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OVERVIEW OF THE NATURAL GAS INDUSTRY IN THE SOUTHERN CONE

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Petrobras

Background

South America: great heterogeneity among countries

SOUTH AMERICA¹



SOCIO-ECONOMIC INDICATORS

Country	Population (Million) (2013)	GDP ³ (Current US\$ ⁴ Billion) (2013)	GDP <i>per Capita</i> (Current US\$) (2013)	HDI ⁵ Rank (2014)	Natural Gas (NG) Demand <i>per Capita</i> (m ³) ⁶ (2013)
Argentina	41.4	609.9	14,715.2	49° (very high)	1,158.4
Bolivia	10.7	30.6	2,867.6	113° (medium)	314.7
Brazil	200.4	2,245.7	11,208.1	79° (high)	187.8
Chile	17.6	277.2	15,732.3	41° (very high)	246.5
Colombia	48.3	378.4	7,831.2	98° (high)	221.5
Ecuador	15.7	94.5	6,002.9	98° (high)	38.1
Paraguay	6.8	29.0	4,264.7	111° (medium)	0.0
Peru	30.4	202.3	6,661.6	82° (high)	216.2
Uruguay	3.4	55.7	16,350.7	50° (high)	29.4
Venezuela	30.4	438.3	14,414.8	67° (high)	1,004.0

Notes: ¹Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela. Data was not computed for Guyana and Surinam and the territories of the Falkland Islands, South Georgia and the South Sandwich Islands and French Guyana due to lack of data. ²Argentina, Bolivia, Brazil, Chile and Uruguay (countries in yellow on the map and in the table). Paraguay also belongs to the Southern Cone in geographical terms but was not analysed in this study as NG is not part of its energy mix. ³Gross Domestic Product. ⁴United States dollars. ⁵Human Development Index. ⁶Cubic metres.

Sources: The World Bank; United Nations Development Programme (UNDP), Human Development Report, 2014; BP Statistical Review, 2014 and Petrobras.

Aims and Methods

Aims

- The aims of the present study are to present a historical account of the main events that have affected NG supply and demand in the countries of the Southern Cone, in addition to describing and analysing the various efforts undertaken to resolve NG supply-demand imbalances in the region since the end of the 2000s.

Methods

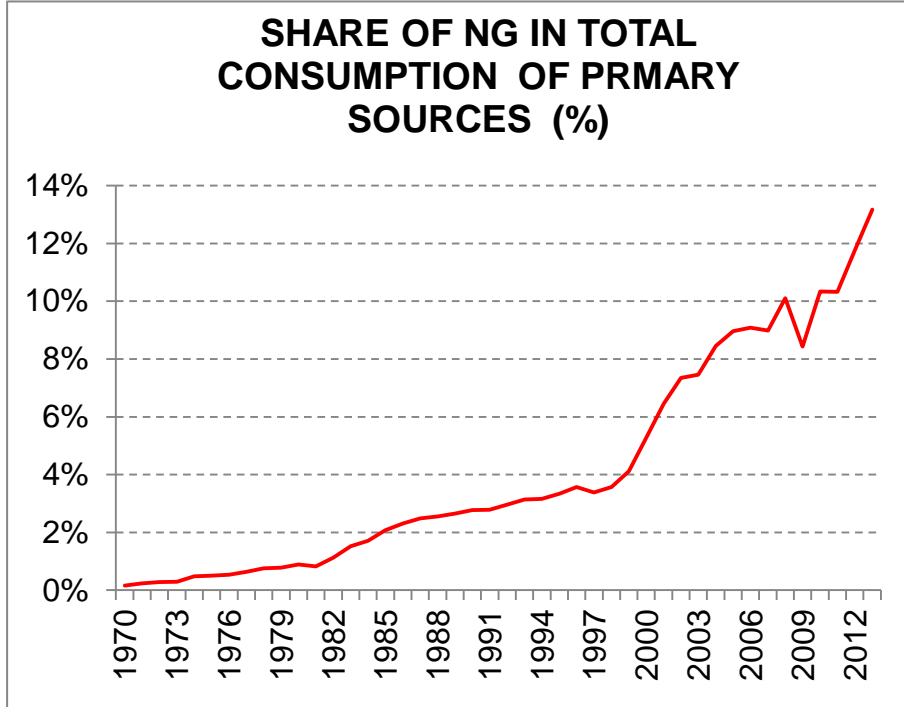
- This study presents a historical account of the main events that have affected NG supply and demand in the Southern Cone.
- To this end, historical data on NG reserves, production, consumption, exports and imports was gathered from public sources, amongst others, in order to analyse the development of the NG market in the region, focusing especially on Brazil, Argentina and Bolivia.
- The study also examines the impact of recent regulatory provisions on investment decisions in Southern Cone countries.

Results: Brazil



The 2000s: a booming NG market

- The inauguration of the Bolivia-Brazil (GASBOL) NG pipeline in July 1999 was a landmark in the development of the NG sector, adding a potential supply of up to 30 million cubic metres per day (m³/d) to local supply (an estimated 16 million m³/d at that time). This occurred 2 years after the promulgation of Law 9478 which abolished the state monopoly on E&P and oil product refining in Brazil and instituted hydrocarbon auctions under a concession regime.
- The discoveries of the Cangoá-Peroá (1997), Manati (2000), Jubarte (2001) and Mexilhão (2003) fields made it even more urgent to develop the market.
- Before 1998, NG's share in the total consumption of primary sources had never surpassed 4 percent (%). Fifteen years later, it had more than tripled, reaching a 13% share (2013).



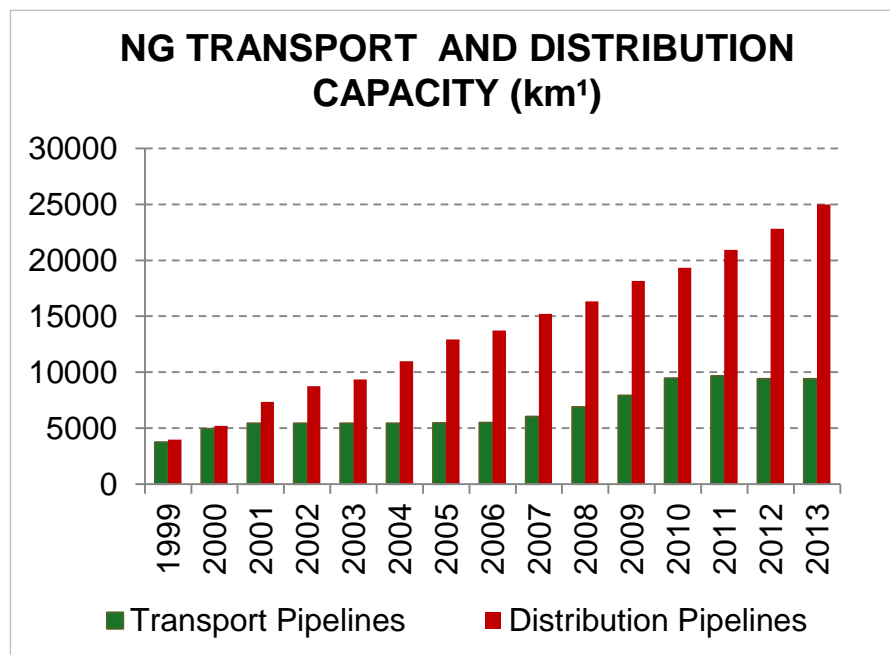
Source: Balanço Energético Nacional (BEN), 2014

Results: Brazil



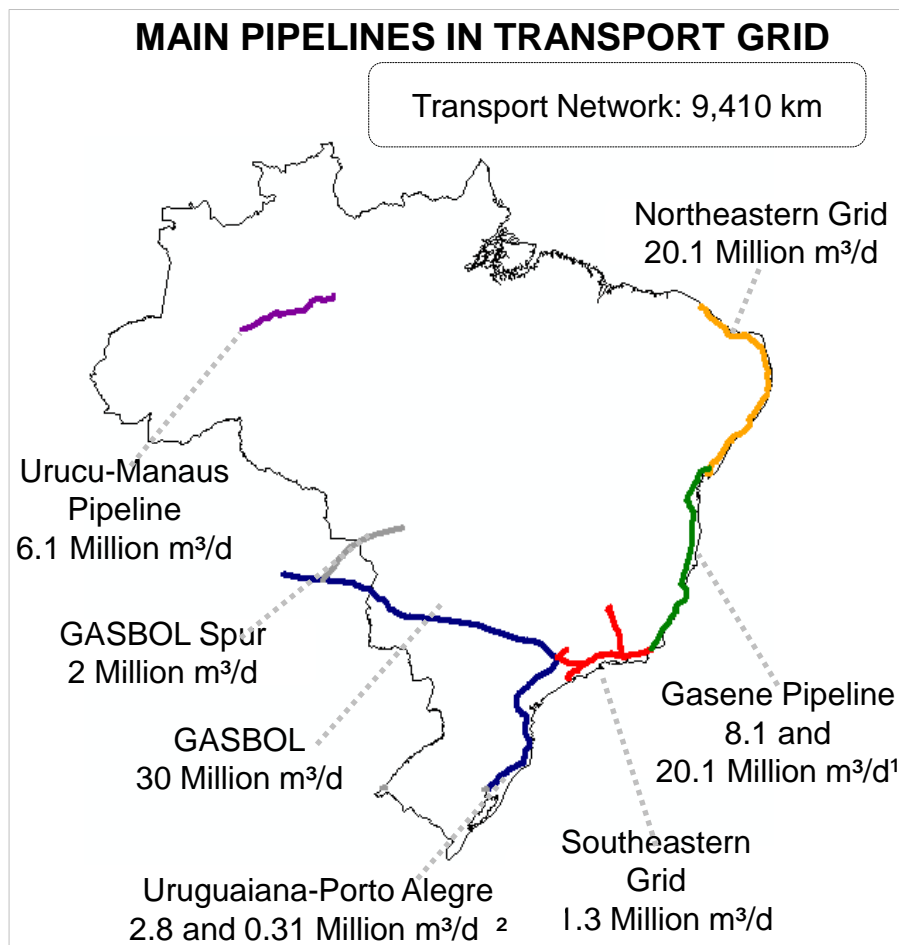
Building the NG market on new foundations

- This growth was only possible due to continuous investment in the transport and distribution network by the largest firm in the country's oil sector, Petrobras, and local NG distributors. This infrastructure was built largely along the Brazilian coast.



Note: ¹ Kilometres.

Source: Boletim Mensal de Acompanhamento da Indústria de Gás Natural nº 92 – Nov 14, Ministério de Minas e Energia (MME).



Notes: ¹Southern and northern sections, respectively. ²Sections 1 and 3, respectively.

Source: IHS Energy.

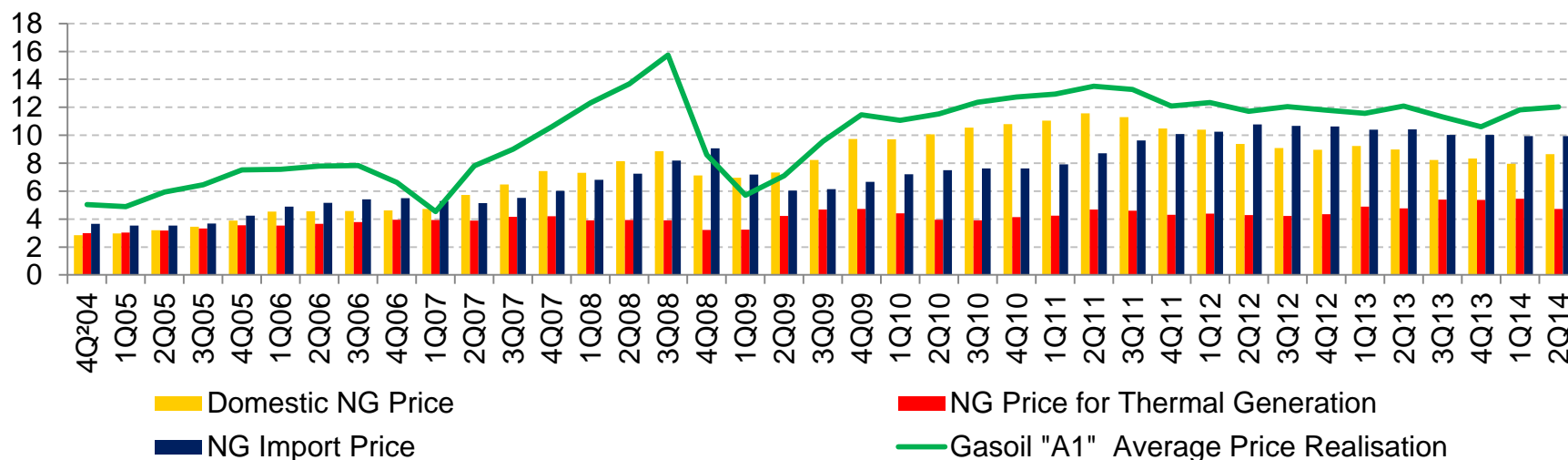
Results: Brazil



Building the NG market on new foundations

- The price policy also encouraged various firms in the industrial sector and, on a smaller scale, in the transport, residential and commercial sectors, to invest in the conversion of their equipment and engines to NG. To ensure the supply of the Southern and Southeastern market, the National Oil Company (NOC) Petrobras created the Early NG Production Plan (PLANGÁS) in 2006, in order to bring forward the development of the Mexilhão and Golfinho fields, as well as the conclusion of the Cacimbas NG Processing Plant and the Cacimbas-Vitória, Cabiúnas-Vitória and Campinas-Rio, Gasduc III and Gastau NG pipelines. A new regulatory framework was also instituted in March 2009, aimed at attracting new players to the industry's midstream segment (Law nº 11909/2009).

COMPARISON BETWEEN NG AND GASOIL CITYGATE PRICES (US\$/MILLION BTU¹)



Notes: ¹British Thermal Units. ² Quarter.

Sources: Petrobras and Ministério de Minas e Energia (MME).

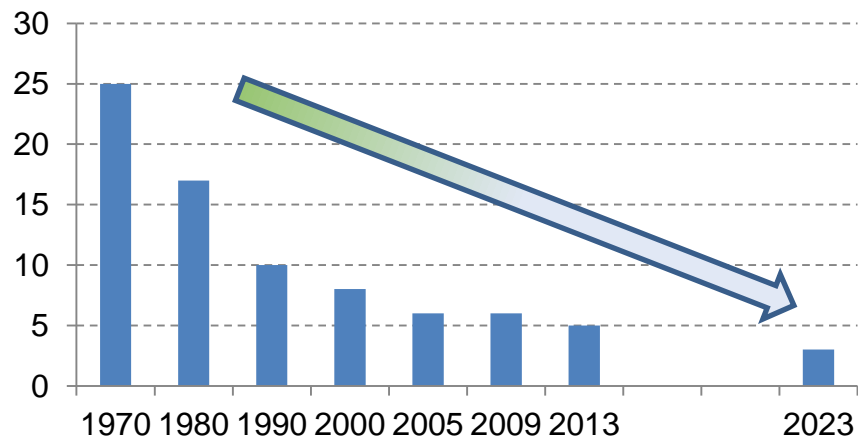
Results: Brazil



Increasingly tight supply-demand balance

- However, more stringent environmental requirements for the construction of reservoir hydroelectric plants, in a system that is predominantly based on hydroelectricity, has increased the National Integrated System's (SIN) hydrological risk during the last 20 years and thus the importance of NG-fired thermal power generation as a source of reliability.

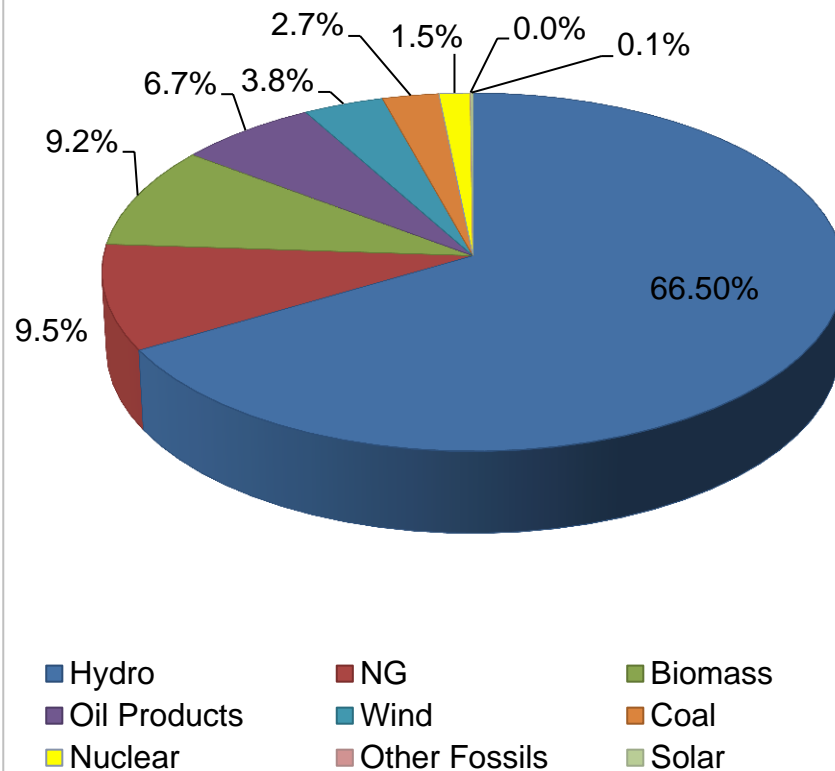
HYDROELECTRIC PLANT STORAGE CAPACITY¹ (MONTHS)



Note: ¹Maximum Stored Electricity (Megawatts(MW).month)/Electricity Load (Average MW (avg. MW)).

Sources: Petrobras, Operador Nacional do Sistema Elétrico (ONS) and Agência Nacional de Energia Elétrica (ANEEL).

INSTALLED ELECTRICITY GENERATION CAPACITY BY SOURCE (%)



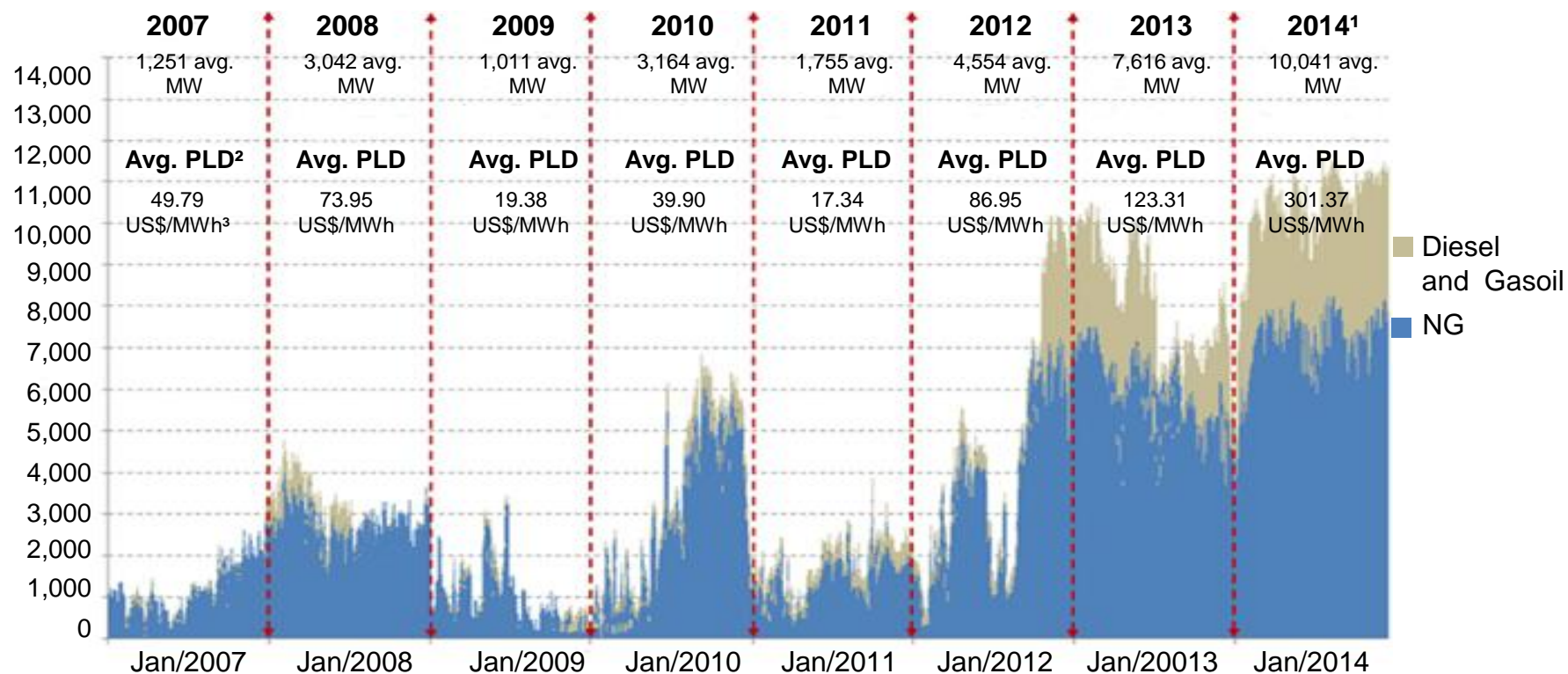
Results: Brazil



Increasingly tight supply-demand balance

- The thermal power dispatch response became critical, especially as from the end of 2012, due to extremely low rainfall, leading NG to play an increasingly important role in generation, in a context of fierce competition between the various sources of demand for NG. The abundance of the early 2000s was already a thing of the past.

NG AND OIL+FIRED THERMAL GENERATION IN THE NATIONAL INTEGRATED SYSTEM (AVG MW)



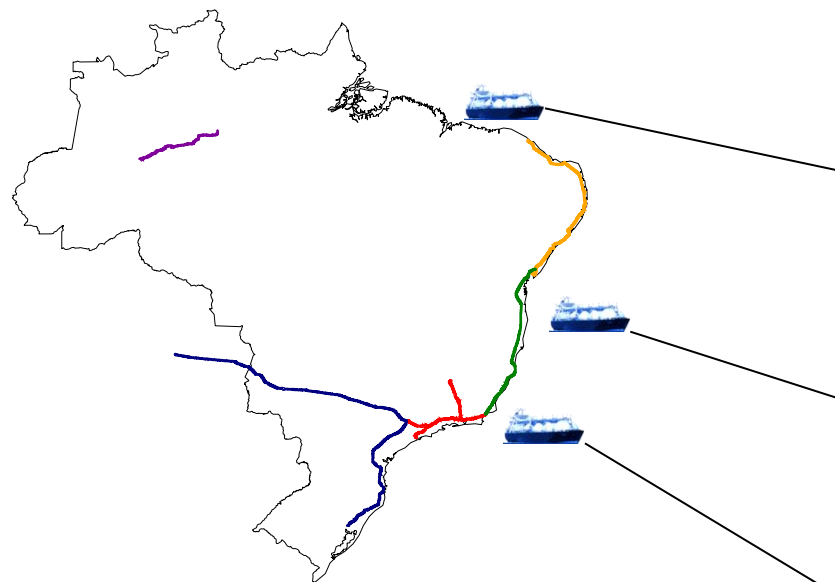
Notes: ¹Until Dec., 15th. ²Average Settlement Price for the Differences. ³Megawatt hour. Source: Petrobras.

Results: Brazil



Opting for LNG

- In order to cater to unpredictable thermal power demand, the country begins to import Liquefied Natural Gas (LNG) in 2009.



LNG REGASIFICATION (REGAS) TERMINALS



Pecém

- Began operations: January, 2009
- Capacity: 7 million m³/d



Bahia

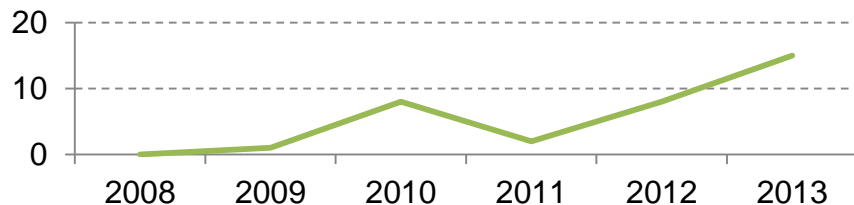
- Began operations: January, 2014
- Capacity: 14 million m³/d



Guanabara Bay

- Began operations: March, 2009
- Capacity: 20 million m³/d

LNG SUPPLY (MILLION m³/d)



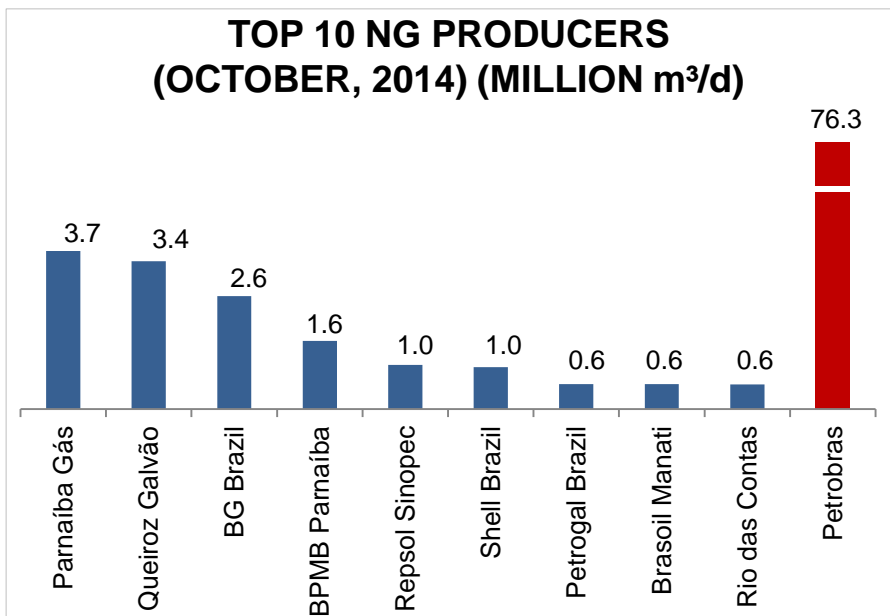
Source: Boletim Mensal de Acompanhamento da Indústria de Gás Natural n° 92 – Nov 14, Ministério de Minas e Energia (MME).

Results: Brazil



Alternatives on the horizon

- The growth of Petrobras's and other concessionaires production of NG in E&P in partnership (or not) with the NOC, both onshore and offshore, especially in the pre-salt polygon, and the expected start of negotiations with Bolivia to renew the contract in 2019, constitute some of the alternatives on the horizon to achieve a medium-term balance between NG supply and demand in Brazil.
- As regards onshore production, the exploration successes in unconventional reservoirs in other parts of the world, especially in the United States (US), have awoken the sector's firms to the potential of these resources in Brazil. The National Oil, NG and Biofuels Agency (ANP) recently issued Resolution nº 21 of April/2014 (RANP nº 21/2014), in order to regulate drilling and hydraulic fracturing activities in unconventional reservoirs, and established operational safety parameters to ensure the protection of human health and the environment.
- However, although various onshore auctions have already occurred in the country, all under a concession regime (the last in Nov./2013, when 72 of the 240 blocks offered were successfully bid for), the firms involved have failed to make commercial unconventional NG discoveries in Brazil.



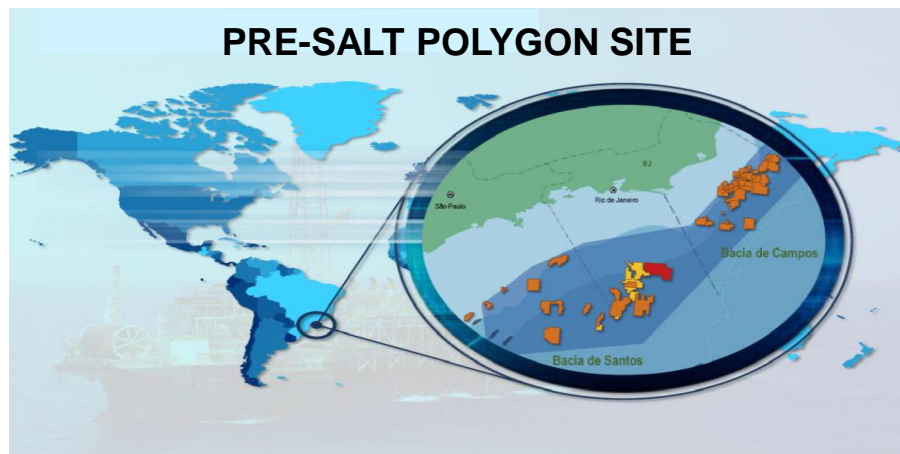
Source: Boletim Mensal de Acompanhamento da Indústria de Gás Natural nº 92 – Nov 14, Ministério de Minas e Energia (MME).

Results: Brazil

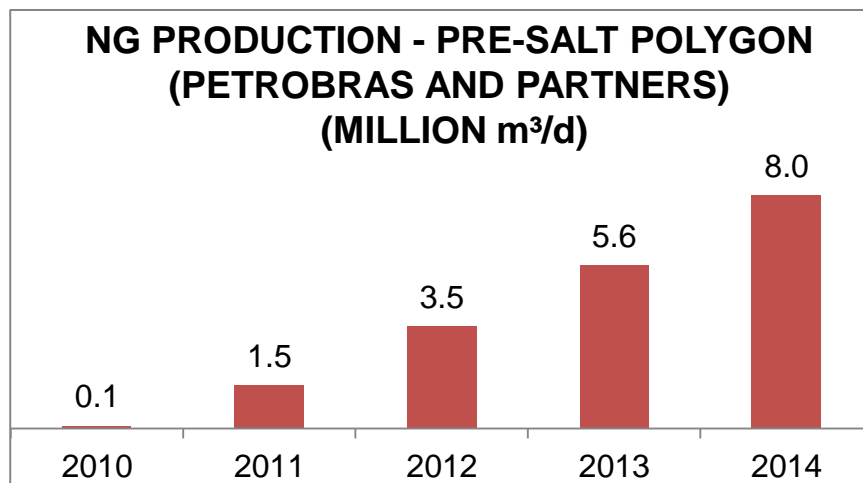


Alternatives on the horizon

- Meanwhile, since 2010, the pre-salt cluster is governed by 2 additional regulatory frameworks (in addition to the concession regime established by Law 9478/1997): Law nº 12276/2010 of Aug./2010, that instituted the Onerous Cession, through which the Union gained the prerogative of granting Petrobras the right, in return for financial compensation, of exploring and producing in its areas; and Law 12351/10, of Dec./2010, which established: the sharing regime; a minimum percentage of profit oil for the Union; Petrobras as the sole operator in all fields; and a compulsory minimum 30% participation of the NOC in all blocks put up for tender in the Pre-Salt fields.
- The first auction under the new regime took place in October 2013 – the Libra auction. The megablock, with estimated reserves of between 8 and 12 billion Barrels of Oil Equivalent (BOE), was awarded to the consortium made up of Petrobras (40%), Shell (20%), Total (20%), China National Petroleum Corporation (CNPC) (10%) and China National Offshore Oil Corporation (CNOOC) (10%). Today, 8 million m³/d are already being produced in the Pre-Salt Polygon, by Petrobras in partnership with other firms in the Santos and Campos basins since Jul./2000 – all under the concession regime.



Source: Petrobras.



Source: Boletim Mensal de Acompanhamento da Indústria de Gás Natural nº 92 – Nov 14, Ministério de Minas e Energia (MME).

Results: Argentina



The 2000s: the beginning of the NG crisis

- With South America's second largest proven NG reserves until the end of the 1990s (secondly only to Venezuela's), Argentina faced a severe economic crisis in 2001 and 2002. Its GDP fell 4.4% between 2000 and 2001 and 10.9% between 2001 and 2002.
- In an attempt to recover the country's level of activity, the government, in January 2002, enacted the Law of Public Emergency and Reform of the Exchange Rate Regime (Law 25561) which established a series of economic measures, including:
 - "Pesification" (denominating prices in Argentinian pesos) of NG and electricity transport and distribution tariffs, previously denominated in US\$;
 - Freezing NG prices at the wellhead at a level of 0.40 US\$/Million BTU;
 - Liberalising prices of NG substitute fuels.
- These measures dealt a severe blow to the hydrocarbon sector, discouraging investments in NG Exploration and Production (E&P) and hindering the discovery of new reserves, while also accelerating the consumption of NG.
- At the end of 2003 Argentina's Proven Reserves (PR) of NG stood at 612 billion m³. The country currently has PR of 316 billion m³ with an estimated Reserves-to-Production ratio (R/P) of only 9 years.



Source: BP Statistical Review of World Energy, 2014.

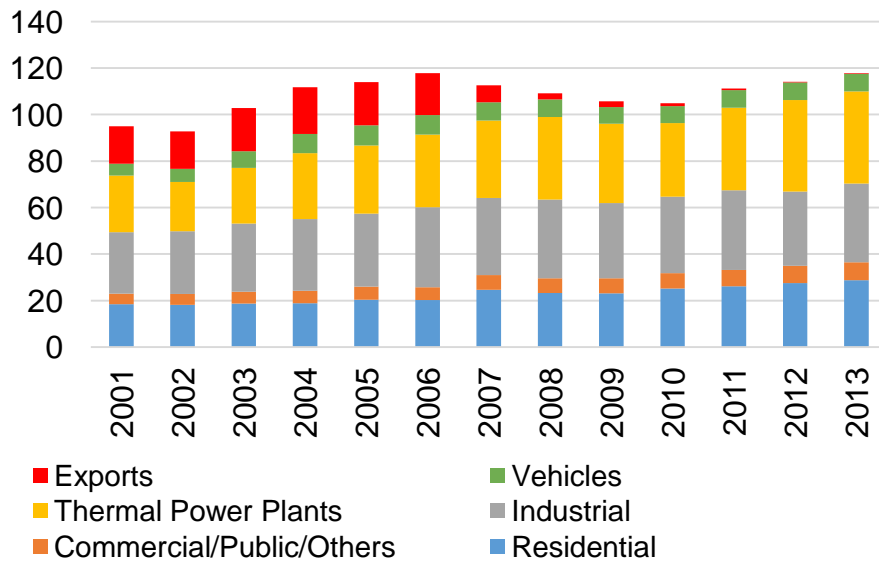
Results: Argentina



Cuts in NG exports

- The consumption of NG is concentrated in the residential, thermal power plant and industrial markets and since the beginning of the 2000s exports account for nearly 20% of total demand for Argentinian NG.
- In 2004, in an attempt to overcome domestic shortages, the Argentinian government, through Energy Secretariat (SE) Resolution N° 265 and Disposition 27, suspended all new export authorisations and established programs to curb the production and transport of NG destined for export.

**NG DEMAND IN ARGENTINA
(MILLION m³/d)**



Source: Ente Nacional Regulador del Gas (ENARGAS).

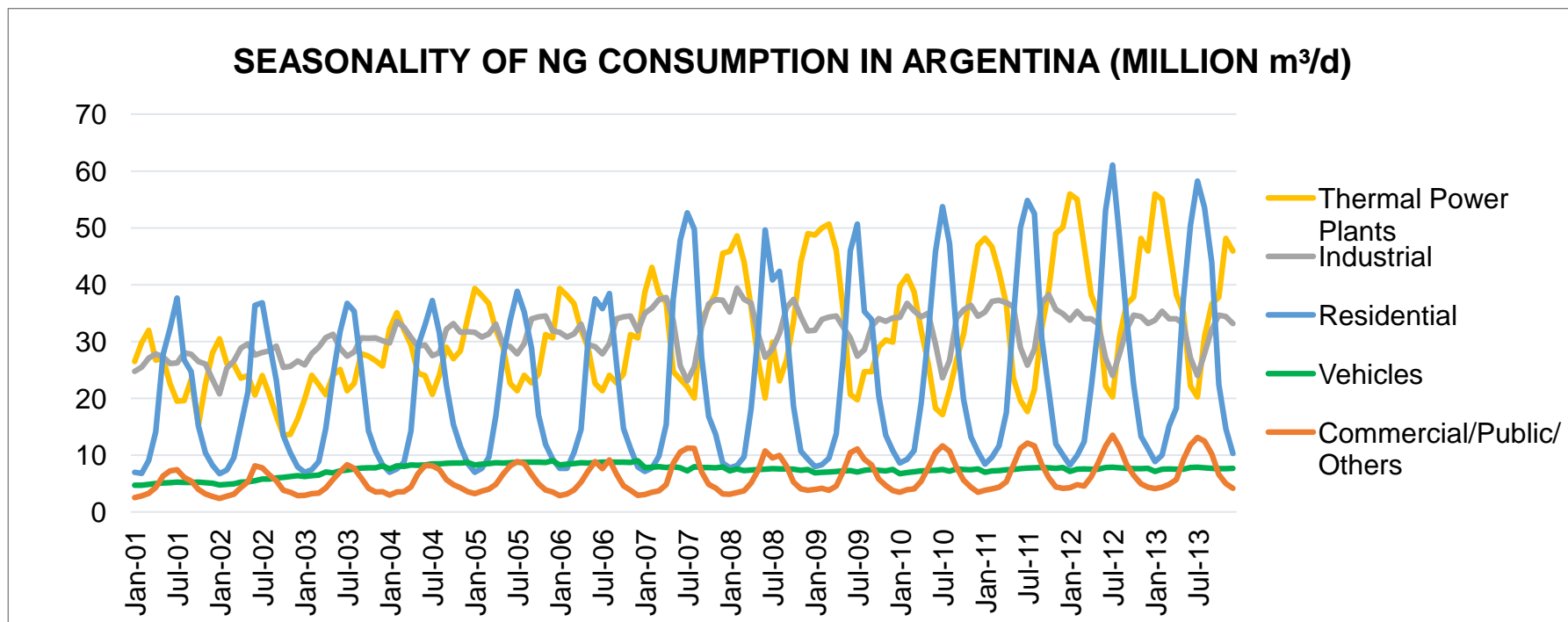
- As from June 2009, with the promulgation of SE Resolution N° 659, producers were obliged to redirect NG to meet domestic demand.
- The measures taken by the government caused various failures in the supply of NG to importing countries. Exports of NG to its neighbours Chile, Uruguay and Brazil were gradually curtailed and never recovered the average levels attained before 2004.

Results: Argentina



Seasonality of demand: prioritisation of the residential segment

- One should highlight that the demand for NG in Argentina is strongly affected by variations in temperature during the year.
- During the Southern hemisphere's coldest months (May to September), the residential consumption of NG in Argentina, used mainly for heating purposes, increases.
- In 2013, the average consumption of NG in January reached 9 million m³/d; in July it was 6.4 times greater: 58 million m³/d. Due to the tight supply-demand balance, the supply of NG for industry and thermal power plants during the winter period is rationed in order to ensure an adequate supply for residential consumers.



Results: Argentina



Supply-Demand imbalance: corrective measures

- In order to restore the domestic NG supply-demand balance, Argentina adopted a series of measures:

Price Review

SE Resolution N° 208/2004, which implemented Decree N° 181/2004

Aim: stimulate NG production and curb demand:

Segmentation of price increase policy by type of consumer:

- **Residential:** prices controlled until 2006 and freed from then onwards;
- **Industrial or thermal power plant customers of distributors:** gradual price increases until mid-2006 and price controls abolished at the end of that year;
- **Industrial customer of producers:** liberalise prices

Agreement with Producers

SE Resolution N° 599/2007

Aim: ensure that domestic demand is met during the 2007-2011 period.

Producers that are parties to the agreement agree to supply NG in accordance with their share of NG production in the 36 months prior to April 2004.

If a supply shortfall were to occur, NG from producers that did not take part in the agreement and NG destined for export would be redirected to the domestic market.

Gas Plus Program

SE Resolutions N° 24/2008, N° 1031/2008 and N° 695/2009

Aim: encourage the production of NG in the country, sustained by the increase in the reserve/production ratio.

After the implementation of SE Resolution N° 24/2008, the volumes resulting from increases in production could, under certain circumstances, be commercialised at more attractive prices without being subject to the price limit stipulated in the Agreement with Producers (2007-2011).

SE Resolutions N° 1031/2008 and N° 695/2009 established some particularities and flexibilities for classifying the project as Gas Plus, which apply solely to unconventional projects.

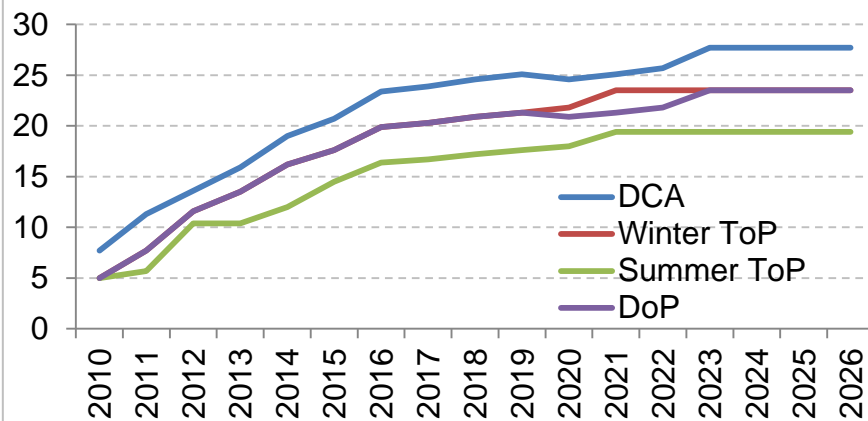
Results: Argentina



Growing dependence on imports of Bolivian NG

- The measures adopted were insufficient to stimulate the production of NG and curb demand. The Argentinian government was left with no alternative but to resume imports of NG from Bolivia that had been interrupted in 1999.
- In 2004, flows of Bolivian NG to Argentinian were resumed on an interruptible basis and, in 2006, Energía Argentina Sociedad Anónima (ENARSA), created by Law 25943/2004, signed a NG supply contract with Yacimientos Petrolíferos Fiscales Bolivianos (YPFB).
- The contract's ramp-up was readjusted by Addendum 1 in March 2010. The Addendum established a new ramp-up of consumption with Delivery or Pay (DoP) and Take or Pay (ToP) commitments and a Daily Contractual Amount (DCA) (Maximum Contractual volumes) of 7.7 million m³/d at the beginning of the contract, increasing over a period of 10 years to 27.7 million m³/d, which would be sustained until the end of the contract in 2026.

**NG CONTRACTUAL VOLUMES – YPFB-ENARSA
(MILLION m³/d)**



Note: Winter ToP and DoP volumes are the same, except between 2020 and 2022.

Source: YPFB

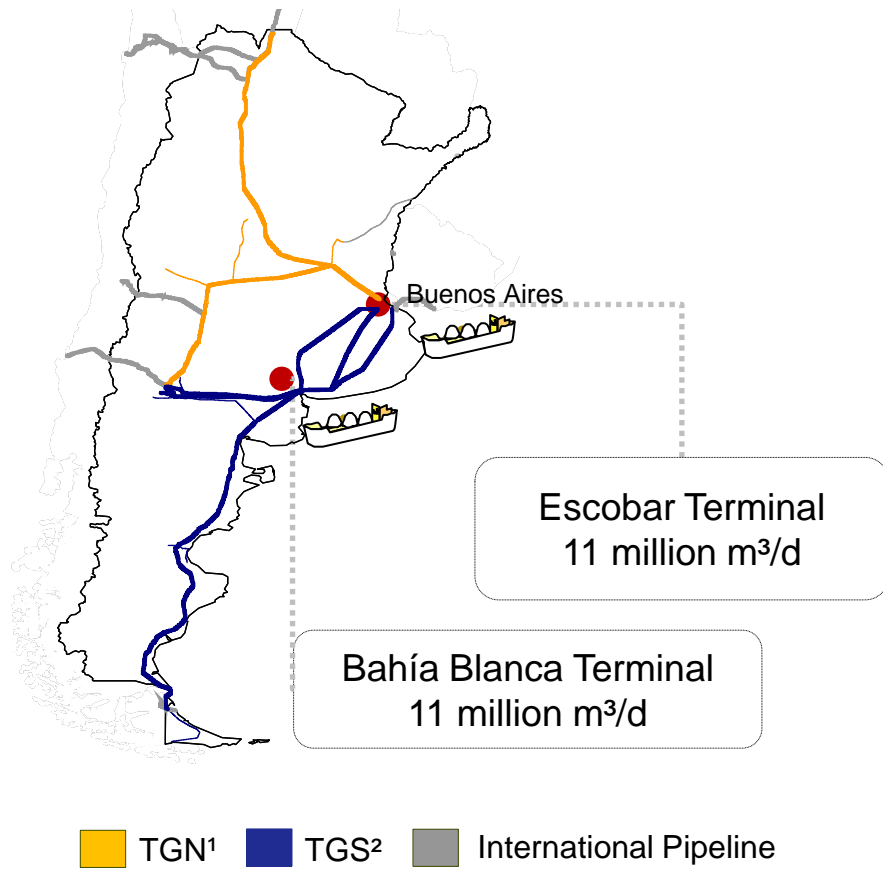
- In June 2012, ENARSA and YPFB signed an Interruptible NG Purchase and Sale Contract for volumes exceeding the DCA of the firm contract. The interruptible contract provided for maximum volumes of 2.7 million m³/d in 2012 and 3.3 million m³/d in 2013. These volumes could be reviewed between the parties until 2026.

Results: Argentina



Growing dependence on LNG imports

LNG INFRASTRUCTURE AND NG PIPELINES



- However the shortage of NG was becoming chronic, with difficulties increasing during the winter. In 2008, after only 6 months of construction works, Argentina overcomes all barriers and inaugurates South America's first LNG regas terminal.
- The Bahía Blanca Terminal is located 643 km southeast of the capital Buenos Aires and currently has a capacity of 11 million m³/d.
- Three years later, the country inaugurated Escobar, its second regas terminal, located on the Paraná river, 48 km from Buenos Aires and with the same capacity as Bahía Blanca.

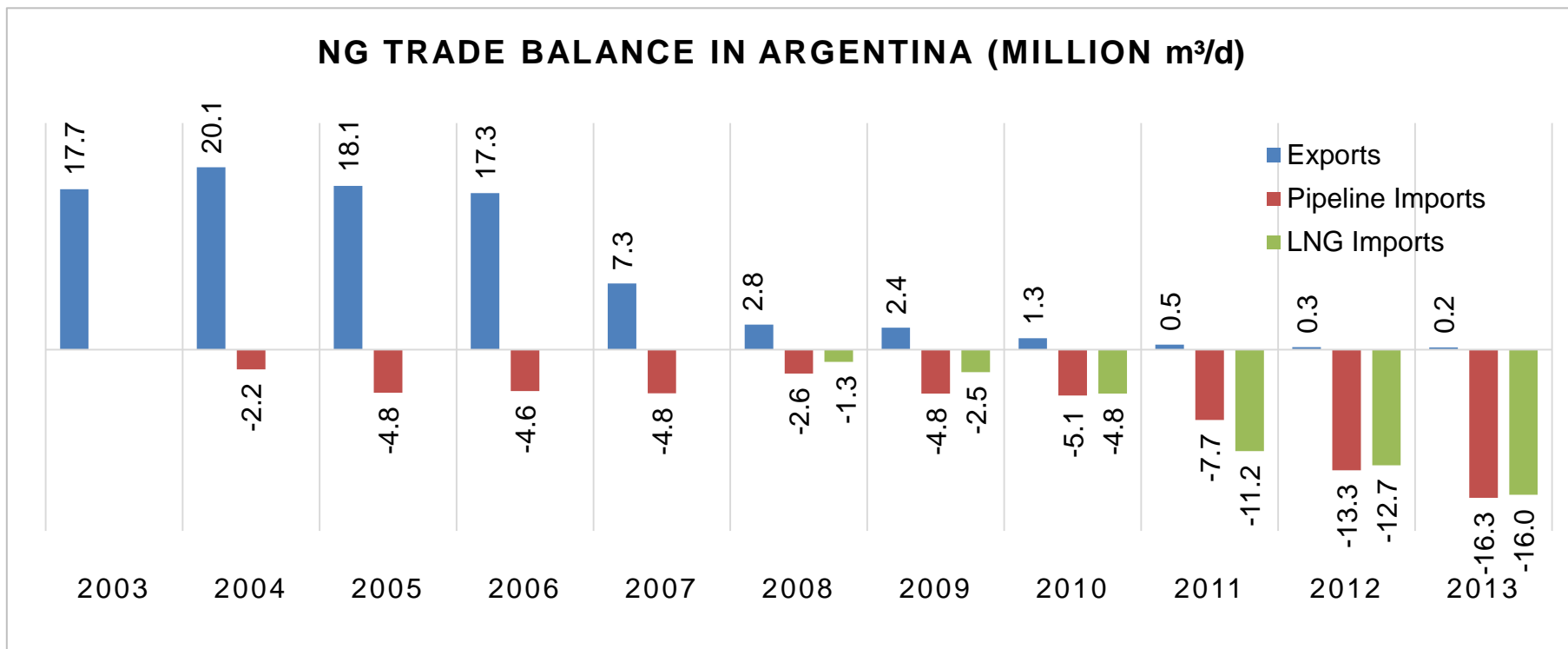
Notes: ¹Transportadora Gas del Norte. ²Transportadora Gas del Sur.
Source: IHS Energy.

Results: Argentina



From NG exporter to importer

- The decline of production due to the maturity of production basins, the lack of investment in E&P, the growing demand driven by the low prices paid by final consumers, and despite public policies that tried to reverse this situation, transformed Argentina from NG exporter to importer.
- Nowadays, 22% of the country's NG needs are met by imports, either via NG pipeline from Bolivia or LNG.



Source: Instituto Argentino del Petróleo y del Gas (IAPG).

Results: Argentina



New measures by the Argentinian government

- In recent years, the Argentinian government has adopted initiatives to encourage investments in the E&P of hydrocarbons, especially uncoventional ones, and has enacted specific legislation to reduce demand:

Production Incentives	<ul style="list-style-type: none">Decree 927/2013 – established import rights for certain goods declared to be essential for the execution of oil firm’s investment plans. Import duties on certain goods can fall from 35% to 14%, or in some cases may be exempt.Decree 929/2013 – allowed new E&P projects with investments of over US\$ 1 billion to export at least 20% of their production free of duties and taxation, in addition to benefitting from higher prices in export markets.Resolution 1/2013 (Plan Gas) – established a new price level of US\$ 7.5 per million BTU for the incremental production of NG. Were companies not to reach the NG production objective established, they would have to pay the government according to the value of equivalent imports in order to fulfill the target, whose price would be equal to the difference between LNG’s import price and US\$ 7.5 per million BTU.Resolution 60/2013 (Plan Gas II) – reduced producers’ penalty payment risk and, in return, provided staggered incentives for the growth of production (price ceiling of US\$ 7.5 per million BTU).
Demand Reduction	<ul style="list-style-type: none">Decree 226/2014 – allowed price increases for residential consumers whose consumption of NG was more than 80% greater than during the previous year.
Nationalisation of YPF¹	<ul style="list-style-type: none">Law N° 26741 and Decree 1277/2012 – nationalised YPF alleging lack of investments by the company in the sector and created the Strategic Planning and Coordination Commission, henceforth responsible for taking all decisions in the hydrocarbon sector, including investments and prices.

Note: ¹Yacimientos Petrolíferos Fiscales. Source: Prepared by the authors based on legislation available at INFOLEG.

Results: Argentina



The New Hydrocarbon Law – Law N° 27007/2014

- In addition, the country established single regulatory framework to regulate both conventional and unconventional production:

Exploration Schedule	Conventional: 1st phase: up to 3 years; 2nd phase: up to 3 years; extension: up to 5 years;
	Unconventional: 1st phase: up to 4 years; 2nd phase: up to 4 years; extension: up to 5 years;
	Offshore: one more year in each phase of conventional exploration.
Concession (Development of Production)	Conventional: 25 years (extension of up to 10 years);
	Unconventional: 35 years (pilot plan: 5 years; extension: up to 10 years);
	Offshore: one more year in each phase of the development of conventional production.
Royalties	12% on production at the wellhead, which may be reduced to 5% after taking the productivity, conditions and location of wells into account. In the case of a deadline extension, they may be increased by up to 3%.
Production Incentives	Decree 929/2013 covers projects whose investments are not lower than US\$ 250 million during their first 3 years. It also adds different percentages for the export of volumes produced; 20% for conventional, 20% for unconventional and 60% for offshore projects.
Extension Bonus	Creates a 2% extension bonus, which is charged on the average price of the corresponding basin.
Social Responsibility	Obliges firms to contribute 2.5% of the initial investment to the Business Social Responsibility Fund

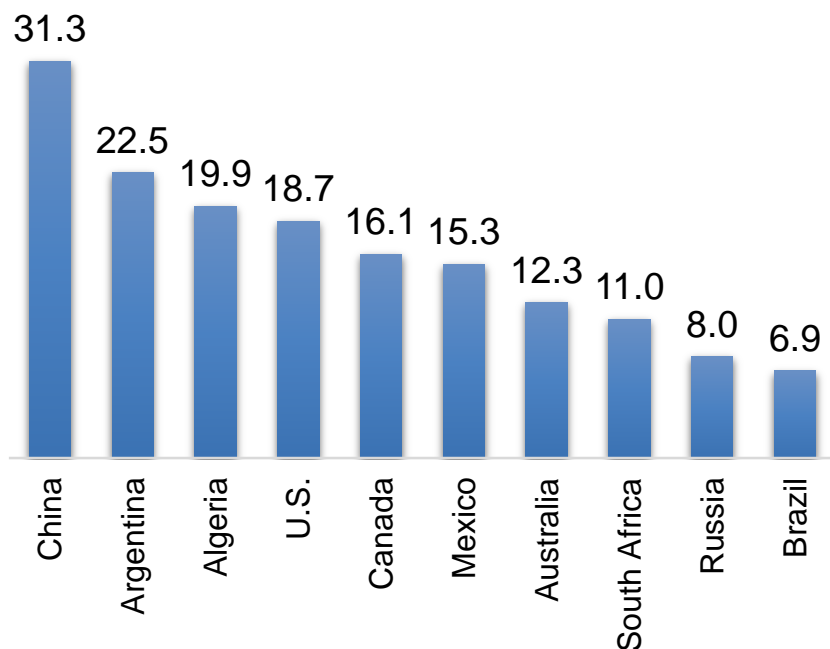
Results: Argentina



Unconventionals: a new frontier

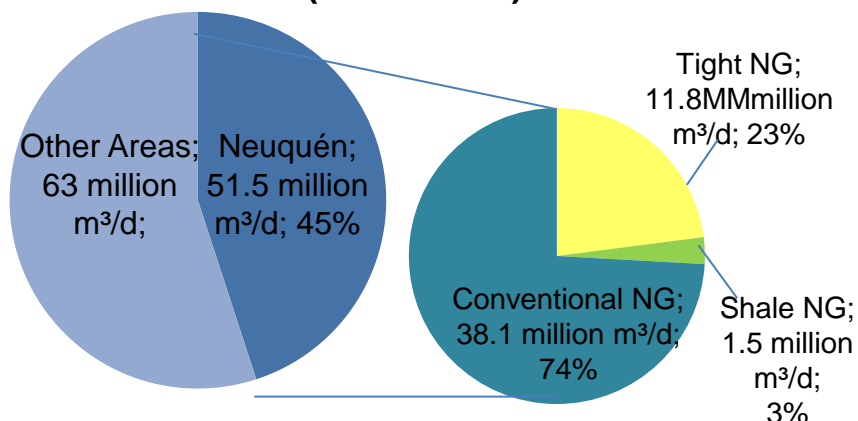
- According to the US Energy Intelligence Administration (EIA), Argentina has the second biggest shale potential in the world, after China.
- Vaca Muerta is the main shale formation in Argentina. Its great potential is due to its geological characteristics and geographical location.
- The formation is located mainly in the Neuquina Basin, in the southwest of Argentina, and extends to the provinces of Neuquén, La Pampa and Río Negro.

TOP 10 COUNTRIES ACCORDING TO SHALE NG POTENTIAL (TRILLION m³) (2013)



Source: EIA, 2013.

NG PRODUCTION (MILLION m³/d) (JUNE/2014)



Source: Agencia de Hidrocarburos.

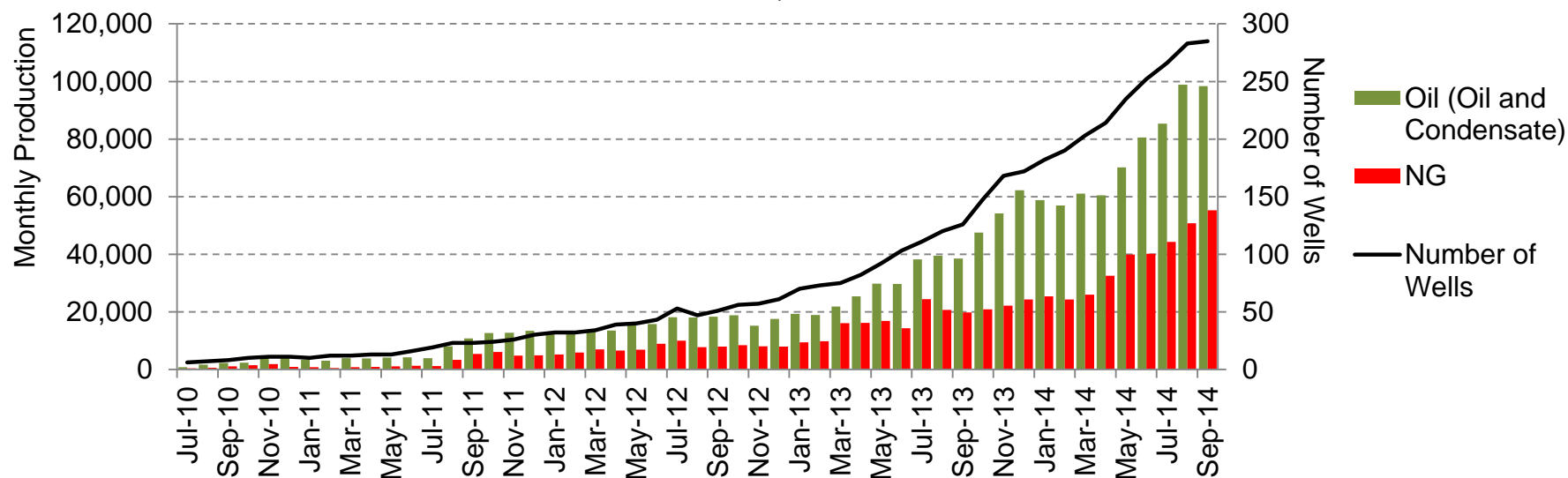
Results: Argentina



Unconventionals: a new frontier

- YPF has been making a great effort to develop shale NG and oil in the country through partnerships with big oil companies. They include majors (Exxon, Shell, Chevron, BP, Total), NOCs such as Petrobras and Petronas and various independents (Apache, Gran Tierra, EOG Resources (EOG), Pluspetrol, Wintershall and others). YPF is the main company operating in the region and has a concession of more than 12,000 square kilometres (km²).
- According to the EIA, Vaca Muerta has an enormous NG potential (8.7 trillion m³) and also has significant oil resources, estimated at 16.2 billion barrels. YPF estimates that 13 million m³/d of NG will be produced from shale formations in 2017. If it is successful in the medium and long term, the production of unconventionals will make a significant contribution to alleviating Argentina's NG supply-demand imbalance.

WELLS DRILLED AND PRODUCTION OF SHALE OIL AND NG IN THE VACA MUERTA FORMATION IN THE NEUQUEN BASIN



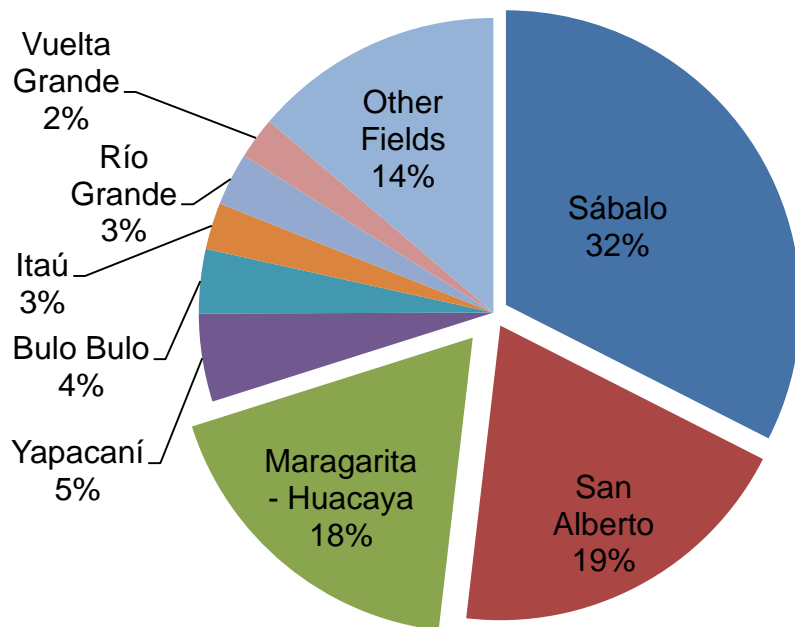
Source: Agencia de Hidrocarburos.

Results: Bolivia

The 1990s: Bolivia, the NG market integration hub

- Bolivia represents the main NG market integration hub in the Southern Cone. Its role in the region's NG market began to take shape in the 1990s, when significant NG reserves were discovered in the Sábalo (1990), San Alberto and Margarita (1998) megafields, which currently account for 70% of the country's production of NG.
- These discoveries were driven by two factors. Firstly, the contractual and fiscal framework created to attract foreign investments after the structural reforms implemented under the auspices of the neoliberal economic policy adopted by the country in 1985 (Supreme Decree 21060).

SHARE OF FIELDS IN THE PRODUCTION OF NG IN BOLIVIA (2013)

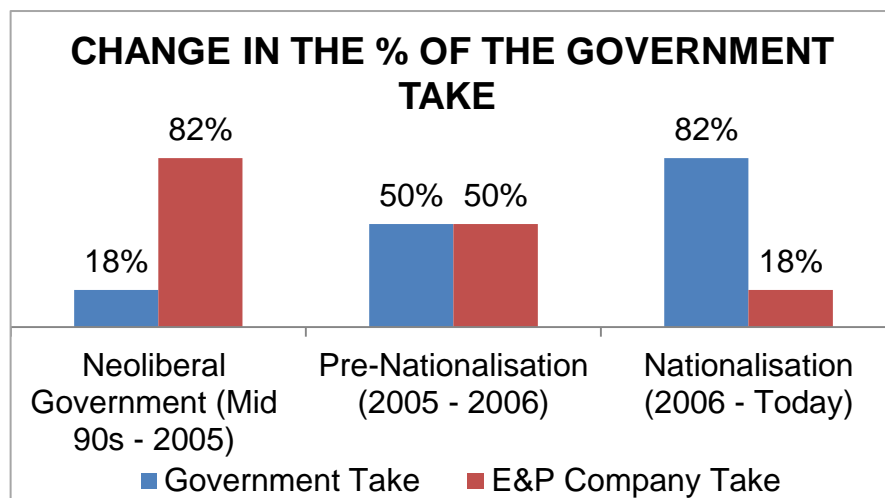


- Secondly, the Gas Supply Agreement (GSA) signed between Petrobras and YPFB in 1996 which created a viable large scale market. Valid until 2019, this contract currently represents ToP volumes of 24 million m³/d and a Maximum Contractual volume of 30 million m³/d. The inauguration of the GASBOL pipeline in 1999, in addition to the Yacimientos-Bolivian Gulf (YABOG) pipeline commissioned in 1972, consolidated Bolivia's infrastructure, enabling NG exports to markets in Brazil as well as Argentina.

Results: Bolivia

The 2000s: increase in state intervention and nationalisation

- Although the reforms, continued during the government of president Sánchez de Lozada (2002 to 2003), favored export driven growth, through hydrocarbons and other products, the tight monetary and fiscal policies, unemployment and low income sparked social and political unrest. Thus, in 2003, the country was engulfed in what came to be known as the “Gas War”, a popular revolt. The escalation of social revolt led to the president’s resignation.
- Vice-President Carlos Mesa assumed the government and, in 2004, instituted a popular referendum which, amongst other issues, approved the creation of a new Hydrocarbon Sector Law (Law 3058/2005). After heated debates in the legislature, the law was promulgated, changing the legal framework towards increased state control and government take, raising taxes on oil and NG from 18% to 50%. This new law initiated the process which led to the nationalisation of oil and NG in the country.
- Evo Morales won the December 2005 elections in the first round and assumed the presidency in 2006, focusing his government’s efforts on land reform and the nationalisation of key sectors of the economy, including hydrocarbons.
- The government issued Supreme Decree 28701 for this sector on May 1st, 2006, shifting from concession based contracts to service contracts (under operator’s risk), transferring all property rights of hydrocarbon production to YPFB, which also took over the commercialisation in the domestic and external markets. The Decree also raised the government’s take from 50% to 82%.

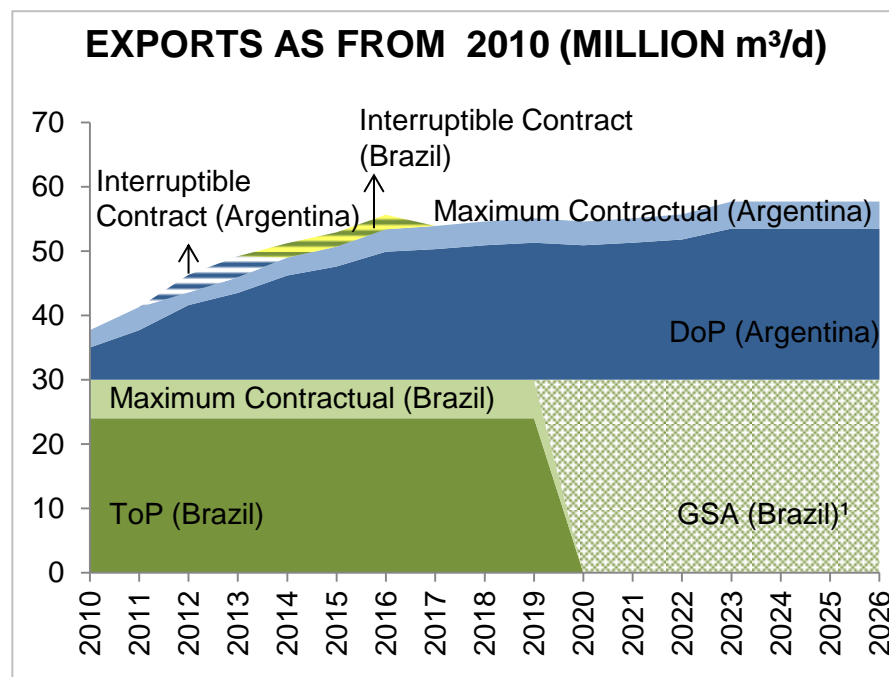


Source: Prepared by the authors.

Results: Bolivia

Growing NG export commitments

- During Morales administration, under government sponsorship, YPFB has sought to sign new agreements with oil firms from neighbouring countries seeking gas markets and technical and financial cooperation.
- In 2006 a contract was signed between YPFB and Argentinian ENARSA to export Bolivian NG to Argentina on an interruptible basis.
- This contract was altered in 2010 by Addendum 1 which this time established delivery (DoP) and receipt (ToP) commitments and a new ramp-up of consumption: 7.7 million m³/d at the beginning of the contract, gradually increasing over 10 years to 27.7 million m³/d, sustained until the end of the agreement in 2026.
- Thus, as from 2010, Bolivia had two firm NG export commitments, with Brazil and Argentina.
- A new interruptible contract was signed between ENARSA and YPFB in 2012, to export NG to Argentina with maximum volumes of 2.7 million m³/d in 2012 and 3.3 million m³/d in 2013 with volumes to be reviewed between the parties until 2026.
- In February 2014, Petrobras and YPFB signed an interruptible NG sale agreement to supply up to 2.24 million m³/d of NG destined to the Cuiabá (Brazil) thermal plant. The contract had an initial duration of 1 month but was extended for 2 years.

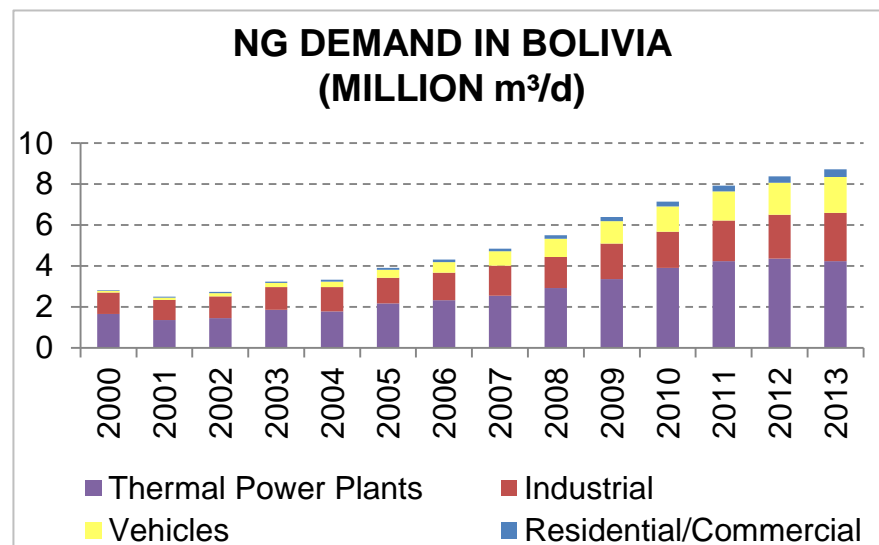


Note: ¹After 2020, according to PE 2030, published by Petrobras.
Source: Prepared by the authors based on contracts entered into by YPFB.

Results: Bolivia

Prioritisation of the domestic market

- Given growing export demand, the government enacted Ministerial Resolution (MR) 255/2006 in December 2006, which established the “field-market” commitment. According to this commitment each field would have to supply a market predefined by YPFB. Marginal and small fields would have to destine 0.5% of their previous year’s annual production to the Bolivian market. Meanwhile, the amount supplied to the domestic market by the large fields would be proportional to the share of these field’s production in the country’s total production during the previous year. In Article 5, MR 255/2006 also stipulated the order of priority governing supply of NG:
 - 1° - Bolivian market;
 - 2° - Brazilian export market;
 - 3° - Argentinian export market.
- This MR was changed by MR 88/2010, which considered only 2 levels of supply priority: 1° Bolivian market; 2° Export markets, according to the chronological order of the signing of NG purchase and sale contracts with YPFB.
- The domestic NG market in Bolivia has been expanding at a fast pace (nearly 10% a year) and in 2013 accounted for 15% of the country’s total NG demand. The main component of demand is the thermal power market (43% of the total).
- In addition with the NG Industrialisation program, which began in November 2009, the government intends to develop three projects; a petrochemical plant, a polyethylene plant and a fertiliser plant, forecast for 2016.

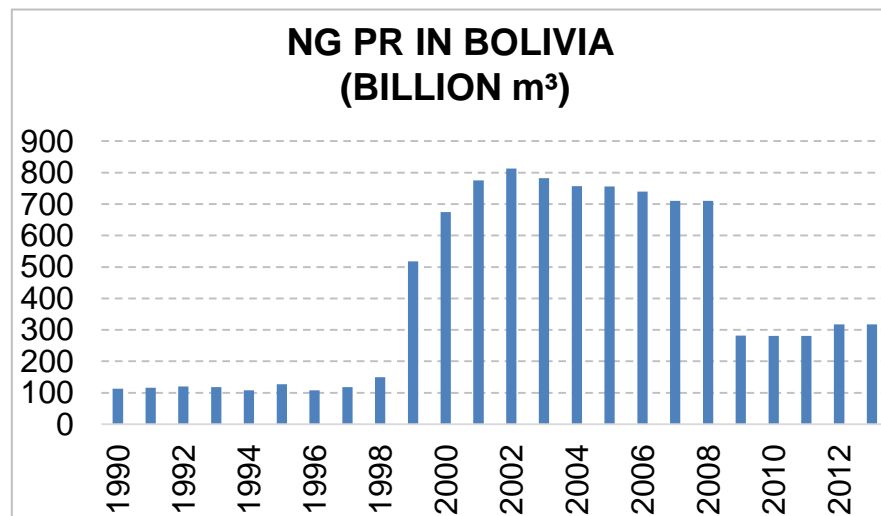


Source: Boletín Energético Nacional (BEN), 2013.

Results: Bolivia

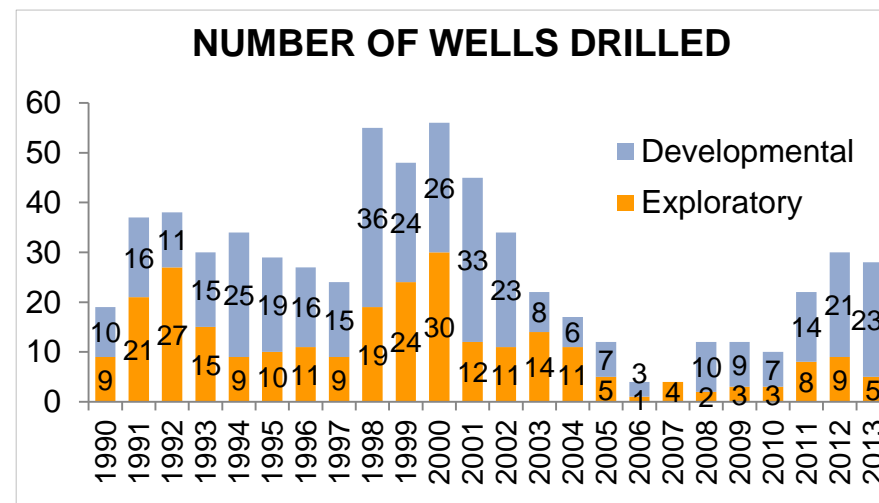
Exploration activity in decline

- To serve the domestic market and export markets, the supply of NG in Bolivia would have to keep pace with the increase in the demand for this fuel, by fostering E&P activities in new areas.
- However, since the nationalisation of hydrocarbons, the exploration effort in Bolivia has been subdued, leading to a decline in discoveries of NG in the country.



Note: The steep decline in Bolivia's PR between 2008 and 2009 is due to a review of the previous methodology. Certification of hydrocarbon reserves: from 1997 to 2005: performed by D'Goldyer & Mac Naughton. For 2009: undertaken by Ryder Scott Company Petroleum Consultants. For 2013: undertaken by GLJ Petroleum Consultants.

Source: BP Statistical Review of World Energy, 2014.



Source: Cámara Boliviana de Hidrocarburos y Energía (CBHE).

- Due to the current contractual and fiscal terms, exploration activities in Bolivia have been limited during recent years, a fact that could put all the commitments signed with Brazil and Argentina at risk.
- Although future production from developing megafields such as Margarita (operated by Repsol) and Incahuasi (operated by Total) constitute an important contribution to NG supply, the Bolivian government has recognized the need to bolster long term investments in exploration in recent years and is seeking solutions to address this problem.

Results: Bolivia

Auction of exploration areas and a new contractual model

- In December 2012, in order to increase exploration activities in the country, YPFB put 15 exploration areas out for tender. The areas tendered and the winning firms are listed below:

Oil Service Contracts ¹	Area: Huacareta -> BG Bolivia
	Area: Cedro -> Petrobras Bolivia
	(Areas: Madre de Díos, La Guardia, Alegría -> No offer)
Study Agreement ²	Areas: Cobija, Nueva Esperanza, Manuripi, Corregidores -> BG Bolivia
	Areas: Pelicano, Carandaiti, Corregidores, Cobija -> Petrobras Bolivia
	Areas: Carandaiti, Nueva Esperanza -> YPFB Andina

Notes: ¹E&P contracts with exploration commitments tied to them.

²E&P contracts with no exploration commitments tied to them (only assessment of potential during a period defined by the government).

Art. 5 MR 262/2011 allows YPFB to subscribe more than one Study Agreement for the same area.

Source: YPFB.

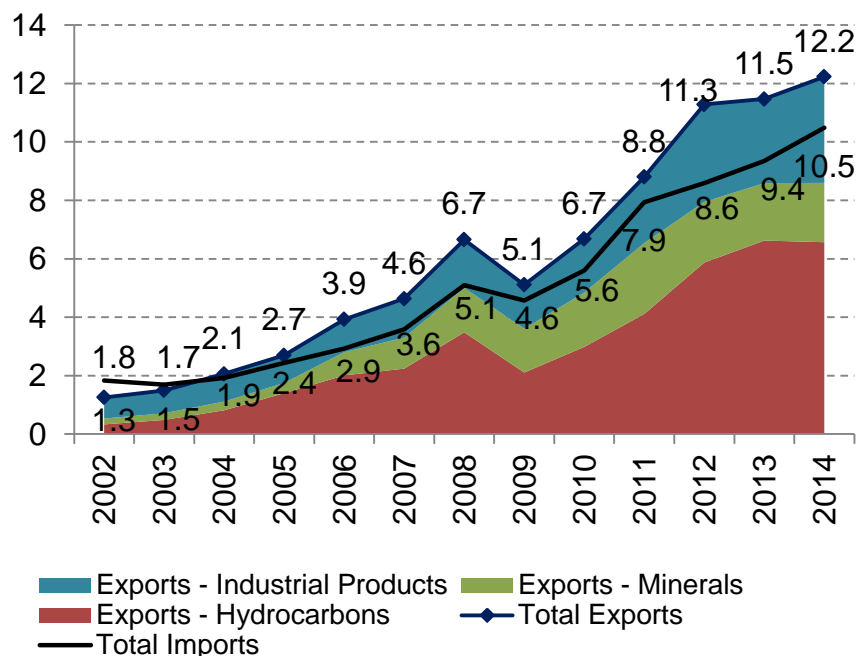
- A particularity of the 2012 bid is that the Oil Service Contract model proposed commits firms that are successful during the exploration phase to form a Mixed Economy Company with YPFB.
- In addition, after the promulgation of Supreme Decree N° 459/2010, some companies were authorised to enter into Study Agreements in areas reserved for YPFB. These firms include various South American NOCs and subsidiaries of YPFB itself: YPFB Andina, YPFB Chaco, Petrobras, YPF, PDVSA.
- In recent years, the Study Agreements have constituted the first step for firms interested in undertaking exploration activities in Bolivia, due to the possibility of accessing information from the National Hydrocarbon Information Center (CNIH), with low levels of investment during this phase.
- When they have completed the studies, firms have the option of signing Oil Service Contracts to begin exploration activities in the country.

Results: Bolivia

Trade balance dependent on hydrocarbon exports

- The country's economy is strongly dependent on hydrocarbon exports. In 2014, they contributed 6.6 billion US\$ to Bolivia's trade balance, with NG accounting for 5.9 billion US\$ (46% of the country's total exports).
- Thus, a reduction in NG E&P investments could have a significant impact on the country's trade balance.
- Similarly, and given that export contracts to Brazil and Argentina are tied to a basket of international gasoil prices, the decline in international oil prices is already severely affecting the country's export revenues.

**BOLIVIAN BALANCE OF TRADE (2002-2014)
(BILLION US\$)**



Note: Projections for 2013 and 2014.

Source: Instituto Nacional de Estadística (INE).

Item	January 2014	January 2015	Change Y-o-Y ¹ (%)
NG Exports (Million US\$)	541.5	380.7	-30%
WTI ² Spot Price FOB ³ (US\$/b ⁴)	94.6	47.2	-50%
Brent ⁵ Spot Price FOB (US\$/b)	108.1	47.8	-56%

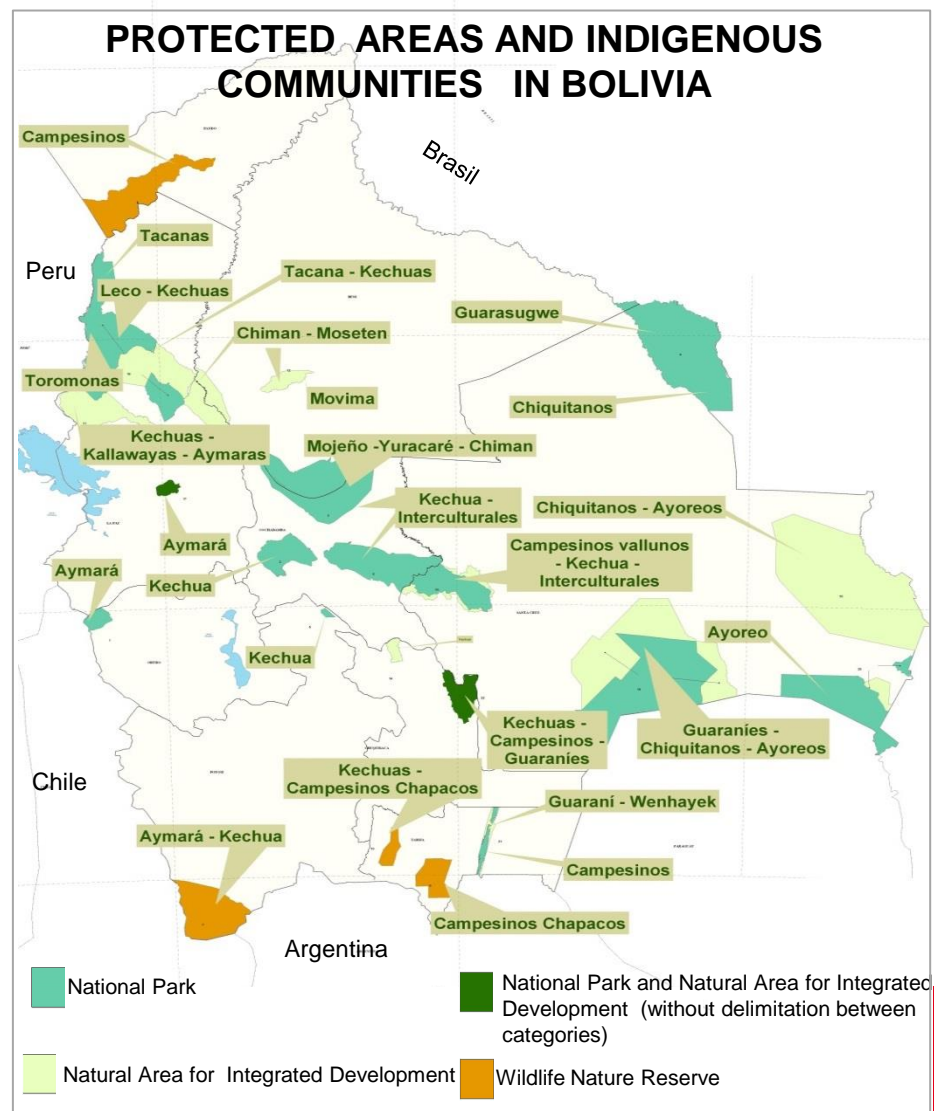
Notes: ¹Year-over-Year. ²Western Texas Intermediate. ³Free on Board. ⁴Barrels. ⁵British petroleum price reference.

Sources: INE and EIA.

Results: Bolivia

Respect for culture and the environment

- Hydrocarbon E&P activities must comply with environmental legislation.
- According to Article 385 of the Political Constitution of the State, protected areas constitute a common good and are part of Bolivia's cultural heritage. Thus, in the case of hydrocarbon projects that encroach on protected areas and/or Native Community Lands, a public hearing must be held prior to obtaining an environmental permit. Decree 2195 was issued in November 2014, establishing compensation for indigenous and peasant peoples and communities affected by the socio-environmental impact of economic activities. This legislation may hamper the development of new exploration activities and thus the discovery of new reserves.
- In order to increase the production of NG and condensates in the country, the government has been considering the possibility of flexibilising current environmental legislation and adopting a package of incentives for producers. These measures are expected to be announced in 2015.



Source: Servicio Nacional de Áreas Protegidas (SERNAP).

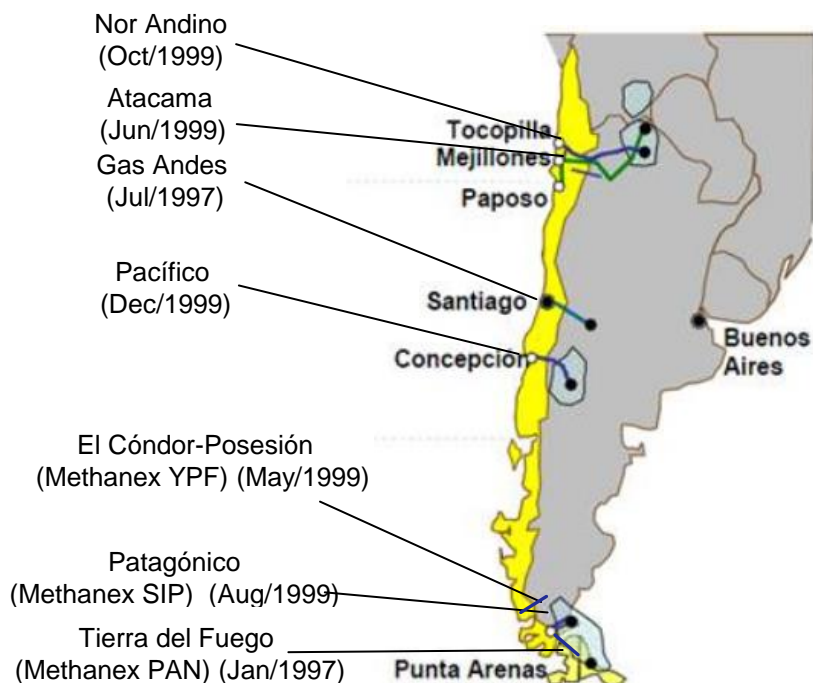
Results: Chile



Integration by pipeline to LNG

- Chile has limited fossil energy resources and during the 1990s, after signing an interchange protocol with Argentina, decided to embark on a daring undertaking: the construction of various pipelines connecting the country to its neighbour's important (and up to then abundant) NG reserves.
- However, in the mid-2000s, the flow of NG from Argentina was gradually interrupted. Thus, it had no alternative but to bet strongly on LNG imports and alternative energies in order to meet domestic demand.

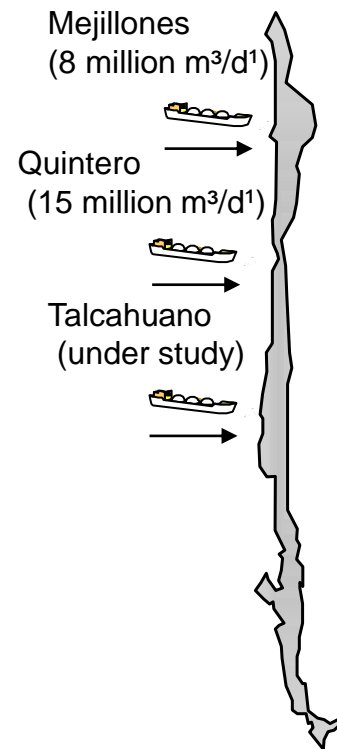
ARGENTINA-CHILE EXPORT NG PIPELINES



Source: ENARGAS.

REGAS PLANTS

- With 2 regas plants inaugurated in 2009 and 2010 and under expansion (Quintero and Mejillones), Chile is also considering the possibility of a 3rd terminal in the environmentally sensitive Biobío region. The country also has a virtual system for LNG transport: a fleet of 25 tankers connecting the Quintero terminal to the Pemuco (Biobío) processing plant.



Note: ¹After expansion.

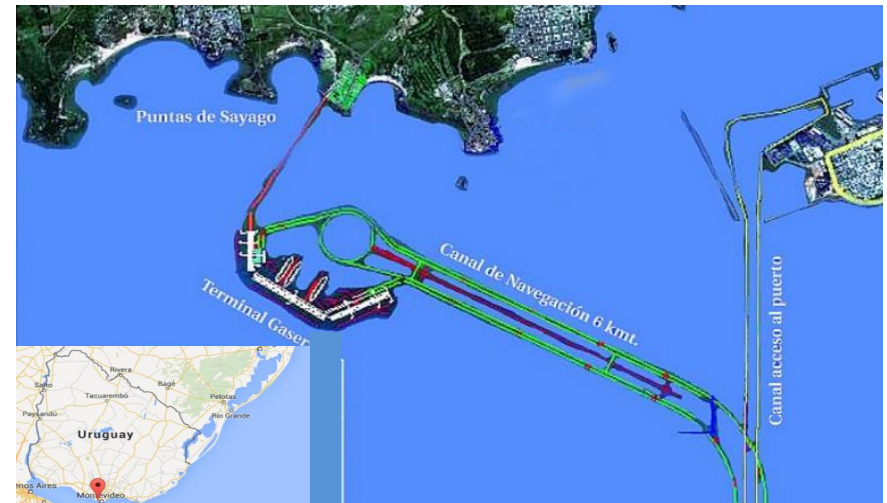


Results: Uruguay

LNG as a new paradigm

- NG became part of the Uruguayan energy mix as from Oct./1998, when the Litoral integration pipeline (Entre Ríos-Paysandú) was inaugurated, connecting Argentina to the country. Similarly to Chile, Uruguay also suffered from cuts in supplies from its neighbour as from 2004. In order to discover domestic energy resources, the country launched two offshore E&P rounds (2009 and 2011), with no concrete results to date, and has recently announced a third.
- Uruguay has also decided to seek a solution via LNG. Considered a possibility since 2007 as part of a plan to diversify its energy sources, the construction of an LNG regas plant was initially conceived as a joint Uruguayan and Argentinian project (Feb./2011).
- However, given Argentina's slowness in embracing the project, Uruguay decided, in March 2012, to go ahead on its own. It chose a floating plant. The new Puntas de Sayago (east of Montevideo) regas plant is being sponsored by the Uruguayan government and built by a joint venture formed by GDF Suez and Marubeni.

PUNTAS DE SAYAGO REGAS PLANT



- Delays in the construction of the plant will not be a problem as a Floating Storage Regas Unit (FSRU) has been provisionally hired to supply between 10 and 15 million m³/d as from June 2015 (data forecast for the inauguration of the regasifier).
- Although it is an Uruguayan project, the terminal could also serve Argentina. This demand would be met by exporting surpluses of NG imported by Uruguay via a NG pipeline.

Summary/Conclusions



Brasil

- Dependence on imports of Bolivian NG and LNG in the short and medium term;
- Electricity demand increasingly dependent on NG-fired generation;
- Great potential in pre-salt reservoirs. Its monetisation will depend on: the volume of NG that will be reinjected; the NG/oil ratio; CO₂ content; and the availability of infrastructure to transport the NG from the fields to the continent.
- Incipient exploration of unconventional NG reservoirs; however there are geological logistics, labor, regulatory and environmental challenges to be overcome and/or met.



Argentina

- Largest NG market in the Southern Cone and increasingly dependent on imports;
- Declining conventional production and growing demand generate imbalances between NG supply and demand;
- The Argentinian government's regulatory efforts have not been sufficient to restore the supply-demand balance;
- Huge unconventional oil and NG potential; however there are geological, logistics, labor, regulatory and environmental challenges to be overcome and/or met.



Bolivia

- Hub of NG integration in the Southern Cone, net exporter of NG;
- Exploration efforts have been discouraged since the nationalisation of hydrocarbons and this may affect the export commitments assumed;
- Bolivian economy strongly dependent on hydrocarbon exports;
- Empowerment of native communities may have a negative impact on hydrocarbon E&P activities.

Summary/Conclusions



Chile

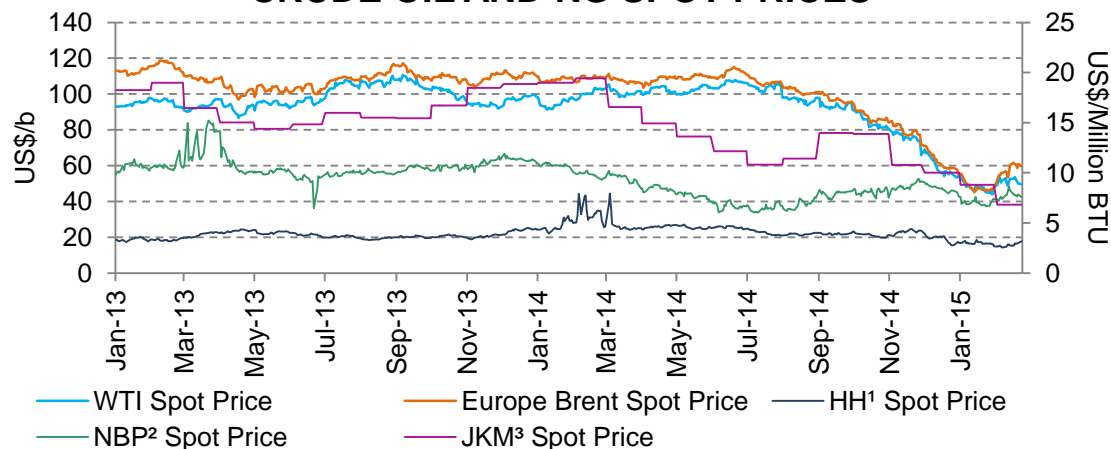
- Net energy importer;
- Environmental issues may delay new LNG plant projects, hydroelectric plants and even E&P of unconventional in Chile's extreme south, increasing its dependence on LNG;
- New expansions of existing regas plants and extension of virtual pipelines to the north/south of the country will constitute the most probable solutions in the short and medium term.



Uruguay

- Net energy importer;
- Regas plant will develop demand in the country and enable it to export NG to Argentina;
- An incipient NG market, the country may soon become another integration hub in the Southern Cone (through LNG).

CRUDE OIL AND NG SPOT PRICES



FINAL REMARK

- The decline in the price of oil since the 3rd quarter of 2014 may compromise/affect pre-salt, Bolivian and unconventional projects in Argentina and Brazil, and even in Chile (Magallanes), making the region even more dependent on LNG and vulnerable to fluctuations in its price - at least during the next 2 years.