Exporting Vaca Muerta

Extreme energy, infrastructure and markets.

Photo: Martín Álvarez Mullally

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Introduction

Almost ten years have gone by since Argentina's promising unconventional gas and oil fields first drew the attention of the local press and became part of the political agenda. For some time, specialized energy publications spoke of nothing else. Now at the mention of the Vaca Muerta shale formation, hydrocarbons in abundance immediately spring to mind. The fields are considered to hold an everlasting supply for the domestic market and have the potential to transform the country into a global energy power.

The gas and oil extracted from Vaca Muerta - and other tight sand and shale formations in the north of Patagonia - account for an increasingly high percentage of Argentina's hydrocarbons. Since 2004, gas extraction in the country had slowed, but this trend has now been reversed by only a small number of massive developments of unconventional fields in the provinces of Neuquén, Río Negro and Santa Cruz. In the second half of 2018, the Argentine Government authorised gas exports to Chile, Uruguay and Brazil again. However, this was not because the country had become energy self-sufficient but rather because it lacked the necessary infrastructure for domestic supply: transport to regions in Argentina not serviced by the gas pipelines system or that import gas; and storage for fluid gas during the warm seasons when consumption is lower. In the currently privatised and transnationalized energy sector, exporting is not only a response to the demands of companies, but also driven by the national and provincial authorities' traditional focus on exports. Moreover, it keeps the sector active - in a country plagued by economic recession, hydrocarbons is one of the few industries that is actually increasing its production.

This report covers a number of different issues relating to Vaca Muerta. Before going into further detail, however, it is worth clarifying that when the term, 'Vaca Muerta' is used, reference is being made to all unconventional shale and tight sand formations under exploration or exploitation in north Patagonia, and not specifically to the shale formations given this name at the beginning of the 20th century. Furthermore, this report refers to Vaca Muerta as an area with blurred boundaries, that stretch beyond the Neuquén Basin. Over the years, these areas have been given different names but they are now falling out of use due to the advancing extraction frontiers.

Furthermore, Vaca Muerta is an extreme energy mega-project that extends beyond Argentina's borders, not only because it's resources will be put on the global market or because of the technological inputs and developments it depends upon, but also because of the various political, financial and corporative stakeholders involved, the priorities and interests of whom go well beyond national and regional limits. It is precisely because of the extraction project's multi-faceted dimension that Vaca Muerta is considered as a mega-project and not just an extraction zone.

One of the key themes addressed in this report is the significance that Vaca Muerta has for Argentina, in every sense. Another central question raised concerns about how the mega-project will become part of the regional gas market and what role large companies play in this

highly transnationalized sector of the country’s economy. In this respect, particular attention will be paid to Shell, which is one of the main players in the global gas market.

Geographical position of Vaca Muerta. Source: Argentina.gob.ar

1. What does Vaca Muerta mean for Argentina?

> *For Argentina and Neuquén, Vaca Muerta means an opportunity to create a centre of regional development, efficiently providing Latin America with hydrocarbons at competitive prices and promoting growth in the region's economy."* Omar Gutiérrez, Governor of Neuquén.[1]

"According to estimates, the proven reserves in the Vaca Muerta field, added to those of the San Jorge and Austral Magallanes basins, are in the order of 27 billion barrels of oil and 802 TCF (trillion cubic feet) of gas. More than 80% of these come from Vaca Muerta. This is estimated at being "more than six times the exploitable conventional oil and, in the case of shale gas, more than 27 times exploitable conventional gas reserves." "Should all the reserves' full potential be realised, Argentina would not only become energy self-sufficient, but would also become an exporting and price-setting country." This *promising forecast* has been further developed in the third report of the *Strategic Studies for the Territorial Development of the Vaca Muerta Region*, prepared by the national Government and expert groups from the provinces of Neuquén, Río Negro, La Pampa, and Mendoza, which make up the Vaca Muerta Region. The document was published in February 2016, when Mauricio Macri had just taken up office as President of Argentina. However, the report was written during the second term of Cristina Fernández de Kirchner. Perhaps the greatest point of agreement between both governments in their plans for the country is the key role of unconventional fields exploitation🕘 in particular Vaca Muerta🕘 to boost Argentina's economy. The differences arise in who should drive and set the course of the mega project and how to distribute its economic benefits. Both administrations even maintained subsidy schemes - with some differences - to promote gas production from unconventional fields. From the very beginning, unconventional activity was closely linked to direct and indirect subsidies. Any variations in this respect were immediately reflected in production volumes and employment levels.[2]

The largest number of unconventional projects are currently in the province of Neuquén. There are just over thirty, although at the time of writing this report only a handful had entered the massive development stage. Meanwhile, in Río Negro, the high productivity of tight sand gas in the Estación Fernández Oro field pushes the extraction frontier to an area with a long history of fruit production. Other projects that are still in the exploration stage have also expanded beyond this border. In the province of Mendoza, Vaca Muerta formation pilot projects are under way, while almost at the southern tip of the country, a massive tight gas development is highly productive in the Campo Indio area of the province of Santa Cruz - a foretaste of how promising unconventional exploitation will be in the Austral basin. According to data from the Argentine Ministry for Energy, between October 2017 and October 2018, the production of shale gas in

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[1] *Neuquén Informa*, 27/03/2018.

[2] Further information on the differences between the two governments regarding Vaca Muerta can be found in EJES *Winners and losers in Argentina in the age of unconventional hydrocarbons* (2017), *Transferencias al sector hidrocarburífero en Argentina* (2018) and *La exportación y el desplazo de YPF* (2018).

Vaca Muerta increased by 243% and shale oil production rose by 70%. In October 2018, shale and compact sand unconventional fields in the Neuquén and Austral basins were reported to have contributed 38% of gas and 15% of oil extracted from all the productive basins.

Photo: Martín Barzilai

As previously noted, the exploitation of unconventional hydrocarbon fields is still in the preliminary stages. The country has not yet received the levels of investment in development projects expected by national and provincial administrations. Most of the unconventional projects being carried out by large companies are pilot projects and only around ten wells are actually producing. The lack of infrastructure is the main drawback for both companies and the Government. More facilities would enable the extracted gas and oil to be transported to national, regional and global markets at a competitive price. In order to meet the fixed goals, new gas and oil pipelines need to be built to increase transport capacities, as well as storage structures and port terminals for exports. Furthermore, so as to replace gas imports from Bolivia and Liquified Natural Gas (LNG) imports from Qatar and Trinidad and Tobago, transport capacities in existing routes need to be increased and new pipelines need to be laid to reach other regions in the country or connect to the main lines.

Mauricio Macri's government intends to stop importing LNG by 2022 and extend this to gas imports from Bolivia by 2026. By then, not only will there be a large enough supply to satisfy the domestic market, but Argentina will have become one of the five main global gas exporters, following the United States, Qatar, Australia and Russia. These ambitions are set on paper in

Argentina's Energy Plan, written under the guidance of Javier Iguacel, who was Minister for Energy until the end of December 2018.

"We will be able to compete with gas supplies from the Middle East. The highest demand comes from China because it is moving away from coal consumption in a transition to gas and renewables. This is a very important strategic move for the Chinese and they are already equipped with many LNG trucks." said Argentina's energy planning coordination secretary, Daniel Dreizzen told an Argentinian daily newspaper, *La Nación*[3]. The CEO of Argentina's state-owned oil company YPF, Daniel Gonzalez supports this analysis. When asked by the same newspaper, he concurred that, "The only way to properly exploit Vaca Muerta is to ensure there is a market for the gas.[4] The Government has confirmed that gas extracted from north Patagonia could be sent via the south of Africa to the Asian market and thus compete with LNG supplies from the Middle East.

The Argentine Government has put its hope in Vaca Muerta to boost the economy. This was made clear when the country held the G20 presidency, where they insisted with a discourse that positions gas as a bridge fuel and raised the need to strengthen the global market. In June 2018, at the G20 Ministerial meeting on Energy, a communiqué was issued recognising, "the key role that natural gas currently plays for many G20 countries, and its potential to expand significantly over the coming decades, supporting transitions towards lower emission energy systems." They also said they would, "endeavour to improve the functioning, transparency and competitiveness of gas markets, with a strategic view of the supply chain — including LNGs and storage facilities — at a global level."[5] It was there that the Secretary of the US Department of Energy, Rick Perry, offered technical assistance to Argentina to build the infrastructure that Vaca Muerta needs, specifically attracting pipeline developers and petrochemical companies.[6] The *Bloomberg* agency expressed its desire to, "make the technology that enabled the shale gas revolution in the United States available to Argentina." [7] In November, the daily newspaper, *El Cronista*, announced that the Government of Argentina has reason to be hopeful: a federal agency supporting investment for development in emerging countries, the Overseas Private Investment Corporation (OPIC), has set aside one billion dollars in loans for American companies wishing to invest in Argentina.[8]

[3] *La Nación*, 30/10/2018.
[4] *La Nación*, 26/10/2018.
[5] *Revista Petroquímica*, 19/06/2018.
[6] In November 2018, the American oil company Exxon bought 21% of share in Oldelvel, the main Neuquén Basin pipeline. Although we cannot assume that the Exxon's decision is linked to Mr Perry's announcement, it is at least consistent with it.
[7] *Bloomberg*, 15/06/2018.
[8] *El Cronista*, 30/11/2018.

Photo: Fabián Ceballos

However, despite widespread and immovable domestic optimism as well as the support received at the G20 summit, the *Vaca Muerta* project is not without its opposition. Last October, The United Nations Committee on Economic, Social and Cultural Rights (CESCR) expressed concerns about the contribution of gas and oil extraction in Vaca Muerta to climate change and its possible negative impacts on the environment. A week earlier, the Intergovernmental Panel on Climate Change (IPCC) had issued a new report highlighting the need to take urgent measure to avoid global warning.

The CESCR's *concluding observations on the 4th periodic report of Argentina* considers that, “exploiting all of [Vaca Muerta’s] shale gas reserves would consume a significant percentage of the entire global carbon budget for achieving the 1.5℃ target laid down in the Paris Agreement.” It recommends, “reconsider the large-scale exploitation of unconventional fossil fuels through hydraulic fracturing (‘fracking’) in the Vaca Muerta region, in order to ensure compliance with the Argentine Republic's climate obligations.

The Committee has also voiced its concern about the lack of adequate assessment of “the use of specific methods of unconventional oil and gas exploitation, such as fracking, and that the local populations have not been duly consulted.” It further recommended that, “the State party adopt a regulatory framework for hydraulic fracturing, including impact assessments in all provinces, preceded by consultations with the communities concerned, and appropriate documentation of its effects on air and water pollution, radioactive emissions, occupational health and safety risks, effects on public health, noise and light pollution and stress, potential to trigger seismic activity, and threats to agriculture, soil quality and the climate system.”

These CESCR concluding observations were published around the same time as a number of events that shed a less idealistic light on the Vaca Muerta project: there was a rise in fatal accidents in the hydrocarbons sector, including five oil workers who lost their lives in the Neuquén Basin in 2018; uncontrolled spills stained the landscape, first from a well in Bandurria Sur, Neuquén, and then a few weeks later in Estación Fernández Oro, Río Negro; dubious oil waste management criteria was brought to light; and an increase in seismic tremors was registered in an area neighbouring the highly productive shale gas field of Fortín de Piedra.[9] Despite the criticism, however, Vaca Muerta continues to be central to the Government's – and by consensus - the State's agenda. Amid a steep recession, the exploitation of unconventional reserves is one of the few resources boosting the economy, and it is generally agreed that from this point of few, *nothing else matters*.

[9] In December 2018, through the company, Tecpetrol SA, the Fortín de Piedra area produced 17.5 million cubic metres a day of gas, accounting for 12% of total consumption in Argentina.

2. Infrastructure

> *"Much more than the rock formation is needed to transform Vaca Muerta into a global super Basin."*
> Ed Kruijs, technical director for Shell in Argentina.[10]

The network of gas pipelines that crosses the country and links the fields with the large consumption centres and the regional market began to be laid out towards the end of the first half of the 20th century. In 1949, the 1600 km Comodoro Rivadavia (Chubut) to Llavallol (Buenos Aires) gas pipeline was inaugurated. At that time, it was the longest pipeline in the world and is the backbone trunk of the *Gasoducto Troncal Sistema Sur*, the main southern pipeline connecting Patagonia. This positioned Argentina at the forefront of gas utilisation, along with the two main world powers of that time, the Soviet Union and the United States.

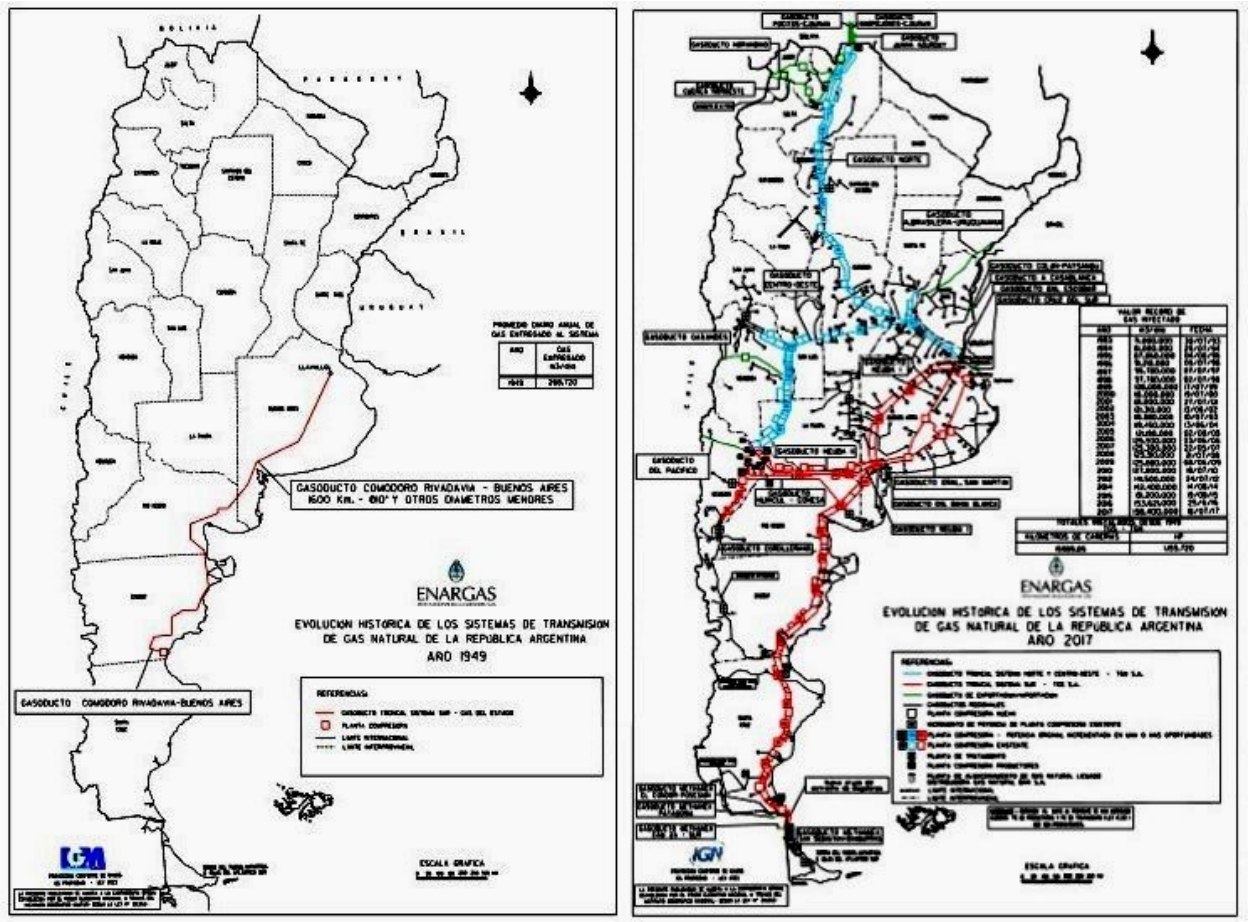
In the following years, the network was extended deeper into the San Jorge Gulf basin with the Comodoro Rivadavia to Cañadón Seco (Santa Cruz) extension. Neuquén Basin production was also connected up with the pipeline running from Plaza Huincul (Neuquén) to General Conesa (Río Negro), where it linked to the backbone. In 1965, transport began from the fields in the province of Salta, through the Campo Durán (Salta) to General Pacheco (Buenos Aires) line, which is the main north gas pipeline, the *Gasoducto Troncal Sistema Norte*. Two years later, the Madrejones to Campo Durán gas pipeline crossed the border into Bolivia, but shortly afterwards fell into disuse. In 1971, a new cross-border link was established between Pocitos and Campo Durán.

In the 1970s, the southern section was also extended with the construction of a new gas pipeline, the *General San Martín*. The first part runs from Pico Truncado (Santa Cruz) to Gutiérrez (Buenos Aires), and this was later extended deeper into southern Patagonia with a pipe running from Pico Truncado, through El Cóndor to San Sebastián (Tierra del Fuego). Meanwhile in 1972, the *Neuba I* pipeline became operational, linking Plaza Huincul (Neuquén) to General Cerri, in the south of Buenos Aires. Three years later the General Cerri to General Pacheco branch was added, supplying the city of Buenos Aires and its urban areas. In the 1980s the *Centro Oeste* pipeline was opened, transporting gas from Mendoza and Neuquén to the province of Santa Fe. This network was further extended to the Entre Ríos province in 1990 with a link from Santa Fe to Paraná, thus enabling further extensions into Brazil and Uruguay and opening the door to exports.

The transport capacity of the northern gas pipeline was also increased in the 1980s, while in Patagonia, pipes were laid in the *Cordillerano* line to connect Plaza Huincul to the touristic cities of San Martín de los Andes (Neuquén) and San Carlos de Bariloche (Río Negro). In 1988, the *Neuba II* gas pipeline from Neuquén to Buenos Aires became operational. Both this and the *Centro Oeste* pipeline were constructed to transport gas from the Loma La Lata mega-reservoir, the discovery of which in 1977 became a landmark in the country's energy history. By 1973,

[10] *Journal of Petroleum Technology*, 22/05/2018.

according to data from the Ministry of Energy, oil accounted for 69% of primary energy resources while natural gas made up 22%. The production start-up of Loma La Lata increased the share of hydrocarbons as a primary energy source and changed the gas/oil ratio. Currently, gas accounts for about 45-50% of primary sources, and oil accounts for 30-35%.[11]



Development of the gas pipeline network in Argentina 1949-2017. *Historical gas atlas*, Enargas.

Just as the discovery of Loma La Lata and other fields in the Neuquén Basin underpinned the gasification of the Argentine energy matrix, the neoliberal reform of the State towards the end of the 1980s and the privatization of the State companies, *YPF* and *Gas del Estado* meant that the production and expansion of gas transportation networks were designed to respond to market logics rather than to a regional energy integration.

At the end of 1994, YPF and Petrobras signed a Memorandum of Understanding to research new business opportunities in the oil and gas sectors together. At this time, a study on exporting

[11] Over the course of the 1970s, Neuquén gradually became the energy supply for Pampa Húmeda. The Chocón-Cerros Colorados hydroelectric plant became operational and then the fields of Puesto Hernández (1969) and Loma La Lata were discovered. Together they increased the supply of oil and gas in the country and meant that Neuquén became the leading energy source in the sector. Towards 1990, the area was further strengthened partly due to the discovery of new gas and oil reserves: El Portón (1990), El Trapial (1991) and Sierra Chata (1993). However, the increase in exports and royalty payments also boosted the provincial budget considerably.

gas to Brazil was carried out. It looked at the possibility of a gas pipeline running from the north-east of Argentina to San Paolo in Brazil, with an approximate length of 2600 km. Speculations were being made at that time about putting new reserves in the Aguaragüe field (province of Salta) on the market. At the beginning of 1996, both countries signed a *Memorandum of Understanding for energy cooperation and interconnection* that provided for gas exports from Aldea Brasilera in the province of Entre Ríos to Uruguayana, Brazil. This was built and became operational in the year 2000.

Similarly, the presidents of Chile (Eduardo Frei Ruiz-Tagle) and Argentina (Carlos Menem) signed a *gas interconnection protocol* in 1995, setting out standards to be met by companies involved in the market. During these years, negotiations and bilateral agreements with Uruguay moved forward and by December 1999 a regional *Memorandum of Understanding on Gas Exchanges and Gas Integration among Mercosur Member States* was passed. By then, most of the export pipelines from Argentina were already in operation or approaching completion.

- **Chile:** *GasAndes*, which began operating in 1997, runs from La Mora, Mendoza to San Bernardo on the outskirts of Santiago; *Atacama*, operational since 1999, stretches from Corneja, Salta to Region II; *Norandino*, operational since 1999 extends from Orán, Salta to Región II; and the *Pacífico*, operational as of 1999, runs from Neuquén to the Biobío Region. Three gas pipelines from the province of Santa Cruz to the Magallánica Region were also laid around this time: *Methanex El Cóndor to Posesión* [Methanex YPF] and *Methanex Patagonia* [Methanex SIP], operational as of 1998; and *Methanex EGS*, operational since 2005. Gas pipelines from Tierra del Fuego to the Magallánica Region, *Methanex San Sebastián to Bandurrias* [Methanex PAE], were operational from 1997; and *Methanex CAM 2A Sur*, operational from 2005.[12]
- **Uruguay:** *Colón to Paysandú*, operational since 1998; *Cruz del Sur*, operational as of 2002; *Casablanca*, was completed in 2000 and has been operational since 2012.[13]

- **Brazil:** *Aldea Brasilera to Uruguayana*, operational as of 2000.

However, the accelerated exploitation of the Neuquén fields and the fact that no new reserves were incorporated, meant that the ascending gas production curve reached its peak in 2004. Towards 2007, Argentina stopped exporting to Chile and increased gas imports from Bolivia.[14] In June 2008, a floating regasification unit began operating in the port of Bahía Blanca, in southern Buenos Aires. Three years later, Argentina's gas importing capacity was increased by the addition of another regasification unit in the port of Escobar, north Buenos Aires. In the

[12] The five southern cross-border pipelines are used to supply the Canadian company Methanex, in Cabo Negro, in the Magallánica Region (Chile). This company is one of the world's largest methanol producers and providers. Its headquarters are in Vancouver and it has production plants in Canada, Chile, Egypt, New Zealand, the United States and Trinidad and Tobago.

[13] The Uruguayan company, Gasoducto Cruz del Sur SA holds the concession for the Cruz del Sur and Casablanca gas pipelines. This limited company is controlled by BG Group, Pan American Energy, ANCAP and Wintershall.

[14] Further information on this can be found in De Dicco (2006), *Estudio sobre el agotamiento de las reservas hidrocarburíferas de Argentina, período 1980-2005.*

years that followed, the flow directions of pipelines that had been used for exports - such as NorAndino and GasAndes - were reversed, and they began to be used to import gas from Chile.

As previously mentioned, the first gas pipelines connecting to Bolivia date back to the 1960s, when the Madrejones to Campo Durán pipes were laid. In 1971, the *Gas de Estado* line from Pocitos to Campo Durán became operational; in 2002 a new *Pluspetrol* pipeline from Madrejones to Campo Durán became operational; and in 2010 the Juana Azurduy branch, also from Madrejones to Campo Durán, became operational. The purpose of the Juana Azurduy line was to import gas from Bolivia through the northern pipeline (*Gasoducto del Noreste Argentino*) to supply Formosa and Chaco and the north of Santa Fe. However, the initial project was changed considerably because on one hand, the supply from Bolivia was not stable, and on the other, extraction in national unconventional fields increased. In the end, the infrastructure was used to transport gas from Patagonia to the north of Argentina. These works enable supplies from Vaca Muerta to be transported to the Bolivian border, which is at close proximity to the networks that link Bolivia to the Brazilian market.[15]

Vaca Muerta, running on the remains of Loma La Lata

When the unconventional potential of the Neuquén Basin began to be promoted in the early years of the 2010s, the existing hydrocarbon infrastructure and the availability of skilled labour were notable. This was substantially different to other formations, that only had the primary resources. However, although the infrastructure and human resources inherited from the glorious days of Loma La Lata were clearly an asset, they were not nearly enough to service Vaca Muerta. This first became evident when companies began to drastically try to reduce production costs and secure the viability of massive developments. There was (and still is) a need for roadworks, aqueducts, repair and extension of railway branches, the construction of frac sand collection and conditioning centres and oil waste treatment plants.[16] Added to this list was a new bottleneck: the lack of infrastructure to transport the rising gas and oil flows to markets. If access to the market is not guaranteed, the potential of unconventional formations itself is not reason enough for the outpouring of investments frequently announced by Vaca

[15] The construction of infrastructure networks and the rise of right-wing neoliberalism in the regional governments meant that local entrepreneurs felt encouraged to explore new ideas.
In April 2017, Petrotecnia, the journal of Argentina's oil and gas institute (Instituto Argentino del Petróleo y el Gas), dedicated the entire edition to addressing the future of gas and its infrastructure.
In an article of this edition, Horacio Cristiani, the director general of Transportadora Gas del Norte sustained that, “If we look at a map of the region, we can see that much infrastructure connects Argentina’s pipeline systems with Chile, Bolivia, Brazil and Uruguay. The next challenge will be to regulate this so that private stakeholders are encouraged to transport gas (and electricity) from one country to another with more consumption efficiency. Will it be possible to make good use of our neighbours’ infrastructure by buying LNG from Brazil and transporting it through Bolivia to Argentina?”

[16] However, the lack of social infrastructure was an even greater setback. A clear example of this can be seen in Añelo, a city that was transformed from one day to the next into the capital of unconventional extraction. In 2014, shortly after being nominated the National Shale Capital, the city fell to pieces in every respect - housing, education, health, roads; basic services such as electricity, gas, water and sanitation - as thousands of men and many women suddenly poured into the promised land. For more information please read the EJES report: Megaproyecto Vaca Muerta. Informe de externalidades, published in March 2017.

Muerta forecasters. The large companies that recognised how promising the Neuquén Basin is, had already planted their flags there some time ago.[17]

Photo: Fabián Ceballos

In July 2015, the Argentine Institute of Oil and Gas (IAPG), headed by companies in the sector, published the report *De Vaca Muerta al hogar de los argentinos* [From Vaca Muerta to the homes of Argentinians], that contained an assessment of the existing gas infrastructure and the infrastructure needed in order to put the gas contained in shale and tight sand formations in northern Patagonia on the market. This assessment concluded that the transportation capacity of the main gas pipelines - mainly San Martín, Neuba II and Norte - needed to be extended to reach the country's major consumption centres: "Although the transport system will have unused capacity in the Neuquén and southern routes during the first years ... all work in progress must be completed." It warns that, "such an ambitious development of the gas industry presupposes that all existing gas transportation infrastructure will be put to use again with high levels of demand in the medium term. Old gas pipelines and compressor plants will require significant investments to ensure the sustainability of the system. ...42% of gas pipelines and 17% of compressor plants owned by TGN [Transportadora Gas del Norte][18] and TGS

[17] See, *European companies set to conquer Vaca Muerta*.

[18] TGN's controlling shareholders are: Gasinvest - a group made up of Tecpetrol Internacional S.L., Compañía General de Combustibles SA y RPM Gas S.A - which owns 56%; Southern Cone Energy Holding Company Inc., owning 24%; and the Buenos Aires stock exchange,20%.(TGN, no data).

[Transportadora Gas del Sur][19] are over 40 years old.[20] ...The new extensions were generally designed without considering the modernisation of existing infrastructure. However, in the medium term, these systems will be put to great use, which will require high investments in order to ensure reliability."

Given that gas consumption drops during the warm months, the IAPG proposed exporting the excess gas to the bordering countries so as not to reduce production, making use of the existing international gas pipelines. It also suggested an alternative solution for the hot season: underground storage facilities and offshore storage tanks in the national and international regasification ports could be used to store the excess gas. Two years after this report was published, the Argentinian Government authorised gas exports from the Austral and Neuquén Basins and the operators, Pluspetrol and YPF plan to store gas in non-producing wells. More than 30 gas export licenses have been granted since this report was completed in July 2018. Gas will be exported mainly to Chile, but also to Brazil and Uruguay. Companies that already sell gas abroad include Total Austral, Pan American Energy, Wintershall, ExxonMobil, YPF, Pluspetrol and Compañía General de Combustibles (CGC).

Although extending the gas pipeline system's transport capacity is for reaching national and regional markets, transforming Vaca Muerta gas into liquid will enable it to be transported to any place in the world with that is equipped with a regasification port terminal. The liquefaction process is, however, merely a solution to the material limits of exporting gas to the global market. It is also affected by other factors such as costs, supply and demand.

Below there is a short list of existing and planned infrastructure that will be used to sell gas from Vaca Muerta.

The Vaca Muerta gas pipeline. In June 2018, the Neuquén province government signed a contract with TGS to build a 130 km-long gas pipeline and a gas treatment plant in the Tratayén area. The gas will be transported from there through TGN's *Centro Oeste* pipeline and TGS' *Neuba II* pipeline. The pipeline will cross the hydrocarbon areas of Bajada de Añelo,[21] Bajo del

[19] TGS' main shareholder is Compañía de Inversiones de Energía SA (CIESA), that owns 51% of its shares.
The remaining shares are owned by the Buenos Aires and New York stock exchanges.
CIESA's shareholders are: (i) Pampa Energía SA, that owns, 50%.; and (ii) Grupo Inversor Petroquímica S.L. (part of the GIP group, led by the Sielecki family), WST SA (Part of the Werthein group) and PCT L.L.C., that owns the remaining 50%.
[20] TGN controls the main northern and centre west gas pipelines, while TGS controls the main southern pipelines.
[21] Operated by YPF S.A . Stockholding in the joint venture [Unión Transitoria de Empresas] for concession over the areas is as follows: YPF SA, 35%; YSUR Energía Argentina S.R.L., 15% (YPF SA); O&G Developments LTD SA (Shell CAPSA) 50%.

Choique to La Invernada,[22] Pampa de las Yeguas I,[23] Pampa de las Yeguas II,[24] Parva Negra Este,[25] Parva Negra Oeste,[26] La Escalonada,[27] Rincón La Ceniza,[28] Los Toldos Norte,[29] Los Toldos Sur,[30] Los Toldos Este,[31] Los Toldos Oeste,[32] La Calera,[33] El Orejano[34] and Sierra Chata,[35]. It would directly benefit companies such as Shell, Total Austral, Exxon Mobil, Dow Chemical, Pluspetrol, YPF and Pampa Energía. Initial works will require an investment of $300 million, which could rise to $800 million, depending on whether new blocks are commissioned.

The Pacific Gas Pipeline. This pipeline was opened in 1999 and originally linked the Loma La Lata mega-reservoir with the Chilean region of Bío Bío. In 2005, it was reconverted into a system that was solely used for domestic transport in Argentina. The network crosses the most productive area of Vaca Muerta and began to be used to transport production from fields belonging to YPF, Total, Shell, Exxon Mobil and Tecpetrol. However, it quickly reached its transport capacity limit. Gasoducto del Pacífico SA (Argentina)[36] aims to increase daily transport capacity from 7.5 million to 12.5 million cubic metres. YPF and Exxon Mobil were

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[22] Operated by ExxonMobil Exploration Argentina S.R.L. Stockholding in the joint venture for concession over the areas is as follows: ExxonMobil Exploration Argentina S.R.L., 90%; Gas y Petróleo del Neuquén SA (GyP) 10%.

[23] Operated by ExxonMobil Exploration Argentina S.R.L. Stockholding in the joint venture for concession over the areas is as follows: YPF SA, 50% ExxonMobil Exploration Argentina S.R.L., 50%.

[24] Operated by Total Austral SA. Stockholding in the joint venture for concession over the areas is as follows: Total Austral SA, 45%; YPF SA, 45%; and GyP SA,10%.

[25] Operated by Pampa Energía SA. Stockholding in the joint venture for concession over the areas is as follows: Pampa Energía SA, 42.50%; ExxonMobil Exploration Argentina, 42.50%; and GyP SA,15%.

[26] Retama Argentina LLC, subsidiary of the American oil company Retamco Operating, renounced its rights over the area at the end of 2018.

[27] Operated by Total Austral SA. Stockholding in the joint venture for concession over the areas is as follows: Total Austral SA, 47.50%; O&G Developments LTD SA 23.75%; GyP SA, 5%; and Shell C.A.P.S.A,
23.75%.

[28] Operated by Total Austral SA. Stockholding in the joint venture for concession over the areas is as follows: Total Austral SA, 47.50%; O&G Developments LTD SA 23.75%; GyP SA, 5%; and Shell C.A.P.S.A,
23.75%.

[29] Operated by Tecpetrol SA. Stockholding in the joint venture for concession over the areas is as follows: Tecpetrol SA, 90%; and GyP SA,10%.

[30] Operated by ExxonMobil Exploration Argentina S.R.L. Stockholding in the joint venture for concession over the areas is as follows: ExxonMobil Exploration Argentina S.R.L., 80%, Tecpetrol SA, 10%; and GyP SA, 10 %.

[31] Operated by Tecpetrol SA . Stockholding in the joint venture for concession over the areas is as follows: Tecpetrol SA, 90%; and GyP SA,10%.

[32] The owner of the exploration area is GyP SA

[33] Operated by Pluspetrol SA . Stockholding in the joint venture for concession over the areas is as follows: YPF SA, 50%; and Pluspetrol SA, 50%.

[34] Operated by YPF SA. Stockholding in the joint venture for concession over the areas is as follows: YPF SA, 50%; and, PBB Polisur SA, 50% (Dow Chemical).

[35] Operated by Petrobras Argentina SA is operating. Stockholding in the joint venture for concession over the areas is as follows: Mobil Argentina SA, 51% (ExxonMobil); Total Austral SA, 3.45%; and Pampa Energía SA, 45.55%.

[36] Gasoducto del Pacífico SA (Argentina)'s main shareholder is Compañía General de Electricidad, that belongs to the Spanish company, Gas Natural Fenosa, owning 56.7%; the smaller shareholders are YPF, the Chilean oil company, Enap, and Trigas (BAE, 14/05/2018).

awarded an open tender to increase the transport capacity by five million cubic metres. They are expected to do this by.

The Rosario Gas Pipeline. In the final quarter of 2018, the construction of a new backbone pipeline was announced. It will begin at the Tratayén treatment plant, situated close to Añelo, one of the most productive areas of Vaca Muerta and connect up to the province of Buenos Aires, thus strengthening development of the existing petrochemical centre there, which is the largest in the country.[37] From there, the route will continue into northern Buenos Aires and into the province of Santa Fe. It will supply the industrial areas of San Nicolás and Rosario. Rosario has become one of the leading global soya processing centres. Furthermore, by connecting the TGN system, gas will be able to be transported to the north-east of Argentina and start replacing imports form Bolivia.

The gas pipeline will have a daily transport capacity of 25 million cubic metres. This is planned to be increased to 40 million in the second stage. Its capacity will be 25% more than that of the *Centro Oeste* pipeline, currently the largest in the region. It is estimated to cost $1.2 billion and will be developed by Tecpetro and TGN, both companies under the Techint group.

The Liquefaction Plant. The only liquefaction plants in Latin America are situated in Peru and Trinidad and Tobago. In Mexico, a plan for a plant in Baja California[38] is currently being assessed. In 2016, the Government of Argentina began to probe into the possibility of a liquefaction vessel operating in the port of Rosales, near Bahía Blanca and about 650 km south of the city of Buenos Aires. The intention was to partner with the national energy company ENARSA, which later became IEASA. Although this project never came to fruition, the Government did not drop the idea, and in October 2018, the national oil company, YPF signed a contract with the Belgian company, Exmar for the installation and operating of the liquefaction vessel, Tango FLNG[39]. Compared to existing projects in the region, this is at a smaller-scale and will enable the transportation of low volumes of gas via boat. The vessel will be producing LNG by the second quarter of 2019. Although its exporting capacity is already being discussed by the press, it may also be possible to transport the gas back to the country through the regasification port terminal in Escobar. This would provide a solution to some of the problems

[37] For more information on the petrochemical centre and its social and environmental impacts, please see Mariela Dobal (2015), Bahía Blanca y White: grietas en el muro de la incertidumbre, in the Observatorio Petrolero Sur (comp.), Polos. Injusticias ambientales e industrialización petrolera en Argentina, Buenos Aires, Ediciones del Jinete Insomne / Observatorio Petrolero Sur, pp. 81-111.

[38] In Trinidad and Tobago, the following plants are operational: Atlantic Tren 1 (1999), Atlantic LNG Tren 2 (2002), Atlantic LNG Tren 3 (2003) and Atlantic LNG Tren 4 (2006). In Peru, there is one plant, the Peru LNG (2010). In 2017, the European Union imported 7% of its total LNG from Peru and 3% from Trinidad and Tobago. The UE's leading supplier was Qatar, 41%; followed by Argelia, 17%; Norway, 7% and the United States, 4%. (Infobae, 29/09/2018).

[39] The liquefaction vessel, Caribbean FLNG - renamed Tango FLNG - was designed in 2014 by Exmar for a project in Colombia to be operated by the company, Pacific Rubiales. This project was cancelled due to the drop in oil prices in June that year (EconoJournal, 10/10/2018).

with the gas pipeline network and could reduce LNG imports.[40] Long term, and depending on how Vaca Muerta develops, YPF intends to build a land-based liquefaction plant.

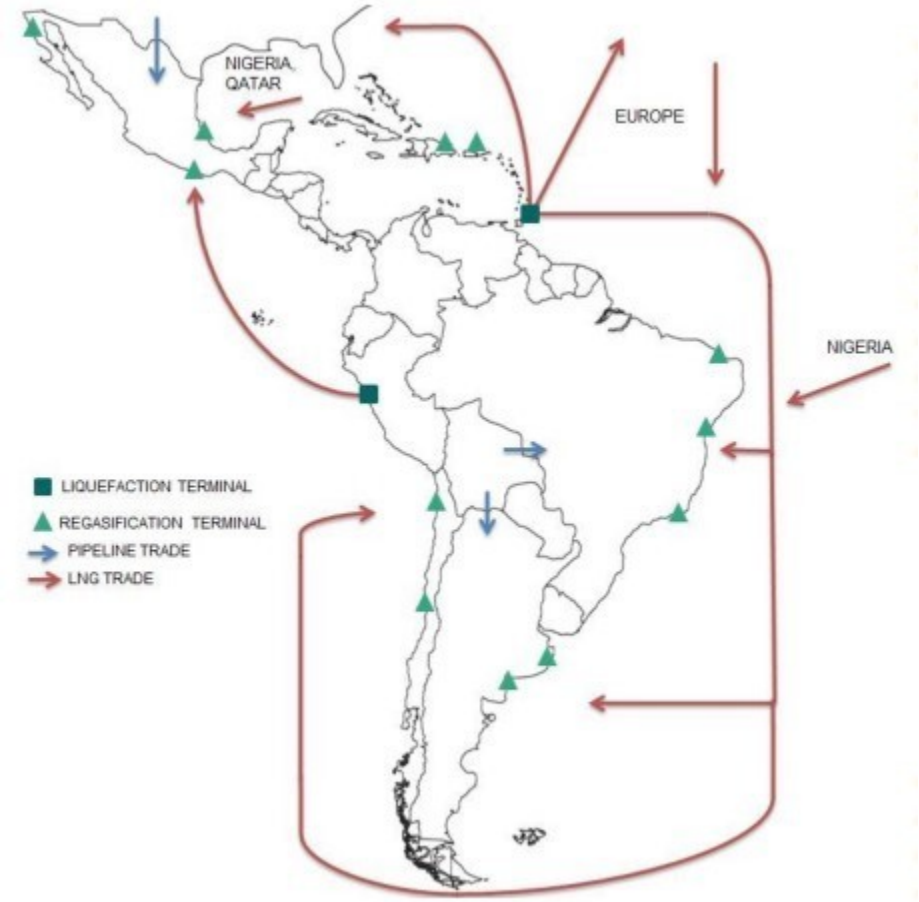
According to its shareholders, TGS also signed a contract with the American company, Excelerate Energy LP, to carry out a feasibility assessment for building a liquefaction plant in Bahía Blanca. Meanwhile, at the beginning of October, the press announced that a delegation from the Qatar Gas Transport Company was coming to Argentina to assess the local gas industry prospects and analyse the technical and financial feasibility of building a liquefaction terminal. However, there was no follow-up to the details of the alleged visit.

Underground Storage Facilities. A number of companies are looking at how to store excess production during periods of low consumption, such as the summer. Alternatives being suggested include the use of fields that have already been exploited for storage. Another is to liquefy the gas and store it in LNG vessels. In Vaca Muerta, the two main unconventional field gas producers, YPF and Tecpetrol, are working on an underground storage project in the Los Bastos field, close to Plaza Huincul, about 120 km from Neuquén Capital.[41]

[40] In 2016, Argentina's Congress began to push for a liquefaction plant to be built in Tierra del Fuego. This would solve the problem of limited transport capacity in the San Martín gas pipeline and would meet local demands with the LNG from the Austral Basin, the second largest gas producer in the country, which in 2018, it accounted for roughly 25% of the gas production and helped reduce imports.

[41] It is a strange coincidence that hydrocarbon production in the Neuquén Basin actually began on this site when oil was discovered there in October 1918.

3. Regional gas trade and Shell's strategy.



Source: BP Statistical Review of World Energy 2015,
International Gas Union – World LNG Report 2014.

> *"Shell's interests are in Gas and integrated projects. ... Shell is a global company with opportunities in Peru, Mexico, Brazil, Argentina and Bolivia. We need to assess the situations and weigh up which country offers the best opportunities."* Martín Rueda, country chair of Shell in Peru and Bolivia.[42]

The extension of extraction frontiers in Latin America and the Caribbean is taking place at a time when technological and infrastructure development is also extending geological frontiers - towards hitherto underestimated reservoirs - and geographical frontiers, incorporating hydrocarbon activity in new territories. There are many examples of this: the importance of Vaca Muerta for Argentina; the compact formations in Brazil; the pre-salt layers in the ultra-deepwater fields in Columbia; the exploration campaigns in the Caribbean; and the expansion into protected areas and indigenous peoples' territories in Bolivia. These amplifications are changing

[42] *El Comercio*, 13/11/2017.

the regional gas market considerably. It is true, however, that they all have financial, technological and infrastructure hurdles to overcome, and they must also deal with resistance from communities that will be deprived of their territories for the cause of the energy market.

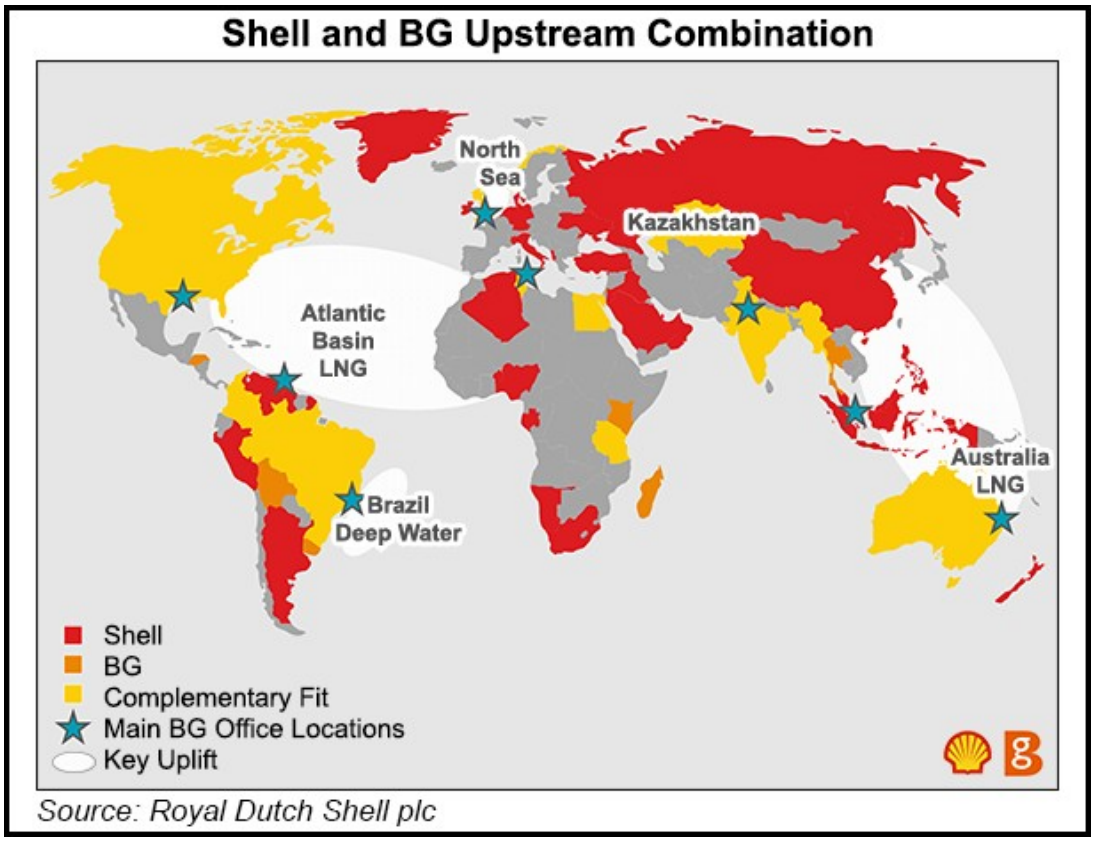
One of the first manifestations of how this new context will change the market is the effect that the new extreme energy projects will have on Bolivia: it will soon no longer be the main supplier for Argentina and Brazil; both countries intend to become energy self-sufficient - and even exporters - in the near future. At the 2018 G20 in Argentina, the Government wagered precisely to keep promoting gas as a bridge fuel in the transition to clean energy resources and to strengthen the gas market.

Both the government and TPF, the national oil company are convinced that Argentina is able to produce gas competitively and export to Latin America and Europe, in addition to entering the Chinese market. Government circles are considering goals that somewhat push the limits, such fulfilling the contract signed with Bolivia (although negotiating volumes and conditions) by maintaining imports until 2026, but from then on ending supplies from Bolivia and becoming a self-sufficient and exporting country. Brazil had also intended to be energy self-sufficient by 2021,[43]. However, the contract for importing Bolivian gas signed by YPFB and Petrobas comes to an end on 31 December 2019. Although the authorities are not expected to renew the contract but rather opt for obtaining supplies from other sources, Shell has already shown an interest in importing gas from Bolivia. At the end of December, the Europe-based company signed a Memorandum of Understanding with the Bolivian State oil company to this end.

The forecasts of Argentina and Brazil aside, Bolivian gas reserves are a bit of a mystery. Several analysts are convinced that production in Bolivia has dropped considerably and that, in the not too distant future, YPFB will not be able to maintain its export obligations. However, the Ministry for Hydrocarbons in Bolivia has ensured that the country has more unconventional resources than Vaca Muerta[44] and that, due to the changing context in Argentina and Brazil, the Government is negotiating the sale of gas to Paraguay and Peru, including the possibility of exporting LNG through Peruvian ports.[45] However, even if Bolivia does have very promising unconventional fields, it could take at least a decade of work to transform them into reserves and get the resources onto the market.

Statements from the various government officials can be confusing and their credibility could be questioned, as could their pursuit of becoming exporting powers. However, it cannot be denied that the extension of the extraction frontiers has caused considerable change in the regional gas market. This is felt most in Argentina, Bolivia, Brazil, Chile and Uruguay. The changes in the latter two countries will be further developed later on. In such a context, analysing the behaviour in these countries of one of the dominant companies in the sector such as Royal Dutch Shell plc sheds a different light on the projects held in such high esteem by countries and regions, but that lose importance when considered from another angle.

[43] *Reporte Energía*, 26/04/2017.
[44] *Río Negro*, 22/03/2018.
[45] The possibility of meeting Peruvian energy demands with Bolivian resources is also being assessed. *América Economía,* 04/05/2018 and *Gestión,* 06/01/2019.



For the past decade, Shell has been working on consolidating its leading position in the gas market and operating in mega-reservoirs in Latin America and the Caribbean. This is why it has building up its presence in strategic areas in the region. In 2013 Shell bought shares in GNL from the Spanish oil company, Repsol. Then in 2016 by buying over BG -another leading gas production, transport and trading company - Shell acquired controlling interest in the liquefaction plant, Atlantic LNG, in Trinidad and Tobago, which is the sixth largest LNG exporter in the world. Moreover, in 2017, Shell bought the shares of Chevron Corporation's Trinidad subsidiary, giving it access to the offshore mega-reservoir Loran Manatee. The purchase of the Repsol shares in 2013 also meant that Shell now controls 20% of Peru LNG, operator of Pampa Melchorita, South America's largest liquefaction plant. Shell thus managed to take up a strategic position in the two countries in the region that were capable of selling gas on the global market.

The British-Dutch company returned to Peru by buying Repsol shares. Using the same tactic, it entered Bolivia in 2016 by buying out BG. After eight years of absence, Shell aims to become one of the main stakeholders in controlling production and play a predominant role in gas trading. All the exploration and exploitation rights held by Shell in Bolivia are in Tarija, a department with one of the largest resistance campaigns against oil companies of recent years. The movement is led by farming communities and leading women from the national reserve, the Reserva Nacional de Fauna y Flora Tariquía.

Buying BG also made Shell Chile's main LNG supplier. It is also no coincidence that in Argentina in 2017, Shell was responsible for 22 out of 68 of the LNG loads bought by the State through the company Empresa Nacional de Energía S.A. (Enarsa). The previous year, out of 76 cargoes that entered the country's regasification ports, Shell had provided only eight.[46] However, the company's growing involvement in LNG and diesel sales, has been the object of a criminal complaint for breaching the Public Ethics Act[47] and the Procurement Regime[48]. The national senator Fernando Solanas reported the then Minister for Energy and Mining, Juan José Aranguren. Until six months prior to taking up public office, Arangueren had been the CEO of Shell Argentina (Shell Compañía Argentina de Petróleo SA), and as Minister for Energy continued to hold shares in Royal Dutch Shell plc.[49] During his time in office, Shell Western Supply was granted seven of the eight tenders for diesel oil vessels. Furthermore, gas imports from Chile were also authorised, bought by ENAP, the national oil company from BG and sold to Enarsa at a price 53% higher than the LNG arriving in Argentina's ports at Argentine ports.[50]

That said, its sales of LNG and diesel are not the most significant of Shell's activity in Argentina. It is rather its return to exploration and production in Vaca Muerta, where it had not shown much interest since the 1970s, when it had turned its attention to refining and sales. Apart from taking over areas in the Neuquén province to access the shale formation, the company went through a restructuring process, getting rid of shares in refining and sales, which it sold to the Brazilian company, Raízen - 50% of which is controlled by Dutch Royal Shell plc - to concentrate on *upstream*. Furthermore, the British-Dutch gas and oil company's interests extends beyond Vaca Muerta, proof of which is in its enthusiasm at the opening of calls for tender for 38 offshore areas in the Argentine Sea. "We can see that this tender is tempting and we expect it to attract considerable interest. Over the past five years, a number of Latin American countries such as Columbia and Brazil have been very active in offshore extraction. Let's hope that Argentina will also join the resurge." says Wael Sawan, Execucitive vice-chair of Deepwater Business.[51]

[46] See Annex 1 for more information on Shell's involvement in LNG sales to the country from 2016 to 2018.

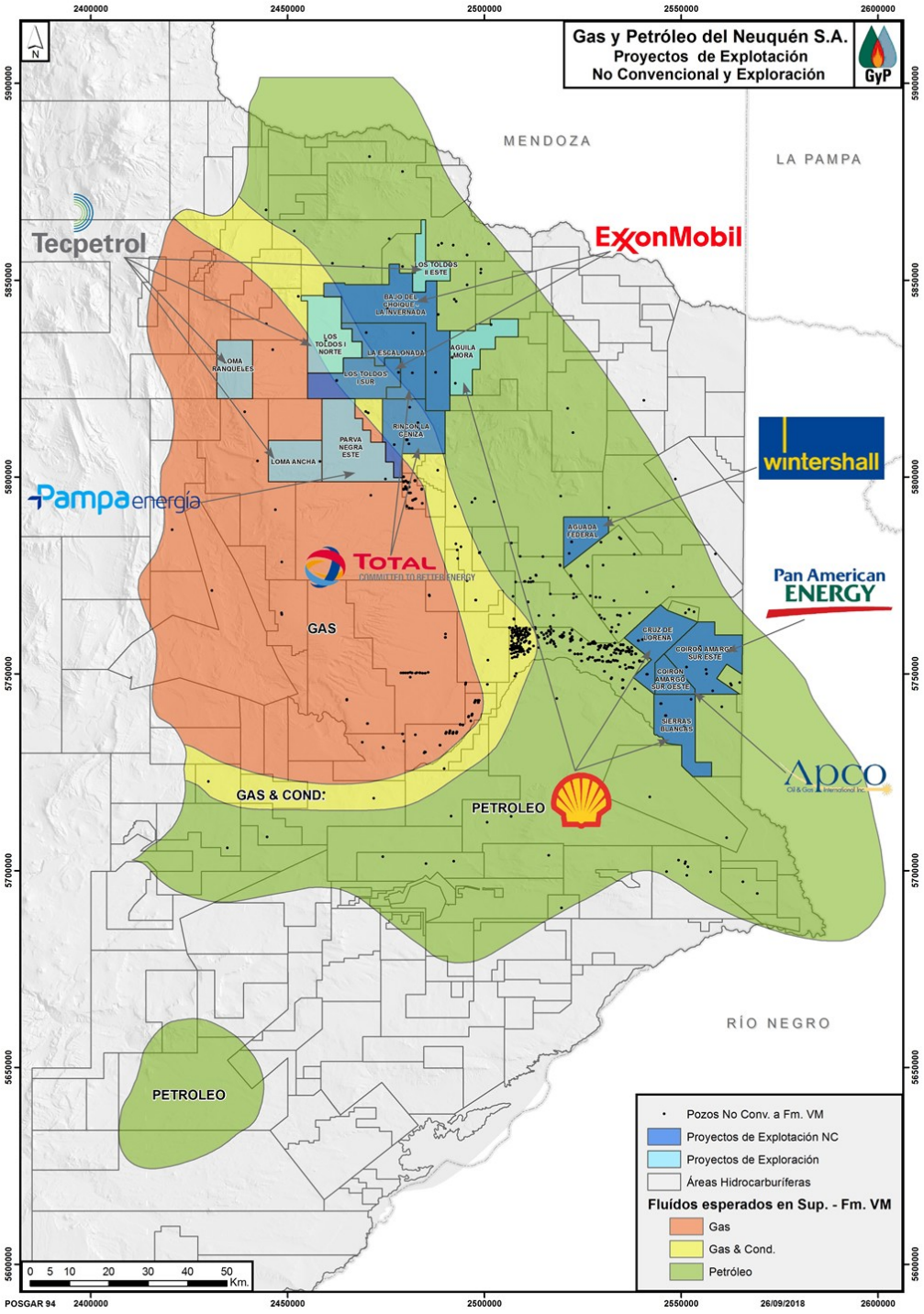
[47] Solanas sustains that Aranguren, as a Government official, breached article 12 of the Public Ethics Act 25.188, because one of the firms he had been director of was made the main contractor for buying diesel on behalf of the Government Aranguren belonged to. See page 12, 09/11/2017.

[48] The senator also ascertains that he violated the Procurement Regime by buying gas from Chile at a price that was 128% higher than that sold by Bolivia to Argentina.
See InfoSur, (no data) and Ministerio de Energía y Minería de la Nación, 14/06/2016.

[49] *Ministerio de Energía y Minería de la Nación*, 13/09/2016.

[50] *La Nueva*, 06/05/2016.

[51] *La Nación*, 17/10/2018.



The U.S. Energy Information Administration (EIA) has confirmed in various reports that Vaca Muerta is characterised by its gas mega-potential, yet Shell focused instead on the *shale oil* production areas of Sierras Blancas, Cruz de Lorena and Coirón Amargo Sur Oeste. At the beginning of 2018, investments were announced for the extraction of 40 million barrels per day by 2021. At that time, no more than 12 million were being produced. However, the decision to focus on oil did not mean they had to miss out on a gas market being boosted by the

exploitation of compact fields. Last July, the Government of Argentina reopened gas exports. As this report was being concluded, 28 licenses had been granted, including three for BG Chile.[52] This opening is a very recent development and too constraining for undecided investors in Vaca Muerta production. However, in spite of it being early days, Shell is not holding back.

Even when the first pilot projects for extraction using hydraulic fracturing, or fracking, had just begun, Vaca Muerta's impact was significant: prospects of transporting high volumes of gas again to Uruguayan networks from Patagonia was encouraging to the Government of Argentina and influenced its plan to build a regasification port terminal near Montevideo. In 2017, the proposal was relaunched with some changes: a smaller port was proposed. Shell took an interest and signed an MoU, but in April 2018, the Uruguayan authorities decided not to renew the agreement due to the company's lack of clarity regarding finalising investments. The project's feasibility depended on a large percentage of the regasified gas being introduced into the Argentine network and this was not guaranteed.[53]

Although it is significant that Shell is redirecting investment back into Argentina in Vaca Muerta, it has bigger fish to fry elsewhere: Shell Global, the company website, reveals that it has higher expectations in the Brazilian deep-water fields than in the shale and compact sand reservoirs in north Patagonia. In 2001, it was the first private company in Brazil to find an offshore reservoir, in the Santos Basin. Furthermore, this year it bought the British company, E&P Enterprise Oil, and began developing blocks in Cuenca de Campos, where extraction had begun in 2001, making it the first company to produce oil after the state monopoly had been relaxed. In 2005, pre-salt exploration work began, but in 2016, after the BG buyout, it became Petrobras' main partner in the mega reservoir. Later on, after the institutional coup d'état that took down Dilma Rousseff in 2017, the company was one of the greatest beneficiaries of the policies implemented by Michel Temer's de facto government, that facilitated private oil companies to start pre-salt operations, enabling Shell to become that largest private operator in the country. Shell's advance into the offshore fields characterises its current global strategy, and in the region, this is manifested not only by the company's dominant presence in the pre-salt reservoirs; but also by the blocks it was awarded in Columbian Caribbean; the exploration campaign it developed on the Uruguayan coasts[54]; and its access to offshore exploration licences in Argentina and Peru.

[52] The Argentine Government issued 34 licenses to export gas between 28 August 2018 and 10 February 2019. 28 of these were for exporting to Chile, three to Uruguay and the rest were for Brazil (Ministry for Energy, no data).

[53] *El Observador*, 06/04/2018.

[54] By buying out BG, Shell obtained access to Uruguay and the rights to explore offshore blocks and and hold shares in the Gasoducto Cruz del Sur SA company, with concessions over two of the three gas pipelines between Argentina and Uruguay.

Annex I

LNG imports in the period 2016-2018

Tables taken for the IEASA webpage; Shell's loads are highlighted.

2016.

LNG imported from the regasification port terminal in Escobar

IMPORTACIÓN GNL ESCOBAR 2016								
FECHA DE AMARRE	EMPRESA	BUQUE	ORIGEN	PRECIO Referencia (*)	PRECIO (usd/mmbtu) (*)	Volúmen (1.000m3)	MMBTU	TOTAL (USD)
16-01	GNA	Arctic Spirit	Trinidad y Tobago	14,40% Brent	6,74	45.401	1.675.524	11.296.382,81
23-01	GNA	Cadiz Knutsen	Trinidad y Tobago	14,40% Brent	6,74	45.200	1.668.124	11.246.492,01
28-01	GNA	Ibérica Knutsen	Trinidad y Tobago	Fijo	5,60	53.761	1.984.079	11.106.874,24
16-02	GNA	Seishu Maru	Trinidad y Tobago	Fijo	5,60	54.324	2.004.834	11.223.060,73
23-02	GNA	Galicia Spirit	Trinidad y Tobago	Fijo	5,60	52.771	1.947.545	10.902.356,91
05-03	GNA	Ibérica Knutsen	Trinidad y Tobago	Fijo	5,60	53.794	1.985.307	11.113.748,59
29-03	GNA	Cádiz Knutsen	Trinidad y Tobago	Fijo	5,60	51.806	1.911.920	10.702.928,16
10-04	GNA	Ibérica Knutsen	Trinidad y Tobago	Fijo	5,60	55.074	2.032.545	11.378.186,91
03-04	GNA	Gaslog Saratoga	Trinidad y Tobago	Fijo	5,60	52.929	1.953.374	10.934.987,65
21-04	GNA	Seishu Maru	Trinidad y Tobago	Fijo	5,20	51.367	1.895.729	9.857.790,80
29-04	Trafigura	Express	Noruega	Fijo	5,05	54.943	2.027.678	10.239.773,90
06-05	Trafigura	Golar Snow	Qatar	12,78% Brent	4,79	55.443	2.046.144	9.801.848,22
10-05	GNA	Catalunya Spirit	Trinidad y Tobago	Fijo	5,20	56.286	2.077.272	10.801.814,40
15-05	Trafigura	Golar Crystal	Qatar	12,78 % Brent	4,79	57.630	2.126.873	10.188.572,42
20-05	Petrobras	Excelsior	Nigeria - T&T	Fijo	4,59	50.926	1.879.453	8.626.689,27
25-05	GNA	Gaslog Saratoga	Trinidad y Tobago	Fijo	5,20	53.155	1.961.724	10.200.964,80
29-05	Petrobras	Excalibur	Nigeria - T&T	Fijo	4,59	50.746	1.872.796	8.596.133,64
04-06	Petrobras	Esshu Maru	Trinidad y Tobago	Fijo	4,59	49.117	1.812.688	8.320.237,92
09-06	Trafigura	Golar Arctic	Australia - T&T	12,78% Brent	5,40	49.624	1.831.380	9.896.228,11
11-06	GNA	Cádiz Knutsen	Trinidad y Tobago	Fijo	4,74	52.719	1.945.608	9.222.181,92
14-06	GNA	Ibérica Knutsen	Trinidad y Tobago	12,78% Brent	5,28	52.191	1.926.140	10.172.137,95
20-06	Trafigura	Golar Seal	Qatar	12,49% Brent	5,40	56.432	2.082.643	11.253.977,98
23-06	GNA	Gaslog Saratoga	Trinidad y Tobago	Fijo	4,74	53.721	1.982.610	9.397.571,40
25-06	Gazprom	Yenisei River	Qatar	11,65 % Brent	4,93	59.173	2.183.792	10.757.141,01
29-06	Petrobras	Excelsior	Nigeria	Fijo	5,89	52.617	1.941.847	11.437.478,83
03-07	Trafigura	Golar Crystal	Qatar	12,478% Brent	5,69	53.919	1.989.899	11.313.870,47
07-07	Trafigura	Golar Snow	Qatar	12,78% Brent	5,82	56.567	2.087.615	12.156.808,43
11-07	Shell	Maran Gas Delphi	USA	Fijo	5,36	50.170	1.851.545	9.924.281,20
15-07	Trafigura	Golar Celsius	Qatar	12,78% Brent	5,82	57.230	2.112.092	12.299.345,34
19-07	GNA	Ibérica Knutsen	Trinidad y Tobago	12,49% Brent	5,69	53.258	1.965.493	11.185.817,21
22-07	GNA	Cádiz Knutsen	Trinidad y Tobago	Fijo	5,15	52.071	1.921.709	9.894.879,64
26-07	Gazprom	Lena River	Qatar	11,65% Brent	5,31	57.903	2.136.920	11.343.626,13
29-07	Shell	Excelsior	Angola	Fijo	5,67	51.859	1.913.887	10.851.739,29
01-08	GNA	Gaslog Saratoga	Trinidad y Tobago	11,49% Brent	5,37	53.180	1.962.613	10.547.277,76
06-08	Trafigura	Golar Glacier	Qatar	12,78% Brent	5,98	57.256	2.113.040	12.630.696,60
10-08	Shell	Bilbao Knutsen	Trinidad y Tobago	Fijo	5,36	50.939	1.879.930	10.076.424,80
14-08	Trafigura	Hoegh Grace	Qatar	12,78% Brent	5,98	55.667	2.054.414	12.280.259,69
18-08	GNA	Ibérica Knutsen	Trinidad y Tobago	12,49% Brent	5,84	52.836	1.949.950	11.391.607,90
21-08	GNA	Cádiz Knutsen	Trinidad y Tobago	Fijo	4,88	50.508	1.864.006	9.087.029,25
25-08	Gazprom	PSKOV	Qatar	11,65% Brent	5,45	58.951	2.175.612	11.854.692,23
31-08	Engie	GDF Suez Neptune	Nigeria	Fijo	5,79	54.193	2.000.000	11.580.000,00
04-09	Petrobras	Cool Runner	Nigeria	Fijo	7,29	54.193	2.000.000	14.580.000,00
12-09	Vitol	Excalibur	USA	Fijo	7,28	54.193	2.000.000	14.554.000,00
17-09	Iberdrola	Arctic Princess	TBC	Fijo	6,27	54.193	2.000.000	12.542.000,00
21-09	Gazprom	Kita LNG	Qatar	Fijo	5,82	54.193	2.000.000	11.648.000,00
26-09	Gazprom	Energy Atlantic	TBC	Fijo	5,82	54.193	2.000.000	11.648.000,00
01-10	Trafigura	Golar Bear	TBC	Fijo	7,29	54.193	2.000.000	14.574.000,00
05-10	Trafigura	A confirmar	TBC	Fijo	7,29	54.193	2.000.000	14.574.000,00
10-10	Shell	A confirmar	TBC	Fijo	6,95	54.193	2.000.000	13.900.000,00
20-10	GNA	A confirmar	TBC	Fijo	5,95	54.193	2.000.000	11.896.000,00
					5,641	2.675.390	98.736.354	557.009.917

LNG imported from the regasification port terminal in Bahía Blanca

IMPORTACIÓN GNL BAHIA BLANCA 2016								
FECHA DE AMARRE	EMPRESA	BUQUE	ORIGEN	PRECIO Referencia (*)	PRECIO (usd/mmbtu)	Volúmen (1.000m3)	MMBTU	TOTAL (USD)
10-01	BP	British Emerald	Nigeria	HH + 2.033	12,593*	86.189	3.180.857	40.056.532
06-03	BP	Excelsior	Qatar	Fijo	5,64	78.346	2.891.374	16.301.567
22-04	BP	Excelsior	Guinea Ecuatorial	Fijo	4,68	75.508	2.786.641	13.044.267
02-05	Statoil	Arctic Discoverer	Noruega	Fijo	4,50	86.165	3.179.942	14.309.739
07-05	Glencore	Stena Clear Sky	USA	Fijo	4,57	84.543	3.120.095	14.258.834
13-05	Trafigura	Gaslog Salem	USA	Fijo	4,37	87.678	3.235.787	14.140.389
19-05	BP	British Emerald	Trinidad y Tobago	Fijo	4,45	81.250	2.998.559	13.328.595
24-05	Koch	Cool Explorer	Australia	Fijo	4,53	87.186	3.217.647	14.575.941
02-06	BP	British Ruby	Nigeria	Fijo	4,38	85.305	3.148.223	13.786.069
09-06	Trafigura	Wilforce	Bélgica	Fijo	4,28	86.561	3.194.584	13.666.430
13-06	Gazprom	Velikiy Novgorod	Qatar	Fijo	4,29	87.745	3.238.268	13.885.693
20-06	Trafigura	Maran Gas Sparta	USA	Fijo	4,18	84.833	3.130.783	13.080.411
25-06	BP	Celestine River	Nigeria	Fijo	4,71	87.375	3.224.605	15.171.767
02-07	Shel	Maran Gas Apollonia	USA	Fijo	4,92	87.572	3.231.874	15.900.820
08-07	Vitol	Cool Explorer	Algeria	HH + 1,94	4,86	86.684	3.199.096	15.538.009
14-07	Shell	Excalibur	Trinidad y Tobago	Fijo	4,72	77.533	2.861.380	13.505.714
19-07	Gazprom	Velikiy Novgorod	Nigeria	HH + 2,072	4,99	77.013	2.842.180	14.179.636
26-07	Shell	LNG Ondo	Nigeria	Fijo	4,66	86.618	3.196.676	14.896.510
31-07	ENI	Wilforce	Algeria	Fijo	5,15	88.196	3.254.909	16.762.779
05-08	Vitol	Stena Clear Sky	UK	Fijo	4,63	81.645	3.013.150	13.950.885
11-08	Vitol	Woodside Good	Nigeria	HH + 1,94	4,61	83.371	3.076.859	14.190.474
22-08	Gazprom	Yenisei River	Nigeria	HH + 2,011	4,68	78.435	2.894.687	13.555.819
28-08	Cheniere	LNG Clean Ocean	USA	Fijo	4,85	75.379	2.781.889	13.492.162
02-09	Statoil	Arctic Aurora	Noruega	Fijo	5,86	83.999	3.100.000	18.150.500
08-09	Vitol	Grace Barleria	Algeria	Fijo	7,78	54.193	2.000.000	15.554.000
17-09	Vitol	Excelsior	TBC	Fijo	6,78	83.999	3.100.000	21.008.700
22-09	Statoil	Excalibur	TBC	Fijo	5,73	83.999	3.100.000	17.775.400
27-09	Vitol	Wilforce	TBC	Fijo	6,37	83.999	3.100.000	19.756.300
16-10	Shell	A confirmar	TBC	Fijo	5,88	83.999	3.100.000	18.228.000
					5,272	2.395.315	88.400.065	466.051.941

2017.

LNG imported from the regasification port terminal in Escobar

IMPORTACIÓN GNL ESCOBAR 2017									
Nr	FECHA DE AMARRE	EMPRESA	BUQUE	ORIGEN	PRECIO Referencia (*)	PRECIO (usd/mmbtu) (*)	Volúmen (1.000m3)	MMBTU	TOTAL (USD)
1	10-03	SHELL (1)	Maran Gas Lindos	Guinea Ecuatorial	Fijo	6,95	59.384	2.191.594	15.231.578,30
2	13-04	Trafigura	Golar Snow	Qatar	Fijo	7,04	56.077	2.069.535	14.559.178,73
3	23-04	GNA	Catalunya Spirit	Trinidad y Tobago	Fijo	6,19	52.278	1.929.333	11.946.429,94
4	03-05	Trafigura	Golar Penguin	Qatar	Fijo	6,38	58.087	2.143.734	13.668.447,98
5	07-05	GNA	Golar Kelvin	Trinidad y Tobago	Fijo	6,04	53.955	1.991.242	12.033.075,41
6	12-05	Trafigura	Golar Ice	Qatar	Fijo	6,38	56.595	2.088.665	13.317.328,04
7	16-05	GNA	Ibérica Knutsen	Trinidad y Tobago	Fijo	6,02	52.965	1.954.694	11.773.121,96
8	20-05	Trafigura	Golar Crystal	Qatar	Fijo	6,38	55.704	2.055.770	13.107.589,52
9	23-05	GNA	Catalunya Spirit	Trinidad y Tobago	Fijo	5,98	52.552	1.939.439	11.597.845,22
10	25-05	Trafigura	Golar Frost	Qatar	Fijo	6,38	58.042	2.142.076	13.657.876,58
11	30-05	Engie	GDF Suez Paris	Qatar	Fijo	6,23	55.356	2.042.942	12.725.485,72
12	03-06	Glencore	Maran Gas Mystras	Qatar	Fijo	6,36	57.508	2.122.343	13.491.734,45
13	07-06	Petrobras	Excalibur	Angola y USA	Fijo	5,52	53.087	1.959.213	10.814.855,76
14	11-06	Shell	Methane Allison Victoria	Guinea Ecuatorial	Fijo	5,42	57.977	2.139.650	11.596.903,00
15	15-06	Shell	Methane Heather Sally	Guinea Ecuatorial	Fijo	5,58	57.840	2.134.612	11.911.134,96
16	20-06	Trafigura	Golar Seal	Qatar	11,29% Brent	5,82	55.158	2.035.641	11.837.252,42
17	22-06	Shell	Maran Gas Lindos	Guinea Ecuatorial	Fijo	5,39	59.214	2.185.330	11.778.928,70
18	25-06	Shell	Bilbao Knutsen	Perú	Fijo	5,68	53.638	1.979.527	11.243.713,36
19	30-06	Shell	Gaslog Santiago	Guinea Ecuatorial	Fijo	5,58	59.247	2.186.539	12.200.887,62
20	04-07	Trafigura	Golar Bear	Qatar	11,26% Brent	5,61	58.983	2.176.799	12.214.019,19
21	07-07	Shell	Madrid Spirit	Guinea Ecuatorial	HH + 2,39	5,46	55.737	2.056.989	11.224.988,97
22	11-07	Shell	Methane Alison Victoria	Guinea Ecuatorial	HH + 2,62	5,69	59.273	2.187.478	12.440.187,39
23	14-07	Shell	Methane Lydon Volney	Guinea Ecuatorial	HH + 2,38	5,45	59.183	2.184.186	11.897.261,14
24	19-07	Glencore	Solaris	Qatar	11,534% Brent	5,75	59.048	2.179.198	12.524.177,76
25	21-07	GNA	Ibérica Knutsen	Trinidad y Tobago	Fijo	5,49	52.597	1.941.112	10.660.587,10
26	26-07	Shell	Maran Gas Lindos	Guinea Ecuatorial	HH + 2,49	5,56	59.296	2.188.359	12.160.710,96
27	30-07	Shell	Bilbao Knutsen	Guinea Ecuatorial	HH + 2,67	5,74	53.954	1.991.201	11.423.520,14
28	03-08	Trafigura	Golar Glacier	Qatar	11,22% Brent	5,44	56.170	2.072.959	11.281.042,88
29	05-08	GNA	Catalunya Spirit	Trinidad y Tobago	Fijo	5,35	52.492	1.937.254	10.362.371,65
30	10-08	Shell	Methane Shirley Elisabeth	Guinea Ecuatorial	HH + 2,49	5,46	57.616	2.126.327	11.607.619,09
31	13-08	Shell	Methane Alison Victoria	Guinea Ecuatorial	HH + 2,67	5,64	59.237	2.186.179	12.327.863,38
32	19-08	Trafigura	Golar Crystal	Qatar	11,22% Brent	5,44	55.978	2.065.891	11.242.578,82
33	28-08	GNA	Ibérica Knutsen	Trinidad y Tobago	Fijo	5,35	52.603	1.941.333	10.384.190,22
34	01-09	Glencore	GDF Suez Paris	Qatar	Fijo	5,40	58.217	2.148.526	11.602.040,40
35	06-09	Glencore	Maran Gas Apollonia	Qatar	Fijo	5,52	57.093	2.107.053	11.630.932,56
36	10-09	Glencore	Cádiz Knutsen	Qatar	10,85% Brent	5,31	57.882	2.136.153	11.336.563,97
37	14-09	Trafigura	Energy Atlantic	Qatar	Fijo	5,70	57.875	2.135.889	12.174.567,30
38	18-09	Trafigura	Maran Gas Alexandria	Qatar	Fijo	5,64	57.857	2.135.240	12.042.753,60
39	25-09	Trafigura	Solaris	Qatar	Fijo	5,67	58.007	2.140.763	12.138.126,21
40	30-09	Glencore	PSKOV	Qatar	Fijo	5,80	58.347	2.153.330	12.489.314,00
41	17-10	Vitol	Ibérica Knutsen	Trinidad y Tobago	Fijo	7,13	53.257	1.965.487	14.013.922,31
						5,82	**2.315.368**	**85.449.585**	**497.672.707**

(1) 2016 reprogrammed vessels

LNG imported from the regasification port terminal in Bahía Blanca

IMPORTACIÓN GNL BAHIA BLANCA 2017									
Nr	FECHA DE AMARRE	EMPRESA	BUQUE	ORIGEN	PRECIO Referencia (*)	PRECIO (usd/mmbtu)	Volúmen (1.000m3)	MMBTU	TOTAL (USD)
1	03-04	Shell (1)	LNG Enugu	Nigeria	Fijo	5,88	86.154	3.179.541	18.695.701,08
2	21-04	Cheniere	Maran Gas Alexandria	USA	Fijo	6,35	91.607	3.380.798	21.468.067,30
3	28-04	Trafigura	Celestine River	Qatar	Fijo	5,89	83.876	3.095.472	18.232.330,08
4	08-05	Cheniere	Cool Voyager	USA	Fijo	5,79	87.903	3.244.080	18.783.223,20
5	14-05	Glencore	Oak Spirit	USA	Fijo	6,03	87.792	3.239.995	19.543.649,84
6	21-05	Glencore	Yari LNG	Qatar	Fijo	5,89	82.458	3.043.160	17.924.212,40
7	25-05	BP	British Ruby	Qatar	Fijo	5,75	87.571	3.231.827	18.566.846,12
8	31-05	BP (1)	Castillo de Villalba	Trinidad y Tobago	Fijo	5,79	77.416	2.857.065	16.539.549,29
9	07-06	Trafigura (1)	Adam LNG	Qatar	Fijo	6,50	87.776	3.239.412	21.039.980,94
10	14-06	Cheniere	Maran Gas Alexandria	USA	HH + 2,450	5,69	87.274	3.220.892	18.313.991,91
11	20-06	Shell	LNG River Orashi	Nigeria	Fijo	5,24	84.358	3.113.264	16.313.503,36
12	25-06	Shell	Gaslog Shangai	USA	Fijo	5,24	83.010	3.063.527	16.052.881,48
13	01-07	Shell	Methane Shirley Elisabeth	Guinea Ecuatorial	HH + 2,180	5,25	83.231	3.071.665	16.117.026,26
14	07-07	Shell	LNG Oyo	Nigeria	HH + 2,290	5,36	85.374	3.150.769	16.878.669,53
15	11-07	BP	British Sapphire	Algeria	Fijo	5,26	87.729	3.237.688	17.014.050,44
16	18-07	Trafigura	Golar Snow	Qatar	HH + 2,492	5,56	84.205	3.107.634	17.275.337,41
17	21-07	Gunvor (1)	LNG River Orashi	Nigeria	Fijo	6,20	86.528	3.193.345	19.792.352,31
18	26-07	Shell	Methane Heather Sally	Trinidad y Tobago	HH + 2,150	5,22	81.760	3.017.375	15.741.645,38
19	01-08	Shell	LNG Benue	Nigeria	HH + 2,240	5,21	86.408	3.188.907	16.611.016,56
20	07-08	Trafigura	Kita LNG	Qatar	Fijo	5,29	84.522	3.119.331	16.501.260,99
21	13-08	Trafigura	Golar Penguin	Qatar	HH + 2,490	5,46	83.965	3.098.757	16.916.114,46
22	18-08	BP	British Ruby	Qatar	Fijo	5,05	86.711	3.200.100	16.144.504,50
23	26-08	Glencore	Yenisei River	Qatar	Fijo	5,05	84.251	3.109.329	15.702.111,45
24	05-09	Shell	Cool Runner	Trinidad y Tobago	Fijo	5,59	49.458	1.825.261	10.203.208,99
25	15-09	Trafigura	Hoegh Giant	Qatar	Fijo	5,32	76.270	2.814.761	14.974.528,52
26	23-09	Shell	LNG Benue	Nigeria	Fijo	6,18	86.033	3.175.073	19.621.951,14
27	10-10	BP	British Diamond	Trinidad y Tobago	Fijo	6,28	84.199	3.107.381	19.505.030,54
						5,65	**2.257.837**	**83.326.409**	**470.472.745**

(1) 2016 reprogrammed vessels

2018.

LNG imported from the regasification port terminals in Escobar and Bahía Blanca

IMPORTACIÓN GNL ESCOBAR 2018									
Nr	FECHA DE AMARRE	EMPRESA	BUQUE	ORIGEN	PRECIO Referencia (*)	PRECIO (usd/mmbtu) (*)	Volúmen (1.000m3)	MMBTU	TOTAL (USD)
1	14-04	Trafigura	TBN	TBC	Fijo	7,135	54.193	2.000.000	14.270.000,00
2	02-05	Trafigura	TBN	TBC	Fijo	7,097	54.193	2.000.000	14.194.000,00
3	11-05	Shell	TBN	TBC	Fijo	7,380	54.193	2.000.000	14.760.000,00
4	19-05	GNA	TBN	TBC	Fijo	6,793	54.193	2.000.000	13.586.000,00
5	02-06	Shell	TBN	TBC	Fijo	6,930	54.193	2.000.000	13.860.000,00
						7,067	**270.963**	**10.000.000**	**70.670.000**

(*) Los precios de cargamentos todavía no descargados correspoden a aquellos ya fijos en su contratación o vinculados a formulas cuyos componentes ya estan definidos.

Los valores de crudo Brent considerados en la formula de precio son los correspondientes al promedio diario de cotizaciones de petróleo crudo Brent del trimestre anterior al de la descarga de ese buque.

Los valores de Gas Natural relacionados con Henry Hub (HH) considerados en la formula de precio son los correspondientes al último día de cotización del precio de futuros HH en el NYMEX (New York Mercantile Exchange) del mes de la descarga.

Datos al cierre del 05/03/2018.-

IMPORTACIÓN GNL BAHIA BLANCA 2018									
Nr	FECHA DE AMARRE	EMPRESA	BUQUE	ORIGEN	PRECIO Referencia (*)	PRECIO (usd/mmbtu)	Volúmen (1.000m3)	MMBTU	TOTAL (USD)
1	04-04	Cheniere	TBN	TBC	HH + 5,07	7,796	83.999	3.100.000	24.167.600,00
2	01-05	Cheniere	TBN	TBC	HH + 4,43	7,167	83.999	3.100.000	22.217.700,00
3	26-05	Cheniere	TBN	TBC	HH + 4,01	6,747	83.999	3.100.000	20.915.700,00
						7,237	**251.996**	**9.300.000**	**67.301.000**

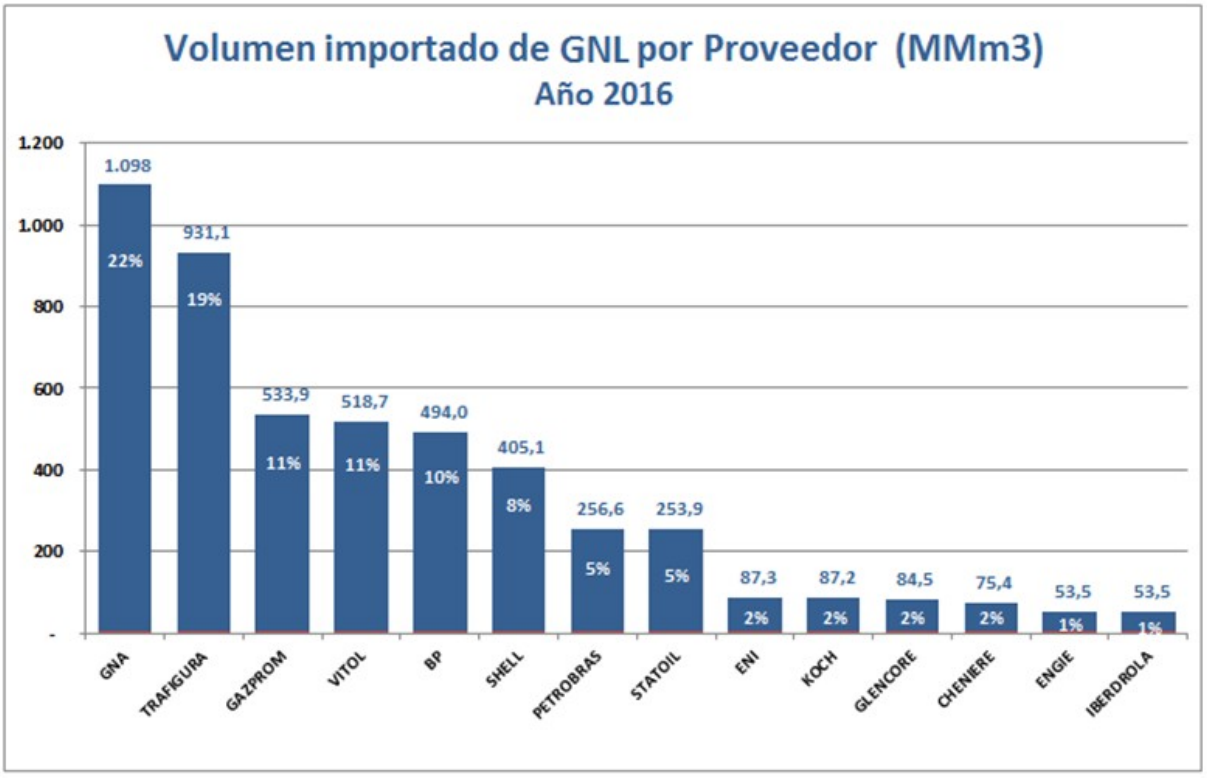
(*) Los precios de cargamentos todavía no descargados correspoden a aquellos ya fijos en su contratación o vinculados a formulas cuyos componentes ya estan definidos

Los valores de Gas Natural relacionados con Henry Hub (HH) considerados en la formula de precio son los correspondientes al último día de cotización del precio de futuros HH en el NYMEX (New York Mercantile Exchange) del mes de la descarga.

Datos al cierre del 05/03/2018.-

Annex II

Stockholding by company in LNG imports in 2016



Source: Ministry for Energy and Mining, 2017.

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