23rd World Gas Conference, Amsterdam 2006

BRAZILIAN NATURAL GAS MARKET DEVELOPMENT 2003-2010: FROM PLENTY OF SUPPLY TO SHORTAGE

A.S. de Cajueiro Costa
J.A. Carvalho de Faria
Brazil
# TABLE OF CONTENTS

1. Abstract

2. Body of paper
   1. Preamble
   2. Natural Gas History In Brazil
   3. Market At The End Of 2003
   4. Market At The End Of 2005
   5. Market Growth Forecast
   6. Challenges
   7. New Projects In Transport Infrastructure
   8. Regulation In The Southern Cone
   9. Conclusions

3. References

4. List Tables

5. List of Figures
ABSTRACT
The paper Expansion of the Bolivia-Brazil Gas Pipeline – presented by the same authors in WGC2003, – showed the reaction of the Brazilian natural gas market to the Bolivian gas supply. It also bore up that expansion of the pipeline would strongly depend upon the Electrical Power Sector in Brazil. Having written the paper under the Transporter (TBG) perspective, Authors now use a different approach. This paper intends to present an analysis from whole gas chain scenario. The aims are to comment the market growth in different segments in the period 2003-2005 and to forecast the next years. It also shall try to demonstrate that gas demand for power generation continues to have an important role in expansions decisions. Also, the natural gas supply from Bolivia (not a constraint in 2003) became a new constraint to the Brazilian market, when the new legislation has just imposed higher taxes on production. On the top of that, Bolivian political issues became a new concern. Formal data from Brazilian publications are the sources for the paper. Scenarios are being built for different demand and supply possibilities. At one side, Brazilian Federal Government motivation is to complement the hydro-electrical generation with the installation of new natural gas power thermal units. That will require not only new supply sources, either indigenous or imports, but also expansion of transportation capacity to deliver incremental quantities to the market. At the other side, but still in the same trend, major players involved intend to monetize their reserves in Bolivian and Brazilian territories. Pipeline network must be reinforced to cover screened scenarios, which forecast supply shortfall due to capacity constraint already observed. Important decisions involving intensive capital investments associated to pipeline grid reinforcement must be done. In the upstream segment, new investments in Bolivia as well as in Brazil are expected. Challenges could be summarized in 2 questions about gas availability:
- Shall new legislation and other political issues in Bolivia affect the incremental of production? 
- In what extension can internal production cope with growing demand?
Challenges related to the demand side can also be summarized in 2 questions:
- Demand growth must be either sustained in the same current levels or constrained by setting up a convenient policy price, for example?
- Which alternatives, if any, must Federal Government search for in relation to the electrical deficit expected for 2008-2009, concerning natural gas supply to thermal generation?
The paper has the purpose to present an updated overview of Brazilian natural gas market. It is going to try to point out its good performance during the last 3 years. Furthermore it will try to bring in public and private challenges for the period 2005-2008/2009. These challenges to the Brazilian Federal Government (public) and to the investors (private) are likely to happen in a short – medium term.
1. PREAMBLE

The aims are to comment the Brazilian natural gas market growth in different segments, before 2003, in the period 2003-2005 and to forecast the next years up to 2010. In spite of their low load factor, the role of power plants shall remain relevant to the market growth. It is going to be seen that the natural gas supply from Bolivia was an actual “booster” for market development until 2005. Now it has become a new constraint to further growth, due to new legislation that has just imposed higher taxes on production. On the top of that, Bolivian political issues became a new concern.

From a broader perspective involving natural gas supply in Southern Cone it shall be shown how different price policies interferes in the supply and demand balance, creating additional constraints to the market growths. However, new opportunities are opened to other supply sources, either from pipeline or from LNG tankers and terminals.

2. BRIEF NATURAL GAS HISTORY IN BRAZIL

Earliest record about natural gas usage in Brazil is in the 1960’s with development and production in Bahia State. The main reason for natural gas usage was liquids recovery from wet gas as stated by Federal Government guidelines. The use of dry gas, after liquids recovery, as heat or energy source was done wherever possible. The dry gas use was heat and power supply to E&P facilities and to an oil refinery. With proven reserves smaller than $25 \times 10^9$ m$^3$ at that time it was not possible to plan and dream about a gas industry.

Gas reserves remained as small as it was in early 60’s until late 70’s and early 80’s when big oil reserves were found in Campos’s Basin, an off-shore area in Rio de Janeiro State. Associated to oil, in this site, proven reserves jumped to $50 \times 10^9$ m$^3$ in 1980 and $125 \times 10^9$ m$^3$ in 1990. Discoveries in the Amazonas State, in the heart of the rain forest were also a tremendous milestone in late 80’s. These reserves allowed Petrobras to develop pipeline projects, in order to offer gas to the market. Gas pipelines from production site to the city of Rio de Janeiro. In Rio there was a local distribution company (LDC) which supplied reformed gas mainly to homes, besides petrochemical industries, became a natural customer for the new gas. In late 80’s a new pipeline connecting Rio de Janeiro to the city of Sao Paulo was put into service making available gas from Campos Basin to the most industrialized site in the country. It took 10 years to reach design capacity in this pipeline. In early 90’s Merluza Field started producing as much as $2,0 \times 10^6$ m$^3$/d to the gas network strengthening a little bit more the supply side of the chain.

As part of a strategic plan by Federal Government, once it was already possible to plan for a more significant role for natural gas in energy matrix in the country, bilateral talks between Brazil and Bolivia were started aiming for natural gas exports from Bolivia to Brazil. As a result, agreements and contracts were signed and a $30 \times 10^6$ m$^3$/d gas pipeline was built in late 90’s, connecting Bolivian reserves to the far south of Brazil and also Campos Basin. As PETROBRAS exploration program in Campos Basin was able to make even more discoveries, gas reserves raised to $225 \times 10^9$ m$^3$ in 2000 and $325 \times 10^9$ m$^3$ by the end of 2004. Figure 1a shows evolution of proven gas reserves from 1960’s to 2004.

At present, there are three independent gas systems in operation that are not interconnected, due the continental dimensions in Brazil and another one under project development:

(i) the Southern-Southeastern System (S-SE), the Northeastern System (NE) and the system of Espirito Santo State, that although is located geographically in the Southeast Region has not had yet its pipelines interlinked to the S-SE system;

(ii) Reserves in the Northern Region, in the State of Amazon which pipeline to the market should be ready to service within 2 years and it will supply gas, in almost of its totality, to power generation plants.
3. MARKET AT THE END OF 2003

The consumption of natural gas in Brazil was strongly influenced by the supply shock observed after the construction, startup and operation of the Gasoduto Bolívia-Brasil (GASBOL) in the years of 1999 (Northern Leg) and 2000 (Southern Leg). At the beginning, the project started offering $17.4 \times 10^6$ m$^3$/d of transport capacity. After the first expansion it reached to $24.6 \times 10^6$ m$^3$/d in January 2003, followed by a second expansion to 30.08 m$^3$/d in July of that same year.

Until then, the gas supply to The Southeastern Region, the largest consuming market of the country, was restricted to the production from Campos’ Basin and Merluza Field, an off-shore field in São Paulo State. 85% of this production was wet gas (associated to oil), therefore subjected to great oscillations either in quality or in availability of the product.

From the beginning of the project until its operations startup, gas industry in Brazil suffered strong influence of the Privatizations of Local Distribution Companies (LDC’s) of States of Rio de Janeiro and of São Paulo, exactly the two largest markets. Seven LDC’s are supplied directly from the GASBOL: “MSGAS” in Mato Grosso do Sul State, “Gás Brasiliano”, “COMGAS” and “Gás Natural São Paulo Sul”, in São Paulo State, “COMPAGÁS” in Paraná State, “SCGÁS” in Santa Catarina State and “SULGÁS” in Rio Grande do Sul State. There are also 3 other LDC’s, “GASMIG” in Minas Gerais State, “CEG” and “CEG RIO” in the Rio de Janeiro State, that although are not supplied directly from GASBOL, are in the same gas pipeline grid.

In spite of the other LDC’s were not privatized, the market response to gas availability can be considered very good. The three southern region LDC’s, COMPAGÁS, SCGÁS and SULGÁS succeeded in the hard task of fast growth of their markets in times where the competition with fuel oil was very tough. On the other hand, there is also a case of a privatized company that market development is much slower than expected like Gas Brasiliano, an LDC’s whose concession is located in the west of Sao Paulo State.

Initially projected to deliver to the industrial market as primary source of energy in industrial processes, the project of the gas pipeline suffered a strong impact, due to the electric power crisis that hit the country in
the year 2001. Power generation projects popped up all over the country and government's programs started encouraging the use of the natural gas for thermal generation of electricity. The immediate consequence was revision of the expansion chronogram for GASBOL, anticipating the offer design capacity of the project planned initially for 2007 to the year 2003.

Looking at the evolution of the market as presented in Figure 1b it can be observed a sustainable and fairly high market growth. It is necessary to point out that the year 2002 must be excluded. One can blame the electricity crisis in 2001, which had strong impact on economical growth in the following year, jeopardizing, therefore, the gas demand. Note, however, that the market growth is always preceded by increase in capacity availability in the pipeline net.

GASBOL pipeline investments and commitment of hiring all available capacity was based on the fact that Open Access would only be introduced in Brazil in the TCX-contract scenery, when the firm demand for capacity in the gas pipeline would have reached \( 24.0 \times 10^6 \) m\(^3\)/d. With this commitment, PETROBRAS hired all the capacity from Tranportadora Brasileira Gasoduto Bolivia x Brazil – TBG, owner and operator of GASBOL pipeline, all \( 30.08 \times 10^6 \) m\(^3\)/d design capacity, creating therefore conditions for the development of the Brazilian natural gas market.

When exclusive state monopoly by PETROBRAS was ended in 1997, GASBOL construction was already in course. Meanwhile, Agencia Nacional de Petróleo – ANP, the regulator, was created. Its main duty is to regulate the oil and natural gas sectors. Once ANP was installed, as an attempt of setting up a base regulation for natural gas, ANP released two Acts, standing out the Act 169/1998, that set up rules for third parties’ access to gas pipelines and the Act 170/1998, that introduced rules for new pipelines construction permits.

Based upon Act 169/1998 some agents requested, in years 2000 and 2001, transport capacity in TBG pipeline. For different reasons, ENERSIL (Enron affiliate) and BG (British Gas) put efforts in getting transport capacity in GASBOL. BG was, and still is, owner of gas reserves in Bolivia and not only the biggest COMGAS shareholder, but its controller. COMGAS has the biggest and most mature natural gas market in Brazil. It was easy to understand its interest for capacity in GASBOL. Regarding ENERSIL it remains very controversial the reason that sparked its interest in hiring capacity with TBG. In spite of being granted \( 1.0 \times 10^6 \) m\(^3\)/d interruptible capacity, it never shipped one gas molecule.

Such attempts to access capacity in a gas pipeline which all available capacity had already been contracted by PETROBRAS on firm basis resulted in a true commercial conflict among the involved
companies. In spite of the fact that BG was granted, through an arbitration process ruled by the regulator (ANP), 2.1 \(10^6\) m\(^3\)/d in year 2001 until the end of 2002, BG and PETROBRAS agreed for a capacity release in GASBOL from PETROBRAS to BG, for 11 years, beginning in January - 2003, in the amount of 0.65 \(10^6\) m\(^3\)/d.

It is probable that all this turmoil related to the open access in GASBOL during the years 2001 and 2002 may have put the interested parties in gas pipelines transport capacity in a more conservative position concerning contracting transport capacity on firm basis. The Open Season for GASBOL expansion over 30 \(10^6\) m\(^3\)/d, launched by ANP in 2001, may be considered a miscarriage. It was not executed mainly because of lack of demand of gas for power generation, that drove away potential interested parties.

Despite the wide range of problems and uncertainties that Brazil was facing during the change of Federal Government, shortly after, in July of 2003, we had already in place the current infrastructure that allowed a considerable growth for gas industry in the country. Although with fabulous growth until then, it seemed at that time to be fairly far away from draining the all installed capacity.

4. MARKET AT THE END OF 2005

It is easily noticed the importance of GASBOL capacity expansion (17.4 \(10^6\) m\(^3\)/d at the end of 2002 and 30.0 \(10^6\) m\(^3\)/d at the end of 2003) as crucial factor for market growth. With average imports of 11.8 \(10^6\) m\(^3\)/d in December of 2002, this amount raised to 15.7 \(10^6\) m\(^3\)/d (+32.7\%) at the end of 2003, 19.1 \(10^6\) m\(^3\)/d (+22.0\%) in Dec-2004 and 25.3 \(10^6\) m\(^3\)/d (+32.2\%) in November - 2005. Figure 2 presents this evolution in the graphic form, where we have in blue lines the available capacity and in orange the evolution of the deliveries from GASBOL.

The numbers related to GASBOL imports indicate an increase of 43\% from November 2005 over December 2003. This fact evidences that the initial market strength, during 2000 to 2003 period, was not over yet. If we look at curve slope for period 2003-2005, Figure 2, it is easy to notice that market growth was even stronger.

In order to perform a deeper analysis over the evolution of Brazilian natural gas market in the last years, we must work with market segmentation.

From these data it is easy to realize that there are two sectors that have been growing above average:

i) the vehicular natural gas (GNV), that displaces gasoline and alcohol in the market of automotive fuels and;

ii) the use in electricity thermal generation.
The presented data shows that GNV growth is above average as well as natural gas for power plants and cogeneration. Table 1 and Figure 3 show the evolution of the participation of all segments from 2000 to 2005.

Although it can be noticed also from Table 1 a reduction in the GNV participation in the following years after 2003, it is important to emphasize that this is due to the fact of the high growth of the Power Generation market and that market of this segment grows above average, being behind only of power generation itself. It can be visualized what is going on Brazilian Market looking at Table 1, where it can be seen the dramatic change on market segmentation from 2000 to 2005:

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Market Segmentation % / Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2000</td>
</tr>
<tr>
<td>Industrial</td>
<td>78%</td>
</tr>
<tr>
<td>GNV</td>
<td>6%</td>
</tr>
<tr>
<td>Residential</td>
<td>3%</td>
</tr>
<tr>
<td>Comercial</td>
<td>1%</td>
</tr>
<tr>
<td>Power</td>
<td>12%</td>
</tr>
</tbody>
</table>
5. MARKET GROWTH FORECAST

As mentioned before, natural gas market in Brazil has been growing at high rates. We could say that several reasons contribute to it. At first, industrial sector (responsible for 55% of the market), has been shifting to natural gas because its competitiveness has increased due to the relative high internal prices of other alternative energy source as fuel oil and electrical power. Currently, such relationship reaches up to 50% in the case of the fuel oils as it can be seen in Figure 4. Therefore Gas Distribution has been able to capture new customers and retain considerable part of the price gap between fuel oil and gas. It is not too strong to say that this sector may become the most profitable segment at the moment in Brazil.

Thermal-electrical generation has been buying gas currently at artificially low prices. As a consequence, in many cases, it can compete with the electric power generated by hydroelectric power units. The Bolivia-Brazil project is responsible for around 50% of market supply. It is, of course, very competitive due to high oil prices. To reinforce that, note that on top of gas prices at Rio Grande, where Bolivia-Brazil pipeline starts, it is added transport cost due to GTB (portion of GASBOL in Bolivia) and TBG to add up to the city-gate price. In practical terms, gas price at Rio Grande is linked to fuel oil international prices. As to transport fees, except for a small price escalator (0.5%/a.a., therefore below inflation rates), they are fixed. When oil prices take off, as recently, gas becomes very competitive sending strong economic signals to the market that, in the end, has been responding very strongly due to high fuel oil and other liquids prices as, at least, diesel and LPG.

PETROBRAS forecast that the internal demand for the natural gas shall increase 17%, reaching amounts higher than $10^6$ m³/day by the year 2010. This growth could be even larger, but due to lack of transport infrastructure in the short term for Northeast (NE) and, in the medium term (2 years) for Southern and Southeastern Regions (S-SE).

The NE region is today the one that presents a real supply shortage, either in the point of view of gas supply or capacity constraints. The shortage happens when power plants are dispatched. These supply problems are located in States of Bahia, Pernambuco and Ceara. LNG imports have been studied as a possible solution for the problem in spite of its high prices, for it could fit to the low load factor of these power plants. The supply scheme would be using LNG routes to USA or Europe from Africa, Australia or Trinidad-Tobago. One could say that in spite of the power generation not being able to pay international LNG prices, because of the relative low cost of electrical energy in Brazil,
the low load factor could make possible and viable the investments in LNG storage and regasification. When compared with pipeline supply, there is a clear advantage in avoiding excess capacity, during the most part of the season. Also relatively small LNG amounts would be ready to operate when the electrical system needs excess energy from thermal generation.

In the next two or three years the S-SE system may have a supply shortage if it happens that all power plants are dispatched simultaneously. To avoid that, it is mandatory to construct the required infrastructure to connect gas reserves to the marketplace. Upstream investments are also necessary to keep pace with gas demand.

6. CHALLENGES

The economically available natural gas reserves, either due to their size or the relative small distance to marketplace in Brazil and Argentina, are located in Bolivia. This Country has the role of the most important supplier to the so called Southern Cone in South America. Figure 5 presents the existing interconnected pipeline grid in Brazil, Bolivia and Argentina. The energy integration is already a reality nowadays. There is just a small gap that will connect Argentina’s to Brazil’s grid to close the grid, as a ring, among these three countries.

The major challenges for Southern Cone can be summarized in one question: How will they converge to a solution that must fulfill three different countries strategies concerning their individual energy needs? It will be, indeed, not only an economical game but also political.

New hydrocarbon legislation was set up in Bolivia by the end of last year (2005). Gas production is now under higher taxes. Larger Government interventions are yet expected in other segments in the gas chain. Yacimientos Petrolíferos Fiscales Bolivianos (YPFB), the Bolivian state company that owned and operated all oil and gas assets in the past, before privatization took place in 1996, was reduced to an agent concerning royalties and official gas exporter as “Aggregator” for several independent gas producers. Now it is expected that YPFB retrieve its old role as a relevant player in the business. In the end, the new Government of Bolivia, beyond higher taxes, has established great instability among agents and players, in such manner that no predictions on how the natural gas system in that country will work are reliable.

Argentina, with the so called “pesificación” of gas prices and transport fees (2000–2001) introduced the current policy price that keeps gas at very low prices. The “pesificación” is nothing else but the fixation of
the prices in the Argentinean currency - the Peso – disregarding the peso devaluation against the American dollar that shifted from 1 to 1 parity to around 3 pesos to 1 dollar exchange rate. The result was that all gas prices, in USD, became very low when compared with previously established and extremely low when compared to international oil and gas prices. With that price policy Argentina had its gas consumption increased, occupying, for instance, substantial portion of the automotive fuel market. The relation between price for vehicles usage - GNV - and gasoline stimulated users to convert their cars to natural gas. The converted fleet is over 1 million vehicles, reaching a consumption around 10 10⁶ m³/d. Recently Argentina started importing from Bolivia again (now in the volume of 6 10⁶ m³/d, with contract of 8 10⁶ m³/d), competing with Brazil in gas purchase from that supply source. Besides, Argentina called for Force Majeure and cut exports to Chile (around 10 10⁶ m³/d) and to Brazil (2.2 10⁶ m³/d). Therefore, Argentina, by means of an inadequate price policy switches its exporter position to importer and brakes the World paradigm that gas suppliers would be always reliable, losing its status as reliable supply source. Until then, it had not happened, not even one, any event of a supply flaw by crossborder gas pipelines in the World by unilateral decision, such as this one. Later on, Russia, using similar procedure, threatened and did cut gas to Ukraine, although motivation was quite different.

Chile, by its turn, came across the complete lack of reliability on gas supply. Even paying in dollars (not in pesos) and at prices much higher than internal prices in Argentina, it had its imports cut. It started searching new alternatives for its needs. Peruvian gas was studied. However, it resulted very dependent in the amount of gas that would be assigned to Argentina and Brazil (Southern area), and it ended up not likely to be viable. Another alternative will be LNG, from distant sources. The basic rules of the integration in the South Cone were broken and Chile will be burdening its energy costs, as a direct consequence.

Brazil is following a price policy not as distorted as it is in Argentina. However, it will not be a surprise if it falls in similar situation. With internal prices relatively low in relation to the international market, shortage scenario may be forecasted, because potential investors don't feel comfortable to make investments which return can not be predicted.

Under these circumstances the challenges for natural gas supply to these two countries are considerable. They have a political feature, by which the Argentina’s, Bolivia’s and Brazil’s Governments need to do an accurate balance between intervention and leaving the market to seek its balance point in a more liberalized way. If, on one side, high international prices stimulate investors in exploration and production and in transport infrastructure, on the other hand, in developing economies, there is not enough income to pay such high international prices. A balanced position between offer and demand is the great challenge for the destiny of the industry of the natural gas in South America Southern Cone.

7. NEW PROJECTS IN TRANSPORT INFRASTRUCTURE

Different plans for gas pipelines are currently under study. Some should have its short term implementation initiated, to startup operations within two or three years, whereas others should have a long term implementation. Notwithstanding, they are all under economical evaluation for later decision.. The Project Malhas SE-NE is under construction for startup operations by the end of 2006. The expansion of the gas pipeline Bolivia-Brazil is in process by an Open Season Capacity Offer. Beyond that, these several projects are under study in order to come up with a solution that could deliver gas to Southern Brazil. Final pipeline solution may result in Bolivian gas reaching Brazil either through Argentina or through Paraguay. This last option may be, in a longer term perspective, the Southern portion of a very much bigger project that would connect Venezuela’s reserves to Brazil, Argentina and Uruguay. Multilateral talks among these four governments concerning this project have already been initiated.

There are also studies focusing on LNG imports from several sources to supply Brazil’s NE region. Brazil’s S-SE were also considered for LNG imports but it seems less attractive. It must be noticed that LNG prices in international markets are very high if compared with current internal gas prices in Brazil. Therefore, from market rules, it is expected that LNG imports shall impact strongly the Bolivian price for gas exported to Brazil. The trend is that the Southern Cone will eventually establish a market price, which consumption centers may be either Buenos Aires in Argentina or Sao Paulo in Brazil. We believe that in a near future one of these must become the reference price for natural gas in the Southern Cone. New price levels may be reached in case LNG projects are rendered. It seems that LNG solution is almost sure for Chile and likely to happen in Brazil.

Notorious fact is that the role of Bolivia and projects for LNG imports can define the destinies of natural gas industry in the Southern Cone. Venezuela may become an alternative that can alter in a long term
basis the higher prices trend for the region. There are of course huge difficulties to be dealt with: (i) very long distances for pipeline supply; (ii) capital investments of over US$ 20 billion; (iii) very complex financing; (iv) very strong environmental issues due to crossing unusual sensitive areas. Nevertheless, the Venezuela project may link huge reserves to markets eager for very big amounts of gas. Conditions for the project are already in place.

8. REGULATION IN THE SOUTHERN CONE

The Southern Cone is constituted of asymmetrical economies and natural gas industries in different developing stages. Brazil is the country, at the same time with the larger economy, but also with a gas industry that is still emerging. Argentina has the second largest economy and its gas industry has already reached maturity. Its regulation is also in pace with the market maturity, although the Government's interferences with the price policy have altered the "rules of the game", causing problems with the several players, both producers and transporters.

In Brazil there are two gas law projects being carried out: one under debate in the Parliament and other being elaborated by Federal Government. The regulator, ANP, released 3 Acts in October -2005, one for Open Access (it regulates the effective Law), other for Capacity Release and the third setting tariff criteria for natural gas transport in pipelines. A second experience of an Open Season for the Bolivia-Brazil gas pipeline is in process. Bolivia has an unstable legislation at this time. Some contracts were broken with the producers, transport regulation is under review and, above all, there are great expectations on what will happen with the new Government.

9. CONCLUSIONS

1. The fast demand growth starting since 1999/2000 to nowadays was enabled because gas imports from Bolivia were able to reach the market through the gas pipeline Bolivia – Brazil. Previous decisions on infrastructure investments were crucial to enable such market growth;

2. The industrial segment is the one with the largest gas demand, followed by thermal generation and vehicular natural gas (GNV);

3. Thermal generation is supplementary to hydro generation in Brazil. This fact leads to low load factor in thermal generation plants. Therefore, LNG imports could be feasible because it would avoid additional investments in pipeline capacities;

4. Bolivia is the largest gas supplier in the Southern Cone. In short and medium terms, Brazil and Argentina are the major buyers of gas from Bolivia. In longer term, Venezuela may compete with Bolivia for Brazilian and Argentinian markets;

5. Greater challenges for market growth in the period 2006-2010 in the Southern Cone are related to four basic factors:
   i. Political and Regulation Issues in Bolivia, Argentina and Brazil;
   ii. Price Policy in Brazil and Argentina;
   iii. Lack of pipeline capacity to cope with gas demand growth;
   iv. Upstream investments, either for existing reserves or new ones.
References
Boletim Mensal do Gas Natural, ANP, nov/2005
Brasil Energia
Google Earth Software
Expansion of Bolívia to Brazil Gas Pipeline, 22nd World Gas Conference, Tokio 2003

List of Tables
Table 1 – Market segmentation in Brazil; 2000 -- 2005

List of Figures
Figure 1a – Natural Gas Proven Reserves in Brazil
Figure 1b – Gasbol Deliveries 2000-2005
Figure 2 – Gasbol Imports 2002 -2005
Figure 3 – Market Growth in Brazil, by segment
Figure 4 – Natural Gas x Fuel Oil prices in Brazil
Figure 5 – Southern Cone Gas Pipeline Grid