Unconventional Resource Development in Latin America
Buenos Aires, Argentina, March 2018

Unconventional Development 8 Years of History Together with Vaca Muerta Formation

Current State of Unconventional Development in Argentina

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Current Status

- More than 810 wells completed on the shales of Vaca Muerta Formation.
- Initially, YPF drilled more than 8 times the number of wells compared to the other companies (peak at 2015) however last year the ratio was reduced to only twice, being still the largest producer.
- Less amount of total wells however increased horizontal ones and with increased lateral legs (2,000; 2,500; 2,700 and 3,000 m).
- Drilling and completion days significantly reduced.
- Number of frac stages considerably increased.
- Overall costs fell sharply (these include operating and service companies).

Current Status

- Since January 2011, more than 77 MMboe were produced from the Vaca Muerta Formation unconventional shales.

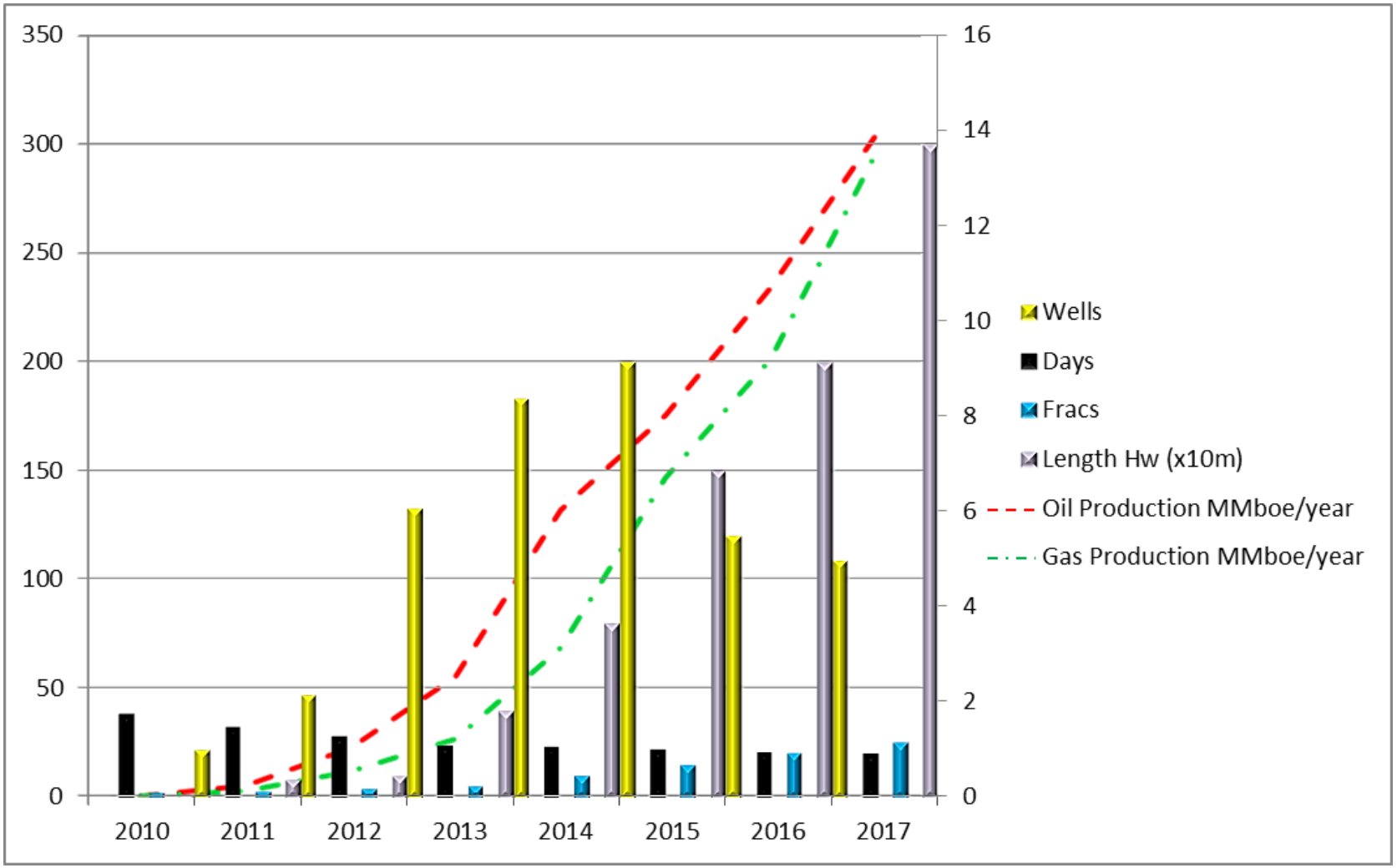
- The production of oil with respect to last year increased by 29%. Comparing with previous years, this increase has been lower.

- Gas production increased by 68%, mainly driven by the fact that a greater number of companies focused on gas projects. This represents 36% of the wells drilled.

- In December 2017, total shale oil production reached 41,000 bopd representing more than 8% of the country.

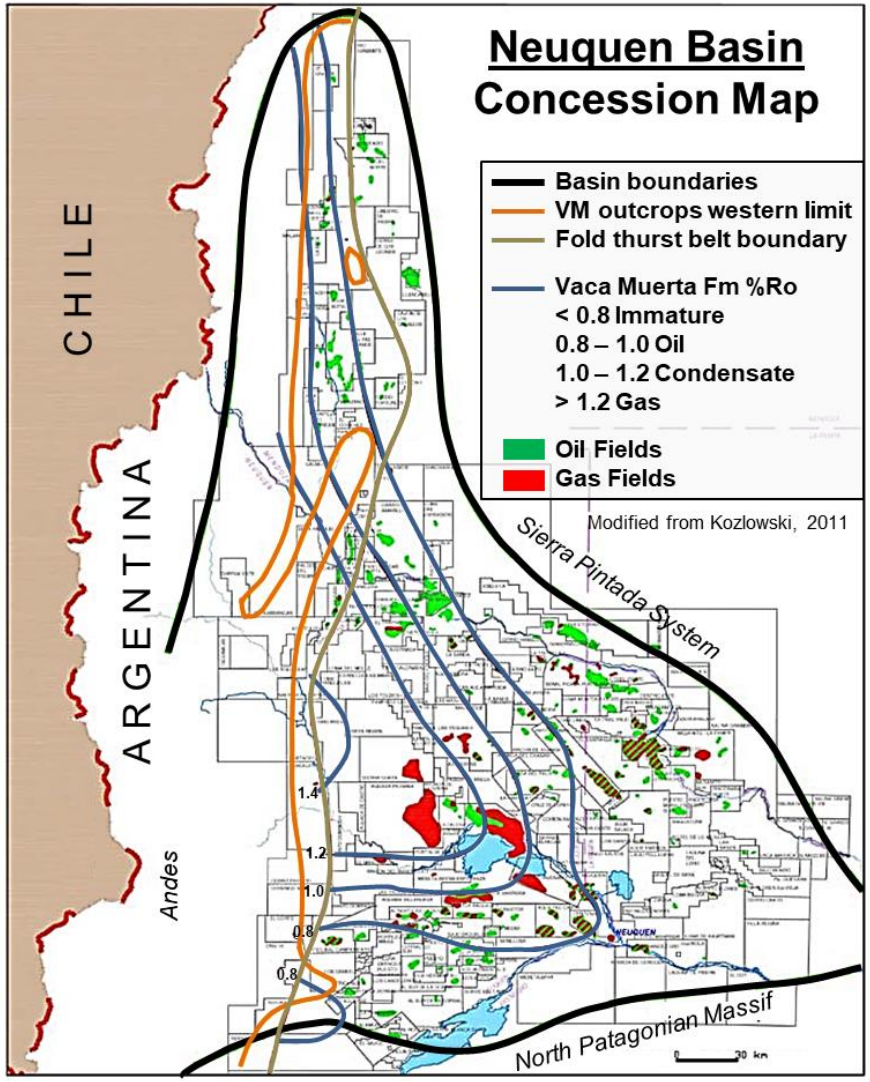
- In December 2017, total shale gas production was around 292 MMcfd, almost 7% of Argentina´s production.

Major Changes since 2010

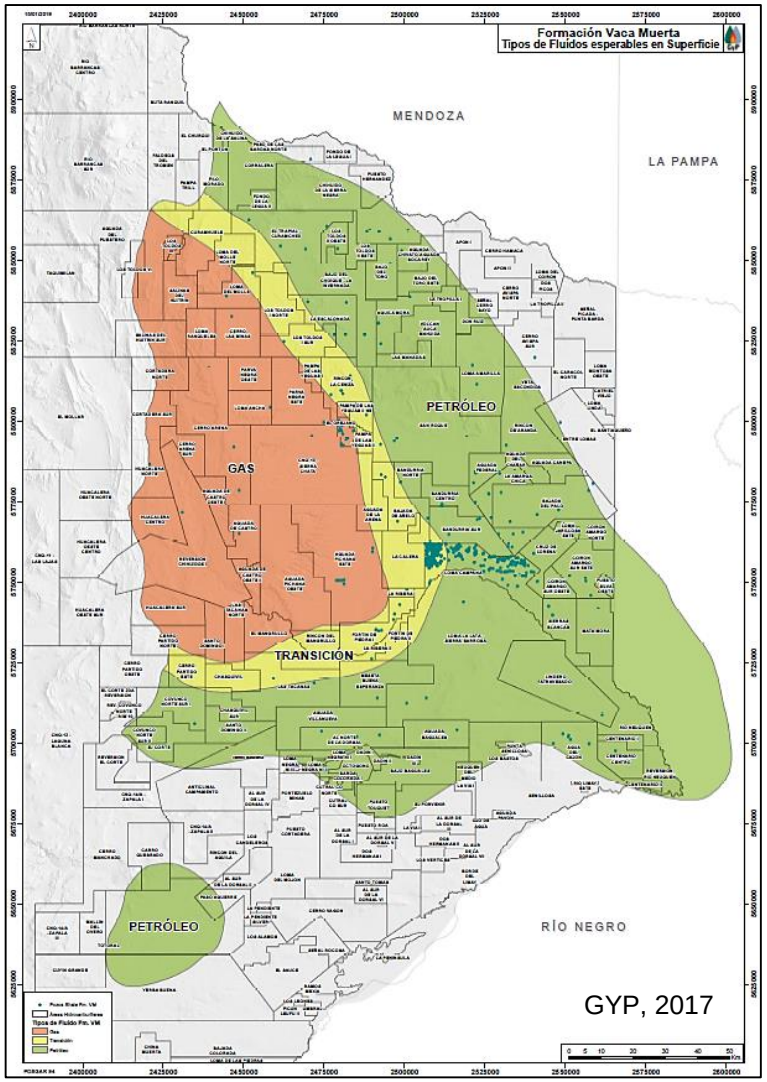


Major Changes since 2010

2011



2017



Latin America Unconventional "Hall of Fame"

	Technically recoverable resources [1]	Geology [2]	Engineering [3]	Accessibility [4]	Services & Logistics [5]	Marketability [6]	Human Resources [7]	Legal Regulations [8]	Environment & Water Issues [9]	Public Concern [10]	Costs [11]
USA	665	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗
Argentina	802	↗	↗	↗	↔	↗	↗	↗	↗	↗	↔
Bolivia	36	↘	↘	↘	↘	↘	↔	↘	↘	↔	↘
Brasil	245	↔	↗	↗	↗	↗	↗	↔	↔	↔	↔
Colombia	55	↔	↗	↗	↗	↗	↗	↔	↔	↘	↔
México	545	↗	↗	↗	↔	↗	↗	↗	↗	↔	↔
Paraguay	75	↘	↘	↗	↘	↘	↔	↔	↔	↔	↔
Uruguay	2	↘	↘	↗	↘	↘	↔	↔	↔	↔	↔
Venezuela	167	↗	↗	↗	↔	↔	↗	↘	↔	↔	↘

Stinco, 2016

References
1: TCF (EIA, 2013)
2: # of basin & formations, # of wells drilled, proved petroleum systems, depth, thickness, mineralogy, studies
3: hydraulic fracture design, facilities, infrastructure, energy, statistics
4: geographical characteristics, roads, depth
5: availability, proppants
6: needs of hydrocarbons in the country, region
7: availability of experienced professionals and technicians
8: laws, norms and decrees supporting the activities
9: sustainability, sources & preservation, water, air, soil, effluents, flora & fauna
10: acceptance, footprint of the activities & social impact
11: U$D per volume

↗ best
↔ average
↘ worst

Vaca Muerta Investment Commitments

Announced date	Asset	Partners	Investment commitment	Type	Production 2017E[1]		Wells at end-2016[2]	Window
					Gas (mmcfd)	Liquids ('000 b/d)		
Nov 2014	Rincon La Ceniza, La Escalonada	Total*-Shell-Gas y Petroleo del Neuquén (GyP)	US$300 million	Pilot	10	1	11	Condensate
Dec 2014	La Amarga Chica	YPF*-Petronas	US$550 million	Pilot	2	4	15	Oil
Aug 2015	Sierras Blancas, Cruz de Lorena	Shell*-GyP-Medanito	US$500 million	Pilot	0	2	12	Oil
Dec 2015	El Orejano	YPF*-Dow	US$500 million	Develop-ment	123	0	45	Gas
Dec 2015	Bajo del Choique-La Invernada	ExxonMobil*-GyP	US$225 million	Pilot	1	0	3	Condensate
Feb 2017	Bajada de Anelo	YPF*-Shell	US$447 million	Pilot	1	0	4	Condensate
March 2017	Fortin de Piedra	Tecpetrol*	US$2.3 billion	Develop-ment	13	3	4	Gas
April 2017	Bandurria Sur	YPF*-Schlumberger	US$390 million	Pilot	0	1	8	Condensate
July 2017	Aguada Pichana Oeste, Aguada de Castro	Pan American Energy*-YPF-Total	US$475 million	Pilot	0	0	0	Gas
July 2017	Aguada Pichana Este	Total*-Pan American Energy-YPF-Wintershall	US$675 million	Develop-ment	53	0	12	Gas
Sept 2017	Los Toldos I Sur	ExxonMobil*-Tecpetrol-GyP	US$200 million	Pilot	0	0	1	Gas
Oct 2017	Loma Campana	YPF*-Chevron	US$500 million	Develop-ment	64	29	525	Condensate/ oil
Nov 2017	Sierra Chata	Pampa Energia*-ExxonMobil	US$520 million	Pilot	0	0	1	Gas
Nov 2017	Loma del Molle Norte	Chevron*-GyP	US$19 million	Pilot	0	0	0	Gas
Nov 2017	Bajo del Toro Este	Statoil*-GyP	US$15 million	Pilot	0	0	0	Oil
Nov 2017	Las Tacanas Norte	Pampa Energia*-GyP	US$207 million	Pilot	0	0	0	Gas
Nov 2017	Parva Negra Oeste	Retama Argentina*-GyP	US$76 million	Pilot	0	0	0	Gas

1: Shale production only
2: Estimated total shale wells. Most Loma Campana wells are vertical.

Wood Mackenzie, 2018

- Increase in the number of projects
- The companies that were already in the basin are still present
- New players were added (including service companies)
- There is a marked tendency to develop gas projects
- There are projects linked to improving the pipelines
- The national and provincial governments have acted proactively to optimize the resource

Argentina Challenges

- A widespread perception stresses that equipment, services and logistics are the bottleneck.

- In spite of local companies are developing technology an important amount of it is still imported, thus increasing costs.

- A positive evolution in reducing uncertainty of the geoscience knowledge, drilling and fracking costs as well as improving the environmental concerns and legal issues could be seen over the since 2011.

- Oil production reached its peak in 1998 while gas in 2001. Since then, in both cases production shows declination with a clear tendency of not being able to recover production unless new projects are successful, such as: new discoveries from onshore and offshore exploration, implementation of improved/enhanced oil recovery plans and unconventional reservoirs development.

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