Argentina’s Shale Oil and Gas: Challenges and Opportunities
Executive Summary

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While the global shale revolution may have slowed recently – in a large part owing to the dramatic decline in international oil prices – Argentina’s small but burgeoning shale industry is poised for explosive growth, the result of a unique convergence of geological, political and economic factors. The country boasts the second largest shale gas and fourth largest shale oil deposits in the world, which according to recent exploration studies, are better or equal in quality to that found in the home of the shale revolution, the United States. Argentina’s world-class source rock is well located, largely situated in sparsely populated areas with good access to water sources necessary for hydraulic fracturing or “fracking”, the process whereby oil and gas are released from shale formations. In addition, Argentina has a healthy domestic market demand for both oil and gas as well as impressive export opportunities in the region, with an existing extensive pipeline system for conventional resources. All of this combined with a stable security environment, generally well-educated workforce and a growing pool of professional engineers, makes the country an encouraging prospect.

Numerous global conglomerates have already recognized this significant potential and have commenced operations in Argentina, including Chevron, Dow Chemical, Petronas, ExxonMobil, Shell, Total and Wintershall. Meanwhile, other international majors and midsize companies have followed their lead over the past few years, showing an increasing interest in investing in the country. These companies know that despite widespread reports about the uncertain and at times unfavorable fiscal and regulatory environment in Argentina, shale is a long-term game; commercially viable resources in Argentina are geological and technical. While there are some encouraging studies to date, companies are still engaged in conducting preliminary investigations of the country’s formations. As such, it remains unclear whether the sizeable deposits in the well-known Vaca Muerta (Spanish for “dead cow”) formation in Neuquén Province in Argentina’s west, as well as other formations across the country, will be capable of eventually returning substantial profits. That being said, in a promising development, Argentine recently joined the ranks of a small elite of countries (the US, Canada and China) that are producing commercial volumes of crude oil from tight formations.

Argentina will also continue to face considerable technical challenges on the road to creating a profitable industry. Companies will need to import costly machinery – which will be particularly difficult until the end of 2015, given the current import restrictions on essential equipment – and keep up-to-date on ever-changing technologies specific to shale. Moreover, until the end of the current administration, companies will have to overcome a number of fiscal risks, which will constrain their activities in the short term. More broadly, the recent fall in the international price of oil has led many to question the viability of shale operations around the world. While in the short term low oil prices will likely affect the local industry’s profitability, the current state of affairs is unlikely to dramatically affect shale’s long-term chances for success in Argentina owing to both the likelihood of an eventual price rebound and broad political support for the industry.

We believe that the principal challenges outlined above are surmountable and ultimately, unlikely to prevent the industry’s growth in Argentina. Regardless of which administration takes the reigns at the end of this year, shale will be firmly on their political agenda. The key challenge for the next government will be to ensure that Argentina’s business climate is capable of attracting the level of investment needed to make shale profitable.

With sufficient levels of investment and the right technological capabilities, the shale industry could take off within the next decade. As argued in the following report, Cefeidas Group is cautiously optimistic about the future of Argentina’s world-class shale resources.

For further analysis of any of the issues contained in this report, including policy advice and recommendations, please contact Cefeidas Group at info@cefeidas.com.
PART I

Assessing the Shale Opportunity
Argentina: Great Expectations

Over the past decade, the United States has experienced a shale boom, with phenomenal growth in the production of this relatively low-cost unconventional resource. Between 2007 and 2013, US natural gas production grew by 27 percent, fueled largely by shale gas activity. The country’s oil production, meanwhile, has climbed 66 percent since 2008.1 This increased output led to a dramatic fall in US energy prices and generated significant revenue for the national government; unconventionals added USD 74 billion in taxes in 2012.2 The boom also triggered a jump in the country’s jobs figures. In 2012, shale drilling activity supported more than 1.3 million jobs, up from 600,000 in 2010.3, 4 Most recently, however, the sharp drop in international oil prices has led to a significant slowdown in US oil drilling with shale output hitting a four-year low in April 2015.

Other countries have at various times attempted to replicate the US experience, both to boost their economies and guarantee domestic energy security (see text box 1). So far, however, most have failed due to the greater technical challenges and development costs associated with shale, as well as specific factors that have allowed the United States to successfully exploit its reserves, including private land and mineral rights ownership,5 high natural gas prices, favorable geology, and technological advancements and innovations. China and Poland, for example – both of which have sizeable shale gas deposits – have found it difficult to create a profitable industry due to regulatory, technological, infrastructural and social challenges. Poland has also suffered from poor test drilling results and across Europe, anti-fracking movements have created a generally hostile environment for shale operations. Meanwhile, even in the United States, large energy companies such as BP, ExxonMobil and Shell are finding it challenging to turn a profit from unconventionals, despite the industry having represented a boom for smaller, independent energy companies.6

5. In the US, private land and mineral rights ownership made an important contribution to the shale gas boom by enabling natural gas firms to obtain reasonable returns from their early investments in new technology by purchasing land, identifying shale reserves and then on-selling it to competitors. This led to the growth of thousands of independent oil and gas companies. Moreover, private ownership increased public acceptance because individual owners shared in the profits.
6. Shell announced in March 2014 that it would cut spending by a fifth and lay off staff at its American exploration and production business. In June the company sold its assets in Eagle Ford and in August announced the sale of two onshore US shale gas properties.
Argentina’s Shale Oil and Gas: Challenges and Opportunities

What is taking place in other countries?

According to the most recent study of the US Energy Information Administration (EIA), a total of 42 counties are assessed to have recoverable shale reserves. In 2013, the EIA examined 137 basins around the world and discovered that almost 8,000 trillion cubic feet of technically recoverable natural gas is located outside North America. China, Argentina, Algeria, Mexico and Canada together account for more than half of the total shale gas available. Meanwhile, outside of the United States, the majority of the world’s shale oil is in Russia, China, Libya and Argentina. However, while a dozen countries have conducted exploratory test wells, the United States, Canada and China are the only three countries that current produce commercial volumes of natural gas from shale formations; China’s level remains very small at only 1.5 percent of total natural gas production.7

Aside from Argentina, two of the most promising countries in Latin America for shale production are Mexico and Brazil.

Mexico. Ranked sixth globally for shale potential, Mexico has the second largest technically recoverable shale gas deposits in Latin America (after Argentina). State-run energy giant Pemex produced shale gas for the first time in March 2011 in Coahuila state, in a formation that forms part of the Eagle Ford area in Texas. The company plans to drill 150 wells through 2016 and has budgeted USD 200 million for shale gas development. More broadly, in August 2014, Mexico’s government passed an energy reform bill into law, ending over 70 years of state ownership.

Brazil. There are significant opportunities for shale gas production in Brazil although the current focus is on offshore pre-salt resources. Brazil is ranked tenth globally for shale gas reserves and in November 2013, the government awarded 72 onshore natural gas and shale gas exploration blocks out of 240 concessions on offer.

Argentina has proven to be the exception. The country’s shale industry is growing fast, albeit from a low base. According to the most recent studies, Argentina is home to the world’s second largest deposits of risked, recoverable shale gas and the fourth largest of technically recoverable shale oil. In May 2013, the US Energy Information Agency (EIA) released a ranking of every country with significant shale gas deposits, estimating that Argentina’s four shale gas basins — in which there are 10 shale formations — contain an impressive 802 trillion cubic feet (Tcf) of risked, shale gas in place out of 3,244 Tcf of risked, technically recoverable shale gas resources (see figure 1). This amounts to 60 times that of the country’s current tested natural gas reserves.

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The most promising of the country’s basins, the Neuquén Basin, is home to both the Vaca Muerta field and the Los Molles formation. This large basin – which also sprawls across parts of the provinces of Mendoza, Rio Negro and La Pampa – has been assessed to contain over half of Argentina’s risked, technically recoverable shale gas resources (estimated at 583 Tcf). According to the most recent figures, the basin is producing up to 42,000–45,000 barrels of oil equivalent from shale per day, which represents approximately 20 percent of the basin’s total oil production. In addition, two more unconventional fields were discovered in 2014. In May 2014, YPF revealed that it had found deposits in Chubut Province, in the D-129 formation of the Golfo San Jorge Basin. Three months later, YPF announced it had also discovered an oil field south of Mendoza Province, in the Agrio formation. At the time of writing, the national energy company was still uncertain what level of production the well it had drilled, Filo Morado, would have. Whatever the result, Argentina’s resources are already being eyed by foreign observers. During a speech in late 2014, Principal Deputy Assistant Secretary for Fossil Energy at the US Department of Energy, Christopher Smith, stated that his department believes that Argentina has “one of the most promising shale opportunities throughout the world”.

Indeed, the country is witnessing a drilling boom of sorts. In late 2014, the number of unconventional wells in Neuquén Province jumped to 671 (from 471 in 2013) and investment climbed from USD 4 billion to USD 5.5 billion. Neuquén’s shale-specific wells in production have climbed significantly over the past couple of years (see figure 3) which has led to a substantial increase in the production of both oil and gas (see figure 4).
FIGURE 3
Shale-specific Wells in Production in Neuquén
Source: Sub-secretary of Mining and Hydrocarbons for Neuquén

FIGURE 4
Production of Shale Oil and Gas in Neuquén, in barrels of oil equivalent per day
Source: Sub-secretary of Mining and Hydrocarbons for Neuquén

FIGURE 5
YPF’s Unconventional Drilling Rigs (2012–2014)
Source: YPF
Argentina’s leading energy company, YPF has been particularly active and is responsible for the vast majority of the production to date. From a national capacity of only four rigs in April 2012, YPF had 75 drilling rigs by the end of 2014, of which 36 are dedicated to shale (see figure 5). 12, 13

Yacimientos Petrolíferos Fiscales (YPF)

Originally established as a state enterprise in 1922, YPF is Argentina’s largest oil and gas company. It was privatized in 1992 but subsequently re-nationalized in May 2012 after the government accused Spanish company Repsol, which controlled YPF at the time, of failing to invest in exploration and increase production. Although now 51 percent state-owned, the company continues to operate as a private entity. As such, it is listed on the Buenos Aires Stock Exchange, while its American Depositary Shares are traded on the New York Stock Exchange. In 2013, the company reported a net income of ARS 5.7 billion (about USD 710 million), more than a 45 percent increase on 2012. The trend continued in 2014, with YPF’s net income for the third quarter of 2014 coming in at ARS 3.2 billion (approximately 382 million), 127 percent higher than the same period the year before.

YPF is the most significant player in Argentina’s energy landscape. The company’s refining capacity represents over half of the country’s total capacity and its oil and gas production accounts for 37 percent of Argentina’s total production. In the second quarter of 2014, the company boosted its total hydrocarbons production by 15.5 percent compared to the same period the year before, with natural gas climbing almost 32 percent and crude oil by 5.6 percent. Since its change in management, YPF has increased its investment from USD 2 to USD 6 billion, improved its production numbers, cash flow, stock price and overall financial situation. However, in line with its ambitious 2013–2017 investment plan, the company needs to attract more than USD 32 billion in investments by 2017 to raise oil and gas output by a third. The company’s CEO Miguel Galuccio has noted that while the overwhelming majority (80 percent) of this funding will come from cash flow, the remaining 20 percent will need to be sourced from loans or debt sales. As part of this plan, YPF sold USD 500 million in bonds in February 2015, following sales of USD 1 billion in April 2014 (the largest bond sale in Argentina’s history) and USD 650 million in late 2013.

In 2010, YPF was awarded most of the areas offered for hydrocarbon exploration in Neuquén, the home of Vaca Muerta. As such, the company owns about three-quarters of the current exploration permits.

In the most productive formation, Vaca Muerta, YPF had a total of 19 drilling rigs and 290 active wells by the end of 2014 (see figures 6 and 7). Meanwhile, in May 2014, YPF successfully drilled a well in the Golfo San Jorge basin in Chubut Province (in the D-129 formation), located in Argentina’s south, with plans to drill another 11 wells over the next three years.\textsuperscript{14} While YPF initially used vertical drilling to exploit the first “sweet spot”\textsuperscript{16} (in Vaca Muerta’s Loma La Lata field), the company has already started to use horizontal drilling for its operations and has employed original techniques to adapt to Argentina’s unique conditions, thereby further developing its shale industry know-how. For example, YPF has started drilling wells of up to 1.5 kilometers, 50 percent longer than the average well in the US. This increase in drilling activity has led to a significant jump in YPF’s bottom line. The nationalized company’s second quarter profit for 2014 was approximately ARS 1.5 billion (approximately USD 184 million), up from ARS 1.09 billion (approximately USD 133 million) in 2013. Overall, oil production rose 5.6 percent and natural gas 31.8 percent, compared to 2013. This impressive growth in such a short period of time has largely been driven by the company’s proactive CEO and President, Miguel Galuccio.


\textsuperscript{15} Chubut Minister of Hydrocarbons Ezequiel Cufré, quoted in “Argentina’s Chubut region sees more shale wells after initial find”, 22 May 2014, http://www.reuters.com/article/2014/05/22/argentina-shale-chubut-idUSL1N0O82GT20140522

\textsuperscript{16} In other words, the most profitable part of a shale play.
Much of YPF’s success since its expropriation from Spanish firm Repsol in 2012 has been credited to the company’s 47 year-old CEO, Miguel Galuccio. Originally from Entre Ríos Province, Galuccio graduated as a hydrocarbons engineer from the Buenos Aires Institute of Technology of Buenos Aires (ITBA) in 1994. Shortly after he joined YPF, rapidly rising through its ranks. Owing to his work at the company’s Dallas-based Maxus subsidiary, he was subsequently chosen to head up the operations and development of YPF’s oil fields in Indonesia. When YPF was acquired by Repsol in 1999, Galuccio resigned to take up a position with oilfield-services company Schlumberger, where he worked in various positions including general manager for Mexico and Central America and the head of Production Management, based in London. For more than a decade, Galuccio helped companies across the globe increase their energy output and in the process, built up a wide network of contacts and established his international reputation.

In 2012, Galuccio was hand-picked by President Cristina Fernández de Kirchner (CFK) to take over as CEO of the newly nationalized YPF. He immediately implemented a 100-day plan that took a three-pronged approach: run the company professionally, create a national identity and ensure that YPF created value for shareholders. Galuccio’s approach paid off with YPF reporting a net profit of USD 377.8 million (ARS 3.21 billion) in the third quarter of 2014 – up more than 127 percent from the same period in 2013 – and was named CEO of the year by the Latin Trade Group. However, despite the company’s impressive growth, Galuccio has noted that 2015 will be a complicated year in terms of the international scenario, stating that “a storm is coming and we will need to weather it”.22

Galuccio is one of a privileged few that has a close working relationship with CFK, yet still manages to maintain YPF’s independence from government. Importantly, he has proven able to bridge the political divide. In June 2014, Galuccio convinced a large part of the political spectrum of Congress to travel to Vaca Muerta to see the company’s shale operations first hand and later that year, was successful in negotiating a series of changes to an amended version of the national Hydrocarbons Law. His broad support among the principal presidential candidates means that he is likely to continue to head up the organization for the foreseeable future.

As a result of all of this activity, Argentina is now one of only four countries – along with the US, Canada and China – to produce commercial volumes of crude oil from tight formations (tight oil), according to the US Energy Information Agency. This production largely originates from Vaca Muerta’s Loma Campana field, with YPF and Chevron jointly producing about 20,000 barrels of tight oil per day from this one area (others projects remain in their exploratory phases). In fact, Loma Campana is currently the second largest producing field in the country, behind only Pan American Energy’s Cerro Dragón in Chubut Province. When the production from tight formations is considered, unconventional gas already represents 24 percent of Neuquén’s total extraction.

This level of drilling activity is forecast to continue over the coming years. Companies such as Nabors Industries and Helmerich & Payne already have some of their largest and most modern rigs in Argentina. In fact, the latter has 19 rigs dedicated to Argentina, nearly half of its total drilling fleet outside North America. By 2019, Neuquén is expected to have 50 specialized drills and a total of 2,000 wells, according to the provincial government’s projections. In a recent study released by the Argentine Institute of Oil and Gas (IAPG), the organization has projected that once 1,000 wells are drilled in Vaca Muerta – which according to current costs will require a total investment of approximately USD 11-15 billion – the province will see a number of economic benefits. These include an increase in GDP of between 75 and 100 percent; the creation of over 60,000 new jobs (which represents approximately 10 percent of the population); and an increase of up to 80 percent in tax revenue. Moreover, as the production process becomes more efficient, the overall costs will continue to drop. Already, YPF has had success in reducing the costs for constructing wells (see figure 8).

More broadly, a substantial increase in natural gas production would allow Argentina to reduce liquefied natural gas (LNG) imports while increased oil production could replace fuel imports of around USD 6 billion, which would represent currency savings of USD 15-19 billion. That being said, to fully capitalize on its unconventional resources and realize these types of savings, Argentina will need to invest in its existing refineries to better adapt plants for the type of oil produced from shale plays (which is light oil) as well as construct new plants to cope with rising volumes.

![FIGURE 8](image)

**FIGURE 8**

YPF Construction Costs for Wells, in millions of USD

Source: YPF

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21 At present, YPF has sufficient processing capacity at its refinery in La Plata, where it refines oil extracted from Loma Campana.
FIGURE 9
YPF Stock Price, in billions of USD

Source: New York Stock Exchange
Positive Winds of Change

Despite widespread criticism of the current administration’s fiscal policies—which have included strict import controls and currency restrictions—since 2012 the Argentine government has in fact taken steps to address the country’s economic problems in a bid to attract foreign investment, especially in its budding shale industry. CFK’s administration has proven particularly committed to making state controlled energy company YPF profitable and attractive to international investors. This is not to say that investment conditions in Argentina’s oil and gas sector are ideal, including when compared to other countries in the region. Rather, these changes simply demonstrate that the government has endeavored to improve market conditions within the current context and will most likely continue to do so into the future. We believe that given the government’s need for additional foreign investments to develop its shale resources—more than ever since it was officially declared in default in July 2014—now is an ideal time for larger companies to seek special and favorable treatment.

As part of this “pragmatic turn”, the government has resolved a number of international disputes and struck deals with international lenders in order to normalize relations with overseas capital markets. In November 2013, the administration was successful in striking a deal with Spain’s largest oil and gas company, Repsol, whose majority stake in YPF had been seized by the Argentine government in April 2012 as part of an overall re-nationalization of the company. The settlement removed a significant barrier to investment—the reputational harm caused by YPF’s nationalization—and increased the likelihood of large-scale foreign participation in the shale industry. Earlier, in October 2013, the government announced it would pay bonds amounting to USD 500 million to five American and European companies that had successfully taken Argentina before the World Bank’s investment tribunal, the International Centre for Settlement of Investment Disputes (ICSID). And in May 2014, after months of negotiations, the Paris Club and the Argentine government were able to reach a deal which allows the country to clear its debt owed to the group since 2002. The deal requires that Argentina pay a total of USD 13.8 billion in arrears to the club over the next five to seven years. The government made its first payment of USD 650 million in July 2014. The negotiated settlement has helped pave the way for Argentina’s government to raise new guarantees or loans from member countries that had previously been prevented from doing so. As a result, countries such as Japan, Germany, the Netherlands, Spain and Italy are now free to invest in Argentina’s oil and gas industry.

The government has also adopted a number of internal measures over the past few years in a bid to attract international investment in Argentina’s oil and gas industry (see text box 4). Most recently, the government has sought to cushion the blow from falling international oil prices on companies, as well as to ensure local employment and maintain investment. In January 2015, Economy Minister Axel Kicillof ratified a stimulus plan whereby companies receive USD 3 per barrel for maintaining or increasing oil production. Moreover, companies operating in Argentina continue to benefit from a higher price from oil, which was in January was set at USD 77 per barrel (admittedly down from USD 83.90 in December 2014), more than a third higher than the price of Brent crude oil. However, while an effective short-term response to the prevailing international climate, it is uncertain for how long the government will have the funds necessary to continue protecting companies in this way.

23 Argentina owed the Paris Club USD 9.06 billion, as well as USD 1.1 billion in interest and USD 3.6 billion in penalties.
In January 2013, through Resolution 1/2013, the Commission for Planning and Strategic Coordination of the National Hydrocarbon Plan created the ‘Excess Natural Gas Injection Incentive Program’. The program established that all domestic producers injecting natural gas into the system in excess of current levels of production could enroll in a plan that would guarantee them USD 7.50 mmBtu, significantly more than previous USD 2.50. The government was able to reach agreements with a number of major oil companies, including YPF, Chevron, Total, Wintershall, Petrobras, Sinopec and Roch.

However, severe penalties for non-compliance drove several companies away. As such, in November 2013 the federal government extended the incentive program to smaller firms. The new deal is aimed at attracting small and medium-sized companies – that inject fewer than 3.5 million cubic meters per day – by offering a slightly lower price (between USD 4 and USD 7.50) but with easier-to-meet production targets: each company must produce the same as the daily average of the last period less 15 percent in order to avoid penalties. The program will continue until 2017 and should amount to an additional USD 676.7 million in state spending, according to Economy Minister Kicillof.
**Preferential Tax Rate for Oil and Gas Equipment Imports.**

In July 2013, the government passed Decree 927/2013 which authorizes lower import duties on certain equipment for the oil and gas sector. Special oil and gas drilling rigs are exempt from import duties, while the tariff for other types of equipment was reduced from a high of 35 percent – the maximum allowed for members of the Mercosur regional trade organization – to 14 percent. To attract these lower duties, companies registered with the National Registry of Hydrocarbons Investments must prove to the Ministry of Industry that the equipment is:

1. essential for implementing their investment plans; and
2. not produced in Argentina and that its import would not affect the potential domestic production of the good.

The decree was initially created to assist YPF, which objected to the requirement to pay a 35 percent tax on special drilling machinery that was not locally available. PAE was the first company to purchase equipment under the scheme, importing five USD 20 million semiautomatic drilling rigs – which were unavailable in Argentina due to the recent increase in activity in Vaca Muerta – to operate in Lindero Atravesado in Neuquén and Golfo San Jorge in Chubut. The company also sent 20 staff to Houston, Texas to undertake training in order to operate the equipment.

Note: This decree was incorporated, and modified, by the recently passed changes to the 1967 national Hydrocarbons Law, discussed in detail in ‘Improved Regulatory Environment’.

**Investment Promotion Regime for the Exploration of Hydrocarbons.**

In December 2012, YPF and Chevron announced that they would enter into a USD 1.24 billion deal to exploit a section of Vaca Muerta (for more information on this joint venture, see Annex A). Signed in July 2013, the deal was only made possible after the Argentine government promised a number of benefits to Chevron, subsequently encapsulated in Decree 929/2013, which extended the benefits to any company that met certain criteria. The decree created a new investment promotion regime for the development of shale gas projects and granted special benefits to oil companies – already holding exploration concessions – which invested more than USD 1 billion in hard currency during the first five years of a project. Once five years have passed, companies will have the right to: export 20 percent of production tax free; maintain their proceeds abroad; and, if the company’s production has to be sold on the local market to satisfy consumer demand, the government will pay the company the equivalent of the world price (in pesos) for oil and gas for 20 percent of production volume.24, 25 Companies will then have “preferential access” to the official exchange rate market to transfer the amount from pesos into foreign currency. The decree also opened up the possibility for companies to extend concessions for 10 more years, to a total of 35 years.

Note: Along with Decree 927/2013, this decree was incorporated, and modified, by the recently passed changes to the 1967 national Hydrocarbons Law. Most significantly, the bill lowered the threshold from LS 1 billion to USD 250 million and reduced the period from five to three years. For a more detailed analysis, see ‘Improved Regulatory Environment’.

**Simplification and Reduction of Oil Exports Taxes.**

In January 2013, through Resolution 1/2013, the Argentine government initiated a new sliding scale withholding system of export taxes for oil shipments in order to increase investment. Under the previous scheme, companies received a fixed amount of USD 42 per barrel, plus compensations for up to USD 28 if production surpassed that of the previous year, which most companies failed to achieve. The new scheme removed the requirement for companies to reach production targets. The changes were introduced at the request of companies such as PAE, which exports a large part of its production and had missed production targets in 2012, in part due to labor conflicts.

Subsequently, in light of falling international oil prices, in October 2014 the Argentina government passed Resolution 803/2014, which lowers the export taxes to be paid as part of the sliding-scale. Since 2007, companies were required to pay a 45 percent export tax if the price of oil fell below USD 80 per barrel. The new resolution establishes that companies will now pay only 13 percent when the price falls below USD 80 a barrel, 11.5 percent for a price of less than USD 75 and 10 for anything below USD 70.26

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24 Companies have “preferential access” to the official exchange rate market to transfer the amount from Argentine pesos into foreign currency.
25 Article 6 of the federal Hydrocarbons Law (No 17,319) established that when the domestic market is not fully supplied, the government can force companies to sell all production of liquid hydrocarbons in the domestic market.
The government has sought to amend their approach for two principal reasons. Firstly, Argentina needs a significant injection of dollars to help finance international payments and boost the economy. Secondly, Argentina – and its national oil company, YPF – requires money, technology and international know-how in order to successfully exploit its shale resources. As such, conditions are currently favorable for international companies looking to invest in Argentina.

Argentina’s slowed economy: the country’s need for shale

For various reasons, Argentina’s economy has faltered over the last few years. Many of the country’s issues stem from the 2001-02 financial crisis and the policy decisions made in its aftermath. For one, since 2002 the country’s utilities tariffs have largely remained frozen, both to help contain rising inflation rates and for fear of a public backlash were prices to be raised. Due to consistently low prices for consumers, the domestic demand has steadily increased. Meanwhile, government subsidies provided to the energy sector to protect local companies from rising costs has deepened the country’s deficit. In 2013, energy subsidies for producers increased by 48 percent compared to 2012. Frozen tariffs have led to largely stagnant revenues and continue to discourage companies from investing in new technologies or pursuing exploration activities. Public services have therefore deteriorated meaning that consumers are even less likely to accept an increase in tariffs. The situation has led to a steady decline in the domestic production of natural gas and therefore, a dramatic rise in imports. (see figure 10).

As a result, Argentina’s energy trade deficit reached nearly USD 6 billion in 2013, a 150 percent increase compared to 2012. In fact, between 2004 and 2013, the country’s imports grew from USD 1 billion to almost USD 12 billion. (see figure 11).

The country’s energy deficit explains, in part, the substantial fall in the Argentine Central Bank’s dollar holdings. Foreign reserves dropped to an eight-year low of USD 26.7 billion in April 2014. The government has since implemented a series of stopgap measures – a sharp devaluation of the Argentine peso, deals with agricultural exporters and a USD 11 billion currency swap with China – which have served to regain some of these losses. A thriving shale industry, however, would help boost gas production, lower pressure on the country’s foreign reserves and ultimately help reverse the current energy deficit.

FIGURE 10

Natural Gas Production and Consumption, in cubic meters at 9,300 Kilocalories (Kcal)

Source: IAPG/Energía Argentina S.A. (ENARSA)
Note: Data not available for consumption for 2014

YPF’s efforts, combined with modifications to government policies, have prompted increasing interest from oil majors in Argentina’s shale plays (see figure 12). Dozens of companies have established operations in Vaca Muerta – including several large multinationals – and numerous other firms have expressed an interest in investing. Chevron, Wintershall and Chinese-Argentinean company Bridas Corporation have already announced more than USD 5 billion worth of investments. Meanwhile, the Argentine unit of multinational Dow Chemical has agreed to invest USD 120 million and Malaysia’s Petronas will inject USD 475 million over the next three years. French company Total is conducting exploratory activities, while Russia’s state-owned gas producer Gazprom and Mexican company Pemex have also at various times demonstrated their interest in Argentina. In April 2015, Gazprom signed a memorandum of understanding (MOU) with YPF. Meanwhile, local firm Pan American Energy invested USD 1.5 billion in 2013 and planned to spend up to USD 2 billion in 2014. At this stage, however, only three joint ventures have made significantly progress to date: (1) Chevron (which is now beyond its pilot stage); (2) Dow (which is still in its pilot stage but is set to enter production within the near future); and (3) Petronas (which remains in the initial stages). For a detailed description of companies investing, or interested in investing, in Argentina see Annex A.
The increase in interest is equally due to the fact that there is a genuine need for large oil companies to find new oil and gas reserves around the world, including in much more politically unstable places than Argentina. Ali Moshiri, president of Africa-Latin American Exploration and Production at Chevron has said that in the oil and gas business “risk is part of the equation” and that “there is nothing close…in the world” to the potential resources in Vaca Muerta.28 Moreover, due to the political and macroeconomic risks, Argentine assets are considered fairly cheap, which has motivated some companies to invest. The activities of local and international oil and gas companies have in turn attracted field service companies such as Halliburton, Schlumberger, Calfrac Well Services and Weatherford International to Neuquén. In fact, more than a hundred companies (including YPF, Baker Hughes and Halliburton) have reportedly signed up to form part of an industrial park in the city of Añelo in Neuquén – about 20 kilometers from Loma Campana – to support the growing number of oil and gas companies.29, 30

Due to the substantial increase in interest from these companies, the price of an acre of land in Vaca Muerta has increased 37 times in the last five years.31 In the formation’s dry gas window, prices now range from USD 2,000–5,000 per acre, while in the rich gas window, acres are selling for up to USD 8,000. Meanwhile, shale oil fields are selling for USD 8,000–15,000. In early 2013, German Wintershall paid approximately USD 7,300 per acre to partner with Gas y Petróleo del Neuquén in Aguada, while Chevron paid USD 10,245 per acre to enter Loma Campana and Dow Chemical USD 10,790 an acre to buy into El Orejano. These prices are similar to the average price of USD 10,000 per acre for shale acreage in the United States in 2013, although well below prices paid at the height of the industry’s boom, during which time Marubeni Corp, a Japanese commodity trader, paid USD 25,000 per acre for a stake in Hun Oil Co’s Eagle Ford shale property.32

Despite such promising signs, the development of the Vaca Muerta basin remains in its preliminary stages. All of the deals struck with international companies fall well short of Galuccio’s USD 37 billion five-year investment plan – in terms of financing, the area covered and the number of wells drilled. Many more companies will have to sign up if Argentina is to reach energy independence in the medium term. Moreover, numerous companies that were granted concession rights in 2008 have so far failed to follow through with their promised investments.

Argentina’s Shale Potential

Geographical Characteristics

According to estimates, Vaca Muerta, which spans 30,000 square kilometers, shares various geographic similarities with shale formations in the United States, including the prolific Eagle Ford play in Texas. Firstly, the average depth of recoverable shale gas in Vaca Muerta is located approximately 2,400 meters below ground, in the middle of the 2,000–3,000 meter range in the US. Secondly, the reservoir pressure is very similar to that of Eagle Ford – between 4,500 and 9,500 pounds per square inch (psi) in Vaca Muerta, compared to a maximum of 8,500 psi in the US play. Thirdly, Vaca Muerta’s average thickness is even higher than that in the US at between 30 and 450 meters compared to a maximum of 100 meters in Eagle Ford. According to YPF, this means that in addition to horizontal wells, companies operating in Argentina will be able to drill vertical wells which are significantly cheaper and require less fracturing. More broadly, these similarities with US fields mean that existing extraction technology – as well as subsequent improvements and innovations – will probably be more easily applied to Argentina’s needs than other countries’, making the overall process less costly over time.

That being said, while these indicators are promising, uncertainty remains over the exact quantity and quality of Argentina’s resources. And like all shale plays, Vaca Muerta is not homogenous and will therefore require that companies use a number of technologies to identify the “sweet spots” for drilling, adding significantly to the overall expense.

Existing Infrastructure

Argentina has well-developed infrastructure for natural gas production and transport, making the country attractive for further hydrocarbon development, particularly compared to other countries. This infrastructure is particularly needed given that fracking is logistically complex, requiring huge volumes of equipment and producing significant amounts of waste. Numerous trucks of chemicals, as well as 3–6 million liters of water, are required for each fracting job.

Argentina’s advanced gas transportation system, both domestically and for export, includes over 18,000 miles of natural gas pipelines, according to the US Energy Information Agency. These strategic pipelines connect production in Neuquén – as well as Golfo San Jorge and the Austral Basin in southern Patagonia – with Buenos Aires and other hubs, as well as with neighboring Brazil, Uruguay and Chile. Moreover, some of the country’s gas pipelines run to the city of Bahía Blanca, a petrochemical export hub in the south of Buenos Aires Province that is home to the country’s largest deepwater port. Importantly, potential gas extraction sites correspond with the gas locations for unconventional hydrocarbons. Given the decline in conventional gas production in Argentina, the excess pipelines could potentially be used for the transport of shale gas. Therefore, the country’s well-developed gas transportation – and field services infrastructure – means that the timeline from exploration to full-scale development will likely be shorter in Argentina than in other shale-rich countries.

As an established conventional hydrocarbon-producing basin, Neuquén Province also has advanced production infrastructure, including a fairly extensive road network and oilfield services capacity, which provincial authorities are seeking to develop further. The Argentine provincial oil and gas company, Gas y Petróleo del Neuquén – which is owned by the provincial government and has been performing exploration activities in the province since 2012 – estimates that the province (which accounts for approximately 50 percent of the country’s total gas production) has enough pipeline capacity to accommodate an increase in unconventional drilling for the next 5–6 years. Moreover, in July 2014, YPF started to operate a 55 kilometer pipeline valued at USD 75 million that connects the Rincón del Mangrullo block with a plant in Loma La Lata and has a capacity of 5 million cubic meters per day. The extension formed part of a combined investment of USD 400 million in the development of tight gas with the operator, Petrolera Pampa.

Developing Argentina’s unconventional resources will still be challenging. Neuquén and other provinces will need to bolster both their workforce capacity and shale-specific infrastructure. For one, there are few shale specialists in Argentina. As experts are difficult to source

34 During the 1990s, Argentina constructed a pipeline export capacity of 5.3 billion cubic meters (bcm) to Chile, 1.5 bcm to Brazil and 1.5 bcm to Uruguay.
Argentina’s Shale Oil and Gas: Challenges and Opportunities
from abroad – and because the equipment is highly specialized – Argentina will continue to require assistance from international contractors to upskill its local workforce. Furthermore, there is a global shortage of key shale exploration and production equipment, specifically drilling rigs. At present, there are likely only a few hundred rigs in operation in the whole of Argentina compared to probably more than 500,000 in the United States. Shale operations will also likely require additional roads to be built – a costly undertaking given Vaca Muerta’s remote location – as well as a significant increase in the number of trucks and drivers, which will add to the overall cost of operations. That being said, these services will not be required for the development of companies’ fracking wells for the next four to five years, allowing time for more advanced technology to be developed. Moreover, many companies are already in the process of addressing these issues. YPF and Chevron, for example, have commissioned American global management consulting firm Bain & Company to assist with plans for a number of infrastructure developments, including hiring fly-in consultants to make on-the-ground assessments in Vaca Muerta.

Well-located Resources

In addition to the benefits of existing infrastructure, Argentina’s largest shale plays are well situated compared to many other countries. Firstly, the areas in which these formations are located are relatively low density. Neuquén has a population of only 551,000 with a density of 5.9 per square kilometer, according to the most recent census.38 In contrast, in China and to some extent the United States, shale-rich areas are densely populated and intensely farmed. Drilling sites in these places have been built very close to homes, which has upset residents and led to regular protests. Multinational oil and gas company Shell, for example, has had to spend a significant amount of money to compensate local residents and government officials in China for using private land and roads.39

Moreover, despite the aridity of the central Neuquén Basin, access to water is unlikely to present as difficult a problem as in many other regions with shale formations. While developing and drilling unconventional wells requires huge volumes of water, Neuquén Province has access to surface water from the Neuquén and Limay Rivers, as well as Lake Nahuel-Huapi. In this way, the basin’s location helps reduce the distance required to provide fresh water for hydraulic fracturing. For example, in 2012, YPF was able to construct a giant reservoir with water from a nearby river to supply the 1,800 cubic meters used for each fracking stage.40 Separately, although Neuquén’s shale formation is located further from major cities than in other countries – which could present problems for smaller operators – big players (such as Chevron) can optimize the existing infrastructure in a way that they have not been able to in the United States.

In addition, there are impressive export opportunities for Argentine shale gas, due to the country’s strategic location in South America. Not only does Argentina have a mature domestic natural gas market, which has evolved over the last 60 years. There is also significant demand in the region that would create impressive export opportunities to countries such as Chile and Brazil. Moreover, Argentina has the ability to easily transport its production to the rest of the world through the deepwater port of Bahía Blanca on the country’s east coast and Chile’s ports on the Pacific Ocean.

Argentina also has fairly advanced gas processing capabilities throughout the country, including in Bahía Blanca. The petrochemical complex has been operated by Dow Argentina, a subsidiary of the US Dow Chemical, since 1995 and consists of six productions plants.41 From 2015, Dow is reportedly planning to improve the equipment and technologies of its polyethylene and plastics production units at the complex to support increased market demand.42

More broadly, unlike many oil and gas regions around the world, Argentina is a politically stable country. There is very little risk of attacks by militants or activists on either pipelines or personnel. In fact, Argentina is a much more secure operating environment than many countries in the region. Companies in Colombia, for example – the fourth-largest oil-producing country in Latin America – regularly face the threat of attacks from insurgent groups. In 2013 alone, there were 259 attacks on oil production centers and in July 2014, one of Colombia’s principal pipelines was effectively paralyzed by an attack.43

Human Capital

In addition to Argentina’s potentially hugely profitable amounts of unconventional resources, the country is also regionally considered to have high levels of human capital. Although the skill sets required for the shale gas industry are highly specific, in the future Argentina will be able to draw on its local graduates to create shale experts. Already, multiple universities are focused on providing training for the new industry, including the University of Buenos Aires, the

37 Note that it is difficult to accurately determine the number of shale gas wells and rigs in the US, as many states do not release official data. This figure is an estimate only, based on figures from a number of sources.
40 There can be up to 10 stages per well.
Institute of Technology in Buenos Aires (ITBA), the National Technological University (UTN), the National University of Patagonia San Juan Bosco, the National University of Patagonia and the National University of Cuyo.44 In addition, the Argentine Institute of Oil and Gas (IAPG) offers various specialization courses.

While the budding industry currently relies heavily on engineers and contractors from overseas, within the next decade Argentina is likely to have a number of well-educated, highly-skilled and experienced professionals. In March 2012, the Argentine Ministry for Education launched the Strategic Plan for Engineering Education 2012-2016 to improve the training of engineers and double the number of graduates by 2021. According to the latest data, 7,900 engineers graduate each year, which represents a large increase on the previous decade. In fact, since 2009, the number of engineering students has grown by 80 percent, with the oil specialty growing at double the rate of other engineering fields.45 According to a recent report by Accenture, as of 2014 the country has approximately 100,000 engineers.46 From these students and professionals, Argentina will need to build its own teams of experts – including fracking crews – to regulate and perform the type of activities specific to the production of shale.

Improved Regulatory Environment

In October 2014, Argentina’s Congress approved a series of amendments to the 1967 federal Hydrocarbons Law (Law 17,319). The newly amended Law 27,007 now covers shale and ultimately seeks to encourage investment by preventing small junior companies from sitting on resources that they cannot exploit. Meanwhile, for unconventional prospects, the law establishes four-year terms and a maximum of 13 years (two periods of four years and an extension of five years).

Royalties

A 12 percent nationwide cap on royalties (on the well-head price) is to be paid to the provinces, plus an additional 3 percent with the first 10-year extension and a maximum of 18 percent for subsequent extensions.

Taxes

The parties agreed to include a pact in an annex to the law that limits provincial gross taxes to 3 percent, which the provinces had wanted to increase to 6 percent. The provinces argued that it would be unconstitutional for this to be included in the law itself.

Corporate Social Responsibility (CSR) payment

Investors are required to make a one-off payment amounting to 2.5 percent of the value of their initial investment towards CSR in the province in which their project is located.

Infrastructure projects

Once a project is approved by the Commission of Planning and Strategic Coordination of the National Plan of Hydrocarbons Investments, the federal government will pay for infrastructure projects in the province(s) in which the project is located. The exact amount will be determined by the commission in relation to the magnitude and reach of the investment project.

Definitions

For the first time, the Hydrocarbons Law differentiates between conventional, unconventional and offshore oil and gas, as well as tertiary recovery methods (also known as enhanced oil recovery).

Longer exploitation concessions

For conventional oil and gas, concessions will be granted for 25 years. For unconventional oil and gas (i.e. shale), concessions last 35 years, and incorporate a “pilot plan” period. Both types of concessions are eligible for unlimited 10 year extensions as long as the licensee has fulfilled its obligations, the production areas are active and the operator has submitted an investment plan.

Exploration licenses

The bill shortens the period for exploration permits for conventional prospects to only three years and a maximum term of 11 years (two periods of three years and an extension period of five years). This was likely included as a way to encourage investment by preventing small junior companies from sitting on reserves that they cannot exploit.

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Once extracted, the hydrocarbons belong to whichever company removed them from the ground.

During the amendment process, governors of the country’s oil and gas-rich provinces successfully placed pressure on the federal government, resulting in a negotiated outcome.

Argentina’s Legislative Framework

For over a century, Argentina’s oil and gas resources were controlled and managed by the federal government, in accordance with the 1967 federal Hydrocarbons Law. However, in 1994, this state of affairs was overturned by a constitutional amendment, which bestowed the original domain of the country’s natural resources on the 23 provinces (Article 124). Given the ongoing application of the Hydrocarbons Law, the briefly-worded 1994 amendment caused confusion over the division of rights between the federal government and the provinces. To address this, in 2007 Congress passed the “Short Law” (Law 26,197, which comprises only seven points), whereby the federal government modified the Hydrocarbons Law and transferred the ownership of all onshore oil and gas concession areas and offshore concession areas up to 12 nautical miles offshore to the provinces. Permits and concessions that had been granted by the federal government were transferred to the provinces under the same terms as they had been granted. However, the power to renew these concessions, and award new ones, now rests with the provinces. The Short Law also extended the provinces’ authority to include regulating activities, awarding transportation concessions (within their territories), as well as collecting exploration fees and royalties for production.

At the same time, the federal government still retains certain key powers. Firstly, the federal government has the domain over and power to grant exploration and exploitation concessions over areas between 12 and 200 miles offshore. Secondly, the national government is empowered to authorize hydrocarbon exports and agree on domestic transportation concessions spanning two or more provinces. Thirdly, and most significantly, the federal government has the exclusive power to draft national policy on hydrocarbons, which is currently embodied in the federal Hydrocarbons Law. In this way, the federal government is responsible for regulating activities, awarding transportation concessions (within their territories), as well as collecting exploration fees and royalties for production.

Equally important, the federal government is responsible for the management of the economy, which is a major determinant of investment decisions in the entire territory, not only for the energy sector. In particular, the government has significant influence over the policies regarding the importation of equipment and repatriation of dividends and export revenues, as well as the functioning of the foreign exchange market. Moreover, due to the fact that underground deposits are the property of the State, individual landowners are prevented from restricting companies’ access to oil or gas. Therefore, if a landowner objects to a project’s development, a court order can ultimately provide access to the property, most often with compensation.

Bidding process

The process of competitive bidding will be amended to achieve uniformity between the different provinces. This unified federal auction system is to be designed by the governors and the Secretary of Energy.

“Carry” system removed

The law eliminates the previous “carry” system, whereby exploratory companies were required to partner with provincial companies that shared in the profits but did not help fund projects. From now on, if companies choose to enter into a partnership, the provincial companies will need to contribute funding.

In addition to resolving regulatory complexities, the changes to the Hydrocarbons Law also seek to favor YPF – which owns about three quarters of the current exploration permits in Vaca Muerta – by giving the company more control over the hydrocarbons process. Moreover, the amended law is almost certainly aimed at increasing the national government’s control over hydrocarbons, thereby weakening the provinces.

As a whole, the private sector seems broadly pleased with the reforms, particularly that the amended law includes definitions for the various types of resources; companies had been concerned by initial suggestions that a shale-specific law would be passed. Indeed, the law has been successful in creating incentives for companies already exploiting Argentina’s conventional operations to extend their operations to unconventionals. Most importantly, the law represents a positive signal for investors and demonstrates...
that Argentina is committed to improving its business climate and developing the country’s shale resources. However, the law has attracted some criticism. For one, despite its more generous conditions for investors, the law’s impact will be fairly limited in the short term. Most of the concessions in Vaca Muerta were purchased years ago and are therefore unaffected by the new regime. Secondly, the law does not establish environmental regulations specifically related to shale projects. The issue was likely to be too divisive and both sides needed a common ground to ensure the passage of the bill. Moreover, the government was aware that it was running out of time to pass the amendments before the end of its term. Therefore, the bill merely called for the eventual creation of a national environmental law to replace the various regulations that currently exist across the country. For background on Argentina’s existing environmental legislation, see text box 3.

Meanwhile, in terms of local regulations, the recent election results in Neuquén Province translate to ongoing certainty for oil and gas operators in Vaca Muerta. In 26 April 2015, Omar Gutiérrez – former Secretary of the Economy and candidate for the Neuquén People’s Movement (MPN), the ruling party in the province since the 1960s – was elected Governor of Neuquén, taking over from Jorge Sapag. During a recent public appearance, Gutiérrez spoke of the need for shale, arguing that it would help Argentina reverse the energy deficit, equalize the trade balance and reduce inflation. Moreover, the current mayor of Añelo, Darío Díaz (another MPN member), was elected by a substantial majority in the municipal elections. The city, located in the center-east of the province, is only eight kilometers from the Loma Campana field; its economy relies heavily on the industry, with the town’s population doubling to 5,000 in just two years owing to the marked increase in oil and gas activity. Mayor since 2007, Díaz has proven supportive of unconventional operations in his territory, proclaiming Añelo the region’s future “shale capital”.

Text Box 3

Environmental Legislation in Argentina

At present, oil and gas activities in Argentina are subject to general environmental rules and specific regulations relating to oil spills, gas flaring, safety restrictions and others. The federal government has the power to establish the minimum standards for environmental protection, which are outlined in the General Environment Law (Law 25,675) (“GEL”), passed in 2002 pursuant to the powers conferred by Section 41 of the national Constitution. In addition, Congress has passed laws regarding the industrial and service waste (Law 25,612), hazardous waste (Law 24,051), the prevention of risks in plants where fuel-related activities are performed (Law 13,660) and health and safety requirements (Law 19,587). Furthermore, Resolution 105/92 requires environmental impact studies and Resolution 340/93 requires that consultants registered with the Secretary of Energy prepare annual environmental audits.

Meanwhile, the provinces have the right to issue regulations that complement the national legislation. Neuquén Province passed Decree 1483/2012, which establishes the rules and procedures for the exploration and exploitation of unconventional reservoirs in its province. The decree incorporates the regulations laid out in Provincial Law 1875, which establishes the guiding principles for the preservation, conservation, protection and improvement of the environment. At present, some provinces with unconventional potential have yet to pass specific regulations or decrees.

PART II

Challenges to the development of Argentina’s shale industry
Despite its enormous production potential, shale presents a number of technical challenges that must be overcome if this budding industry is ever to become profitable in Argentina.

Firstly, shale extraction requires specific, expensive and often hard to source materials and technology. Oil and gas companies operating in Argentina, for example, currently need to import certain types of proppant – a specific type of sand that is blasted into underground rocks along with water and chemicals to "prop" open hydraulic fractures – from Brazil and the United States. The price of these imports adds a significant cost to the overall process. For one, YPF is working towards sourcing all of its proppants locally and has already begun trucking in one type of sand from both Entre Ríos. In fact, through identifying multiple proppant providers – the company currently sources sand from five suppliers – YPF has managed to halve the amount of money spent on proppant since 2011. Most recently, YPF revealed that the overall cost of drilling is projected to fall 10 percent by the end of 2016, in a large part by replacing expensive imports with domestic supplies of sand for fracking. The company has already started constructing a plant in Neuquén that will refine sand mined in Chubut for use in fracking. At present, the cost of drilling and completing wells is still expensive compared to international standards. Horizontal wells are the more expensive of the two options, costing USD 13-14 million. According to YPF’s CEO Galuccio, vertical wells cost USD 6.9 million (the company is aiming to have this reduced to USD 6 million by the end of 2015), with each well taking about 18 days to drill.\(^\text{31, 32}\)

Although this represents a significant improvement since the first wells were drilled in Vaca Muerta (at which time they cost approximately USD 11 million), the figure remains much higher than in the United States, where wells are drilled for USD 2-3 million. Each stage of fracking, meanwhile, currently costs USD 550,000, about eight times more than in the United States. The situation is not helped by the fact that international service providers such as Schlumberger, Halliburton and...
Baker Hughes are charging a premium due to the macroeconomic risks in Argentina. In order to lower the overall cost of drilling, YPF is therefore looking at re-negotiating its contracts with these service providers, highlighting the long term nature of the projects in Argentina and the economy’s prospects for improvement.

Secondly, shale requires a substantial expansion of supporting infrastructure assets, ranging from pipelines and roads to power-generation plants and housing. Vaca Muerta will need additional connecting roads for trucks to support the supply of goods and services, pipelines to deliver and dispose of water used during fracking and facilities for those working on site, all of which will increase the burden on the province’s existing infrastructure. Moreover, the construction of this infrastructure will be more costly due to the area’s remoteness, requiring equipment to be delivered from regional hubs. As such, YPF is considering building a railway to its sites in Vaca Muerta for sand storage. Additional infrastructure will be needed for silos and other storage to support the distribution network for sand and water. Furthermore, water treatment facilities for shale wells are more technologically sophisticated and therefore more expensive than typical wastewater plants and will require additional investment.

Thirdly, companies face the technical challenge of analyzing their respective areas of the formation and identifying the best areas to drill, also known as “sweet spots”. Shale formation conditions and characteristics vary widely between countries as well as from one shale formation area to another. As such, companies need to develop a thorough and detailed knowledge of their local reservoir’s characteristics—obtained through extensive analysis—before they can accurately assess the play’s viability. This then allows companies to determine the best production mechanism and techniques to keep development costs under control and optimize overall production. However, all of this research and analysis must be balanced with the need to commence production and turn a profit. For example, YPF has found itself under pressure—largely from minority, non-government shareholders, who control 37 percent of the company—to produce larger quantities of shale gas. As such, while continuing to investigate and assess its underground resources, YPF has already drilled a number of wells. The company is using a combination of technologies, such as microseismic surveys, provided by different companies to improve their subsurface understanding and more accurately identify the sweet spots to drill and complete unconventional gas wells. However, it is possible that YPF would benefit from having additional time to study the information before drilling and ensuring the best and most up-to-date technology is being used, which would lead to greater efficiency. So far, YPF has had most luck in the northwestern part of Vaca Muerta and has identified Bajada de Añelo-Bandurria-La Amarga Chica, Narambuena-Bajo del Toro and El Orejano-Pampa de las Yeguas 1 as the most promising regions.

53 YPF 2014 Field Trip – Company Overview PowerPoint Presentation, 17 March 2014
Environmental Challenges

The exact environmental risks associated with the exploitation of shale remain unclear. In the United States, shale production – particularly the use of fracking – has caused concerns over the possible impacts of operations on water and air quality, seismic activity and even greenhouse gas emissions.

Owing to these fears, there has been significant opposition to the development of shale industries worldwide. France and Bulgaria have gone so far as to impose nationwide moratoriums on shale gas production. Meanwhile, in the United States the national Environmental Protection Agency is currently undertaking a comprehensive study to examine the potential human health and environmental impacts of fracking, which is expected to be released in 2015. In the meantime, in March 2015, the US Secretary of the Interior released new regulations that limit fracking on public lands, including new standards for well casing, water disposal and the disclosure of chemicals. While restrictive, the new rules apply to only federally owned land, which makes up 11 percent of oil production.55

The main environmental challenges center on the use and disposal of water during the fracking process. Firstly, the process of fracking requires huge volumes of freshwater as brackish water is more likely to damage shale equipment.56 A typical well requires approximately five million gallons of water to drill and fracture – depending on the basin and geological formation – which is the equivalent of 1,000 water truck movements. However, this does not in fact represent a significant challenge in Neuquén, where nearby rivers such as the Limay, Colorado and Neuquén hold huge volumes of freshwater.57 According to a study by the provincial government, these three rivers have a capacity of 9 billion cubic meters of water per year, based on their minimum flow, while unconventional projects would use only 10 million cubic meters per year; this calculation was made on the basis of the performance of 2,500 exploration wells within the next five years.58 These projections have been echoed by Neuquén Governor Jorge Sapag, who in February 2014 stated that 95 percent of the water in his province simply flows out to the Atlantic Ocean.

A September 2014 study by the World Resources Institute, meanwhile, calculated that 72 percent of shale resources in Argentina face low to medium water stress.59 As such, even the large-scale development of shale gas is unlikely to lead to conflicts between the industry and major water users in the agriculture sector, such as fresh fruit farmers and wineries. In fact, local industries in Neuquén would possibly be able to eventually benefit from the improved water distribution infrastructure constructed by oil and gas companies.

The other main environmental risk posed by shale is the potential for groundwater contamination, although this is currently the subject of debate among experts. Many environmentalists argue that after fracking, the injected fluid containing dissolved chemicals and other contaminants carries the risk of groundwater contamination upon its return to the surface if not correctly stored and treated. However, while this fluid contains 8-15 chemical additives, most of these are found in household items, often at higher levels. Moreover, companies in Argentina are required to divulge their formula before they can receive authorization to conduct operations. Others argue that vertical fracking – at three miles below the ground – is too deep to affect groundwater supplies, which are much closer to the surface; shale deposits in Argentina are located between 2,500 and 4,500 meters below ground whereas freshwater aquifers for consumption are at 300 meters. Either way, the issue is less of a risk in Neuquén where the use of underground water resources by oil and gas companies is prohibited under local law and where there are strict requirements for the treatment of “flowback” water. In other words, companies are required to carefully handle their wastewater discharge and develop adequate wastewater treatment capacity. YPF and Chevron have already started treating some of the flowback water from their operations.

57 Due to the abundance of water, Neuquén Province is home to six hydroelectric plants and is the country’s largest producer of electricity.
Moreover, Neuquén’s provincial government has sought to improve water management within its territory. The government is currently promoting the creation of an industrial water supply network for fracking operations in order to avoid the cost of hauling water to fracking locations with trucks, which costs around USD 100,000 per well. Meanwhile, the provincial Department of Energy and Public Utilities has prepared a draft for the Blue Aqueduct Network, an irrigation network in the central desert area of Neuquén between the Río Colorado and Neuquén Rivers. This network would serve as an important resource for water users and would cover three territorial sectors – adding up to more than 10,000 square kilometers – where shale activity is likely to take place.60 And in a positive move for the shale industry, the government has moved oversight of environmental issues, including the use of water, to the Minister of Energy and Public Services, Guillermo Coco. As such, the province’s oil and gas regulator is also the water regulator.

Social Challenges

The environmental challenges listed above have led to a certain degree of social opposition from local indigenous tribes – particularly the Mapuche in Neuquén – and anti-fracking groups, some of whom have joined forces with international organizations.

The Mapuche indigenous tribe is one of the leading opponents of shale exploration in the Vaca Muerta basin. With a population in decline, the group has been vocal about what they see as the dangers posed to their future by the shale industry. In late 2011, Mapuche protestors seized a gas processing plant near Zapala, a touristic city in the center of Neuquén province, arguing that the project had led to water contamination. In 2012, in collaboration with the Argentine-based anti-fossil fuel group Observatorio Petrolero Sur, the Mapuche protested against the proposed deal between YPF and Chevron, claiming it would be in violation of international treaties covering indigenous peoples. The group argued that according to International Labour Organization Convention No. 169, signed by Argentina in 2000, their leaders should have been consulted prior to the agreement. More recently, in May 2014, the group took part in the first International Anti Chevron Day, attributing some illnesses in the community to pollution from previous oil and gas drilling and arguing that the shale project with YPF will poison their water sources. However, the fact remains that the group’s objections were not sufficient to stop the deal going ahead or change the government’s approach to regulating the industry and in the future, are unlikely to present a significant risk.

This is in a large part due to their small presence in the country; the group, which is concentrated in the provinces of Neuquén and Río Negro, has a total population of only 113,000.62

Meanwhile, domestic environmentalist groups have been more vocal in recent years. Of note, in May 2014, the Federal Criminal Court of Appeal in Buenos Aires City ordered the continuation of an investigation into CFK’s decision to sign Decree 929/2013, which formed the basis of the July 2013 agreement between YPF and Chevron in Vaca Muerta. In 2013, a legislator from the New Left party filed a complaint over the agreement, arguing that it represents an abuse of authority, a dereliction of public duty and attempted environmental damage to the area. The investigation has since been supported by the Argentine Association of Environmental Lawyers (Asociación Argentina de Abogados Ambientalistas, AAAA). Moreover, the head of Argentina’s Supreme Court of Justice, Ricardo Lorenzetti, is known as being broadly pro-environment. Justice Lorenzetti has been a member of the joint OAS-UNEP International Advisory Council for the Advancement of Justice, Governance and Law for Environmental Sustainability and in June 2012 served as the Co-President of the UNEP World Congress on Justice, Governance and Law for Environmental Sustainability.63 Most recently, in April 2014, Justice Lorenzetti publicly stated that environmental conflicts in Argentina deserve more attention and criticized the government for not being more focused on the issue.

At the same time, local anti-fossil fuel group Observatorio Petrolero Sur has attempted to attract international attention to its mission against fracking. In 2014, the group helped produce a film called “Fracking Patagonia” with the Friends of the Earth France, part of an international network of environmental organizations. The anti-fracking campaign also continues to be championed by filmmaker, politician and presidential hopeful, Fernando “Pino” Solanas, who in early 2014 released a documentary called “La Guerra del Fracking” (“The Fracking War”). Due to his position as Senator for his party, Project South, Solanas is provided with more space in the traditional media than other environmental activists. Indeed, his already relatively high visibility in Argentina went global after he was photographed with Pope Francis and activists holding t-shirts with anti-fracking slogans. However, while it is likely that the 79-year-old Solanas will continue to raise his concerns about shale during this year’s presidential campaigning, he is unlikely to garner much support at the polls. More broadly, compared to the strong anti-fracking movements in the US and Europe, Argentina’s groups remain fairly small and disjointed.

We believe that while indigenous groups and environmentalists are unlikely to pose a significant threat in and of themselves, their cause could be supported by those at the center of Argentina’s political scene: the sizeable urban upper-middle class in Buenos Aires. Environmental and social issues resonate with this demographic more than the rest of the country. Should these voters – who are often targeted by politicians such as Solanas – decide to take up the fight against shale, it is possible that the country could witness an anti-fracking campaign similar to what has taken place in other parts of the world, such as the United States and the United Kingdom.

Moreover, there is a real risk of periodic disruptions from unions. Employee organizations in Neuquén and Santa Cruz have at various times organized wide-spread strikes and destroyed facilities to obtain higher wages. In one of the most well-known strikes, in June 2012, 400 members of a faction of the Construction Workers Union of Argentina (UOCRA) took control of Cerro Dragón in Chubut Province, Argentina’s largest oil field which produces approximately 15 percent of the country’s total output and is operated by Pan American Energy. Union members destroyed trucks and crucial equipment and prevented 6,700 PAE workers from accessing the site. The Cerro Dragón field was unable to produce oil for five days during the dispute and oil production remained depressed in the months following the protest. More recently, in 2013 Argentine union CTA (Central de los Trabajadores Argentinos) criticized the Chevron-YPF agreement as well as the supposed environmental consequences of the fracking technique. The group has also hosted public meetings and debates to raise awareness and promote anti-fracking messages. Union protests have at times been supported by the Neuquén Mapuche Confederation, which accounts for at least 29 communities that live on the Vaca Muerta formation.

Despite the real challenge faced by unions, companies have so far proven successful at working with these groups and managing the risk. Chevron, for one, reportedly has a good working relationship with local unions owing to the fact that their members recognize that the shale industry represents thousands of local jobs.

However, to further increase their profitability by boosting productivity and lowering labor costs, Chevron and other companies will ultimately need to negotiate with workers’ unions to amend Argentina’s restrictive employment laws.
Argentina’s Shale Oil and Gas: Challenges and Opportunities

After the 2001 crash, for the first time in its history Argentina enjoyed twin fiscal and current account surpluses. For almost a decade, this unique situation allowed the federal government to fuel expenditures and stabilize its external position without resorting to international credit markets. Most importantly, the CFK administration was able to maintain a steady flow of dollars needed to honor the country’s USD-denominated debt, pay for energy and fund YPF’s investment needs for oil and gas exploration. However, by 2011, both surpluses had almost completely disappeared. This exacerbated already existing fears of devaluation, the result of efforts to maintain a stable exchange rate despite high inflation, which made the dollar artificially cheap. This lead to an increase in the dollarization of assets and capital flight, which climbed to USD 21.5 billion in 2011.64

Still unable to access international credit markets, the government reacted in two ways. Firstly, the fiscal front was tackled by issuing intra-government loans from both the Social Security Agency and the Central Bank, as well as the monetization of the fiscal deficit. Secondly, the government introduced politically sensitive regulations and restrictive measures including the tightening of import controls, bans on the purchase of dollars by individuals and restrictions on the repatriation of dividends. In other words, the administration made a constant decision to sacrifice economic growth to ensure a steady supply of dollars.

However, while this new strategy initially proved successful for meeting the administration’s short-term dollar needs, it was more costly than anticipated in terms of general economic activity, as well as consumer and investor confidence: Argentina’s GDP has grown very little since 2011 and the economy is currently in recession; inflation remains in the 30 percent range; and a parallel currency market was created in which the dollar is traded 50 percent above its official value. Therefore, despite the previously mentioned “pragmatic turn” embarked on in 2013, the administration’s current approach demonstrates a dysfunctional decision-making process, policy improvisation and a high degree of internal fragmentation.


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**TEXT BOX 4**

Argentina’s economic difficulties

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Fiscal Constraints

Since 2011, the government has adopted a series of unorthodox and largely short-sighted measures to try and cope with a steady decline in the government’s public accounts (for more background see text box 4). While broadly derided overseas, the restricting factors – such as import controls and currency restrictions – have not completely deterred companies and investors from investing in the country’s energy sector. Many are accustomed to operating in difficult environments and understand that changes are on the horizon. In the meantime, they continue to take advantage of the current government’s attempts to promote the oil and gas industry.

However, multinational companies and foreign investors have been more tentative than they would be otherwise, which has slowed development. In particular, Argentina’s complex foreign exchange control regime has acted as a deterrent to companies looking to conduct exploratory and drilling activities in Vaca Muerta. Essentially, current restrictions translate to three investment deterrents: import restrictions for machinery and capital goods; limits on the ability to pay dividends abroad and the forceful repatriation of export revenues; and, a black market for foreign exchange in which the dollar is traded well above its official value. Foreign direct investment (FDI) dollars are exchanged at the official

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exchange rate, thereby creating an immediate, artificial tax on FDI. These foreign exchange regulations have created additional costs for shale projects in particular, owing to the substantial amount of technology and material that needs to be imported. Moreover, due to the expenses incurred during shale exploratory and extractive operations, the government – through YPF – and local companies will need to be able to borrow significant amounts of capital from overseas to fund their activities. Just the drilling of wells alone is expensive; approximately USD 7 million per vertical well and USD 13 million per horizontal well.

As previously mentioned, the government has recently sought to make some corrections to the country’s policies, implementing more business-friendly regulations. However, sweeping, long term measures to deal with macroeconomic imbalances need to be taken before there will be any significant change to the overall investment environment. These include lifting import controls, allowing dividend payments and closing the gap between the official and unofficial exchange rate. This would require coordinated action on the fiscal and monetary fronts, not simply quick-fix measures.

Moreover, as with other countries, Argentina’s shale industry faces an external challenge: the international prices for oil and gas. As has been widely reported, the international price for crude oil has plummeted over the past six months from a high of around USD 115 per barrel in June 2014 to just USD 44 per barrel in January (for West Texas Intermediate). As of May, the price had climbed back up to nearly USD 60 per barrel. Although it is difficult to determine what will happen next, most analysts predict that the price will eventually rise once more, viewing the downturn as part of a cyclical process.

While at this lower price Argentina’s shale resources may become less profitable in the short term, the long-term development of the country’s unconventional resources is unlikely to be dramatically affected. Firstly, long term investments, such as the exploration and exploitation of unconventionals, are usually made with various price scenarios in mind. As such, despite the current situation, companies have demonstrated their commitment to investing in Argentina’s shale resources. In fact, several deals have been struck with international operators in recent months. In December 2014, Malaysia’s state controlled oil company Petronas and YPF ratified a USD 550 million agreement that had been signed in August to develop an area in Neuquén Province, and in November 2014 German energy giant Wintershall agreed to launch its first pilot project. In March 2015, the company launched its first own-operated exploration well in Argentina in the Aguada Federal block in Neuquén. In February 2015, ExxonMobil reported that they will partner with XTO Energy – the largest holder of natural gas reserves in the US, which merged with Exxon in 2010 – to explore their area of Neuquén.66

Secondly, given the significant economic potential of Argentina’s shale resources and the country’s prevailing financial difficulties, maintaining the industry’s attractiveness to international investors remains important to the current government and is likely to be a key focus of the next administration. As such, the government has continued to push YPF – a national oil company and by far the largest player in the Argentina’s shale industry – to continue investing in Vaca Muerta despite the fall in oil prices. Indeed, over the last 18 months YPF has placed more than USD 2.2 billion on international capital markets. Unlike private firms, shareholder profits and the extraction of resources are not YPF’s sole objective. Rather, the company is equally focused on the country’s promoting economic and social development. As such, they have proven willing to weather short-term profit losses in favor of long-term gains for the company, the industry and Argentina as a whole.

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66 “XTO Energy, la mayor productora de shale oil del planeta, se suma a Vaca Muerta”, El Inversor Online, 20 February 2015, http://elinversoronline.com/2015/02/xto-energy-la-mayor-productora-de-shale-oil-del-planeta-se-suma-a-vaca-muerta/
Political Challenges

The End of the CFK Administration

Despite declining economic conditions, we do not expect a major economic crisis in Argentina to take place in the short- to medium-term. The fiscal and external balances have deteriorated, but there are still sufficient levels of foreign reserves and other indicators – such as the debt-to-GDP ratio – that remain positive. However, the government’s macroeconomic mismanagement has limited the room for economic and political maneuvering. The fiscal difficulties continue to reduce the government’s capacity to implement anti-cyclical policies and – given its limited access to international credit markets – have forced it to finance its deficit through intra-government loans and an expansionist monetary policy, which will keep inflationary pressures in place for the foreseeable future. All of this will have an effect on the development of the shale industry over 2015 and into 2016.

We assume that CFK will try to leave a “political legacy” that would allow her to remain an important political player after 2015. While the government’s heterogeneous coalition was relatively easily maintained in times of economic growth, the economic deterioration – along with the government’s mistakes and the fact that CFK cannot be re-elected in 2015 – has created tensions between traditional Peronist and pro-CFK elements within the current administration. CFK relies on an extremely small number of advisors in order to make most high-level decisions. Within this small circle, the most influential are Economy Minister Axel Kicillof and the President’s Legal and Technical Secretary Carlos Zannini, who are closer to left-wing non-Peronist CFK supporters than to traditional Peronist positions. CFK has also made room for loyal elements in several areas of government. These supporters retain legislative seats and occupy a series of high level positions in the bureaucracy, often at the expense of traditional Peronist players, such as governors, mayors and union leaders.

CFK’s decision to rely principally on loyal “kirchnerist” sectors is a strategic decision. The president could be seeking to bolster her camp’s support in anticipation of a defection of Peronist elements in 2015 and promote them in the legislative lists for the future Peronist candidate. Indeed, relying on loyal sectors may help CFK better cope with the succession period and post-2015 scenario. However, this strategy is risky. The provinces are highly dependent on financial
transfers from the federal government, especially in recent years, and CFK’s assumption is that governors still depend on her purse strings. But with the current fiscal deterioration and CFK’s weakened political position, support will not likely follow these lines. The economic slowdown and lower tax collections have led to diminishing funds and budgetary restrictions, which has adversely affected presidential-provincial relations. Similar to other times in Argentina’s history, CFK’s inability to provide the same level of fiscal benefits to provincial politicians means that the governors may begin to undermine her government to fulfill their own political objectives. This will mean that CFK – and her loyal sectors after her, such as Scioli – may be forced to compromise with Peronist governors. Moreover, CFK continues to have relatively high approval ratings, which gives her a fairly strong hold of the political agenda. As such, it will be difficult for the Peronist candidate to completely sever all ties with the current president.

In the meantime, the main presidential candidates have constructed their strategies in response to the government’s approach. Buenos Aires Governor Daniel Scioli has decided to base his campaign on seeking the support of traditional Peronist actors to become the party’s official candidate, while at the same time presenting himself as a responsible leader willing to maintain the government’s successful policies but change others. Congressman and former Tigre Mayor Sergio Massa has chosen to circumvent the party and run as an independent, although with the support of some Peronists. Mayor of Buenos Aires City, Mauricio Macri, will run as a non-Peronist “third way” option. Despite this difference, in many other ways Massa and Macri are likely to take a similar approach. Both will try and attract the support of some members of the Radical party, as well as attempt to reach the second round and collect as many anti kirchnerist voters afterwards.

During the October 2015 election, many presidential contenders will benefit from taking a more pro-business approach that will help distinguish them from the CFK government. Moreover, we believe that the current macroeconomic situation is not sustainable, and that the next president will be forced to introduce orthodox measures and proceed with a broad fiscal re-adjustment. Furthermore, we believe that the public’s demands have evolved and that there is a considerable social mandate for a less confrontational government.

Whatever the election result, the next administration is likely to lift some of the trade and capital restrictions that currently affect the oil and gas sector. In addition, access to international markets will no doubt be pursued and the energy sector will continue to be promoted.

However, it will not be an easy road. While the current state of the economy can be attributed to a series of policy mistakes, their accumulation has transformed a circumstantial dilemma into a structural one. High inflation, various foreign exchange regulations, a persistent fiscal deficit, devaluation pressures, subsidies and price distortions will not be easy to deconstruct in the short term; on the contrary, normalizing the economy will require a carefully sequenced plan, one which will take at least a couple of years to achieve.

Regarding energy in particular, it is virtually impossible that YPF will be re-nationalized in the near future. Buenos Aires Province Governor Daniel Scioli, one of the most promising presidential candidates, is very supportive of the oil and gas industry and has publicly stated his desire to improve the current business climate in order to encourage investment. Moreover, Scioli’s very close relationship with Galuccio has helped him to gain a good understanding of the shale industry. In fact, Scioli has openly stated that he would maintain Galuccio as YPF’s CEO were he to be elected president. Massa, meanwhile, has stated that energy is essential to Argentina’s growth and development and as such, there should be a federal policy that encourages long-term investment in energy as a way of achieving self-sufficiency. Massa has raised the possibility of creating a national agency for hydrocarbons that would audit oil resources, plan the energy matrix and fix the parameters for environmental sustainability. Macri is also keenly interested in the subject of hydrocarbons and investments that could solve Argentina’s problem of greater fuel production. In September 2013, he emphasized that to solve Argentina’s energy problem the country requires important investments, citing Galuccio’s statement that “many Chevrons” are needed with transparent contracts. Moreover, in December 2014, Macri stated that there was a distinct possibility that Galuccio would remain in his post in the case of a PRO Party victory.

In May 2014, in another encouraging sign for the future of the local shale industry, former US Deputy Energy Secretary Daniel Poneman – who was replaced by Elizabeth Sherwood-Randall in September 2014 – visited Argentina to sign an agreement to extend cooperation between both countries on energy issues, including unconventional oil and gas resources. The agreement represents a new phase of a deal originally signed in 2010. The two countries will share knowledge of new technologies for the energy sector, which could potentially accelerate the development of Argentina’s shale reserves. After touring the Vaca Muerta area with Galuccio, Poneman described the formation as “physically impressive” and admitted the technology on display was promising, but emphasized that companies need more confidence in the country’s government. This sort of agreement bodes well for Argentina’s nascent shale industry, particularly given the need for significant investment in technology and training from the United States.

CONCLUSION

Argentina continues to represent one of the most promising areas for shale outside of the United States. The country houses some of the world’s largest – and best quality – shale oil and gas deposits, which are located far from major population centers and in provinces already practiced in supporting conventional oil and gas production. Unlike in Europe and North America, the industry is unlikely to face substantial opposition from environmental and social groups. And while Argentina’s general macroeconomic situation and fiscal policies have at times hindered investment, the current administration has sought to make shale as attractive as possible to international companies owing to its significant economic potential. According to recent projections by Accenture, the successful development of shale could translate to USD 67.8 billion for the country’s GDP – more than 12.5 percent of the country’s current GDP69 – and the creation of 20-22,000 jobs each year until 2035.70

Admittedly, the industry is still in the very early stages of development, and faces the additional short-term challenge of a drop global oil prices. The overall figures for drilling fall continue to fall far below the levels needed to make the industry profitable or to have significant flow-on effects for the national economy. The Eagle Ford shale play in the United States alone at its peak produced 1.5 million barrels of oil equivalent per day,71 more than Argentina’s entire conventional and unconventional oil production which currently stands at around 570,000 barrels, with approximately 45,000 of those barrels produced in Vaca Muerta.72 73 However, Argentina’s industry has been developing quickly in recent years. Since 2011, a great number of oil and gas giants from overseas have set up operations in the country, the most significant being the YPF-Chevron deal signed in 2013. Since the agreement was inked, YPF and Chevron have invested more than USD 3 billion in Vaca Muerta.

It is likely that Argentina’s next administration – whichever individual or party comes to power – will implement several policies to help advance the shale industry, and the energy sector more broadly. This will serve to push the industry to develop more quickly than it has been able to over the last few years. With the freedom to import the requisite highly specific equipment, technology and personnel – as well as the ability to repatriate profits and more easily invest in the country – it is possible that the shale industry will make Argentina energy independent once more.

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ANNEX A

International interest in Argentina’s shale resources

Companies Operating in Argentina

Apache

In mid-February 2014, US multinational Apache announced that it had agreed to sell all of its Argentine oil and gas operations to YPF for USD 852 million. The company, which had been in Argentina since 2001, has seen a recent slip in profits and has therefore been selling assets around the world. With estimated resources of 540 billion cubic feet of natural gas, the acquisition increased YPF’s gas reserves by 15 percent, making it the largest purchase by the company since its re-nationalization. Following the deal, YPF sold on part of the acreage acquired from Apache to Argentine company Pluspetrol for USD 217 million, thereby doubling its unconventional holdings. In December 2014, the ex-Apache YPF subsidiary, re-named Yacimientos del Sur (YSUR), signed a deal with the government of Río Negro Province to invest USD 3 billion over the next decade.75

Chevron

In August 2013, the legislature of Neuquén Province approved a decree authorizing the first large scale development of shale gas reserves in Vaca Muerta - a USD 1.24 billion dollar deal between state giant YPF and Chevron, the world’s second largest energy company. The deal grants YPF and Chevron, who signed an agreement in July 2013, exploration and production rights in Vaca Muerta for the next 35 years. Both companies are guaranteed a 16 percent return on investment, while Neuquén Province is granted an estimated USD 8.9 billion in royalties for the entire period.76

So far, the venture has been even more successful than anticipated. In September 2014, the project was producing 31,000 barrels of oil equivalent per day, making it the second most productive oilfield in the country (behind Cerro Dragón, operated by Pan American Energy in Golfo San Jorge).77

The project entails two phases, the first of which was completed in March 2014. This pilot program involved Chevron spending USD 300 million to drill approximately 120 wells in a 5,000 acre (20 square kilometer) tract of a 96,000 acre concession in the Loma Campana and Loma La Lata fields.78 In April 2014, Chevron signed agreements with YPF to continue the development of the project and invest USD 1.6 billion in 2014 for large-scale drilling and production in the Loma Campana concession. The plans are for the partnership to drill 170 wells in Loma Campana by the end of 2014, as part of an overall target of 1,562 wells, in order to produce 50,000 barrels of shale oil and 3 million cubic meters of shale gas by 2017. The agreements also called for the exploration of shale oil and gas resources in the 48,000-acre (200 square kilometers) Narambuena area located 70 miles (100 kilometers) north of Loma Campana.79

Most recently, Chevron’s Vice President for Latin America and Africa, Ali Moshiri, has said that Loma Campana is one of a small handful of projects in which Chevron is a non-operating partner. This is the case because of the company’s confidence in YPF’s strong management team, which he said has achieved “phenomenal improvements in research and technology”.80

Dow Chemical

In September 2013, a local subsidiary of US petrochemical giant Dow Chemical and YPF signed a final accord to invest a total of USD 188 million to explore shale gas in the El Orejano zone of the Vaca Muerta shale formation.81 Dow will invest USD 120 million with the remainder coming from YPF. The joint venture grants Dow Chemical a 50 percent stake in developing the 42 square kilometer

75 “Se firmó el Acta de Renegociación entre Río Negro e YPF por siete áreas hidrocarburíferas”, Gobierno de Río Negro, 3 December 2014, http://www.rionegro.gov.ar/?contID=19640

Argentina’s Shale Oil and Gas: Challenges and Opportunities
ExxonMobil holds interests in approximately 900,000 net acres in Vaca Muerta. In 2011, ExxonMobil entered into a farm-out agreement with Americas Petrogas for the exploration and potential exploitation of Petrogas’s Los Toldos blocks in the western region of the Neuquén basin (600 square kilometers). ExxonMobil committed to fund USD 53.9 million during the exploration phase with a further USD 22.4 million if the parties proceed to the exploitation phase, for a total potential investment of USD 76.3 million. ExxonMobil and Petrogas have a 45 percent interest and GyP holds a 10 percent interest. In May 2014, in partnership with GyP, ExxonMobil announced that it had discovered non-conventional oil and gas in the Bajo del Choique X-2 well, with initial results suggesting an average flow rate of 770 barrels of oil per day. ExxonMobil owns 85 percent of the block, while Gas y Petróleo del Neuquén controls the remaining 15 percent. As at September 2014, ExxonMobil had drilled five wells in the Bajo del Choique and La Invernada blocks, and it was reported that the company was looking for investors to help progress the development of its unconventional resources. Meanwhile, YPF and ExxonMobil share two areas – Loma del Molle and Pampa de la Mares – with the Argentine energy giant acting as operator for both. In October 2014, ExxonMobil’s second-in-charge met with YPF to discuss further joint projects in Vaca Muerta for unconventional. In December 2014, ExxonMobil announced it had made a new discovery in Vaca Muerta with the La Invernada X-3 well, which produced a flow rate of 448 barrels of oil and 1 million cubic feet of gas per day in the initial test and which after 60 days had produced 31,400 barrels of oil equivalent. The discovery was made 20 miles from the Bajo del Choique block. The company is conducting further data analysis to further assess the well’s potential.

Gazprom

In April 2015, YPF and Russia’s Gazprom International concluded an MOU to exploit an area of Vaca Muerta, part of a broader cooperation framework between the two countries. While the exact details of the agreement are unclear, the document reportedly stipulates the main areas of cooperation, including exploration, production and transmission of hydrocarbons in Argentina and third countries.

Pan American Energy

The second largest oil company in Argentina, PAE, is 60 percent owned by the BP and 40 percent controlled by Bridas, owned by CNOOC Ltd, a subsidiary of CNOOC Group, China’s largest offshore energy explorer, as well as Argentine billionnaire brothers Carlos and Alejandro Bulgheroni. The company is focused on the development of their 509-square-kilometer Lindero Atravesado block in Neuquén, which is jointly operated with YPF and is located 50 kilometers from the City of Neuquén. As of April 2014, PAE was expected to spend USD 200 million in 2015 to extract shale both tight gas and shale oil from the formation. In November 2014, PAE had reportedly invested over USD 100 million and had purchased five semi-automatic drilling teams, one of which was allocated to Neuquén, which can reach depths of up to 4,000 meters and will be used to exploit unconventional gas. According to PAE, Lindero Atravesado has tripled the company’s gas production and will generate USD 300 million by the end of 2014.

Petronas (Petroleum Nasional Bhd)

Following an MOU signed in early 2014, in August YPF signed a USD 550 million agreement with Malaysia’s state-controlled oil company, Petronas, to develop a 187 square kilometer (72 square mile) area in the northeast zone of Neuquén’s Loma Campana called Amarga Chica. According to the terms of the agreement, Petronas will invest USD 475 million – with the remaining USD 75 million coming from YPF – to drill approximately 30 unconventional wells in three years. The pilot program is due to commence once the final project documents, such as the ownership of the concession area and the tax framework, are executed, poss-
In December 2011, Shell, along with Argentine independent Medanito, signed an agreement with GyP to explore for shale in Aguila Mora and Sierras Blancas in Vaca Muerta, which laid out a five year investment plan. In late 2013, Shell announced its intention to increase its shale capital expenditures to about USD 500 million in 2014, as well as to boost test drilling in Vaca Muerta in hopes of producing light crude from its shale gas operations.

Over the past decade, Shell has not had a particularly easy relationship with the Kirchner governments. In 2005, Néstor Kirchner boycotted the company and former Trade Secretary Guillermo Moreno initiated more than 50 criminal complaints. Most recently, Kicillof accused them of trying to trigger a run on the dollar in January 2014. However, despite these challenges, the company remains a key player in the provision of gasoline and diesel and has made steady progress with regards to oil exploration in Vaca Muerta.

**Sinopec**

In January 2015, YPF signed a preliminary agreement with Chinese company Sinopec to enter a new joint venture targeting both conventional and shale resources. The MOU will cover different market segments, upstream and potentially downstream, according to a statement by YPF. Sinopec’s Argentine subsidiary is Argentina’s fourth-largest crude producer and has more than 1,500 producing wells but has not yet tapped the country’s shale formations. YPF and Sinopec previously signed an agreement in 2014 to extend the exploration in the La Ventana concession in Mendoza until 2027.

**Wintershall**

In January 2013, German energy giant Wintershall – the fourth-largest natural gas producer in Argentina – ratified a joint venture agreement with GyP, for exploration and the possible development of the 97 square kilometer Aguada Federal block. Wintershall acquired a 50 percent stake from GyP and assumed operatorship of the block. The partnership is planning to drill up to six wells as part of the USD 109 million exploration program. The company is a major player on the world stage, holding the third largest reserves of unconventional resources. If successful, a 15-year pilot program will then be enacted for the production of 20 wells and 120 “intensive-action” wells as part of the rest of the USD 3.5 billion investment. In June 2015, the company is scheduled to begin a pilot stage that will see the drilling of 20 horizontal wells, which could take up to four years.

**Interested Companies**

**Eni**

YPF is reportedly in negotiations with Italian multinational oil and gas company Eni, one of Europe’s largest companies. In May 2014, a delegation of the Italian company’s executives and technicians travelled to Buenos Aires to discuss the development of unconventional hydrocarbons.

**Petróleos Mexicanos (Pemex)**

Mexico’s state-owned petroleum company has begun negotiations with YPF to develop 6.4 percent of Vaca Muerta, a deal valued at USD 5 billion. According to Argentine newspaper Clarín, conversations between YPF President Galuccio and Pemex President Emilio Lozoya began in May 2013. However, according to an independent adviser from Pemex, Mario Gabriel Budebo, the partnership will not be official until at least 2018, in order for the company to concentrate on Mexico for at least the next five years.
About Cefeidas Group

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Cefeidas Group is a boutique international advisory firm based in Buenos Aires. Our expert risk analysis of the political and regulatory environment in the Southern Cone (Argentina, Chile, Uruguay and Paraguay) empowers our clients to make informed decisions regarding their in-country operations and investments.

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- **Corporate Governance and Compliance**: we help our clients to introduce and strengthen sound corporate governance practices, perform board evaluations, and design and implement compliance programs.
- **Strategic Partnership Development**: we utilize the depth of our local and international resources to help clients identify and develop constructive relationships and strategic partnerships to unleash their business potential.
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