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VACA MUERTA

and its challenges

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An approach to the unconventional hydrocarbon production in the Neuquén Province



GOBIERNO
DE LA PROVINCIA
DEL NEUQUÉN

NEUQUÉN
PROVINCIA



Neuquén Province Snapshot

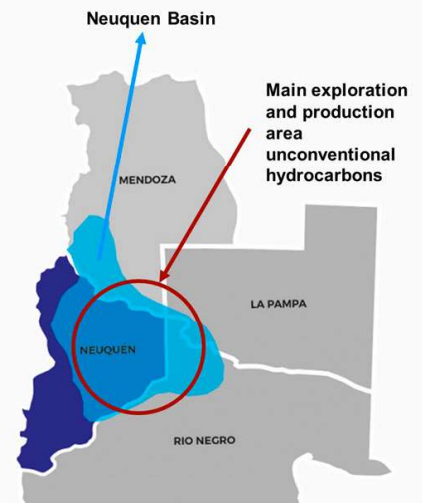
- **Area:** 36,323 square miles (94,078 km²) (2.5% of the national territory)
- **Population:** 720,000 inhabitants
- **Density:** 7.16 inhab/km² (16th place among 23 Argentine provinces)
- **Nominal GDP:** us\$ 12.1 billion in 2015.
- **GDP Per capita:** us\$ 17,181 in 2016 // Argentina: us\$ 12,495
- **Provincial budget:** us\$ 2.57 billion (2019)
- **Unemployment rate:** 4.5% in 4th trim 2018 // Argentina: 9,1%
- **Poverty rate:** 25,8 in 1st Sem, 2018 // Argentina: 27,3%



Neuquen Province Snapshot

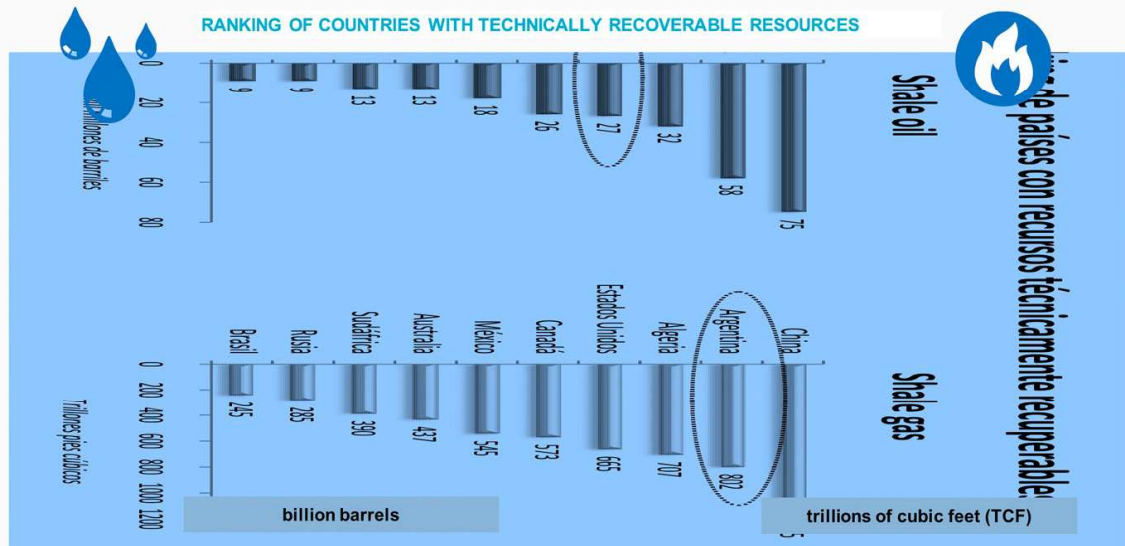
Neuquén is a province with past, present and future linked energy production

- **Oil in Neuquen is discovered in 1918.** During the next 60 years new oil deposits are discovered and exploited in Neuquen Province.
- In 1968, with the construction of the “El Chocón” dam, Neuquén **entered the hydroelectric phase.** Another seven dams will be built in later years.
- **In 1976, the conventional natural gas phase began in Neuquén:** the Loma La Lata field, a gas giant with a potential of 12 TCF, was discovered.
- The maximum conventional oil production is achieved in 1998, and the maximum production of conventional gas in 2004. Neuquén begins a strong productive and exploratory decline.
- In 2010, the exploration of unconventional hydrocarbons began in Neuquén with the first 6 wells. A year later, the International Energy Agency of the USA reports **on the potential of unconventional hydrocarbons in Argentina: the world's second unconventional gas reservoir, and the fourth unconventional oil reservoir.**
- **The majority of these huge resources are concentrated in Neuquén:** the “Shale Era” reaches the Neuquén basin, in the hands of the “**Vaca Muerta**” formation. The “Vaca Muerta” formation, when compared to the main “rocks” of the world, is among the best in the world: it is the 4th in the lowest depth; and the 5th in useful thickness and content of organic matter. All these factors make it one of the best comparative advantages.



Neuquén is a province with past, present and future linked energy production

Neuquén Province has geology and energy resources to boost energy development and economic potential of Argentina.



Neuquén is a province with past, present and future linked energy production

Neuquén Energy Today



- ▶ Share of national proven natural gas reserves: 37.7%
- ▶ Natural gas production 2018: 24,316 million m3
- ▶ Share of national natural gas production: 52%
- ▶ Share of national proven oil reserves: 11.7%
- ▶ Oil production 2018: 6,78 million m3 (42,6 million barrels)
- ▶ Share of national oil production: 23%
- ▶ Hydroelectric power generation: 10.285 Gwh/a
- ▶ Share of national hydroelectric power generation: 25% (8 dams in Neuquén)

Neuquén Energy Today

The Neuquen Basin at glance (2018-2019)

94,078 km²	29,445 km²	34	27 %	7
TOTAL AREA OF THE NEUQUEN PROVINCE	AREA OF THE NEUQUEN PROVINCE WITH NO CONVENTIONAL RESOURCES	CONCESSIONED BLOCKS FOR NON-CONVENTIONAL ACTIVITY	OF NQN BASIN AREA WITH CONCESSIONED BLOCKS (8,822 km ²)	CONCESSIONED BLOCKS IN MASSIVE DEVELOPMENT (4% OF THE "VACA MUERTA AREA")
1,700	546	12,000	US\$ 8 BILLION	US\$ 165 BILLION
UNCONVENTIONAL WELLS DRILLED	UNCONVENTIONAL WELLS IN EXPLORATORY PHASE (PILOT)	UNCONVENTIONAL WELLS PROJECTED IN DEVELOPMENT PHASE	INVESTMENT AMMOUNT IN EXPLORATORY PHASE (PILOT)	PROJECTED INVESTMENT AMMOUNT IN DEVELOPMENT PHASE



The energy sector is a locomotive that pulls all the activities of the provincial economy, and increasingly, of the Argentine economy.

Neuquén Energy Today

The energy development in Neuquén today



- Today Neuquén is at the forefront of investments in the country. Between 2016 and 2018, thanks to the hydrocarbon activity in Vaca Muerta, Neuquén was the second province in the country with the highest number of foreign investments, capturing ads for 54 projects for 21 billion dollars.
- The development of Vaca Muerta has accumulated investments of more than 27 billion dollars since 2012, the year in which the shale of Neuquén began to be explored. Only in 2018 some 4,5 billion dollars were invested in the upstream segment, 31% more than the 3,4 billion dollars registered in 2017. ExxonMobil, Chevron, Royal Dutch-Shell, Total Austral, Wintershall, Equinor (ex-Statoil) and Petronas are some of the global energy players with investments in Neuquén.
- With the current concessions, the confirmed pilot plans amount to **8,2 billion dollars**, and the massive developments project for more of **165 billion dollars**.
- Oil production in the province of Neuquén grew by **12.7%** in relation to 2017 (achieving the best brand of the last 7 years). **In gas, with a 10% year-on-year increase**, production grew for the fifth consecutive year, reaching the highest value in the last 10 years.
- The unconventional oil represents 61% of the Neuquén oil production. The unconventional gas production already represents 67% of the total gas produced by Neuquén (25% tight / 40% shale).

Neuquén Energy Today

The energy development in Neuquén today

- Neuquén oil is 23% of the total volume of Argentine production. Neuquén gas accounts for 52% of Argentine gas production.** Neuquen consolidates its position as the second largest producer of crude oil (only behind Chubut, with a 30% share) and the main producer of natural gas, explaining almost all of the growth in the supply of oil and natural gas nationwide.
- The natural gas of Neuquen, in the medium term will replace the one imported by LNG vessels, but the Province is already studying three destinations for gas: a) Domestic demand** (only 50% of homes in Argentina have gas network, replace thermal power plants, expand CNG automotive fleet), **b) Demand for Industrialization** (new Petrochemical projects), and **c) Exportation** (short-term export to Chile, and medium-term construction of LNG Plants to export through the Atlantic and Pacific oceans).
- The infrastructure to attract, treat and transport the Neuquen oil production to the domestic and international markets is in perfect condition, and the province of Neuquén will export oil again in the second half of 2019.**



Neuquén Energy Today

The economic and social impact of energy development in Neuquén

This huge energetic growth of the province of Neuquén has had, and has, a strong positive impact on the social and economic indicators of the province and of Northern Patagonia:

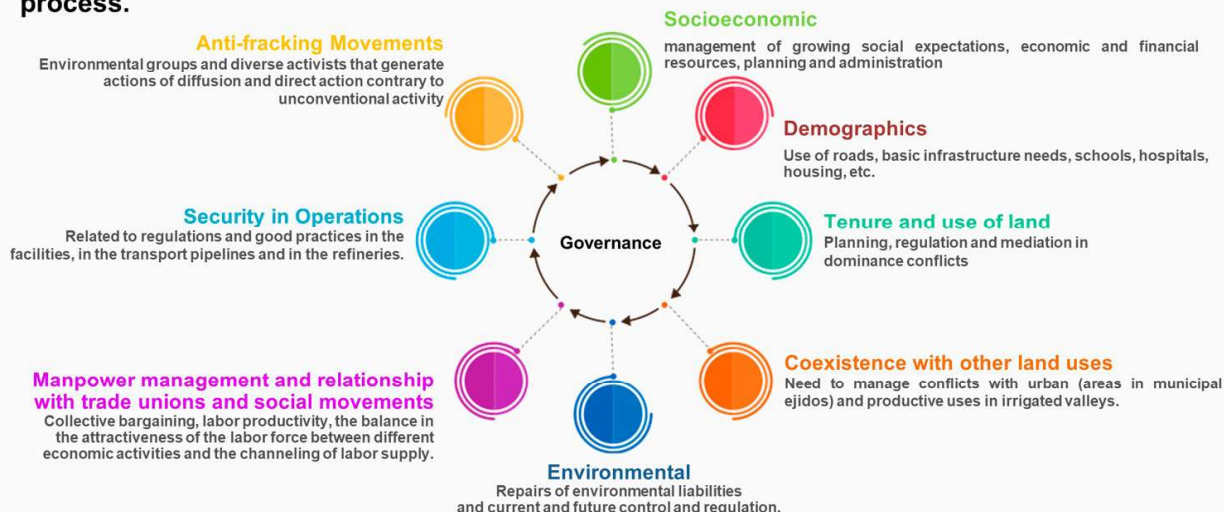


- Between 1960 and 2017, the province of Neuquén increased its population six times to the current 720,000 inhabitants. In Argentina the population only doubled. Today, there are around 28 families who live daily on average in the province, attracted by the opportunities of energy development. We expect 50,000 new inhabitants in the next 5 years.
- We have the highest life expectancy in the country in women (81.97 years) and the second in men (75.43 years).
- Today we are the fifth province with the lowest infant mortality rate in the country (5.4 / 1,000); and one of the lowest maternal mortality rates (1 / 10,000)
- The index of poverty (people below the poverty line) in Neuquén fell by 8.8 percentage points in mid-2018 compared to the end of 2016 (from 34.5 to 25.8), while that of Argentina fell by 3 percentage points. in that period (from 30.3 to 27.3%). Neuquén is one of the five provinces in Argentina with the lowest level of inequality according to the Provincial Sustainable Development Index prepared by the United Nations Development Program (UNDP)
- The size of the Neuquen economy multiplied by 24 in 57 years. The Argentine economy hardly tripled.
- The GDP per capita of the Province of Neuquén is 37% more than the Argentine GDP pc.
- The stock of enterprises in the Province grew by 62% in the last 10 years.
- The stock of the automotive fleet grew 58% in Neuquén between 2009 and 2018, while in the country it did 18.6%
- Sales at supermarkets grew by 35.1% in Neuquén in 2018 compared to 2017, while the consolidated at the country level grew 28.5%).
- In the IV-Trim. In 2018, unemployment in NQN was 4.8%, almost half that of the national unemployment rate (9.1%). While in Argentina the registered employment collapses, with a loss of 131,000 jobs registered to December of last year, Neuquén showed a growth of 6.2% in this matter, which implies the creation of 7,000 new jobs in the interannual variation. Since mid-2017, about 22 new jobs per day have been created in the province.

The economic and social impact of energy development in Neuquén

Main challenges to the governance in the “Vaca Muerta Region”

But this important growth also generates challenges for public policies, which require new approaches and innovative methodologies that guarantee adequate governance of the development process.



Main challenges to the governance in the “Vaca Muerta Region”

Three key challenges (and investment opportunities) for “Vaca Muerta” development

The task of planning and management is permanent, in a dynamic environment such as the one proposed by the non-conventional energy activity. The Provincial Government has a Quinquenal Plan 2019-2023 that includes an agenda of infrastructure investments in the “Vaca Muerta” area, whose financing will come from public and private sources:

1 - Logistic infrastructure

- Regional/national new oil pipelines (+600 kms) and gas pipelines (+1,000 kms), new hydrocarbon treatment plants; and natural gas liquefaction (LNG) facilities
- Expansion of the high voltage transmission lines (+4,585 kms)
- Regional/local water transport pipelines for O&G upstream blocks
- Strategic road paving provincial program and new bridges (980 kms to be paved in Neuquén)
- Air transport facilities (for passengers and air freight)
- Railway Transport: “Norpatagonic Cargo Railroad” to Vaca Muerta (700 kms), and “Southern Transandean Railroad” between Neuquén and Chile (276 kms).
- Digital Connectivity (Development of the 600 kms Provincial Optical Fiber Network)
- New Logistic Areas

2 - Economic and energetic diversification infrastructure

- Renewable Energy Projects: seven wind farms projects; fourth medium and high-sized hydroelectric dams on the Neuquén River (*Chihuido I and Chihuido II, Cerro Rayoso, La Invernada*); some small hydro dams projects, and two geothermal power stations (*Copahue y Domuyo*).
- New irrigated areas under for agribusiness: two irrigation projects (total 23,500 hectares) for agricultural production in the area of Vaca Muerta, to be developed by private public association system.
- New Industrial Parks

3 - Housing and urban infrastructure

- Housing: they have been built (or are under construction) about 4,000 houses in the last two years in “Vaca Muerta area” // we need to build +10,000 houses per year.
- More gas and electricity for homes and enterprises: they are building new electrical substations, new home gas compression plants, and extending new distribution networks to homes and industries.
- Health system: a new Norpatagonic Regional Hospital in Neuquén City is planned.
- Education system: About 100,000 new students will join in ten years the provincial education system. It will be necessary to build +200 new schools at all educational levels
- Sport and Culture facilities: The provincial government deployed a strong investment in sports and cultural infrastructure of regional, local and town impact.

Three key challenges (and investment opportunities) for “Vaca Muerta” development



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