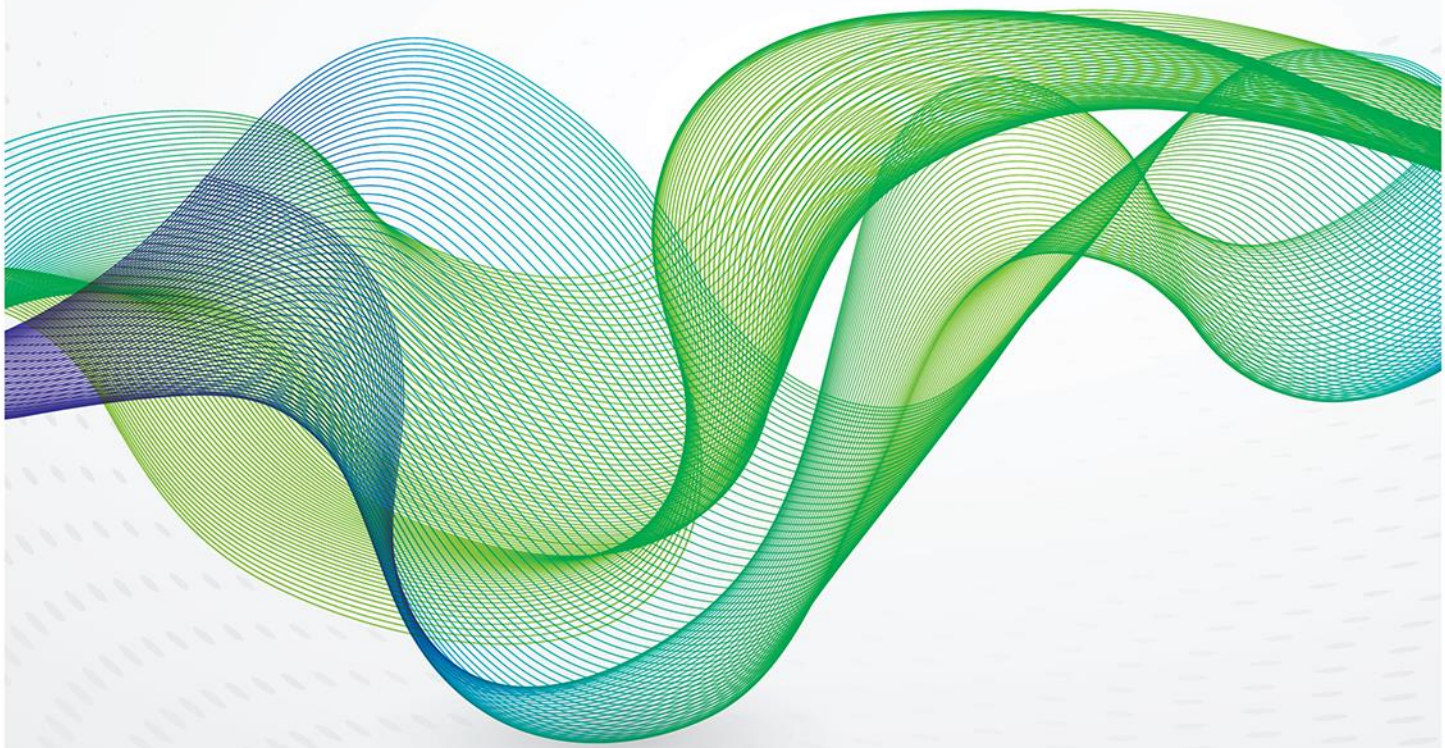
THE OXFORD INSTITUTE FOR ENERGY STUDIES

April 2017

The vanishing LNG Market in Brazil



Oxford Energy Comment

Ieda Gomes

Introduction

Brazil started importing LNG in 2009 as an insurance against a repeat of a power shortage similar to the one which crippled the economy in 2001, and which had such strong repercussions for the 2002 presidential election. The Brazilian power sector is heavily dependent on hydroelectric plants, whose availability is not only impacted by climatic phenomena but also by the government's decision to restrict the construction of plants with large reservoirs, favouring instead plants fed by rivers. In the period 2011-2015, imports of LNG increased dramatically as the Brazilian economy was still growing and a prolonged drought resulted in the virtual depletion of regional hydro reservoirs.

Petrobras is currently the sole importer of LNG and owns three FSRU terminals in the states of Rio de Janeiro, Bahia and Ceara. Other private projects have been announced, all based on a gas/power configuration, but only the Golar Power-led CELSE 170,000 m3 FSRU terminal and 1516 MW power plant is getting off the ground. This project will be built in the north eastern state of Sergipe with completion planned for 2020.

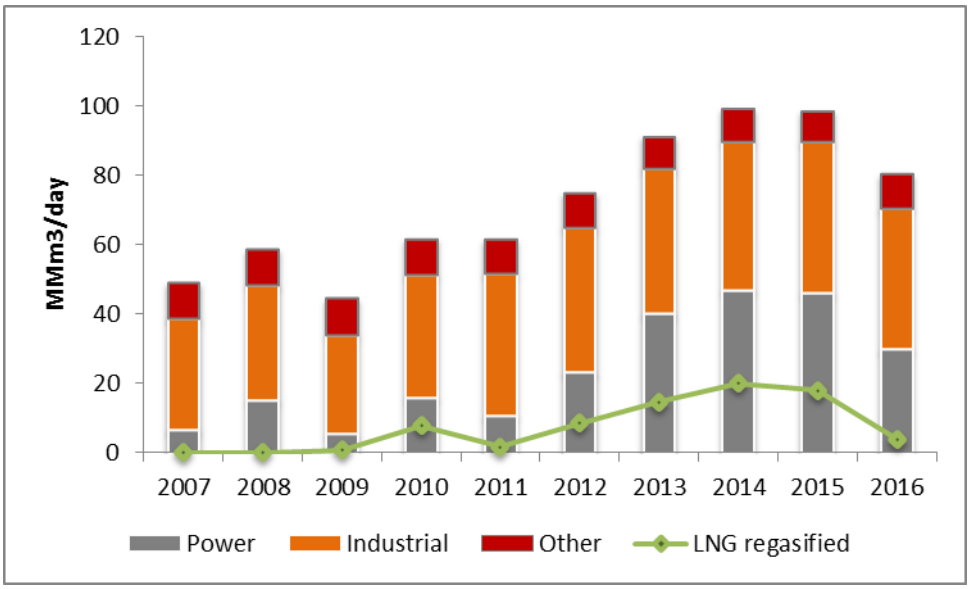
In 2015 Petrobras imported record volumes of 5.7 mtpa (7.56 Bcma) and spent $2.75 billion FOB on LNG imports. Over the last 4-5 years, Brazil and Argentina (which imported 4.7 mtpa in the same year) have become rising stars in the LNG importing club. Some of the LNG imported by Petrobras was re-routed to Argentina and other international markets, as the company started building its international trading business. The record year for LNG regasification in Brazil was 2014 with an average of 19.93 MM m^3/day processed in the three terminals. During the 2014 presidential election campaign, the incumbent president wanted to ensure that the lights would not go out, so the government directed Petrobras to run its gas-fired power plants virtually on base load, which required large volumes of LNG to complement domestic and Bolivian gas supplies.

The tide changes: the impact of the economic crisis on gas demand

In 2014 natural gas consumption stood at a record 99.3 MMm^3/day (36.2 Bcma), with the industrial and power segments consuming 42.9 MMm^3/day (15.7 Bcma) and 46.8 MMm^3/day (17.1 Bcma) respectively. Consumption then fell slightly in 2015 to 98.63 MMm^3/day. For the first time in history, consumption in the power sector surpassed industrial demand. But the tide started to change when the economy contracted by 3.8 per cent in 2015, following a drop in prices for Brazilian commodities such as oil, iron ore and soya; this was accompanied by a corruption scandal that undermined investors' confidence and slowed down investment by Petrobras. The economic crisis in Brazil adversely impacted the larger gas consuming sectors of the economy, namely the industry and power segments.

Industrial economic output has declined steadily over the last three years: minus 3 per cent in 2014, minus 8.3 per cent in 2015 and minus 6.6 per cent in 2016. The whole economy, in particular the residential sector, was negatively impacted by a significant increase in electricity prices in 2015. (This came about because the government had kept prices artificially low during the presidential campaign of 2014 in order to contain inflation.) As a consequence of the weaker economy and higher prices, the consumption of electricity in Brazil fell by 2.1 per cent in 2015 and a further 0.9 per cent in 2016. Industrial consumption of electricity contracted by 5.3 per cent in 2015 and a further 2.9 per cent in 2016. The real impact on the natural gas sector was felt at the end of the first quarter of 2016, when consumption dropped to 80.3 MMm^3/day (29.3 Bcma) with industry and power consumption at 40.8 MMm^3/day (14.9 Bcma) and 29.6 MMm^3/day (10.8 Bcma) respectively. The strong decline in power sector consumption was the result of a combination of lower electricity demand, an increase of 8.8 GW in wind, biomass and hydro power capacity in 2016, and higher storage levels in most hydro regional reservoirs.

Figure 1: Brazil – Gas demand and LNG regasified volumes



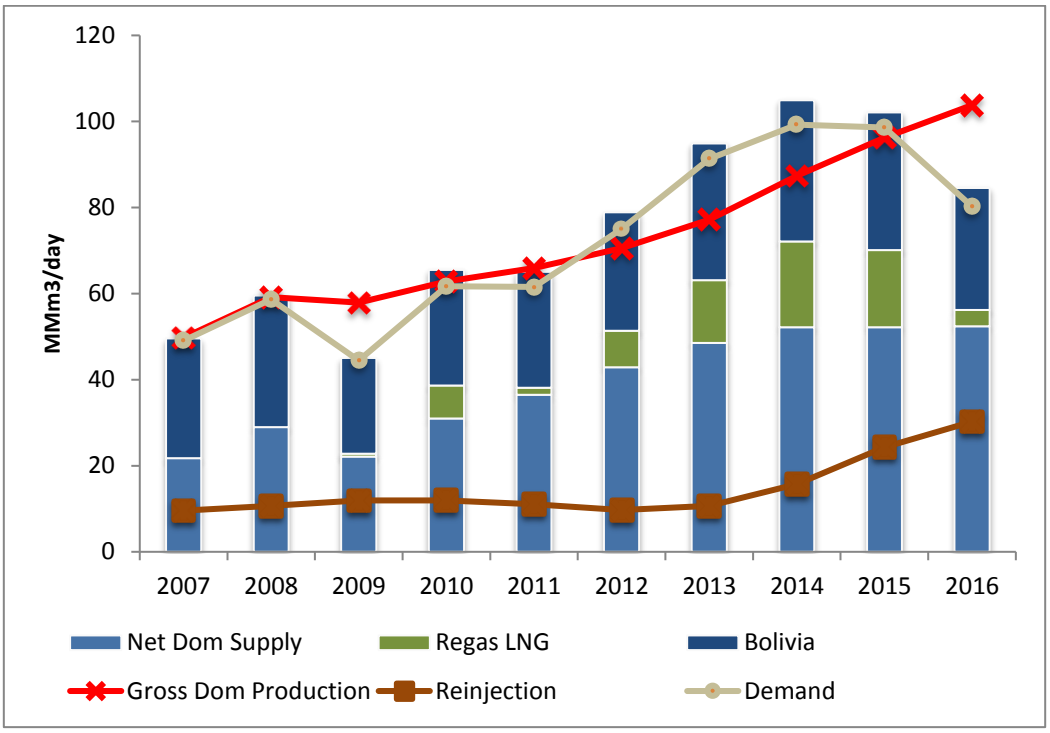
Source: Brazil's Ministry of Mines and Energy

Up until 2015 the net supply of gas in Brazil was roughly split between 50 per cent domestic and 50 per cent imported gas. For example, in 2015 net gas supplies stood at 102.58 MMm^3/day (37.5 Bcma) with Bolivia supplying 32.03 MMm^3/day (11.7 Bcma) and regasified LNG at 17.94 MMm^3/day (6.5 Bcma), the balance made up by domestic gas at 52.15 MMm^3/day[1] (19.2 Bcma). By 2016 net gas supplies had fallen to 84.54 MMm^3/day (30.9 Bcma), due to lower demand. Supplies were made up of 28.03 MMm^3/day from Bolivia (10.2 Bcma), 52.4 MMm^3/day (19.1 Bcma) of domestic gas and only 3.81 MMm^3/day (1.4 Bcma) of LNG.

Over the last three years gross domestic gas production has been ramping up steadily as a result of the growing contribution of associated gas from the offshore pre-salt gas provinces. For example, in December 2016 gross gas production in Brazil reached a record 111.77 MMm^3/day. A large quantity of the domestic production has been reinjected due to the lack of offshore pipeline infrastructure allowing gas to reach markets. In 2016 the amount of gas reinjected averaged 30.24 MM m^3/day, which is nearly equivalent to the volume imported from Bolivia. Over the last few months Petrobras has been able to pump additional volumes of domestic gas to the market via two offshore pipelines located in Rio de Janeiro and Sao Paulo, with a third in construction and slated for start-up in 2018. Figure 2 below illustrates the balance of demand and supply and the evolution of the participation of domestic and imported supplies in the gas mix.

[1] Net gas supply equals gross domestic production minus reinjection, flared, E&P operations. Net gas supply includes circa 4.28 MMm^3/day used in gas pipeline operations.

Figure 2: Brazil - Natural gas production, reinjection and importation



Source: Brazil's Ministry of Mines and Energy

Faced with a situation of lower domestic demand, increased domestic production and the need to curb foreign currency expenditure, Petrobras moved swiftly to rebalance its supply configuration. LNG imports were the first to suffer. Petrobras moved its larger Excelerate FSRU from the Guanabara LNG terminal (TEGUA) to the northeast terminal of Pecem in Ceara, which had a smaller FSRU chartered with Golar ('Golar Spirit'). TEGUA stopped regasifying LNG in May 2016 and the terminal in Bahia stopped regasifying in October 2016. The Pecem terminal is still operating at approximately 10 per cent of the Excelerate FSRU capacity[2] (25 per cent of its original capacity). The volume of LNG being regasified fell to its lowest point in 4Q 2016, when it registered an average of 1.46 MMm^3/day. In December 2016 Petrobras announced that it was invoking an early termination clause in its charter contract with the 'Golar Spirit'. The contract was due to expire in August 2018 but Petrobras decided to terminate it by June 2017. In addition Petrobras may be forced to demobilise the Pecem terminal because the State of Ceara authorities intend to utilise the area currently being used by the terminal for other purposes[3]. If this happens, the in-country regasification capacity may drop to 14-20 MMm3/day, depending on which of the remaining FSRUs stays in place.

Unintended consequences for Bolivia and Argentina

In addition to reducing LNG imports, Petrobras has also exercised the downward flexibility in its contract with Bolivia that allows for 80 per cent monthly flexibility over an annual average (Take or Pay of 80 per cent).

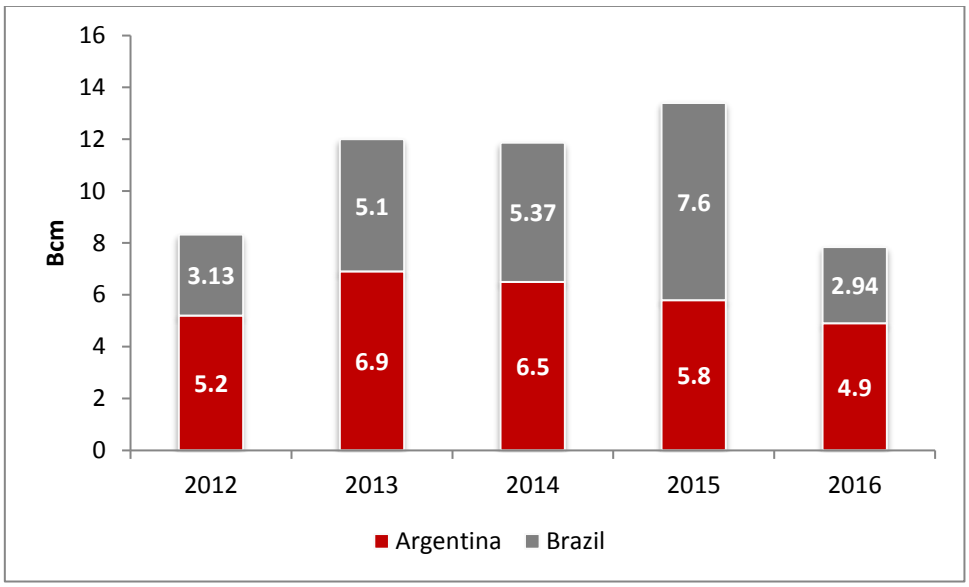
In February 2017 Petrobras announced that it was halving its offtake from Bolivia from 30 MMm^3/day to 14.5 MMm^3/day, alleging lower industrial and power demand and higher domestic production. This prompted Bolivia's YPFB to accelerate the search for alternative markets in Brazil and Argentina.

[2] FSRU contracted capacity is 20 MMm^3/day
[3] http://br.reuters.com/article/businessNews/idBRKCN11T2H6

According to YPFB's CEO[4] they are currently in talks with Argentina's state company ENARSA and Sao Paulo's gas distribution company (Comgas) to sell 8 MM^3/day. Although Petrobras reportedly increased its offtake from Bolivia to around 22 MMm^3/day in early March, it is not expected that they will take the full contractual volumes over the next few months.

Petrobras' decision may also impact imports of LNG to Argentina because if more Bolivian gas is made available to Argentina it may consequently import less LNG. The demand for gas in Argentina has been declining due to the increase in tariffs implemented by President Macri and sluggish economic performance more generally. In 2016 Argentina's ENARSA imported 4.9 Bcm of LNG, compared to 5.8 Bcm in 2015. In 2016 ENARSA also cancelled and postponed some cargoes due to milder than expected winter temperatures.

Figure 3: Brazil and Argentina - LNG imports (2012-2016)



Source: ENARSA, BP Statistical Review and Brazil's Ministry of Mines and Energy

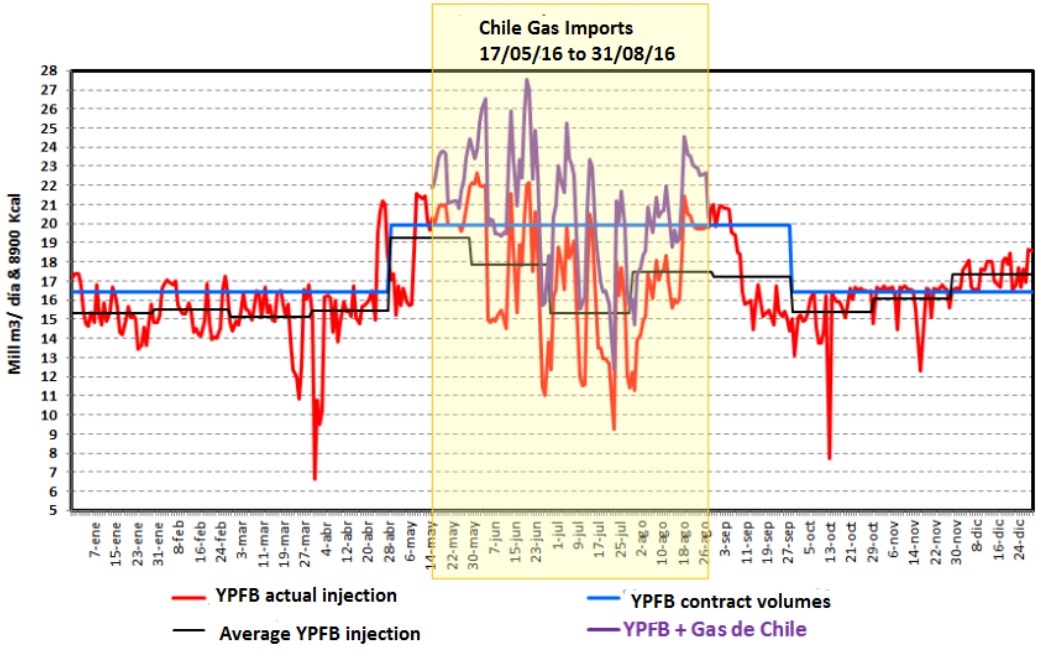
Lower LNG prices resulted in considerable savings for Argentina, but Bolivian gas is still cheaper than LNG. YPFB's projections for 1Q 2017 indicate prices for Brazil of $3.37-3.84 /MMBTU (entry at the Rio Grande pipeline) and $4.34/MMBTU at the Argentina border. ENARSA's LNG tender for cargoes to be delivered in 2017 shows an average DES price of $5.74-6.0/MMBtu.

Argentina and Bolivia's gas contracts allow for deliveries of 20 MMm^3/day from May to September and 16 MMm^3/day from October to April. Due to Brazil taking its full 30 MMm^3/day contractual volumes from 2013 to 3Q 2016, Argentina was not able to take its winter contractual volumes from Bolivia, as the latter also faced a host of production delivery issues. In 2016, in addition to direct imports of LNG, Argentina had to resort to importing LNG from Chile, transported via pipeline, to meet winter demand because the Escobar and Bahia Blanca terminals were fully booked during this period.

Figure 4 shows that Bolivia's gas exports to Argentina were consistently below contract volumes, except in December 2016 when Brazil had already reduced imports from Bolivia to 18 MMm^3/day.

[4] http://www.eldiario.net/noticias/2017/2017_03/nt170308/economia.php?n=12

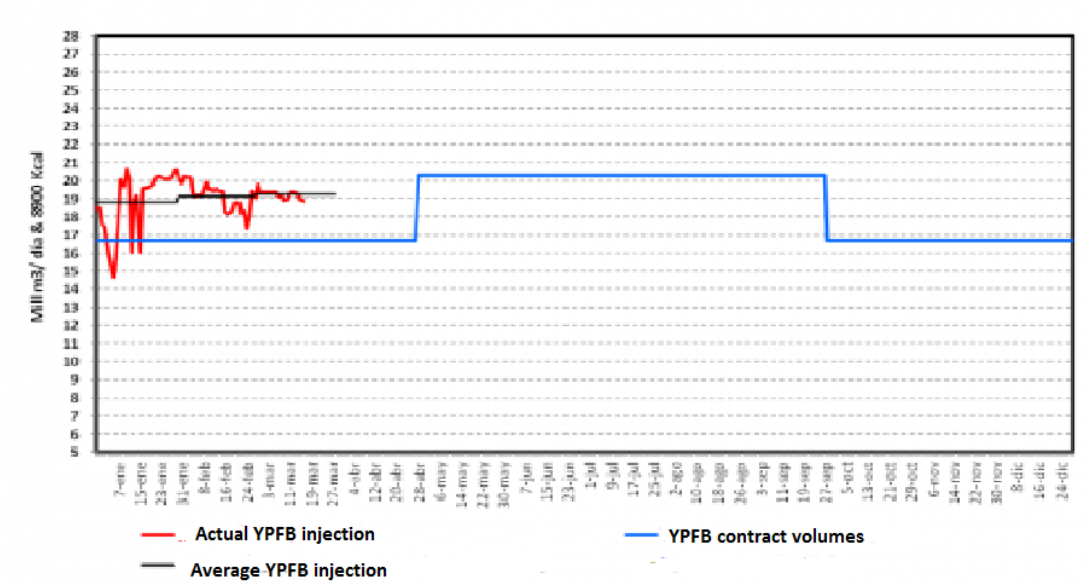
Figure 4: Bolivia and Chilean gas exports to Argentina in 2016 (MMm3/day)



Source: Argentina Ministry of Energy and Mines

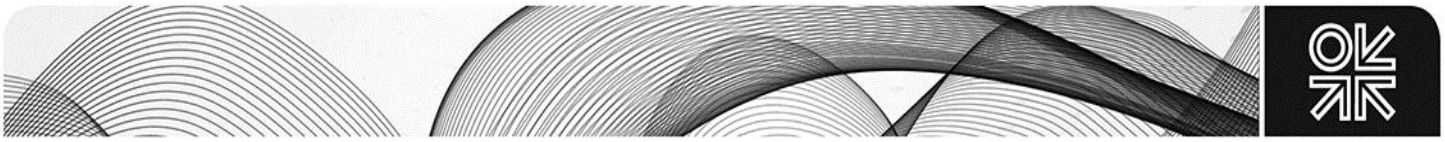
In early 2017 Bolivia was able to export additional volumes of up 3 MMm^3/day to Argentina (Figure 5) as Brazilian exports dwindled. They may well continue exporting such additional volumes in winter. If this turns out to be the case, Bolivia's additional export volumes to Argentina may reach 1.1 Bcma, equivalent to around 0.84 mtpa of LNG. This may cause Argentina to revise its plans to import LNG and gas from Chile.

Figure 5: Bolivian gas exports to Argentina in 2017 (MMm3/day)



Source: Argentina Ministry of Energy and Mines

If Brazil permanently reduces its offtake to 22-24 MMm^3/day (8-8.8 Bcma), Bolivia will have a surplus of 6-8 MMm^3/day until the expiry dates of the contracts with Brazil (2019-2020). Argentina could currently take up to 22 MMm^3/day due to transportation capacity restrictions in the north. This could



be increased to 24 MMm^3/day if Argentina completes additional work to its trunk pipeline system in the north of the country.

In a situation of surplus LNG supplies and relatively weak LNG/gas prices, the loss of the Brazilian market and the potential decrease in Argentina's imports may be a significant blow for Atlantic Basin suppliers. The Brazilian economy is not expected to recover any time soon, with a meagre GDP growth of 0.5 per cent predicted for 2017. Power generation capacity grew by 6 per cent in 2016, mostly as a result of wind and small hydro sources and the government is forecasting another 9.9 GW (hydro and wind) to be added during 2017. Lower demand and relatively good hydro conditions have improved the level of the reservoirs in the southeast and south, which stood at 40.2 per cent and 51.6 per cent of capacity in February 2017. This will contribute to a further reduction in demand for thermal power generation in these important industrial regions.

The reduction in Brazil's imports may have unintended consequences for Bolivia's economy which is heavily dependent on natural gas exports to Brazil and Argentina. In 2016 natural gas exports accounted for nearly 30 per cent of Bolivia's exports[5]. Because exported gas prices are indexed to a basket of fuel oils, Bolivia's gas export revenues were heavily impacted by the drop in oil prices. In addition to the impact of lower prices, the Bolivian economy will suffer a further blow due to the loss of 10-30 per cent of its gas export revenues, depending on Petrobras' offtake gas during 2017. The Bolivian government has forecast GDP growth of 4.8 per cent for 2017 based upon expectations of higher oil prices this year. The reduction in Brazil's imports may represent losses of up to $0.5 billion for Bolivia.

Economic analysts are predicting a subdued Brazilian economy until 2018. Despite this scenario some international players are positioning themselves to capture potential markets for their LNG in Brazil with the hope that more gas-fired power plants will be dispatched as the economy improves in 2018-2019 and also because more thermal power back-up will be needed with the increase in wind and run-of-river hydro capacity. In March 2016 Exxon signed an LNG Framework Agreement to supply the Porto de Sergipe project, which has secured PPAs starting in 2020. In March 2017 Total and Petrobras closed a $2.2 billion deal involving upstream assets and also the transfer of 50 per cent of the equity in two Petrobras owned power plants, Romulo de Almeida (138 MW) and Celso Furtado (186 MW), plus access to the Bahia LNG terminal[6] for Total. Other developments which may turn out to be speculative include Kogas and Posco, who are studying a potential new onshore terminal in Ceara to replace Pecem. Norsk Hydro has also signed a letter of intent with the Government of the State of Para in January 2017 to study the feasibility of an LNG terminal in the state. In early 2016 Petrobras also included the TEGUA and Pecem terminals in its asset divestment programme but so far the sales have not been completed.

In conclusion, the prospects for LNG imports in Brazil in 2017 seem quite weak, and this may also be the case to a lesser degree in Argentina. ENARSA's LNG tenders for most of 2017 have been completed and they are buying only 2.5 mtpa until August; as the country could benefit from higher availability of Bolivian gas, its LNG import requirements might be lower than previous years. Regardless, any growth in Argentina's LNG imports is currently constrained by capacity limitations at the existing terminals of Bahia Blanca and Escobar (while each terminal is designed to take 5 Bcma, the latter is constrained to take partial cargoes due to draft limitations). As a result, although South American markets have provided a useful outlet for LNG suppliers with surplus output over the past few years, it would seem that prospects for future demand are dampening at just the time when the next surge of LNG production is set to hit the market from 2017-2020.

[5] Ministerio de Relaciones Exteriores Bolivia, year on year September 2016/2015
[6] Brasil Energia, 02/03/2017