katar possess the third bigger natural gas reserve of world and one of the biggest plants of liquid gas. One expects that the natural gas is the energy elementary school whose growth if develops more quickly in the world of the one than any another one. Figure 1 illustrates the trend of increase in the consumption to a 2.3% aa in the period between 2001 and 2025. For the same period, they is esteem that the oil grows to a 1.9% aa. Under this perspective, the gas consumption will reach in 2025 4.3 trillions of cubical meters. An increase in the order of 70% consumption, carry out the amount that was consumed in 2001 (ENERGY INFORMATION ADMINISTRATION, 2005).

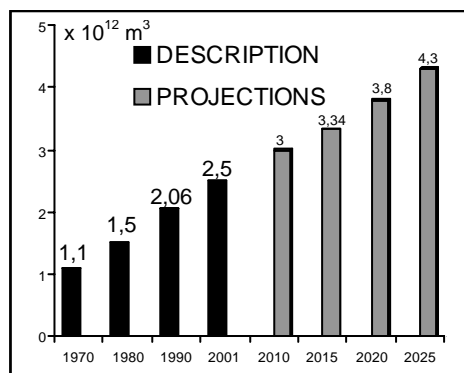


Figure 1: Natural gas consumption in period of 1970 – 2025  
Source: Energy Information Administration, 2005

It is believed that it has increase accented in the natural gas demand in the developing countries, where if the same foresees an average of 4.1% growth aa for period and the electricity generation must be the biggest application of the energy one. In the countries where the gas market is mature, the average growth is of the order of 1.6 % aa in the reference period. The increase in the world-wide gas consumption will motivate the commerce and the construction of new international gas-lines, which already meet in workmanships or project. Great reserves are distant of the consuming centers, this indicate that probably the increment in the international gas commerce occurs in the liquid gas form (ENERGY INFORMATION ADMINISTRATION, 2005).

The estimates of growth of the world-wide natural gas reserves had increased per the ninth consecutive year. The increase in the reserves of the industrialized countries was of 0.2 trillions of cubical meters between the years of 2003 and 2004. During the last decade, exactly with the increase in the natural gas consumption, the reserves had remained in high platforms. The average forecast of duration of the world-wide reserves is of the order of 60 years. Americas Central and of the South have forecast for 68.8 years, Africa 88.9 years and bigger Middle East that 100 years. Studies carried through periodically for the United States Geological Survey (USGS) evaluate the potential of production in long stated period of oil and natural gas. It is calculated that still it has great reserves to be discovered and during next the twenty and five years will be able to occur increase of 66.5 trillions of cubical meters. The Middle East and Russia will participate with half of the new reserves (USGS, 2000). Russia withholds the biggest natural gas reserves of the world, with 27.6 %. In as place comes the Iran, with 15.5% and in third place the Katar, with 15% (OIL & JOURNAL GAS, 2004).

## 6. NATURAL GAS SECTOR IN BRAZIL

It has great potential of natural gas consumption in the country, stimulated for the power plant generation and the industrial use. The growth of the consumption in thermo-electric sector was of the order of 72% and in the industrial branch of 13.7% according to MINISTRY OF MINES AND ENERGY (2005).

The natural gas production was of 46.5 million cubical meters per day in the year of 2004, what it corresponds to a growth of 7.5% in relation the 2003. The importations of the gas of Bolivia had increased 60% in relation the 2003, what it corresponds to a daily flow of 22.2 million cubical meters. One believes that the increase in the demand of the energy one is motivated by the consumption in thermo-electricity; therefore such enterprises make possible the development of the necessary infrastructure for the use in other sectors. according to projections carried through in the Decennial Plan of Expansion 2003-2012 (MME, 2002), the electricity consumption to per catches of the country will only have to come back to the value of 170 kilowatt-hour for month in the year of 2008, in 2000 such mark was registered for the last time. The generation in the public power plant central offices had growth of 61.8 %, in the use of the gas, the two last years. (MME, 2005) the total consumption of electric energy in Brazil will have to grow to an annual average tax of 6.1% to the year to the long one of the decennial horizon, reaching the sum of 577.2 terawatt/hour for the end period. Considering only the consumption taken care of for the concessionaires, the growth tax is of 5.7% to the year, with a total of energy of 510.1 terawatt/hour for 2012. The difference is taken care of by the auto-production (MME, 2002).

Considering the cited factors, recovery of the consumption of electric energy in the sectors, level of storage in the reservoirs and the projected growth, a panorama is had that indicates a retardation in the evolution of consumption of electric energy. However, the future expansion of the electric generation in Brazil must mainly be made with thermo-electric plants that operate with cycles of power based in turbines the gas and with small hydraulic center. To also detach, the accented growth in the use of the energy one for ends of road transport, that presented growth of 19% in relation to the year of 2003 (MME, 2005).

Currently the Brazilian energy matrix is based in the oil and the electricity, with great prominence in the first participation of the energy one. One believes that in the next years the tripod formed for oil, electricity and natural gas will support offers energy intern. Figure 2 illustrates the participation of the energy ones in offers energy intern. It is perceived great use of the oil, front to the too much energy sources.

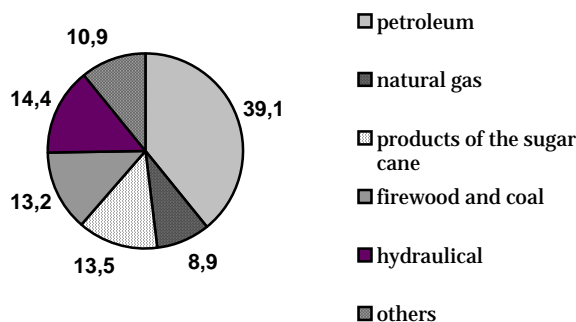


Figure 2: Brazilian energy matrix in 2004 [%]  
 Source: Ministry of Mines and Energy, 2005

The production of oil and derivatives, in 2004, was 0.5% inferior to the previous year; already the demand grew 5.8% in the same period. The gasoline, the kerosene of aviation and the diesel oil increased the demand of the energy one. An important point that it deserves prominence inhabits in the retraction of the use of the combustible oil in 11%. This if must, to a large extent, to the substitution of this fuel for the natural gas, mainly in the industrial applications. The rocking of the production and consumption of oil discloses to oil lack diesel, naphtha and GLP; e excess of gasoline and combustible oil (MME, 2005).

The generation of Brazilian electric energy presented growth of 6.3% in 2004, when compared with the previous year. This result is deriving of the substantial growth in the thermal generation (17%) and of the hydraulical generation (6.7%) (MME, 2005).

The natural gas continued the growth trend, the production of exactly was 7.5% superior to the year of 2003 and the industrial sector continued to be the biggest consuming sector. The generation of happened electric energy of this source also presented prosperous indices. The sector of road transport participated with increment of 19% in the consumption in 2003. The firewood, coal and products of the sugar cane do not have great importance for the generation of electric energy, however in the sector of transports the sugar cane participate of essential form, with ethanol. Brazil third is placed in the classification center- South American of proven gas reserves. The last discoveries in the Basin of Saints, in the state of São Paulo, had increased the Brazilian horizon of production. However, the biggest reserves meet in the “Bacia de Campos”, in the state of Rio de Janeiro. Table 1 shows the relative data natural gas reserves to the proven Brazilian, to the long one of this decade. Proven reserves are those whose analysis of geologic data and engineering propitiates the commercial recovery of the gas, considering aspects related to the economic viability, legal operation and regulations and tributaries (MME, 2005).

Table 1: Brazilian natural gas reserves  
Source: Anp, 2005

	Proven natural gas reserves [x 10 <sup>9</sup> m <sup>3</sup> ]					
	2000	2001	2002	2003	2004	2005
Terra	78.60	77.16	76.07	76.60	73.73	71.75
Mar	142.40	145.57	168.48	168.74	252.35	234.64
<b>Total</b>	<b>221.00</b>	<b>222.73</b>	<b>244.55</b>	<b>245.34</b>	<b>326.08</b>	<b>306.39</b>

The Brazilian natural gas production grew substantially in the first half of this decade, the tax of increment between 2000 and 2005 were of the 33% order. The increases in the consumption in the industrial sectors, thermo-electrical generation and road transport had been the responsible ones for the increase in the demand of the energy one. Table 2 shows the referring data to the production in last the six years.

Table 2: Brazilian natural gas production  
Source: Anp, 2005

	Domestic natural gas production [x 10 <sup>6</sup> m <sup>3</sup> ]					
	2000	2001	2002	2003	2004	2005
Alagoas	738.34	762.92	781.76	917.93	1187.16	1168.65
Amazonas	2000.20	2427.33	2743.18	2992.56	3620.76	3567.21
Bahia	1895.92	1966.55	2016.82	2165.87	2256.61	1984.29
Ceará	100.09	92.97	110.24	100.13	126.09	111.11
Espírito Santo	317.18	388.95	421.50	509.38	509.83	519.06
Paraná	47.21	38.25	9.39	56.40	65.22	67.71
Rio de Janeiro	5721.03	5968.33	6886.34	6660.15	6779.08	7967.18
Rio Grande do Norte	1265.25	1197.66	1360.29	1268.90	1365.58	1316.53
São Paulo	324.10	343.98	394.19	388.23	383.40	379.71
Sergipe	873.57	811.86	801.45	732.51	677.43	617.74
<b>Total</b>	<b>1328288</b>	<b>13998.80</b>	<b>15525.15</b>	<b>15792.06</b>	<b>16971.16</b>	<b>17699.20</b>

The natural gas consumption is led by the energy sector, followed for the industrial sector. In last the ten years the growth was of the order of 260% in these sectors, what it indicates great trend to the use and substitution of other energy ones for the gas. No longer commercial sector, in the same period, the demand grew ten times. Figure 3 illustrates the trend and evolution in the use of the energy one for sector of economic activity.

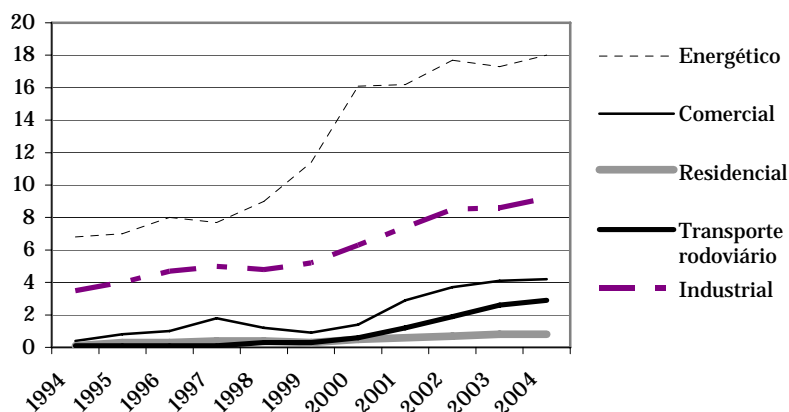


Figure 3: Natural gas consumption for sector of economic activity  
Source: Ministry of Mines and Energy, 2005

## 7. CURRENT SITUATION OF THE NATURAL GAS INDUSTRY

The question that brings apprehension to the operating companies and potential investors, in the natural gas sector of the South America, mentions the heterogenic to it of the practical regulators between the countries. It has, therefore, necessity of an alignment of the rules between the countries. The countries possess distinct politics and Laws in the treatment of the energy one. However it has a problem, as to create general, steady and clear rules between countries with scenes many heteroclite between itself, as for example, Brazil, Bolivia and Argentina. In Argentina the natural gas sector total is liberalized and the mature industry. In Brazil the sector still search identity in way to the little consistent scene. In Bolivia, the picture is of a great volume of reserves without a domestic market to absorb them. The structural difference of the natural gas industry between these countries takes the adoption of practical different regulators front to the specificities of each case. The conditions of offer of the natural gas in Brazil are favorable and the company who leads the market in the country is Brazilian Petroleum S/A (Petrobras). The agreements and investments in Bolivia, including the proper gas-line, guarantee the capacity of offers superior to the demand. The Federal Constitution, in its article 177, praises that the activities of research and cultivates of the oil deposits, natural gas and other fluid hydro-carbons are monopoly of the State; as well as the refinement of the national or foreign oil; the importation and basic exportation of the related products and derivatives; the maritime transport of the rude oil of national origin or basic derivatives of oil, produced in the country, and natural gas of any origin also it is. In the first paragraph of this article, it has the mention on the power of the State in previously contracting state-owned companies or private for the accomplishment of the cited activities, since that the conditions established in law are observed (BRAZIL, 1988).

One of the main changes of the Federal Constitution, the Constitutional Emendation number 9, of 9 of November of 1995, authorized private the Federal Government to contract company for the activities discriminated in article 177. Later, these activities, before reserved, would start to constitute Law n. 9.478, of 6 of August of 1997, which she was known as Law of the Oil (BRAZIL, 1995).

The Federal Constitution, by means of article 25, assures to the States the right of direct exploration or through private contracts with company, the gas distribution for gas-lines (BRAZIL, 1988). A legal interpretation of article 25 sends to the prohibition of great consumers in buying gas of the producers directly. This form, the final users need to buy of the local company of distribution. Law n. 9.478, of 6 of August of 1997, make use on the national energy politics, the relative activities to the monopoly of the oil, institute the National Advice of Energy Politics (CNPE) and the National Agency of the Oil, Gas Natural and Bio-combustible (ANP). With sights to the natural gas, Law n. 9.478 sends the four important points: the regulation, Petrobras, production, transport and distribution. The regulation of the market of oil and gas fits the ANP, in all the periods of training, only with exception to the distribution of the gas, therefore such responsibility fits to the States. Article 8 lists fifteen points of responsibility of the ANP. It fits prominence for the implementation of the national politics of oil and gas, organization of the rounds of bidding for production and concession of the operation licenses and authorization for processing, transport and importation of gas. While the concessions of the stage of production alone can be granted under competition carried through auctions, this is not required for the grant of authorizations. It is important to notice that the ANP is also responsible for the resolution of the processes of access disputes the ducts to carry oil or gas (BRAZIL, 1997).

Before the reform process, Petrobras represented the Brazilian government, dominating total the market of oil and gas in Brazil. This emprise poses all exploration areas, which produced the hydro-carbons. All the ducts and almost all the refineries also were under its control. With the continuation of the paper of Petrobras as representative of the Brazilian State in the new opened market, the company was authorized to keep all its producing fields. Also she was authorized to keep areas of exploration and evaluation, if it demonstrated to the potential of hydro-carbons and financial capacity. The ANP decided which areas of exploration and evaluation the Petrobras could keep, and concessions had been granted for these and all the producing areas in 1998. Other areas had been opened for the rounds of bidding organized by the ANP. The Petrobras started to grant parts of its private concessions for company in 1998, in November of 2006 is marked the eighth round of bidding. In the period of 180 days after the implementation of Law n. 9.478, the Petrobras received authorizations to operate its infrastructure of transport and distribution, what include all the gas-lines and units of processing. Law n. 9.478 also establish that the federal government will keep at least 50% plus an action to hold back most of the capital of the Petrobras. It is formal competing in equality of private conditions with company in the Brazilian sector of hydro-carbons. Article 65 of Law n. 9.478, praise that Petrobras would have to constitute a subsidiary one with specific attributions to operate ducts, terminals and fleet of ships. Thus, in 12 of June of 1998, the Petrobras was created Transport S/A (Transpetro). The system of concession for the stage of production represents an orientation to the market with relatively homogeneous terms. The system involves total property of the equity of the production in the well and capital assets; royalties (basically 10%) and minimum programs of work supported by guarantees, long phases of production and relative commitments to the abandonment of the area. If it was not for the domination of the market for the Petrobras, the system would be similar to the English. Taxes low, are formed by royalties, special participation of payments, bond, taxes of surface and income tax (BRAZIL, 1997).

With relation to the transport and distribution, the rights of transport, gas storage and importation they are gotten through authorizations of the ANP. In the present time, the Petrobras has the virtual monopoly on the production and gas transport. A aspect of Law n. 9.478 are that this law not dismember the vertical integration of the Brazilian gas

market, especially considering the enormous participation of the equity of the Petrobras in much company of distribution. Currently the turbulent climate in Bolivia resulted in bigger taxes on the natural gas exportations and some uncertainties in the market. The confusion of the gas started when the Congress of Bolivia approved a new tax of 32% on buys, above of current 18% in royalties. This has impact in Brazil, where half of the consumed natural gas is Bolivian, and the Petrobras is the foreign company with bigger participation in the gas sector of Bolivia. The turbulence inhibits new investments for the foreign companies in ground Andean. However it is not probable that Bolivia reduces the level of exportations, therefore the energy one constitutes important prescription for the country. The Bolivian government decided to transfer to the state YPFB place the control on the oil fields and gas that are under company responsibility multinationals, Petrobras also. A new contractual model, that reserves to the current concessionaires the paper of operators of wells, is in proceeding in the Ministry of the Hydro-carbons Bolivian. This new contract will have prescribed the nationalization of the reserves of the country, by means of decree. The companies will have six months, after the publication of the decree, to adapt itself to the new rules. Under these new rules, the company will leave of being concessionaires of exploration and production and will start to be rendering of service. The Law of the Hydro-carbons, of 17 of May of 2005, nationalized the reserves and praises that all the current concessionaire's change for new contracts (MINISTERIO OF MINERIA AND HIDROCARBUROS, 2005).

In Brazil, the Project of Law of the Senate moves for the Federal Senate n° 226, of 2005, of authorship of the Senator of the Republic Rodolpho Tourinho that in the last management occupied the folder of the Ministry of Mines and Energy (MME). The objective of the project is in the justification to implement specific programs for the use of the natural gas and to establish lines of direction for importation and exportation, with sights to the attendance of the internal necessities of consumption. The reference projects the Law n° 9,478, and says that the same one does not take care of to the interests and characteristic of the gas sector. The institution of the Operator of the National System of Natural Gas Transport still considers (Ongás) (BRAZIL, 2005).

The essence of the project can be described for the following points: the authorization for the activities of transport must be carried through legal regimen of concession, instead of the current authorizations; the access of third to the transport gas-lines must be regulated by the ANP, instead of negotiated between the parts; the concession of new gas-lines of transport must adopt public biddings; clearer separation enters the businesses of transport and commercialization of the natural gas; to occur public invocation for interested in getting transport capacity, when it will have magnifying of the gas-lines (BRAZIL, 2005).

The Federal Government directed to the House of Representatives the Project of Law n. 6.673, of 2006, whose also reference target the natural gas sector. In this project the discretional power of the MME is increased, what it would bring relative consequences, for example, in the transport sector it would have acquaintanceship between the regimen of authorizations or determined concessions for the MME. Thus, the stated periods of exclusiveness in the activity would be defined by the MME and in this meantime access will not exist of third to the new gas-lines. The project also is interposed enters the autonomy of the States in the regulation of the canalized gas distribution, therefore it imposes conditions related with the commercialization of the gas for the final consumers (BRAZIL, 2006).

In the moving one to the Brazilian reserves, the Petrobras announced that it will invest about US\$ 18 billion in the Basin of Saints, in the decennial horizon, the activities of exploration and production. This represents an addition of 12 million cubical meters per day, in the natural gas supply for the consuming market of the Southeastern region. The forecast is that this occurs in as the semester of 2008 e, in 2010 this flow will have to reach 30 million cubical meters per day. In case that this mark is reached the external dependence of the energy one is reduced, what it will represent advantages for the sector (PETROBRAS, 2006).

One expects that the consolidation of the exploration and production of the Basin of Saints contributes for the strongly of the national natural gas industry.

## **8. RESULTS AND CONCLUSION**

So that it has an environment favorable to the development of a new sector has of if having basic conditions that do not support the natural diffidence of the market. Enough demand of the energy one exists that it justifies new investments in the sector. The environment is favorable in that it refers to the national production and reserves of the energy one. However, the internal and external questions of order politics must be nullified. The participation of the private capital is basic, therefore it guarantees the competition and specialization, what is reverted in lesser prices, had to the productivity increase. It fits to point out that since that was promulgated the Federal Constitution (BRAZIL, 1988) the commercialization of gas to the final consumers is attributed to the Units of the Federacy. Until then such activity she was done for the Petrobras. On that instant the installation of the national industry of gas production was based on the reforms that had occurred in other countries. In this way, with Constitutional Emendation n. 9 (BRAZIL, 1995) and Law n. 9.478 (BRAZIL, 1997) had had beginning the changes of the Brazilian energy sector. Currently very if it argues on which must be the model used for the Brazilian gas industry. It in such a way has projects of law in the Senate (BRAZIL, 2005) as in the Federal Congress (BRAZIL, 2006) that they praise a specific legislation for the sector, with the creation of proper agencies. However, the legislation existing, and presented previously, makes possible to regulate the sector, without having necessity to still more burden the State with new agencies, secretariats etc. The



reading and the interpretation legal semantics and play light in the question and can be perceived that the point that must be articulated mentions the common rules to it for the actors of the sector in the international scope, because national the legislation takes care of to the enumerated requirements as being most excellent than they had occurred to the long one of the world. Thus, the problematic one installed currently in the country for large extent elapses of the impediments politicians. It is clearly that some adjustments must be made in the legislation, however if does not have to modify main, to long of the time the gas industry will ripen, since that it has favorable conditions and for such is necessary that the State fulfills its paper of regulating agency. After the inquiries and studies carried through on the natural gas sector are possible to conclude that:

- In the world it has great trend so that it has the substitution of other modal energy ones for the natural gas;
- The use of the energy one in the country Is completely feasible and that the perspectives so that the natural gas appears to the side of the oil and the electric energy in the energy matrix are favorable;
- It is not necessary to create a new legislation, with the posterior implantation of agencies or secretariats, with the specific objective to only act in the natural gas sector. The legislation on the subject contemplates and takes care of to the necessities of the segment;
- The implantation of the Brazilian gas industry follows the steps trod for other countries that today meet in more mature conjunctures and of success;
- The necessity of creation of common rules Exists that regulate the sector in the South America.

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