Argentina Energy Plan

—OIL AND GAS GUIDELINES—

Secretaría de Gobierno de Energía

Secretaría de Planeamiento Energético

Our vision

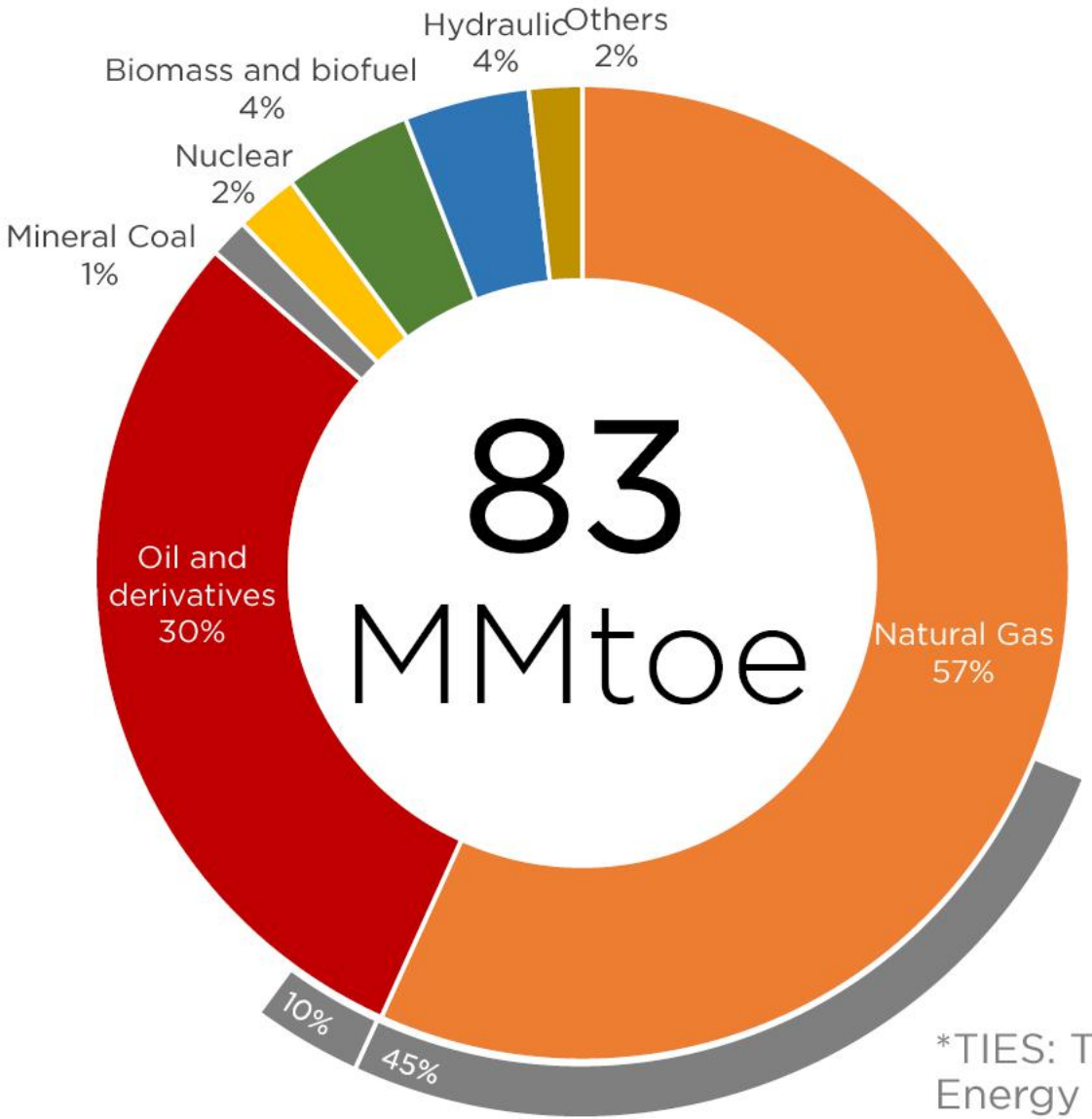
Provide Argentinians with abundant, clean and low cost energy, and transform our country in a **World Class Energy Supplier** through the massive and responsible development of **unconventional resources** and through the fast incorporation of renewables, reaching competitive costs for the development of the small and medium-sized enterprises (SMEs), the industries and the transport.

Our six objectives

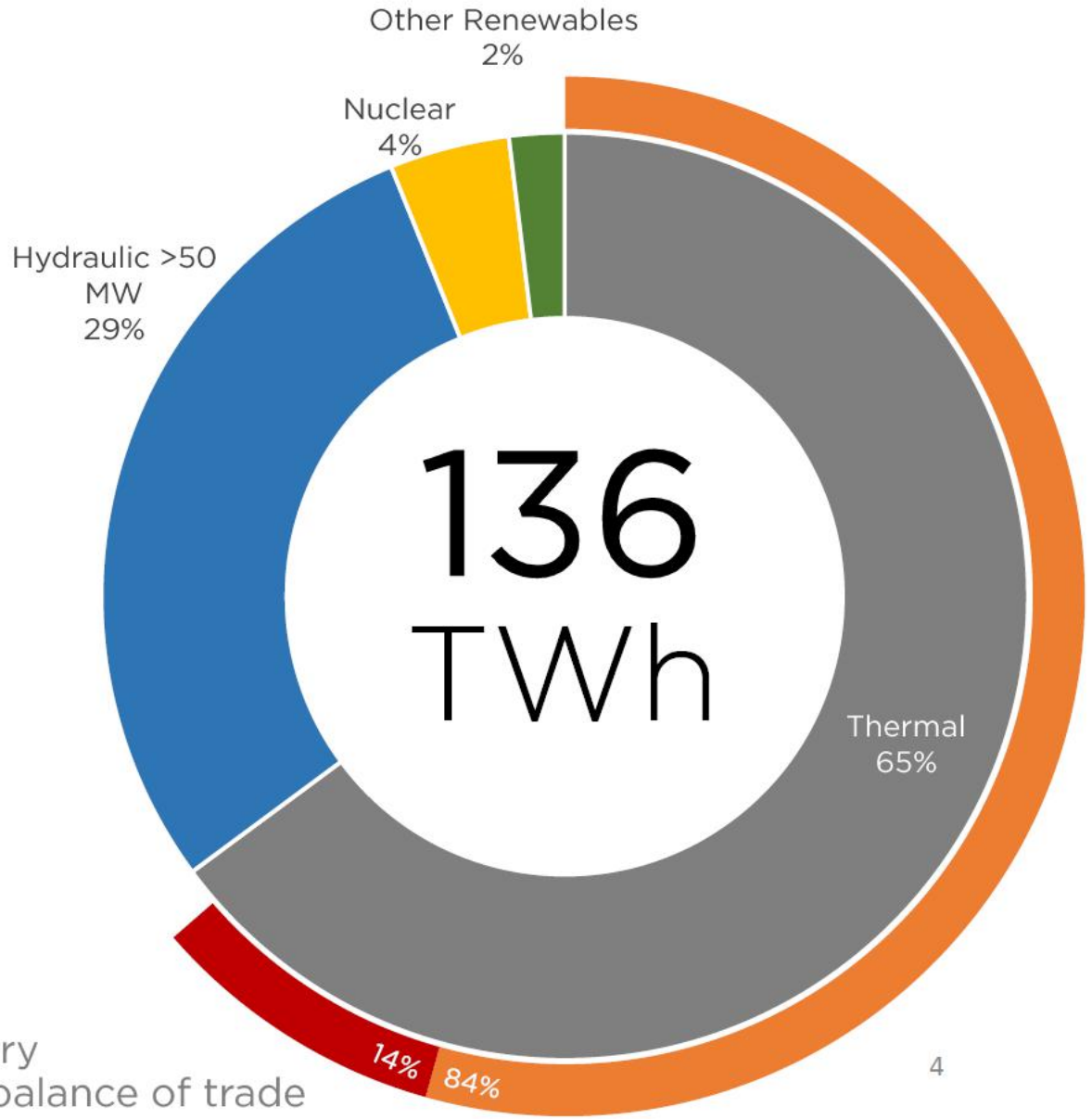
1. **Double oil production in 5 years,** reaching 1 million barrels per day and to export 500 thousand daily.
2. **Double natural gas production in 5 years**, to achieve 260 MMm^3 (9.2 Bcf) per day and to export 100 MMm^3 (3.5 Bcf) daily.
3. **Create 500 thousand new jobs** associated with the development of Vaca Muerta.
4. **Enhance Argentina's trade balance**, by contributing 15.000 MMUSD of net anual exports in 2023 .
5. **Develop the full potential of renewable energy,** reaching by 2025 a 20% share of Argentina's electricity consumption.
6. Due to this great energy offer **reach world class competitive prices** to strongly develop SMEs, industries and transport sector.

Argentine energy matrix

Internal energy supply* - 2017



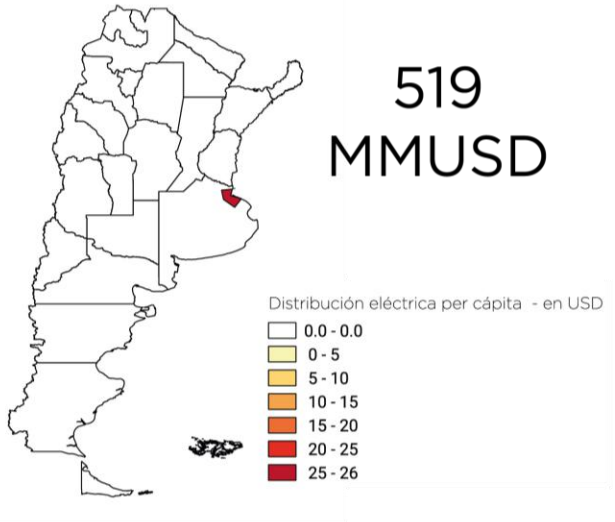
Power generation matrix – 2017



*TIES: Total Primary Energy Supply + balance of trade

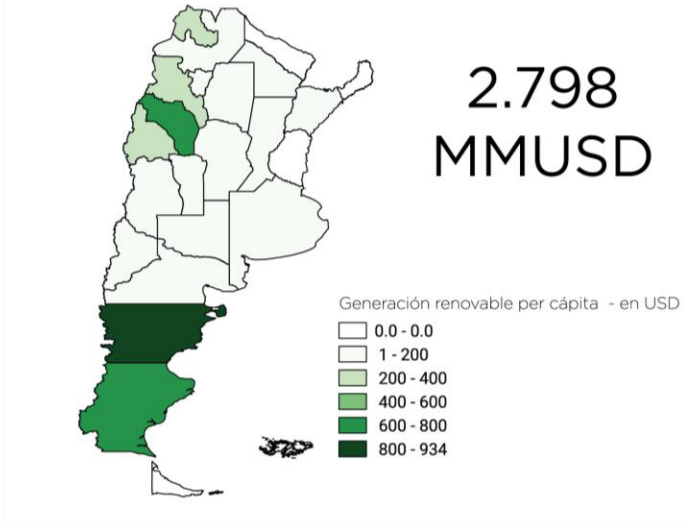
Private investment in the energy sector – 2018 est.

Power distribution (data for AMBA)



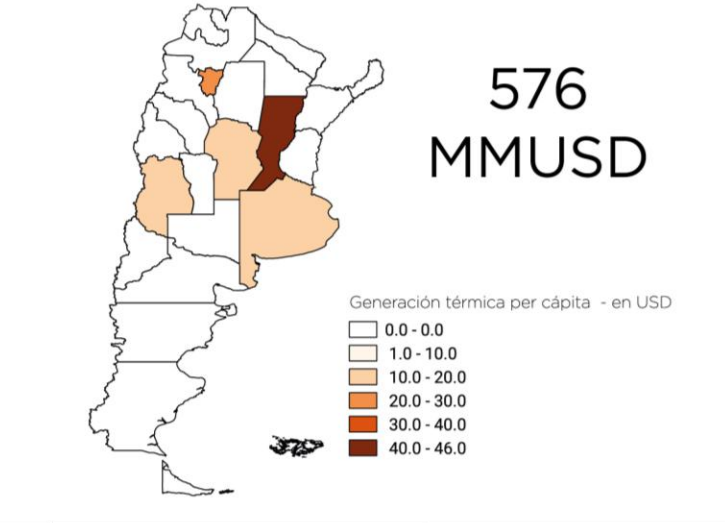
519 MMUSD

Renewable generation



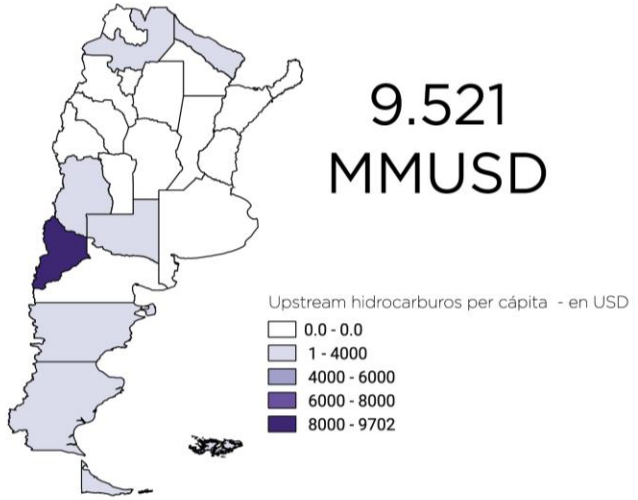
2.798 MMUSD

Thermal power generation



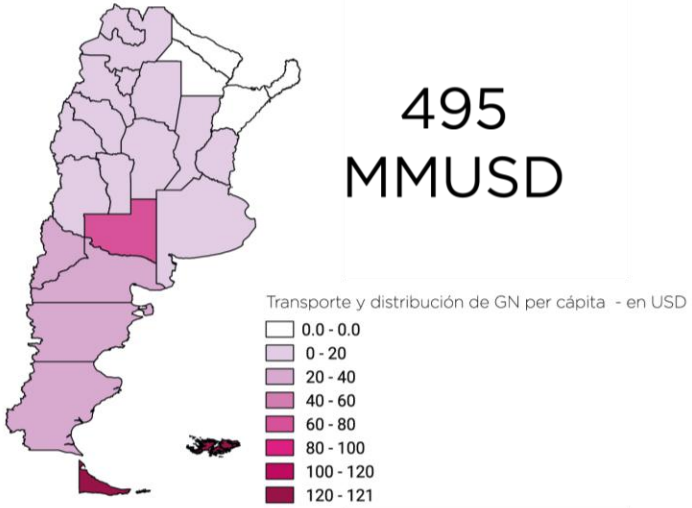
576 MMUSD

Upstream O&G



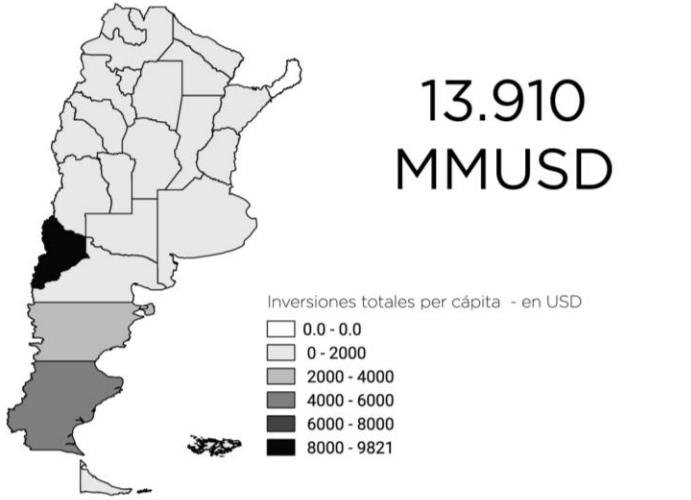
9.521 MMUSD

Transport and distribution of Oil and Gas



495 MMUSD

Total private investment



13.910 MMUSD

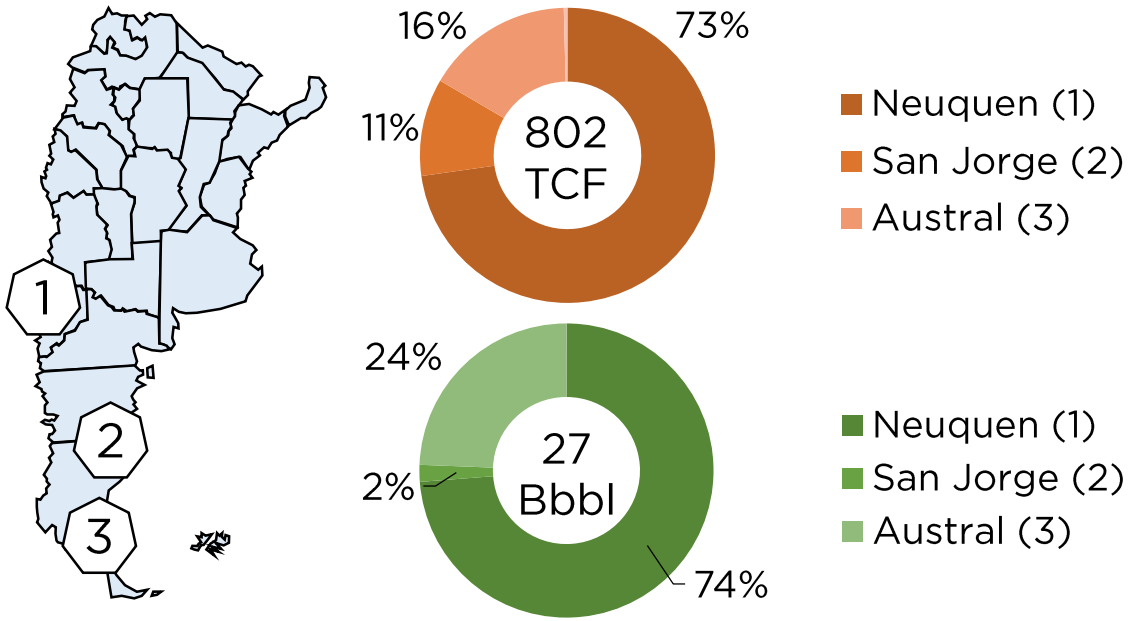
Vaca Muerta, Focusing Unconventional Resources

World Shale Resources

Shale Resource Assessments (EIA 2013) estimates that World has total resources of:

- 7,577 TCF of gas
- 419 Bn. bbl of oil

Argentina: Resources per Basin



11% of gas and 7% of oil World unconventional resources are in 3 different basins in Argentina

Most of it is located in the Vaca Muerta formation at Neuquen and Mendoza Province

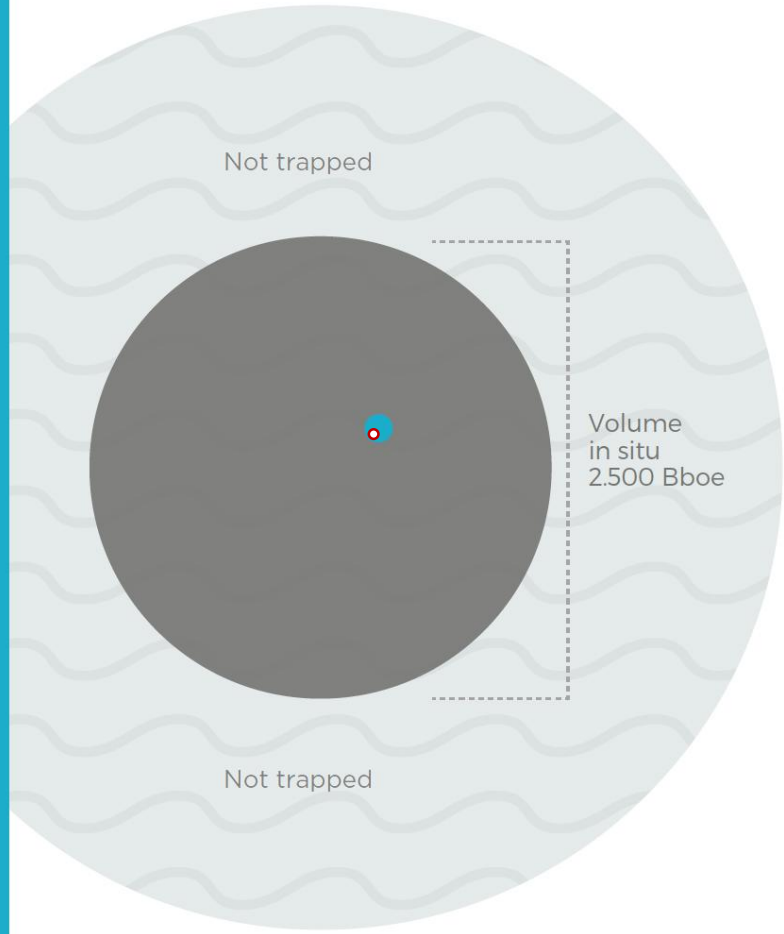
How hugh is Vaca Muerta?

One of the best resources in the world

Unconventional Gas Resources

Unconventional Oil Resources

Source: EIA 2013.



Generated volume **5.000 Bboe**

2.460 Bboe (98%)
Trapped in unconventional reservoirs

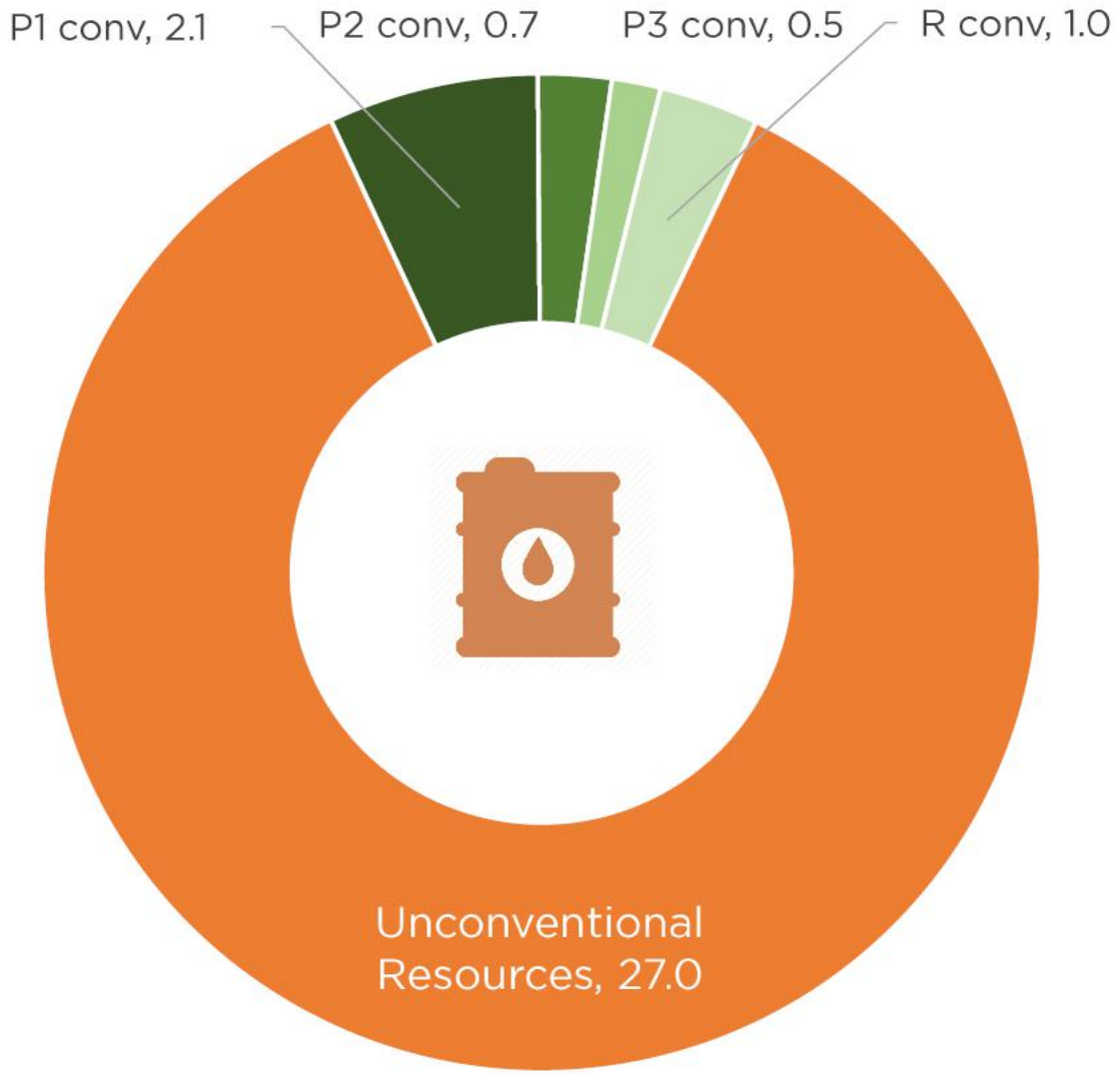
How much is technically recoverable?
According to DOE:
7% - 169 Bboe

40 Bboe (2%)
Trapped in conventional reservoirs

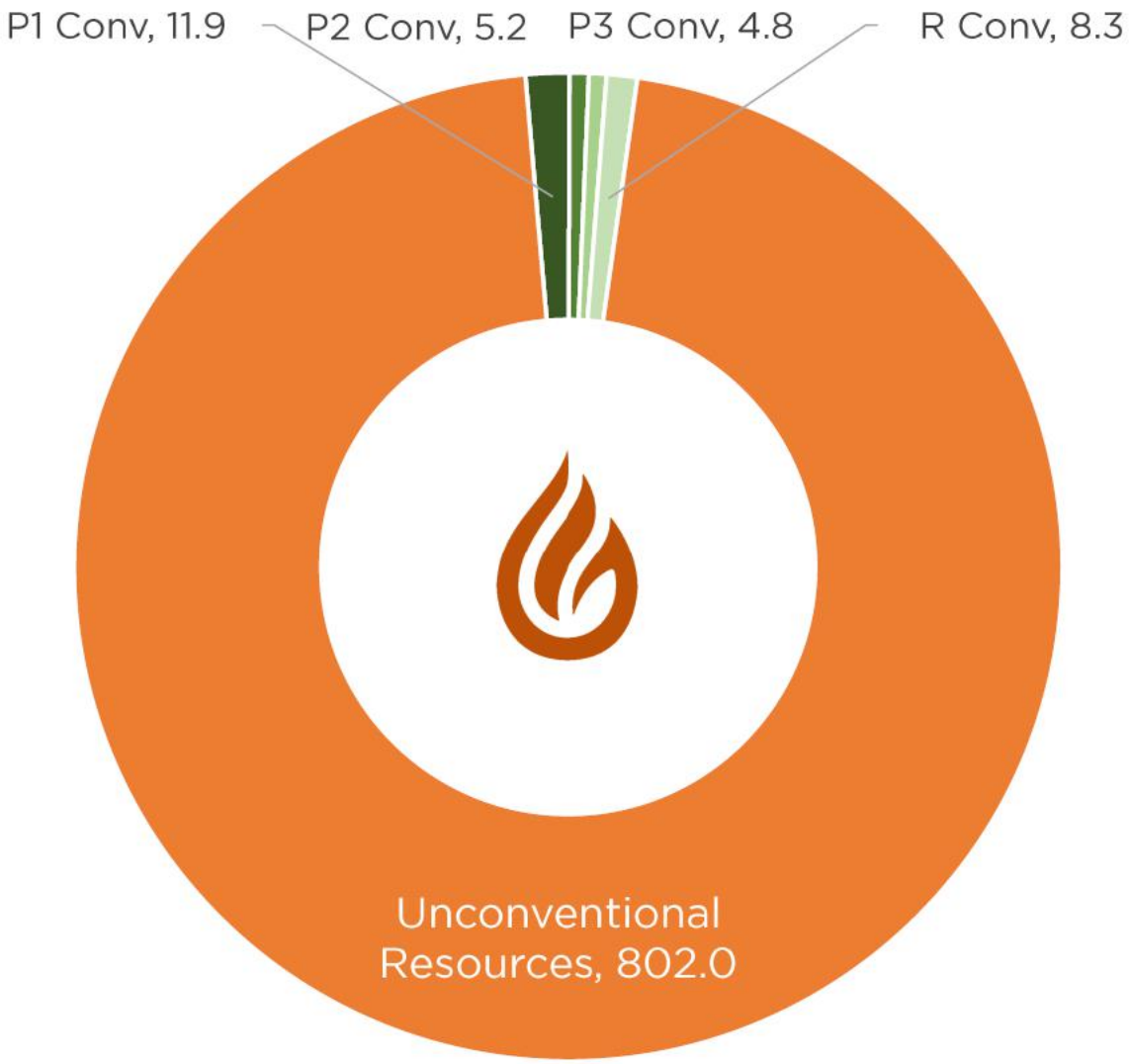
Already Produced: 8,5
Recoverable: 9,7

Argentina Reserves and Resources

Oil Reserves and Resources (Bbbl)

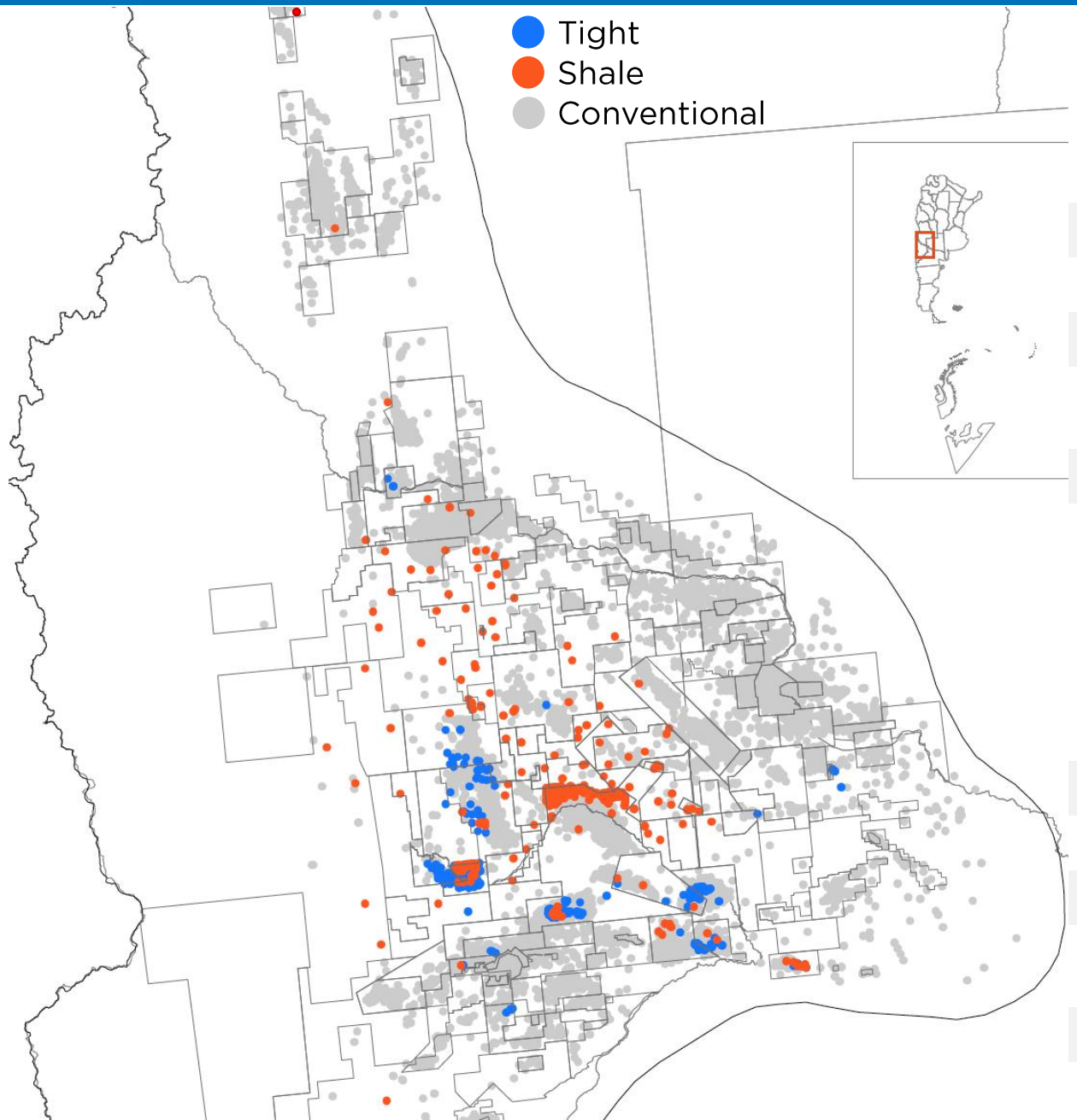


Natural Gas Reserves and Resources (Tcf)



Source: EIA (USA) and Secretariat of Energy (Argentina)

Sweet spots of Vaca Muerta – Sustainability of the *Plateau*



Oil

Neuquén Window: 22,000 km^2	5.4+ MM Acres
EUR / Well	631 kbbl/well
Landing points/area	2.5/km2 (2.5/247 acres)
MMbbl/Area	1.6 MMbbl/km2 (6.5 kbbl/acre)
Unconventional Production *Plateau* 2030	1,143 kbbl/day
Reservoir to exploite in 25 years	10,434 MMbbl
Exploited Area	6,614 km2 / 1.6 MM acres (30%)

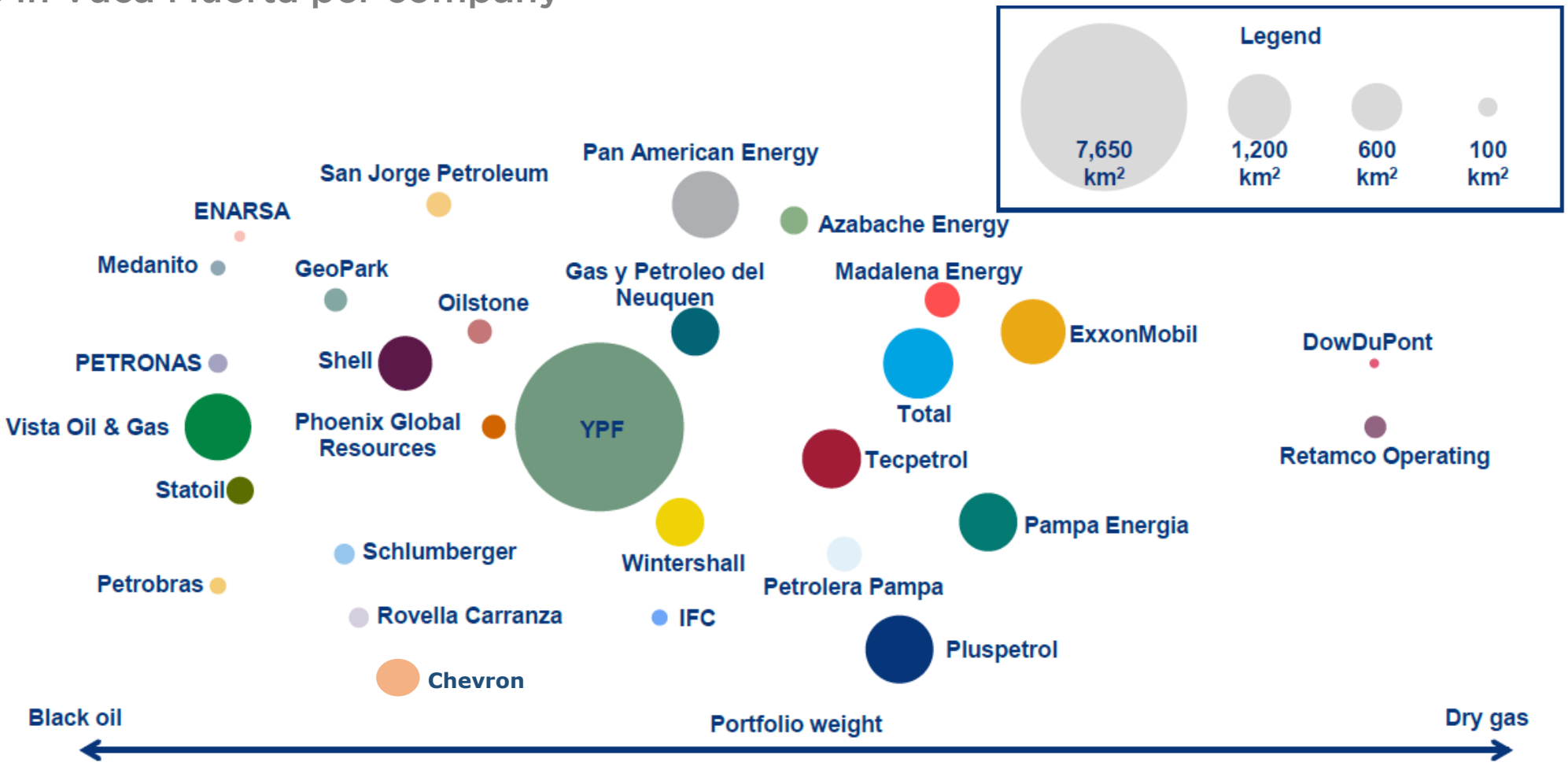
Gas

Neuquén Window: 13,000 km^2	3.2+ MM acres
EUR / Well	12.9 BCF/well
Landing points/area	2.5/km^2 (2.5/247 acres)
BCF/area	32.25 BCF/km^2 (0.13 BCF/acre)
Unconventional Production *Plateau* 2030	14.1 BCF/day
Reservoir to exploit in 25 years	128.6 TCF
Exploited Area	3,990 km^2 / 987,643 acres (31%)

Current players in Vaca Muerta (Wood Mackenzie)

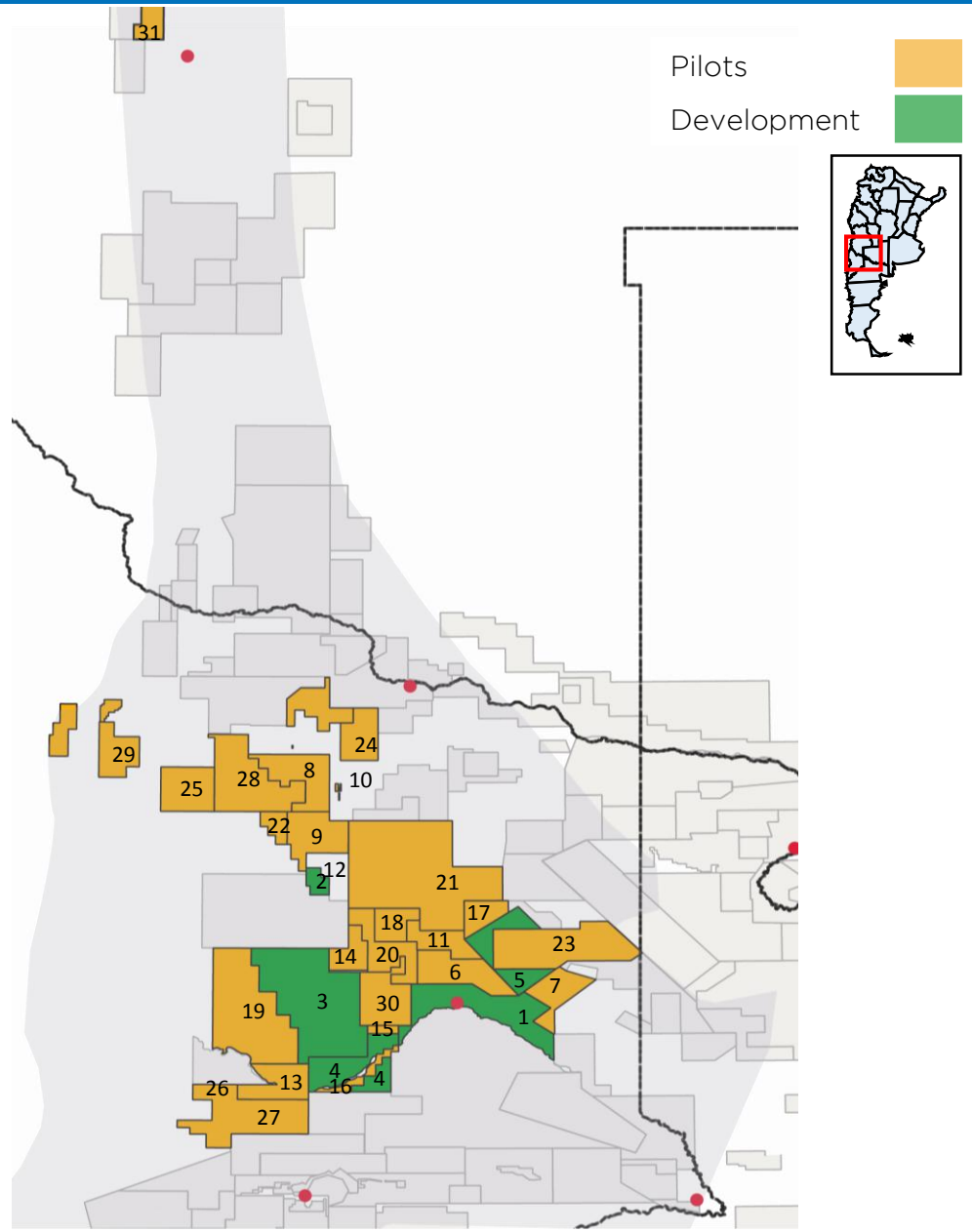
- More than 30 big, independent and local companies are active in Vaca Muerta

Acreage in Vaca Muerta per company



Source: Wood Mackenzie

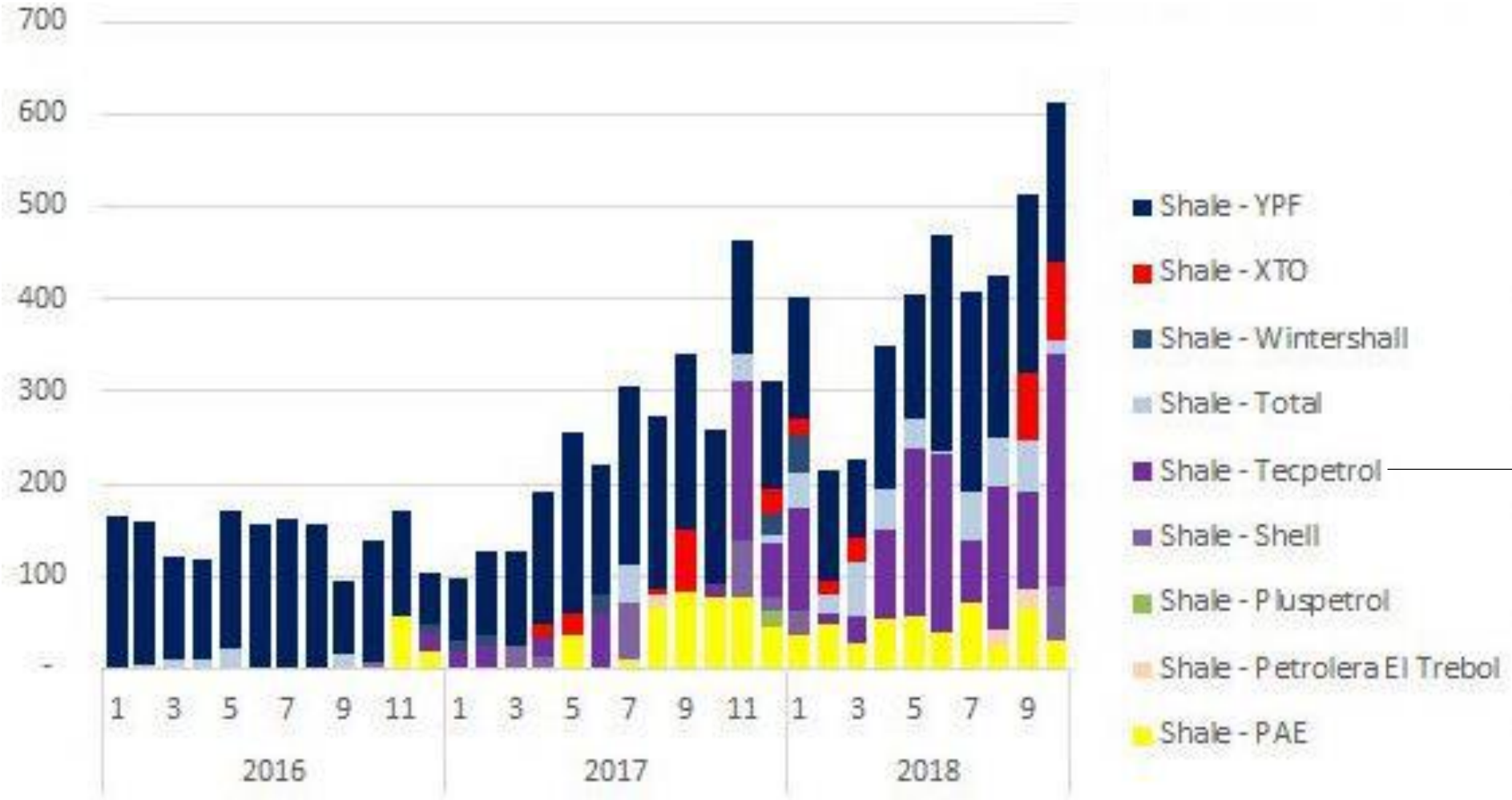
31 key projects sanctioned, and way more to come



	Area	Operador	Black Oil	Light Oil	Wet Gas	Dry Gas	Cond	2010	11	12	13	14	15	16	17	18
1	Loma Campana	YPF														
2	El Orejano	YPF														
3	Aguada Pichana Este	Total														
4	Fortín de Piedra	Tecpetrol														
5	La Amarga Chica	YPF														
6	Bandurria Sur	YPF														
7	Cruz de Lorena - Sierras Blancas	Shell														
8	La Escalonada	Total														
9	Rincon de la Ceniza	Total														
10	Bajo del Choique - La Invernada	ExxonMobil														
11	Bandurria Centro	PAE														
12	Pampa de las Yeguas I	ExxonMobil														
13	Rincon del Mangrullo	YPF														
14	Aguada de la Arena	YPF														
15	La Ribera I	YPF														
16	La Ribera II	YPF														
17	Aguada Federal	Wintershall														
18	Bandurria Norte	Wintershall														
19	Aguada Pichana Oeste - Aguada de Castro	PAE														
20	Bajada de Anelo	Shell														
21	San Roque	Total														
22	Los Toldos I Sur	ExxonMobil														
23	Bajada de Palo	Vista Oil & Gas														
24	Bajo del Toro	YPF														
25	Cerro Arena	YPF														
26	Las Tacanas	YPF														
27	Las Tacanas Norte	Pampa														
28	Cerro Las Minas	YPF														
29	Salinas del Huitrin	YPF														
30	La Calera	Pluspetrol														
31	Puesto Rojas	Phoenix														

Sources: WoodMackenzie, Ministerio de Energía y Recursos Naturales de Neuquén y Ministerio de Energía de la Nación

Fractures stages by month are improving



Fortín de Piedra
Tecpetrol – 100%

Operative efficiency record:

20 fracture stages in less than 24hs:

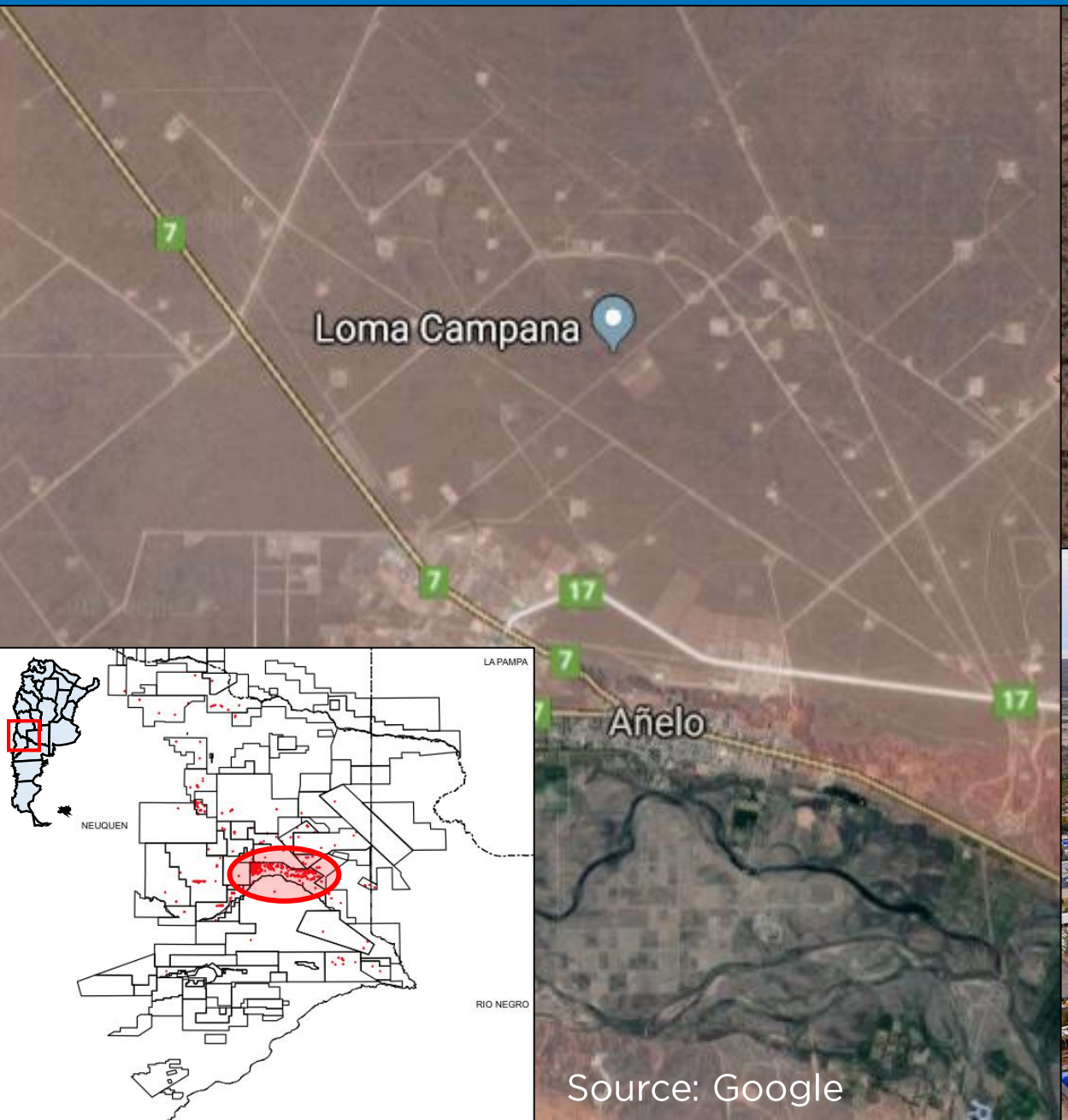
- FP-1101 (SLB): 8 stages
- FP-1051 (SLB): 6 stages
- FP-1021 (BHGE): 6 stages

From 180 to 612 fractures/month stages in almost 3 years (58% CAGR), 20% m/m last period.
Keeping pace is essential to unlock Argentina Shale Potential

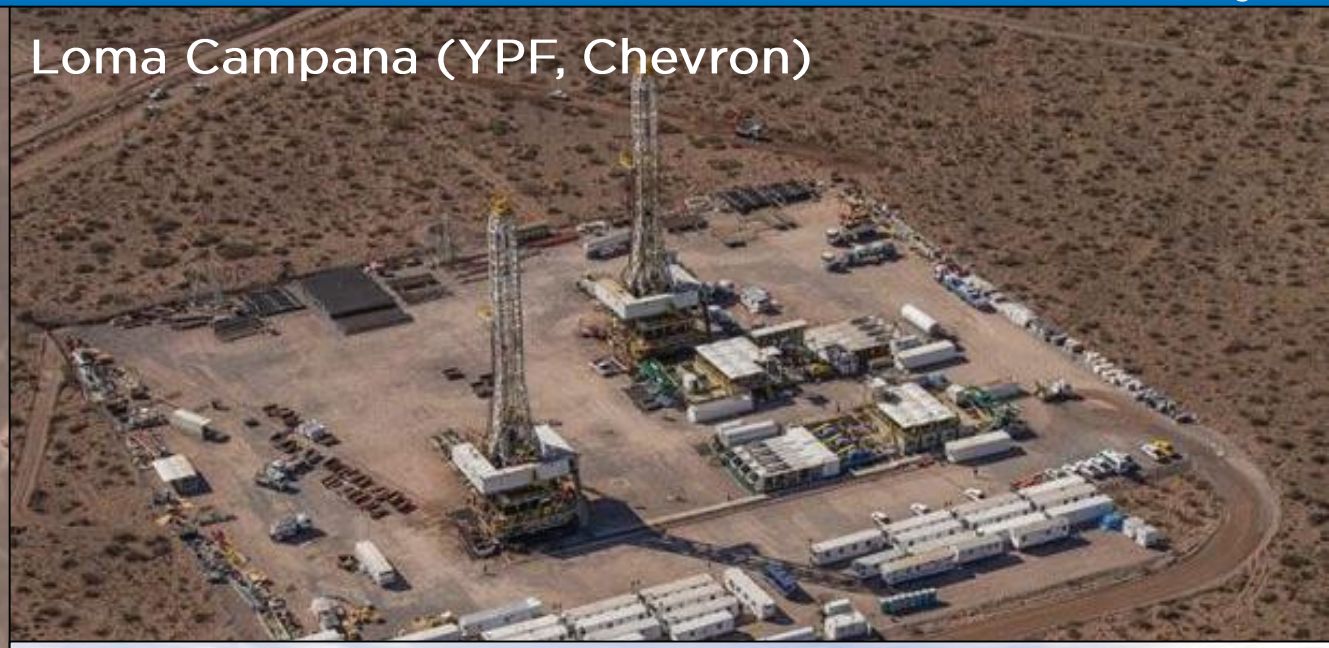
From 0 to 635 MMscf/day in 2 years

Source: Neuquen Informa

First unconventional oil field of Argentina

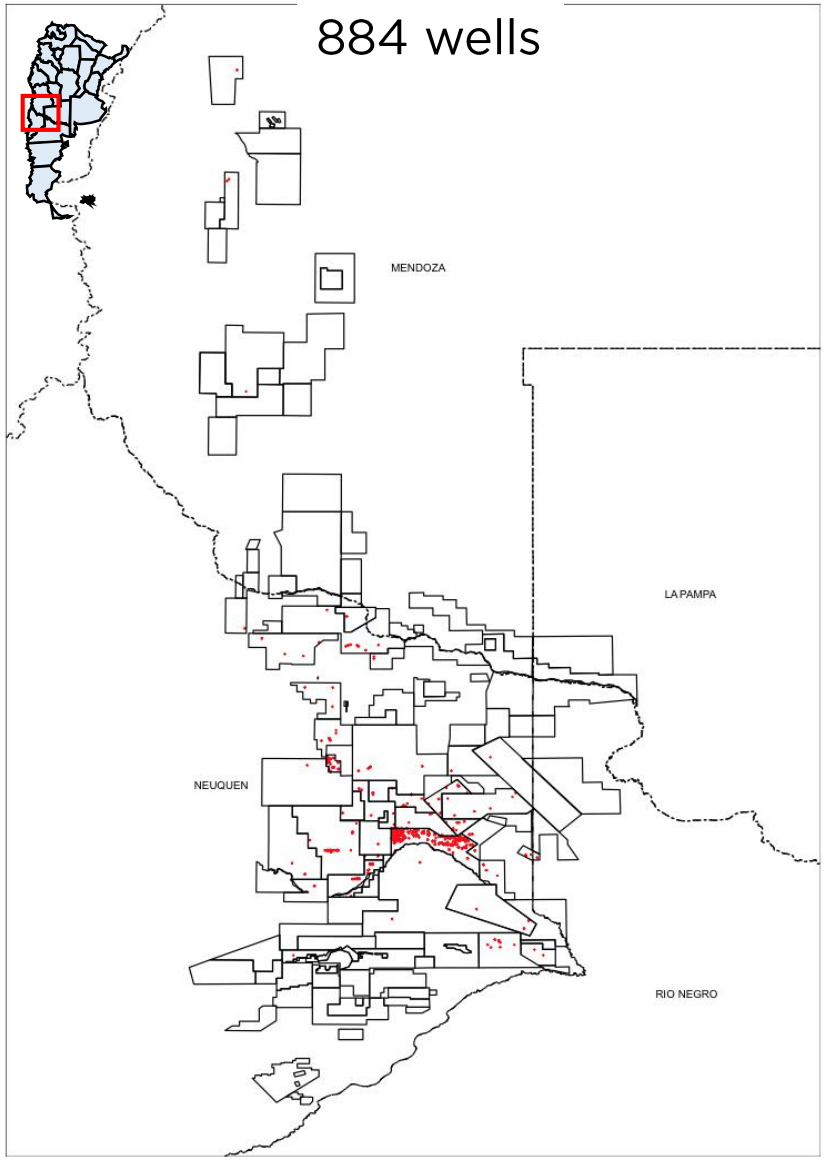


Source: Google

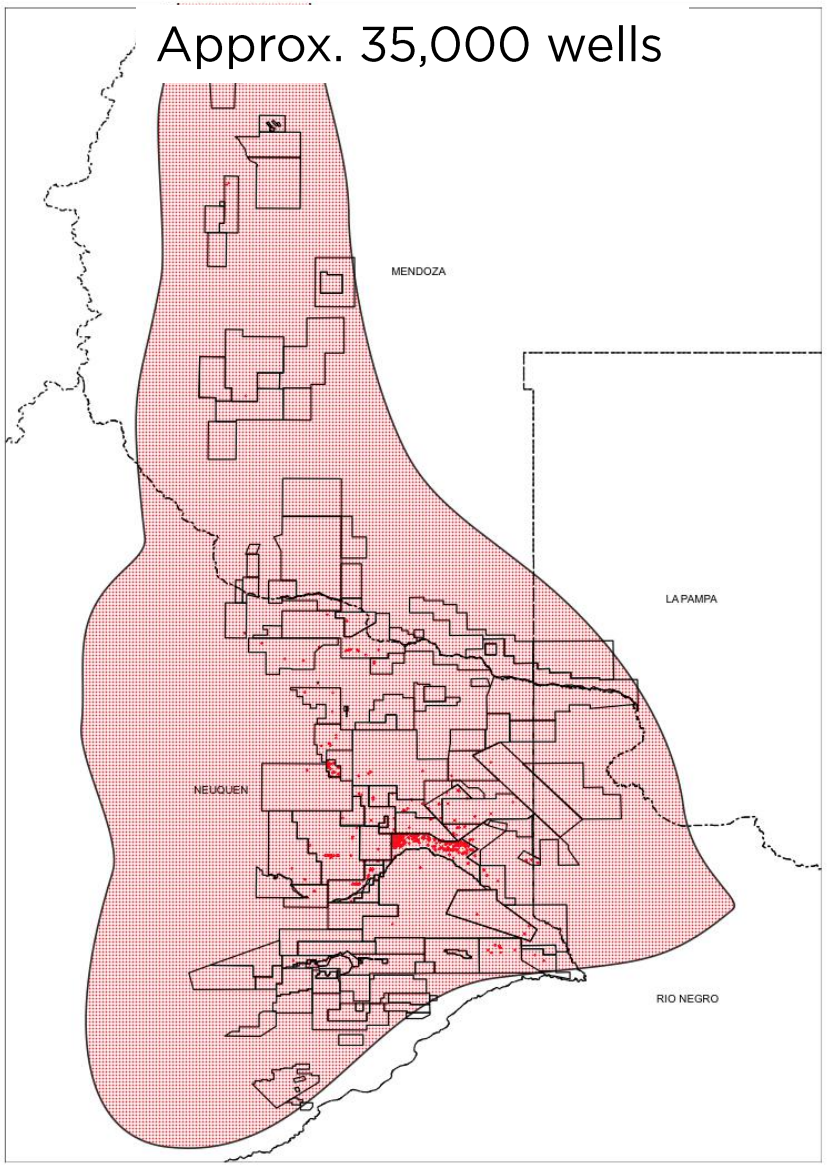


What would Vaca Muerta look like at full development?

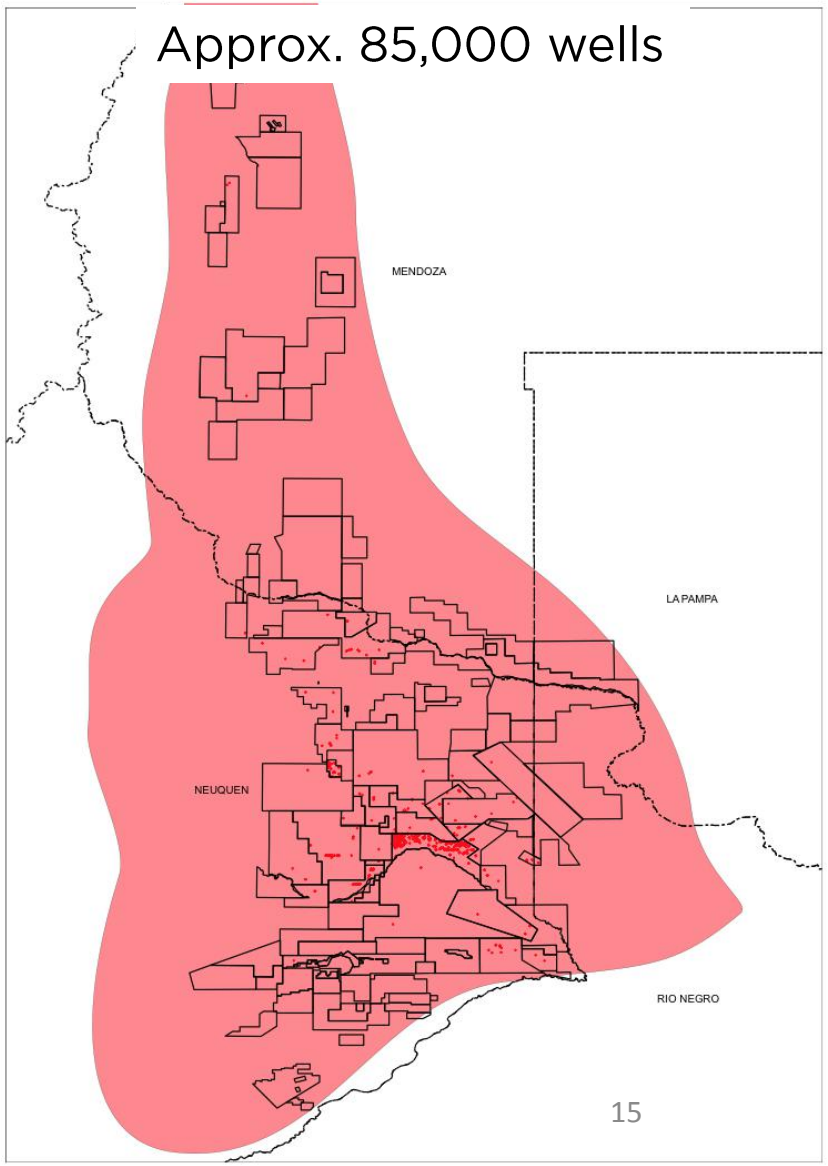
Current
Vaca Muerta shale wells •



Vaca Muerta shale wells •
@ Loma Campana's density

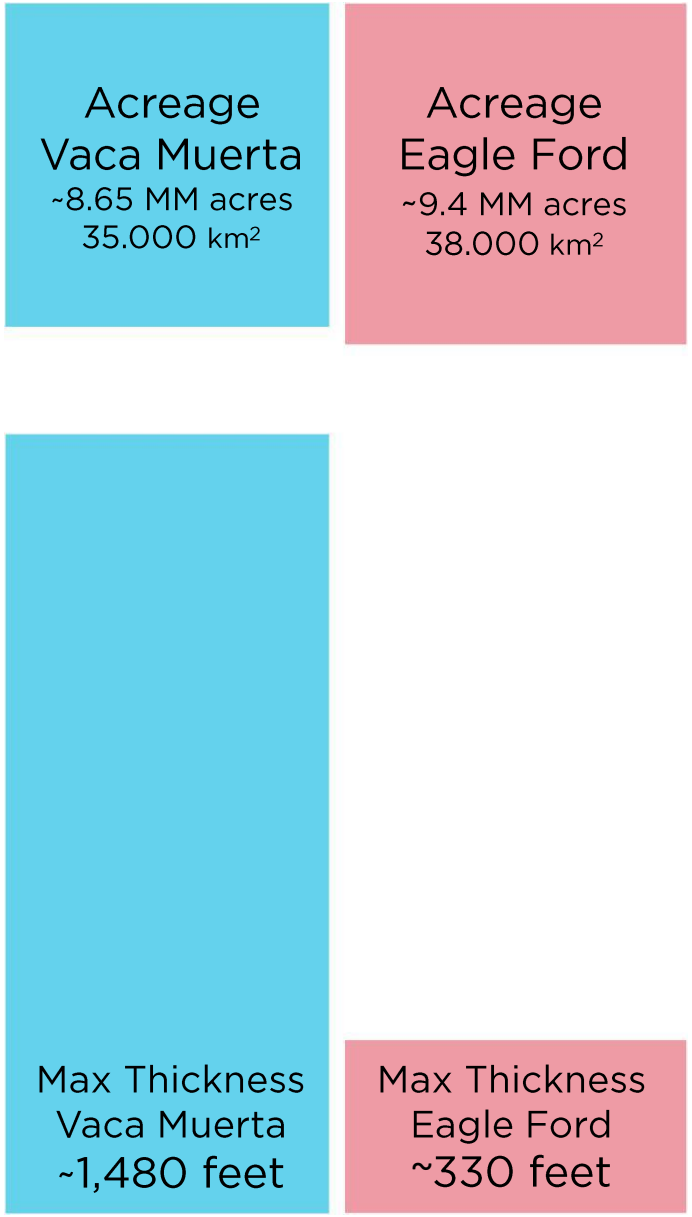


Vaca Muerta shale wells •
@ 2,5 landing points/km^2



Vaca Muerta: competitive formation indicators

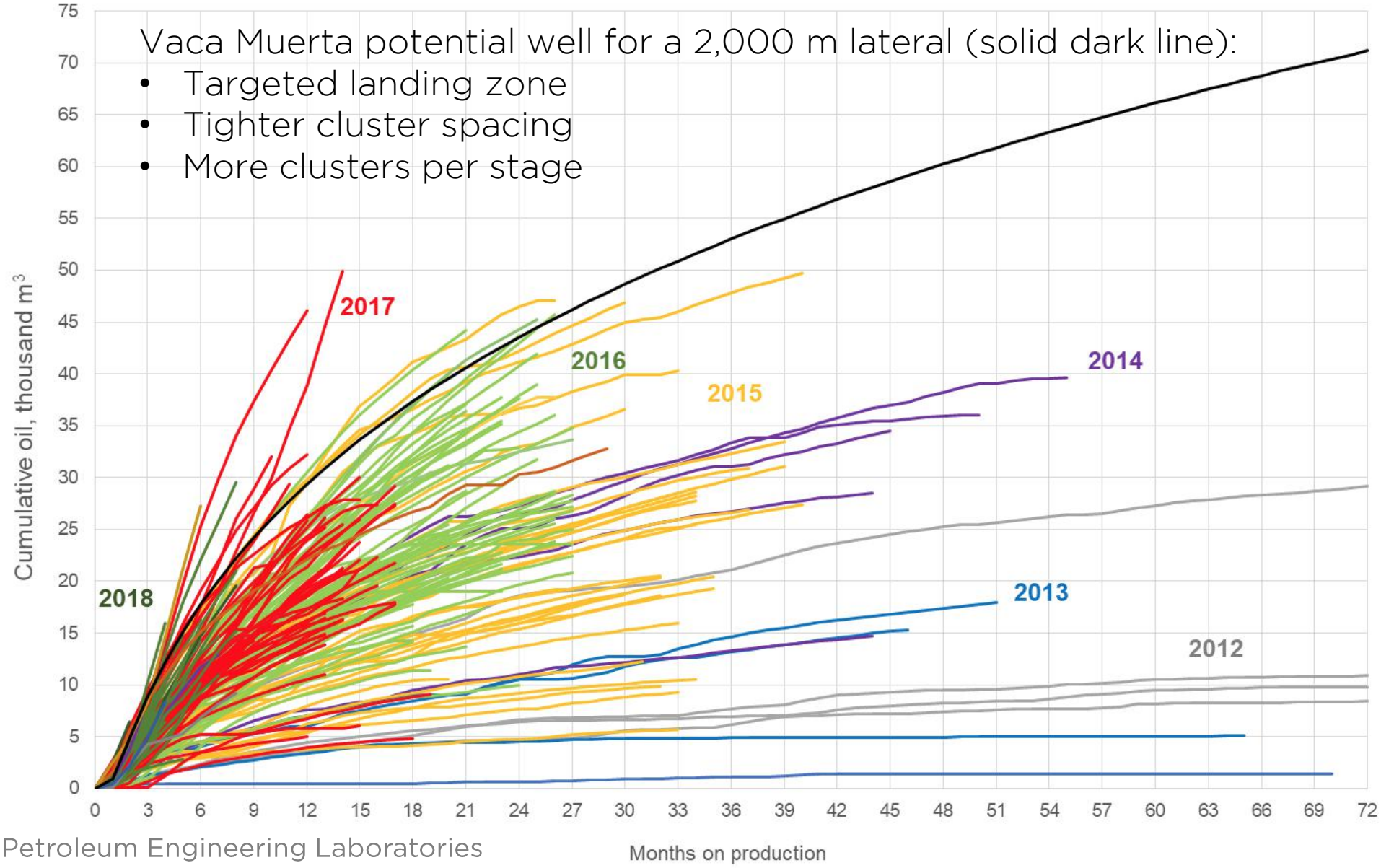
Play	TOC [%]	Thickness [m]	Reservoir pressure [psi]
Vaca Muerta	3—10	30—450	4,500—9,500
Barnett	4—5	60—90	3,000—4,000
Haynesville	0,5—4	60—90	7,000—12,000
Marcellus	2—12	10—60	2,000—5,500
Eagle Ford	3—5	30—100	4,500—8,500
Wolfcamp (Permian)	3	200—300	4,600



Sources: Energy Information Administration (EEUU), 2013 & YPF, 2014

Vaca Muerta horizontal well performance (WDVG)

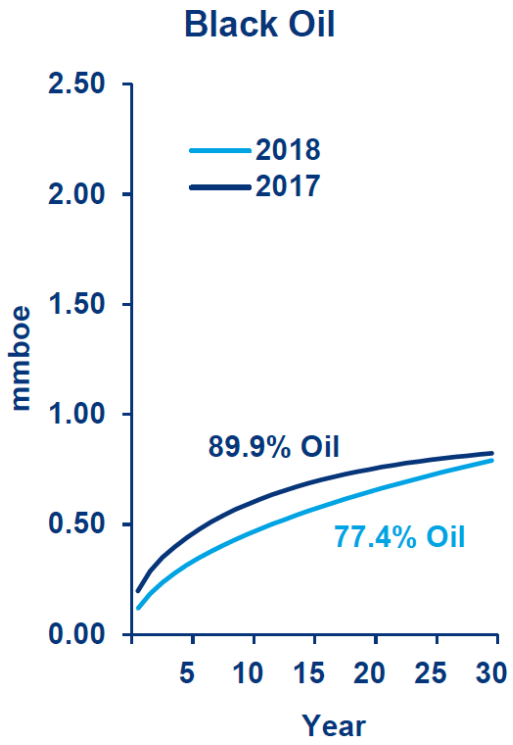
Relentless progress through the years but still below potential

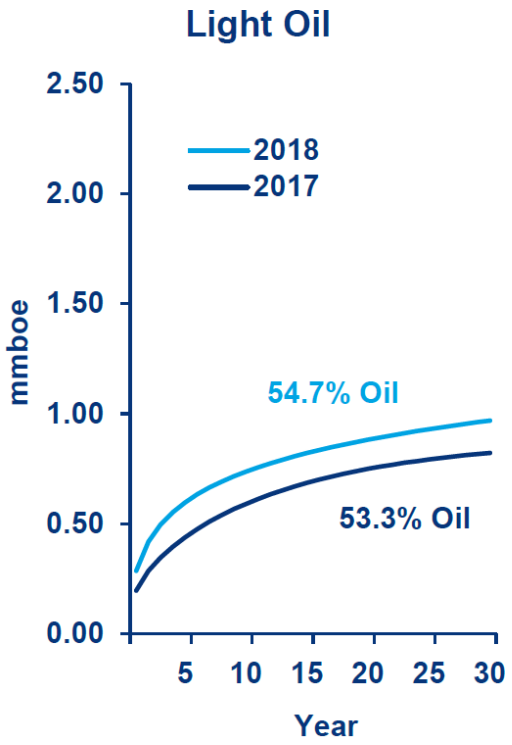


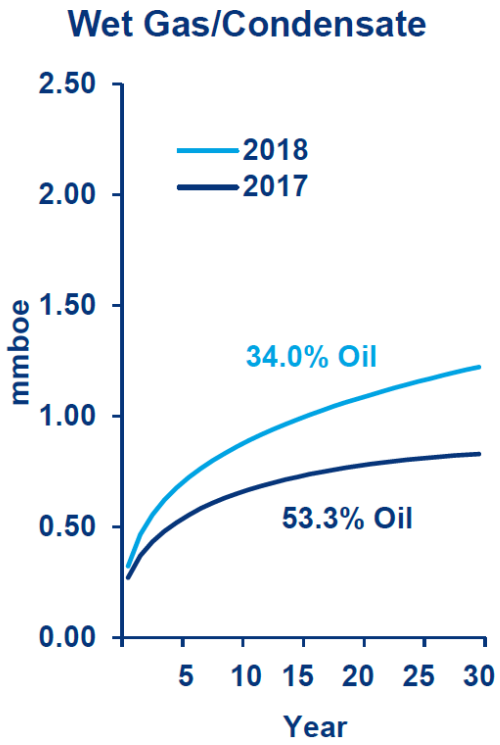
Source: WDVG Petroleum Engineering Laboratories

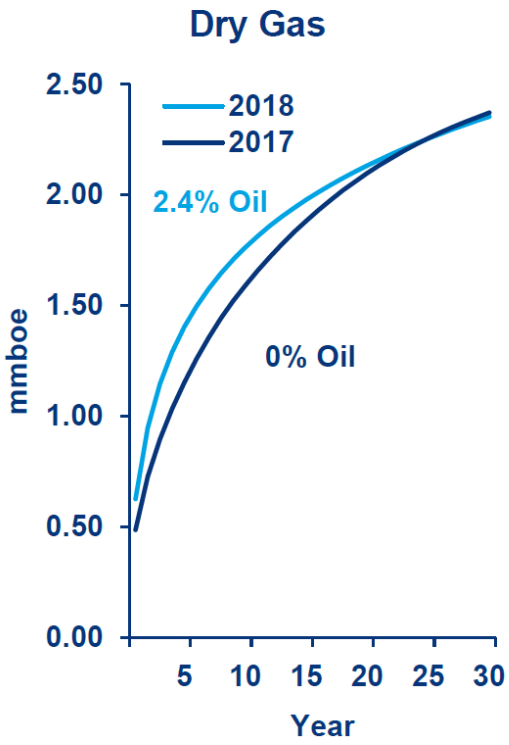
Accumulated production by type of wells (Wood Mackenzie)

	IP30 (boe/d)			EUR (mmboe)			Cum 180 (kboe)			Cum 365 (kboe)		
	2017	2018	% change	2017	2018	% change	2017	2018	% change	2017	2018	% change
Black Oil	901	531	**-41%**	0.82	0.79	**-4%**	111	71	**-36%**	174	116	**-33%**
Light Oil	901	945	5%	0.82	0.97	18%	111	155	39%	174	280	61%
Wet Gas	911	1,076	18%	0.83	1.22	47%	103	177	71%	151	313	107%
Dry Gas	2,440	1,993	**-18%**	2.37	2.35	**-1%**	306	327	7%	484	604	25%





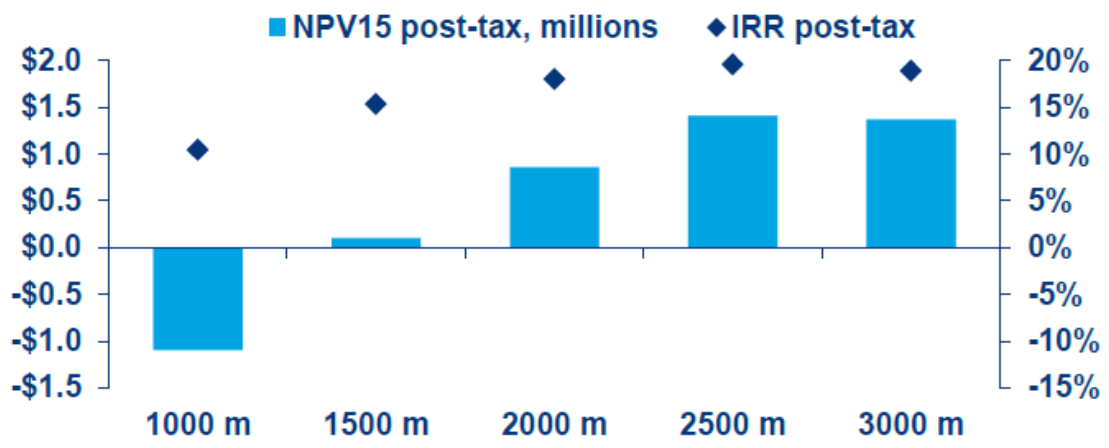




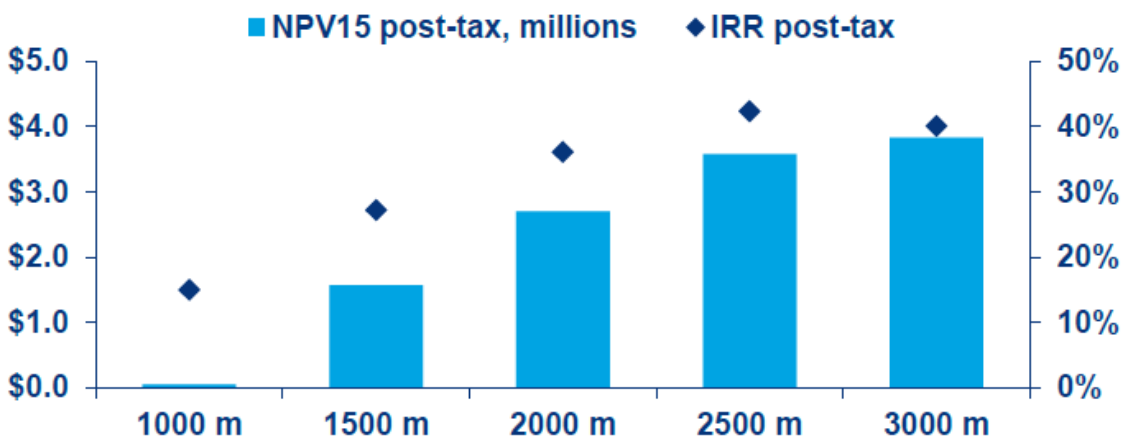
Source: Wood Mackenzie

Economic values of horizontal wells (Wood Mackenzie)

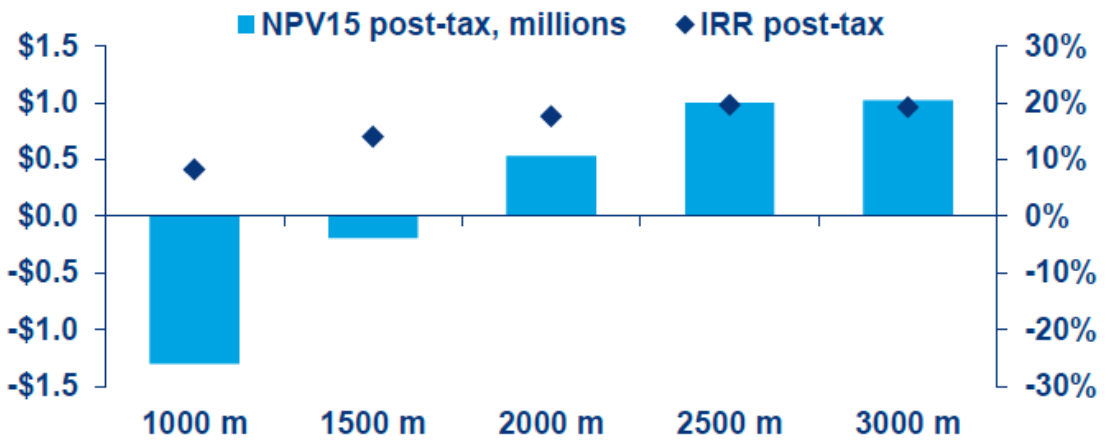
Black Oil window type well



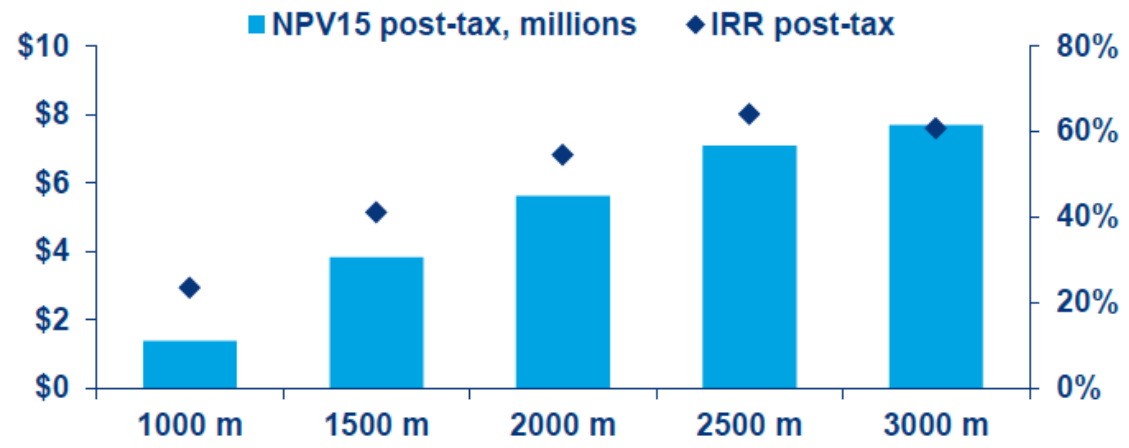
Light Oil window type well



Wet Gas/Condensate window type well



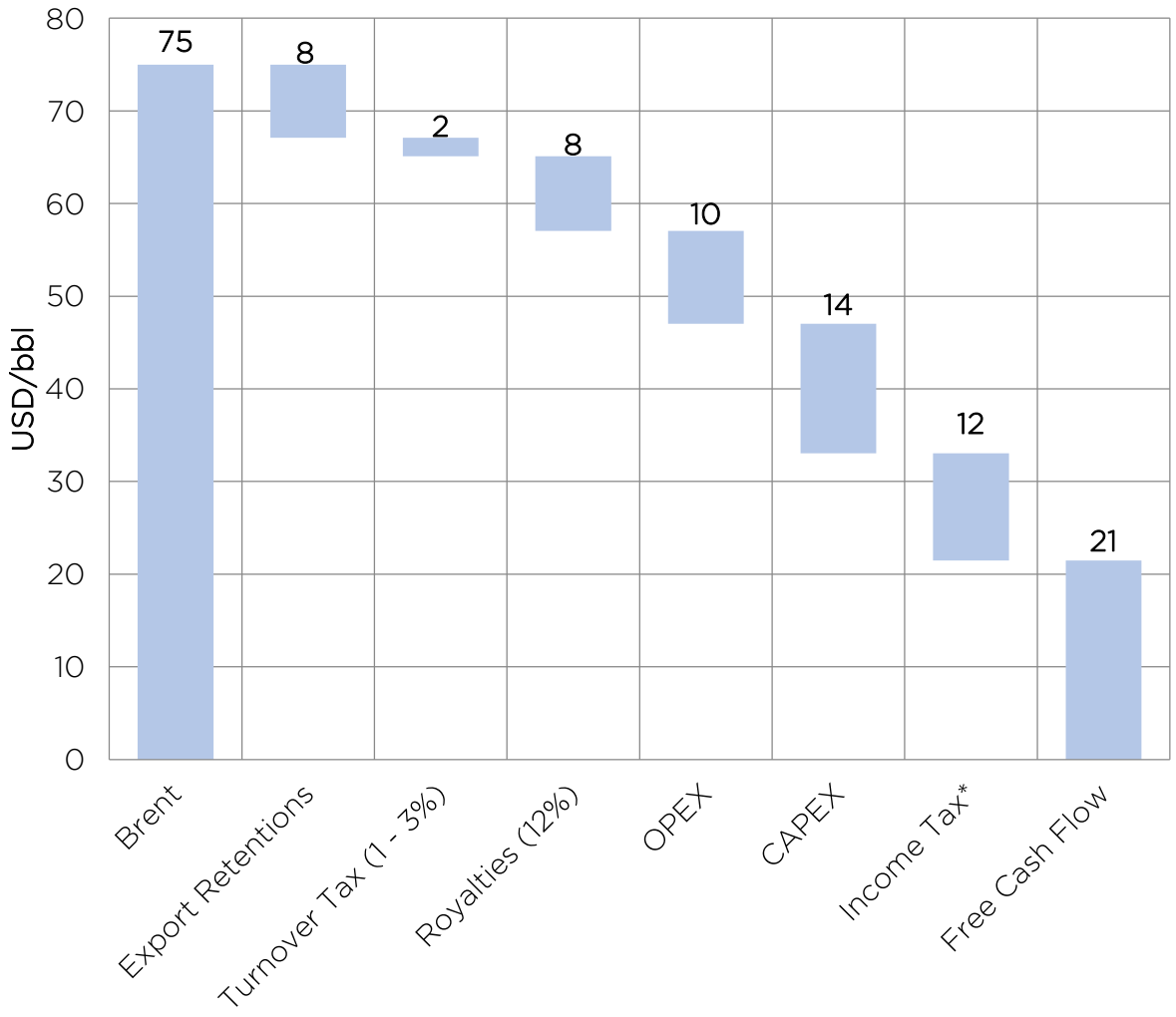
Dry Gas window type well



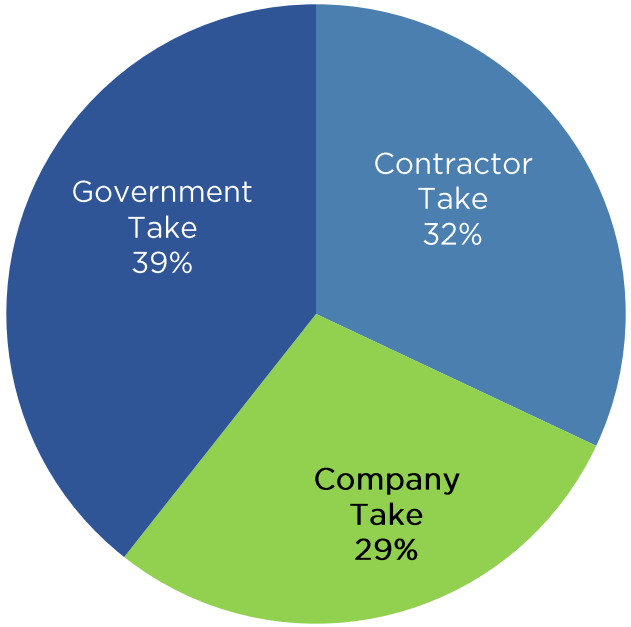
Source: Wood Mackenzie

Argentina has an Atractive Fiscal Regime

Cash Flow Breakdown
Figures for a type oil development



Take per Player
Figures for a type oil development

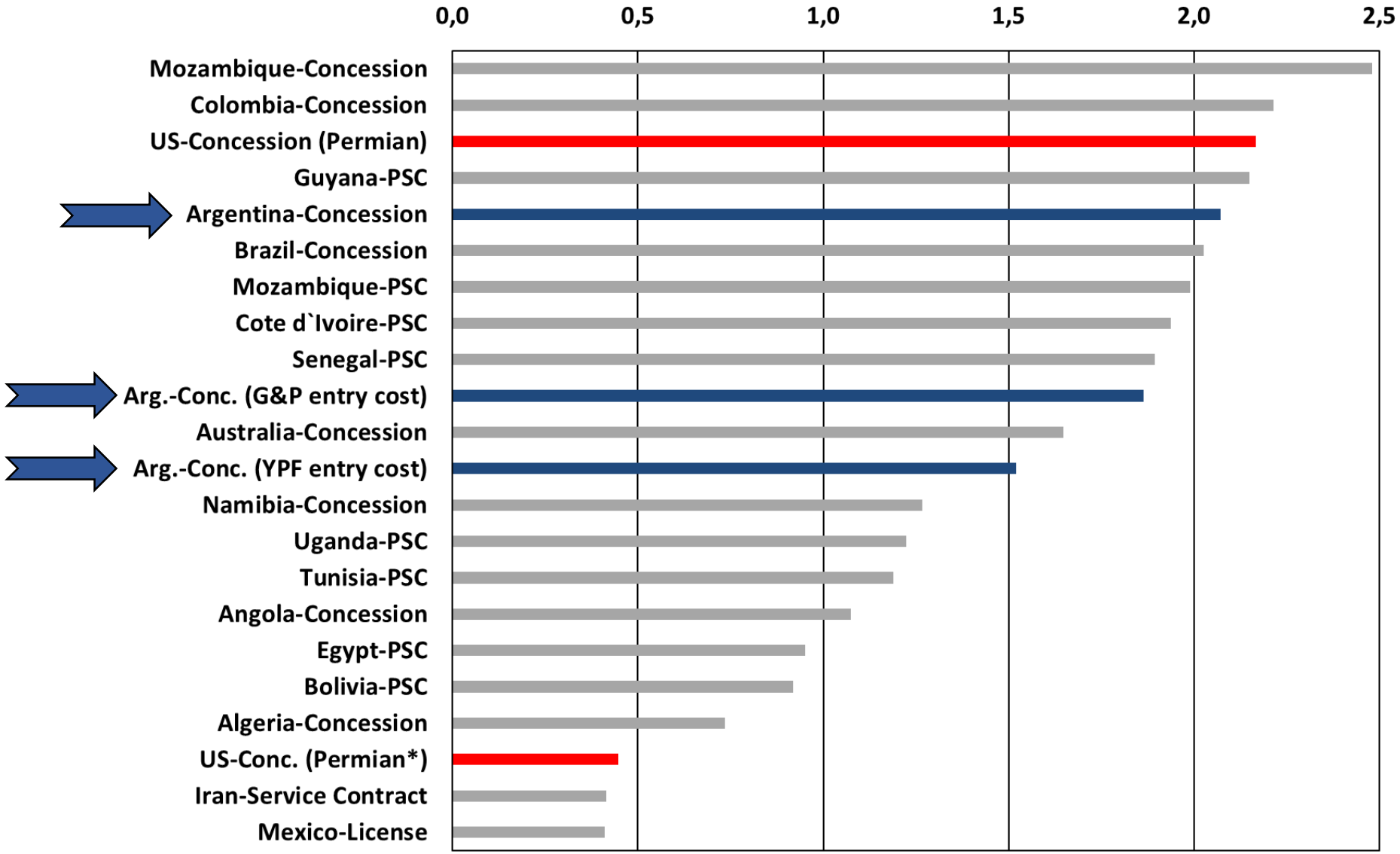


- Unconventional Exploitation Provincial Concession ("CENCH")
  - Contract life of 35 years with 12% royalties
  - Option to extend contract for 10 years more
- Competitive Royalties and Income Tax compared with other countries

* 35% Income Tax used in this chart. If income is reinvested, Income Tax would be 25% from 2021-on

Argentina's concession terms are competitive, much more when including the Vaca Muerta cost of entry (Wood Mackenzie)

Remaining NPV post-tax (US$/boe) at 15%



Notes: *Permian including original entry cost at US$15,000/acre | * Vaca Muerta entry costs based on recent YPF and GyP transactions

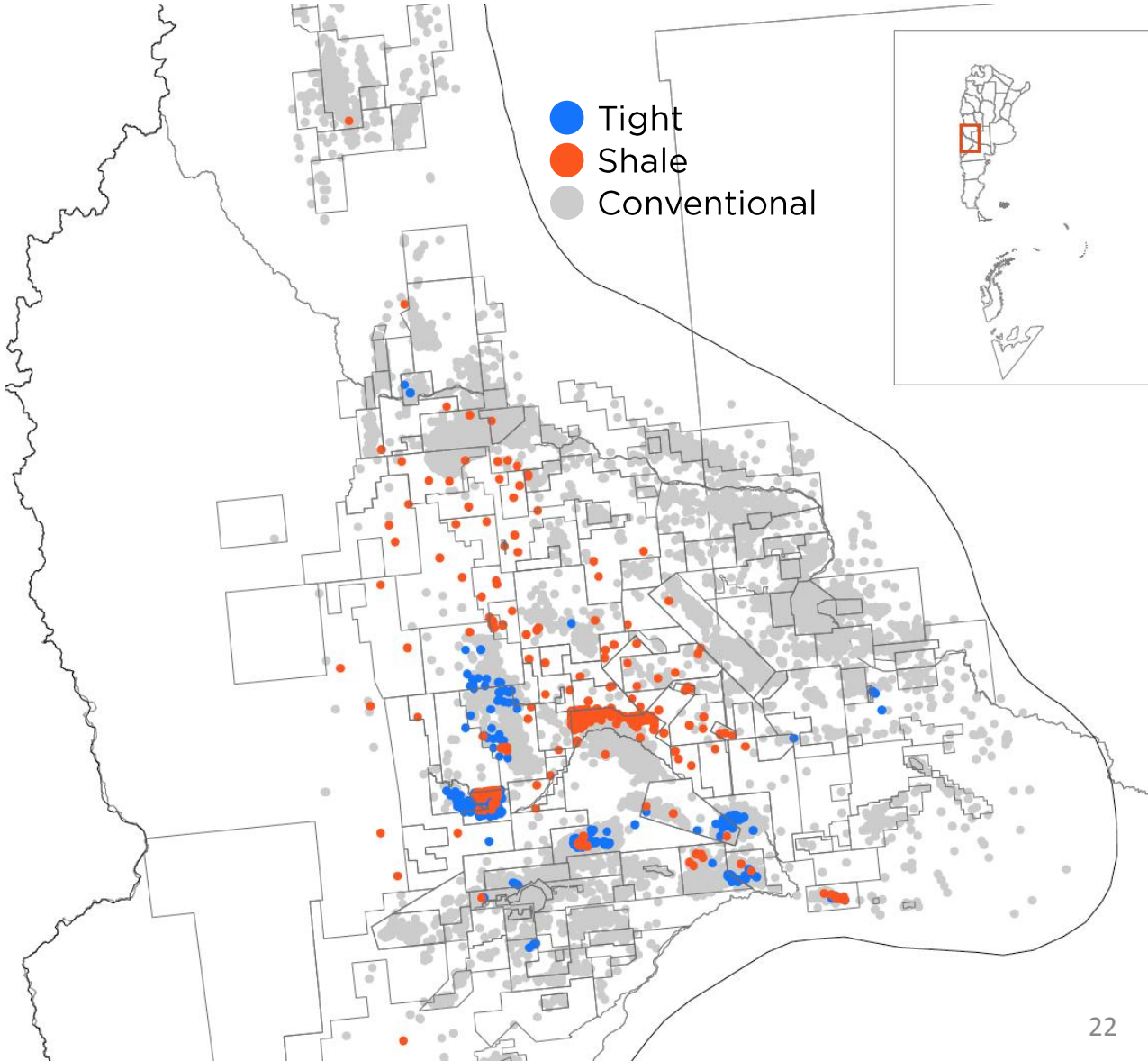
Source: Wood Mackenzie

How to step in Vaca Muerta?

New players can enter by participating in:

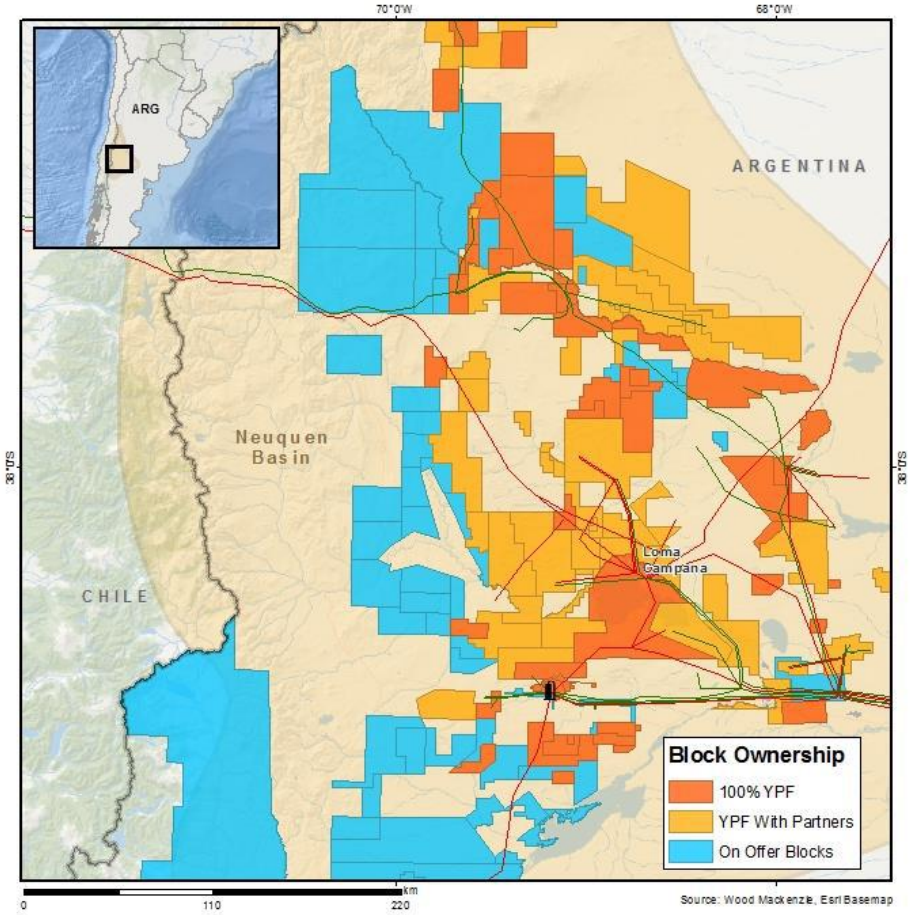
1. M&A process with acreage holders companies in Vaca Muerta.
2. Area bidding process lead by the Neuquen Province (GyP) every quarter.
3. IEASA (Ex-ENARSA) Farm-Out in Aguada del Chañar.
4. Executing Technical Evaluation Agreement on free areas with Mendoza Province.

There is plenty of room in Vaca Muerta

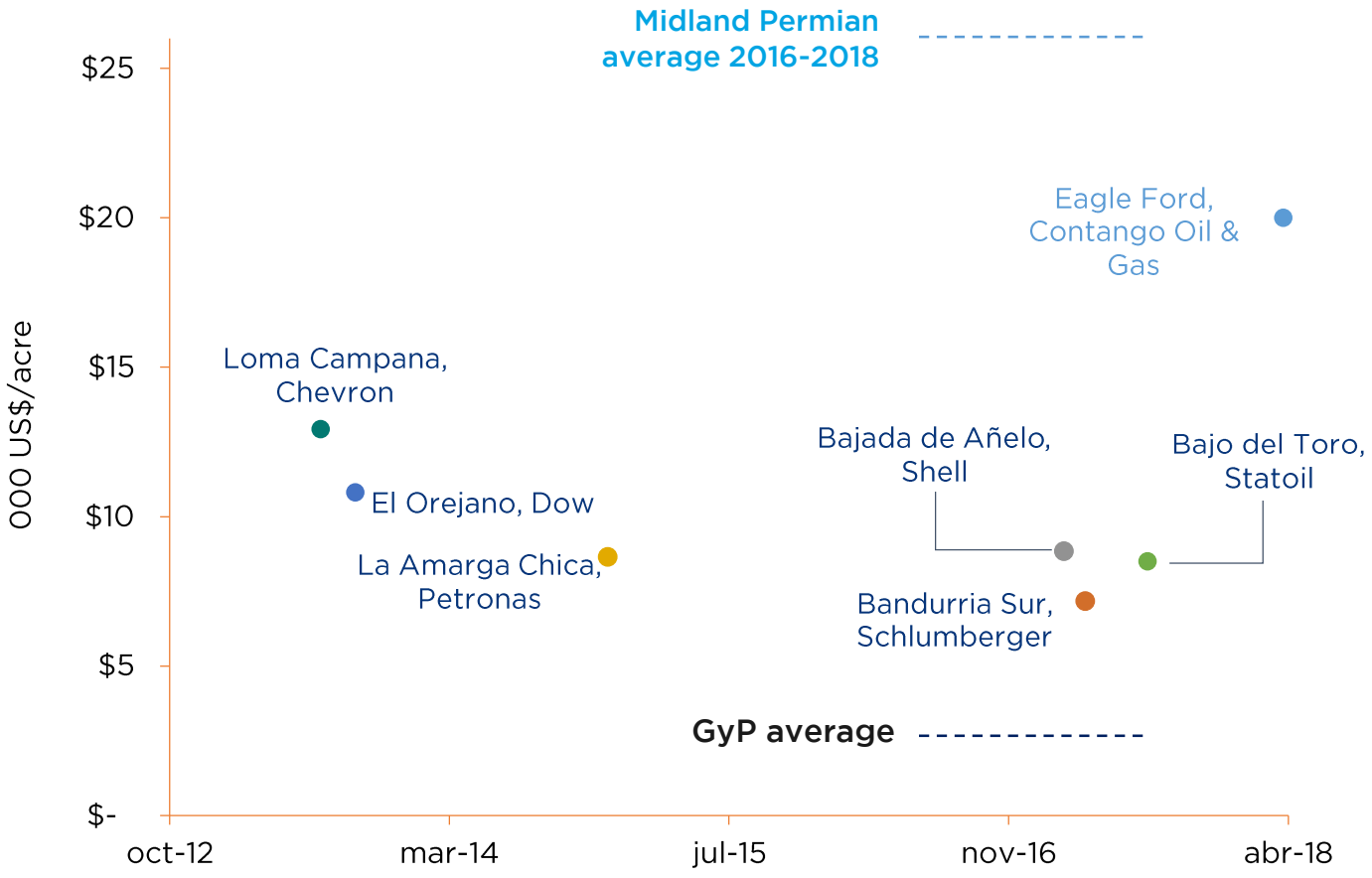


1) YPF farm-ins case: averaged US$8,000/acre, less than half L48 costs of US$20,000-30,000 per acre (Wood Mackenzie)

YPF in the Neuquen Basin

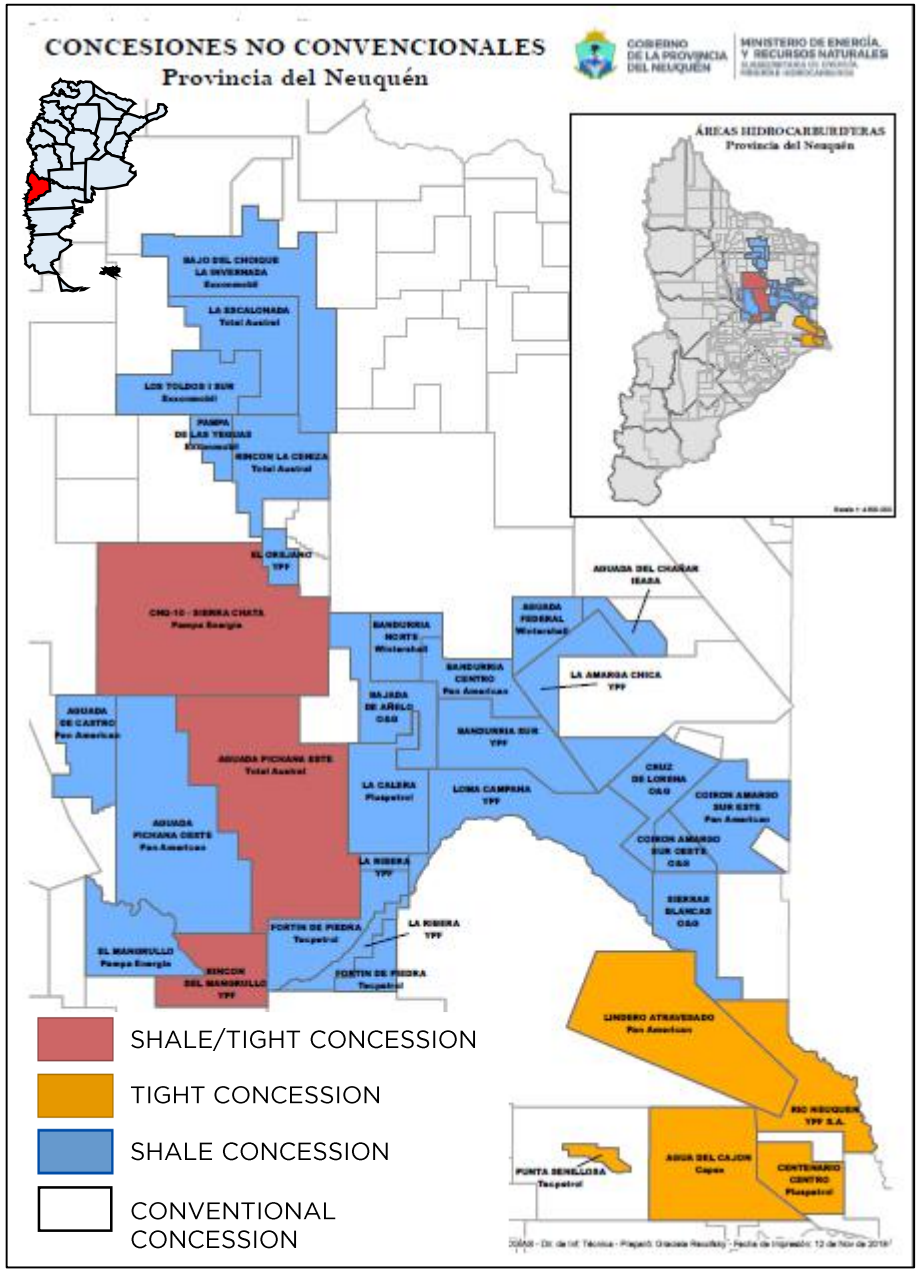


Cost per acre, YPF farm-ins



Source: Wood Mackenzie M&A tool

1) Opportunity to partner current operators to obtain Unconventional Exploitation Concession

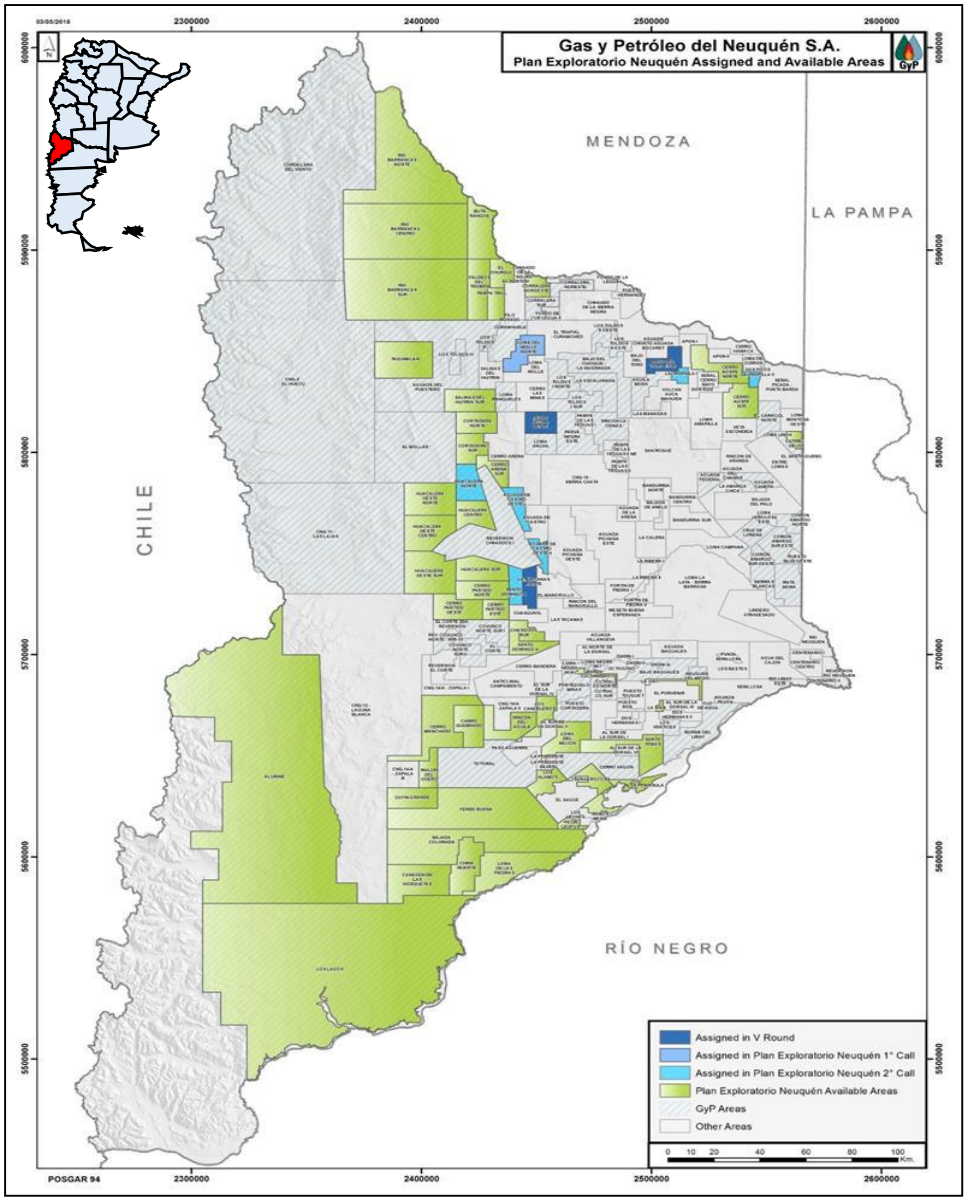


By the end of October, Neuquen Province has granted 32 Unconventional Exploitation Concessions (CENCH) to produce from shale and tight reservoirs.

Only less than 20% of the blocks (10% of Neuquen blocks surface) have been assigned with a CENCH.

Mendoza Province is going to grant it first Unconventional Exploitation Concession, with place for more opportunities.

2) M&A Transactions with GyP are very competitive based on the latest deals in Vaca Muerta



- Gas y Petroleo de Neuquen ("GyP") license round **entry costs** (signature bonus and work commitments) have averaged **US$3,000/acre**.
- **43 areas available for association** under the "Plan Exploratorio Neuquen".
- Blocks located under the **3 Vaca Muerta windows**: Dry Gas, Wet Gas and Oil.
- Almost all blocks have **available seismic** (2D or 3D) and/or **well information**.
- GyP offers bidding round Quarterly. **Next bid date on November 29th, 2018**. Bids will be received between 8:30hs and 14:30hs Argentina Time. Opening will be same day at 15:00hs.
- Terms and conditions published at GyP web site (http://www.gypnqn.com.ar).

Source: Wood Mackenzie M&A tool, GyP

Neuquen: abundant energy and landscape to enjoy

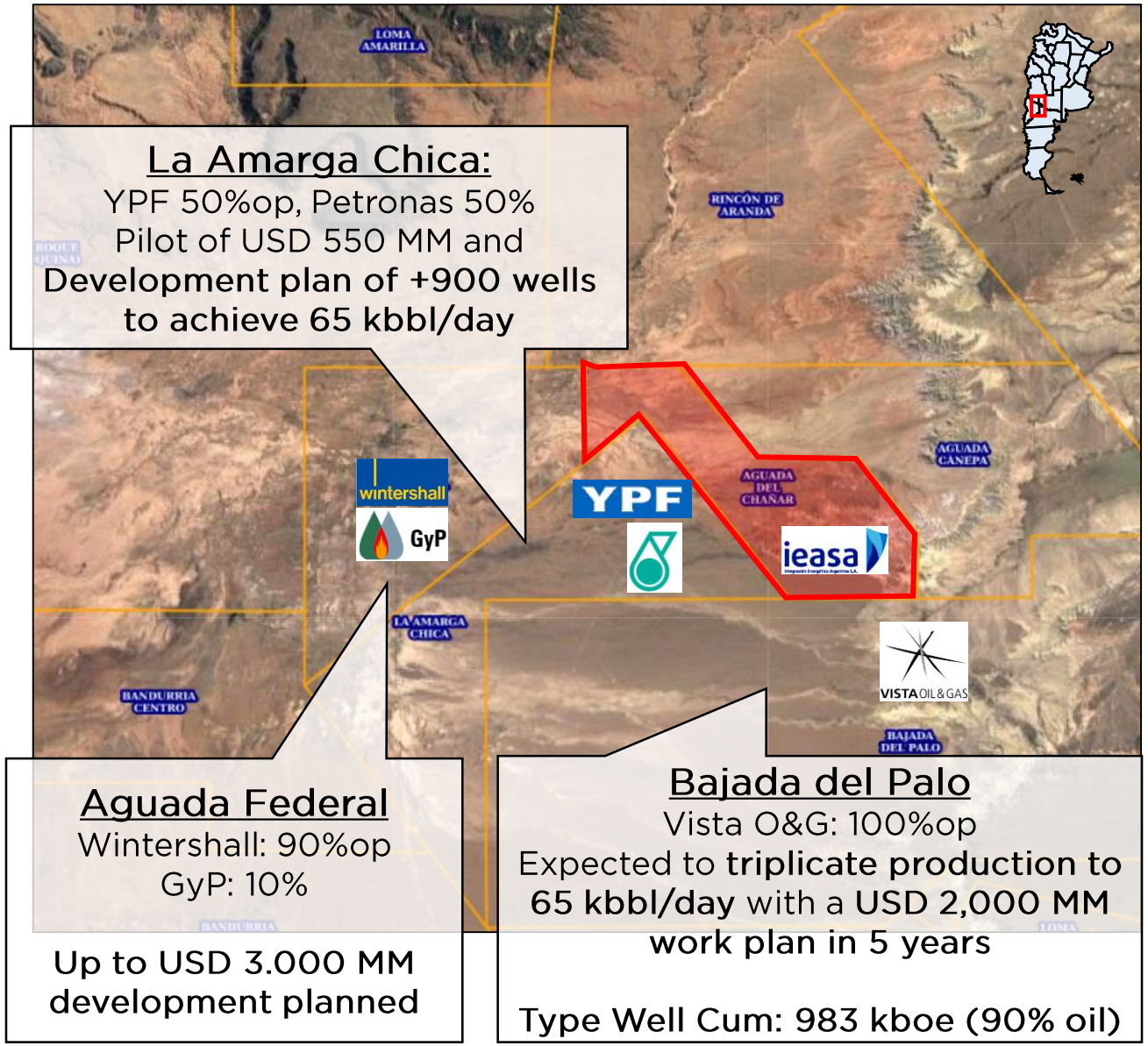
Secretaría de Gobierno de Energía
Secretaría de Planeamiento Energético


Neuquen City


Villa La Angostura


Lago Mari Menuco

3) IEASA Farm-Out: Aguada del Chañar ready to drill and restart production thru interventions on a prolific Vaca Muerta region

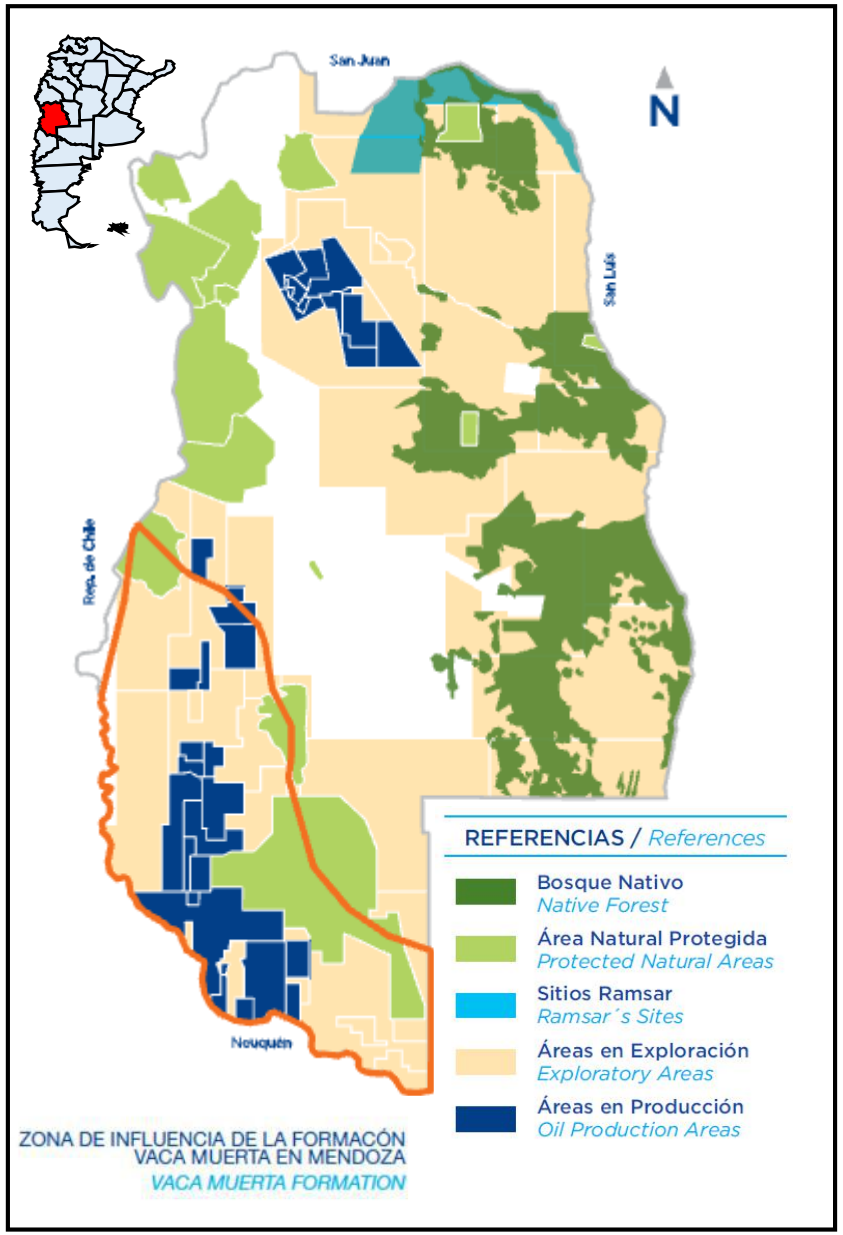


Aguada del Chañar: Farm Out Opportunity

- **100% IEASA** owned Concession.
- Total area of **14,085 acres**
- Cumulated conventional production: **80 kbbl and 3.5 BCF.**
- **Unconventional Exploitation Concession (CENCH)** granted on October 5th, 2018 for **35 years with 12% fixed royalties**
- **USD 10 MM commitment** within **next 2 years** (2D and deepening an existing well).
- **Tight Gas opportunities** in Punta Rosada and Lajas Fm.
- **GYP.Nq.BCh-3 PROVED VACA MUERTA** with cumulated 35 kbbl **production (without fracturing)**
- The area counts with a **Gas Treatment Plant** with connection to YPF Loma Campana facilities to dispatch production in an area surrounded by massive projects.
- **Existing Oil battery with 3 stocking tanks** of 160 m3 each.
- Bidding process to be launched on early December.

Source: IEASA, Vista O&G, Public information

4) Mendoza Province is also offering competitive TEA conditions to explore Vaca Muerta at the north of Neuquen Basin



- **53 blocks** with Vaca Muerta **unconventional potential** at the south of the province
- High quantity, quality and availability of **exploratory data** in this area.
- **Information survey** as cores analysis, TOC, vitrinite refractance, etc. also **available**.
- Mendoza Province is encouraging companies to start with **Technical Evaluation Agreements ("TEA")** that could lead into a Exploratory Permit and after to a Exploitation Concession.
- **Companies can propose** their Area of Interest, Work Program and Time in which evaluation will be carried on.

Source: Wood Mackenzie M&A tool, Mendoza Province

Mendoza: focused in all natural resources development

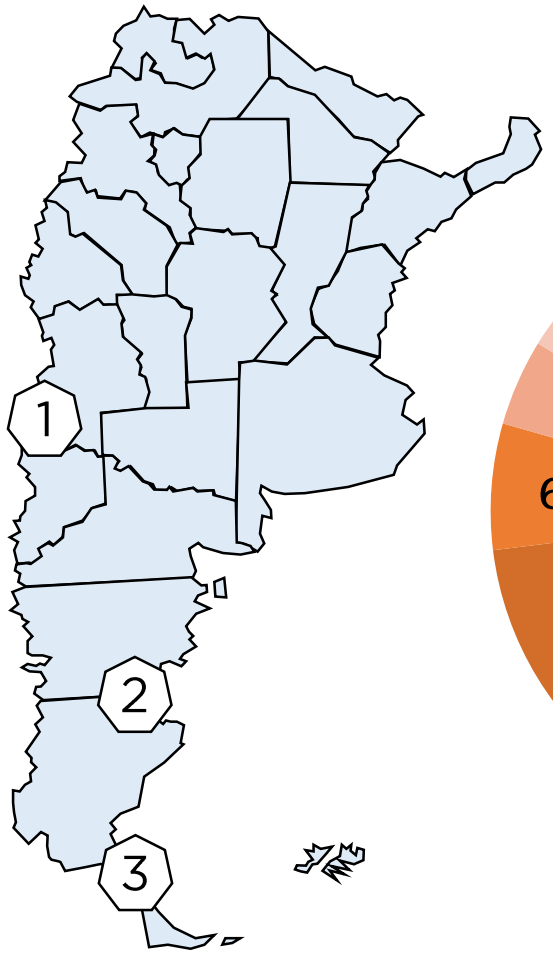

Las Leñas Sky Center

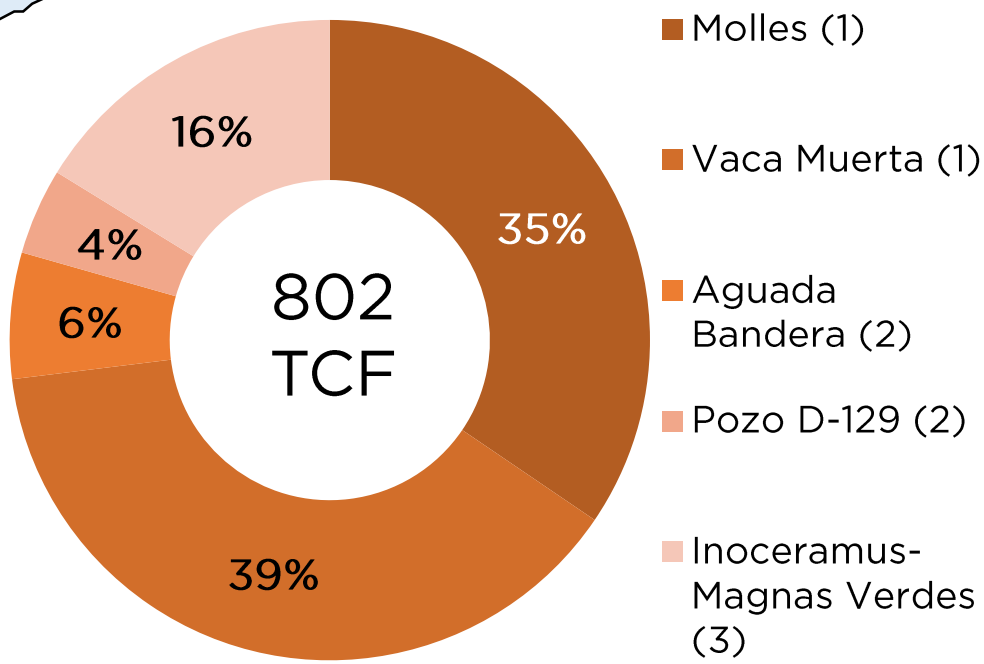
Wine Route

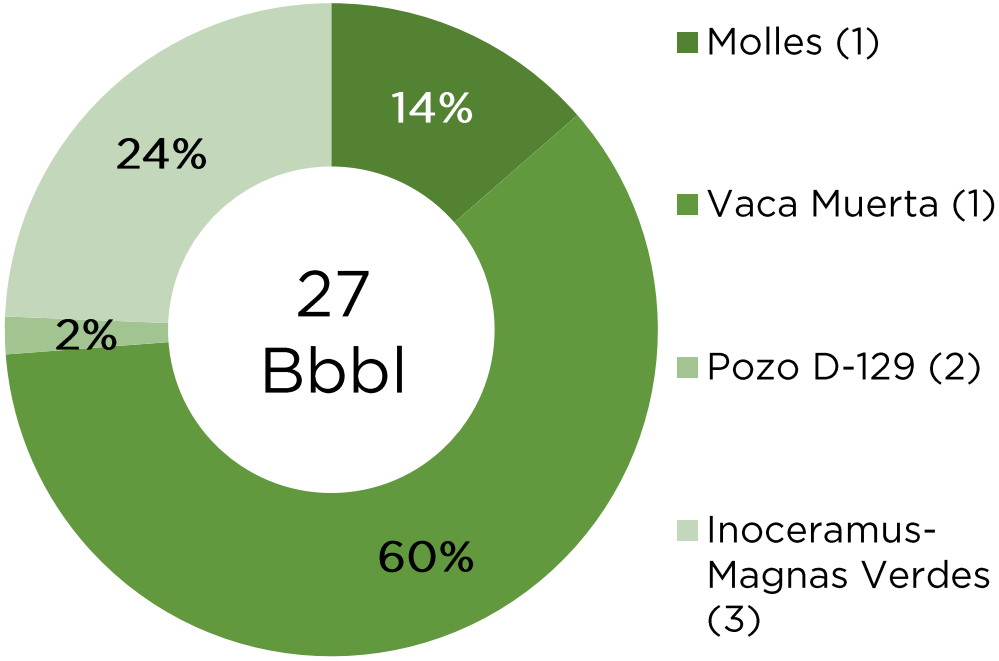
Mendoza City


Llancanelo Oil Field

Other Unconventional Formations



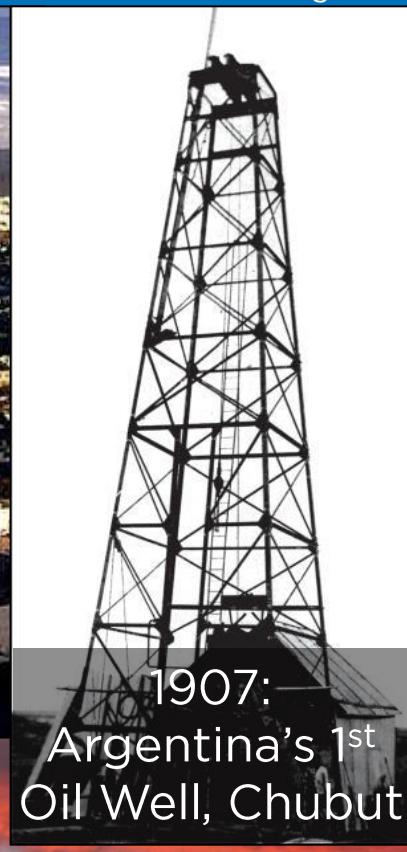




1. Neuquina Basin
2. San Jorge Basin
3. Austral Basin

Source: EIA (2013)

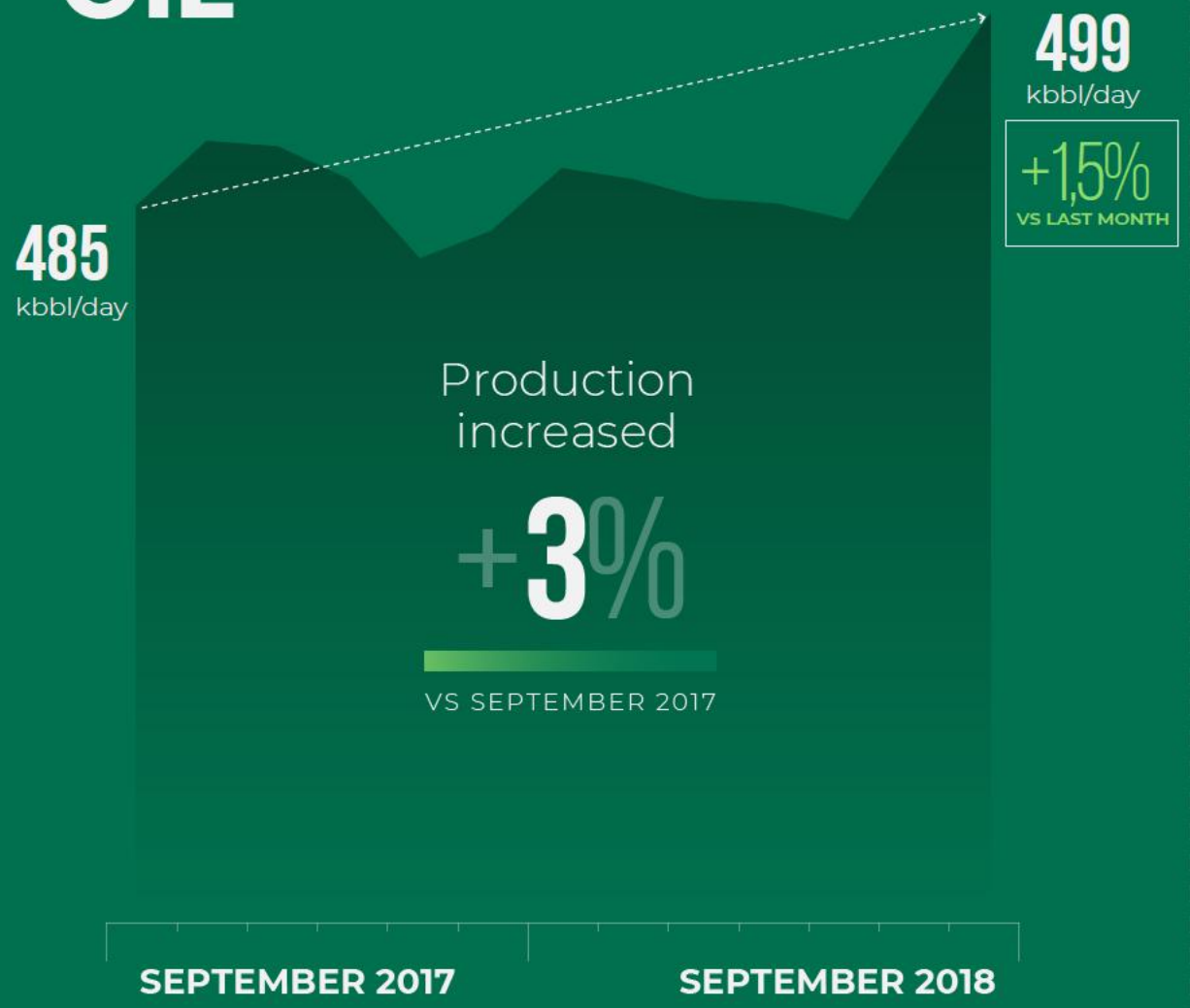
San Jorge Basin (Chubut and Santa Cruz North) and Austral Basin (Tierra del Fuego and Santa Cruz South)



Argentina is one of the four countries in the world which is commercially developing unconventional resources

SEPTEMBER 2018

OIL



SHALE OIL

+68%

+7%
VS LAST MONTH

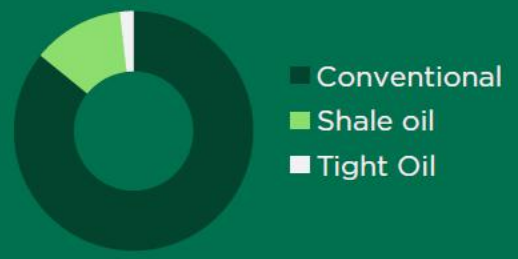
SEPTEMBER 2018 VS SEPTEMBER 2017

UNCONVENTIONAL OIL SHALE + TIGHT

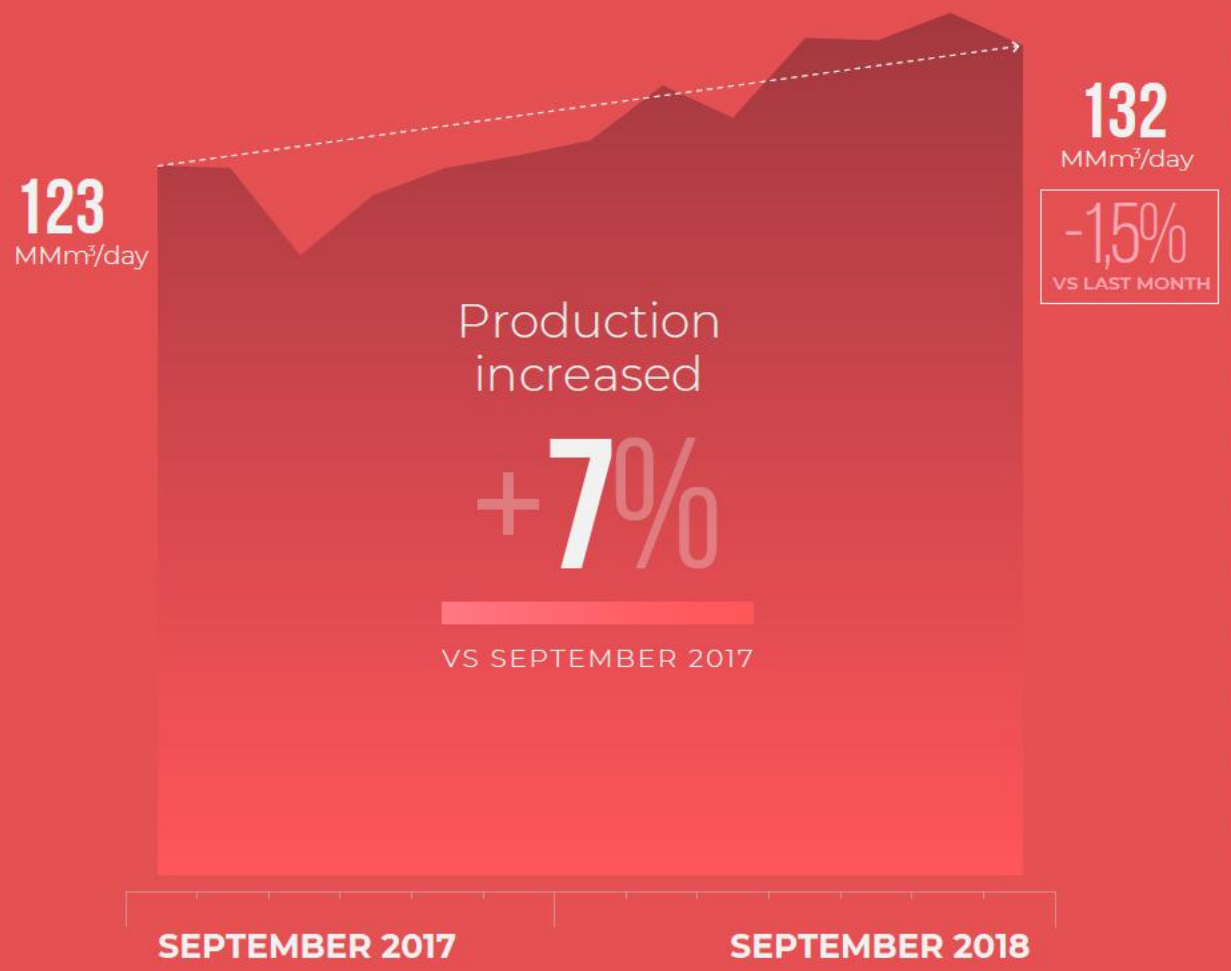
REPRESENTS

15%

OF TOTAL
PRODUCTION



NATURAL GAS



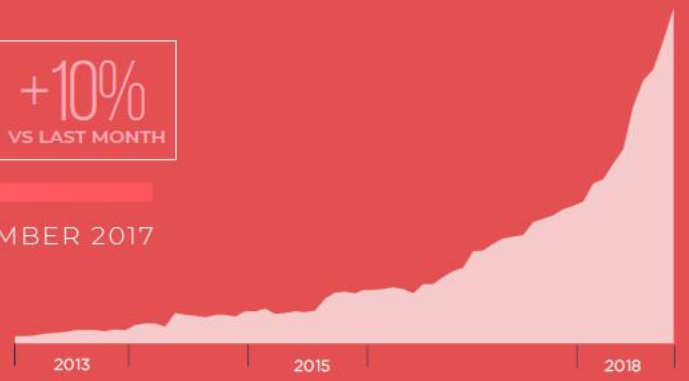
SHALE GAS

22
MMm³/day

+256%

+10%
VS LAST MONTH

SEPTEMBER 2018 VS SEPTEMBER 2017



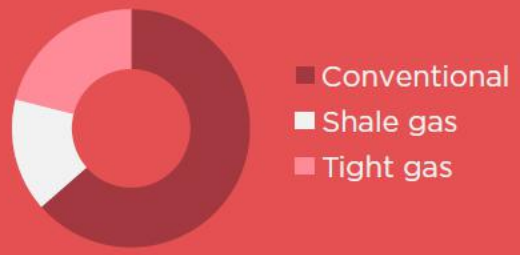
UNCONVENTIONAL GAS

SHALE + TIGHT

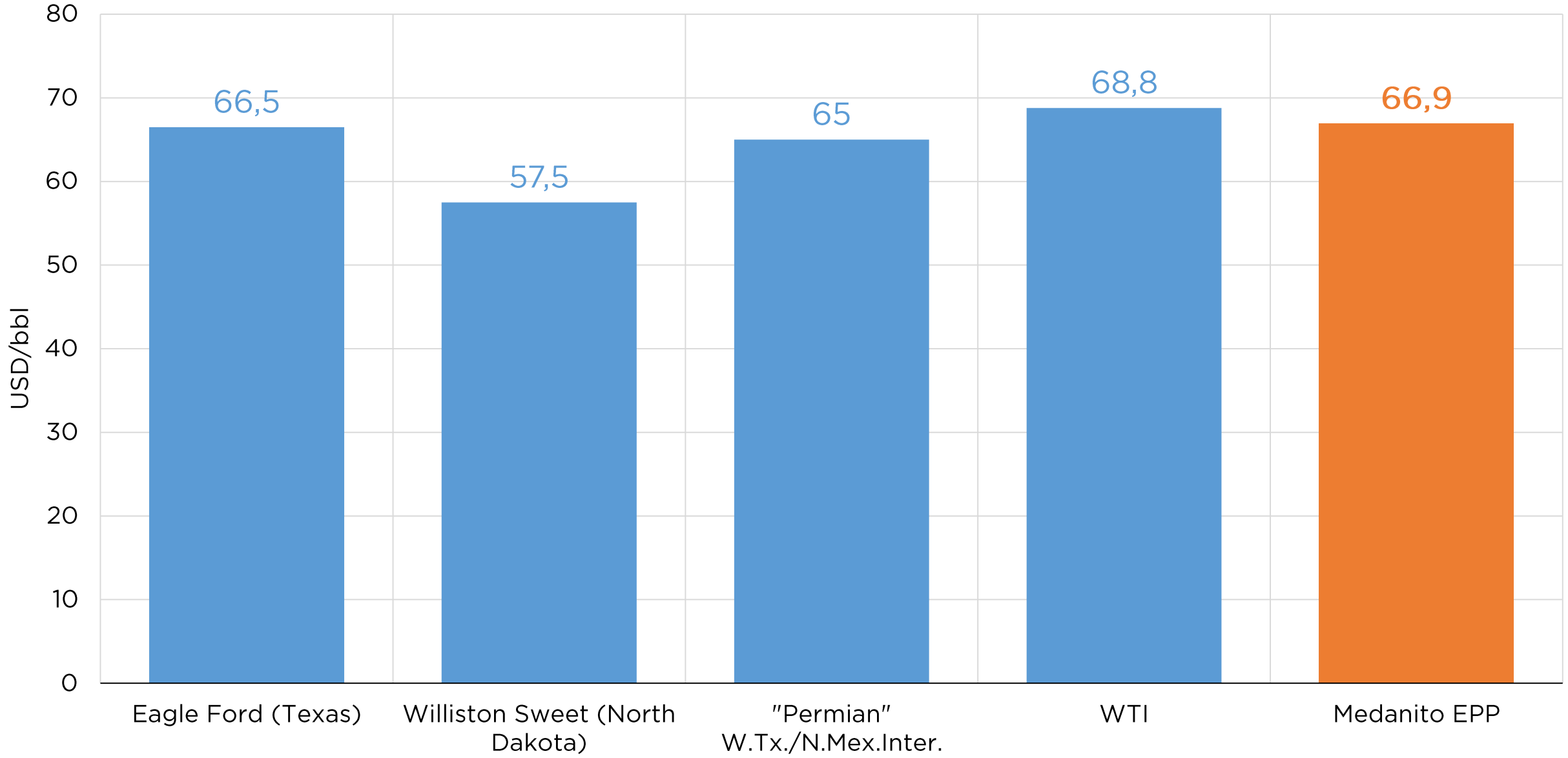
REPRESENTS

37%

OF TOTAL
PRODUCTION

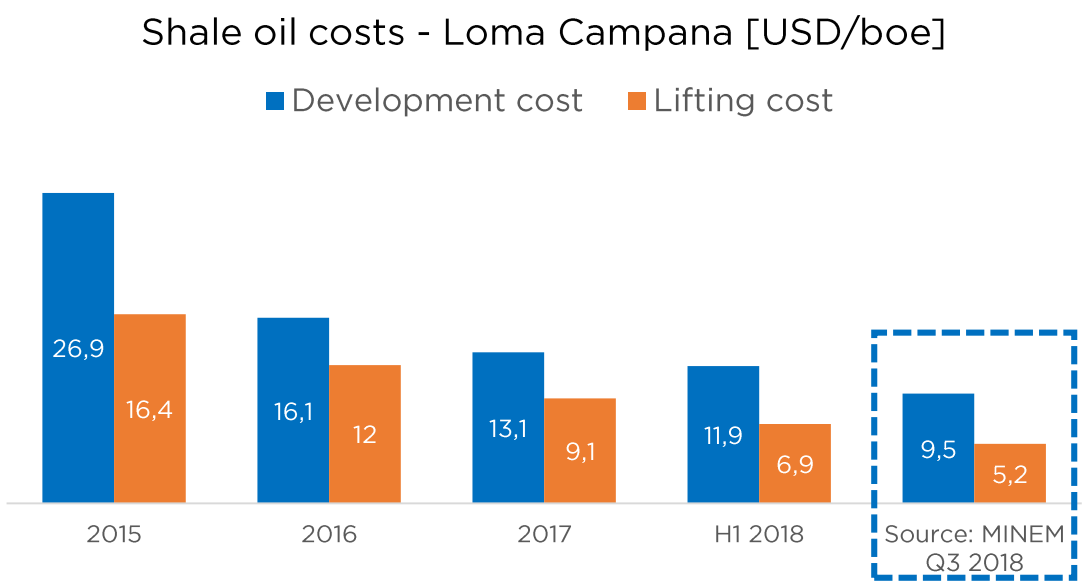


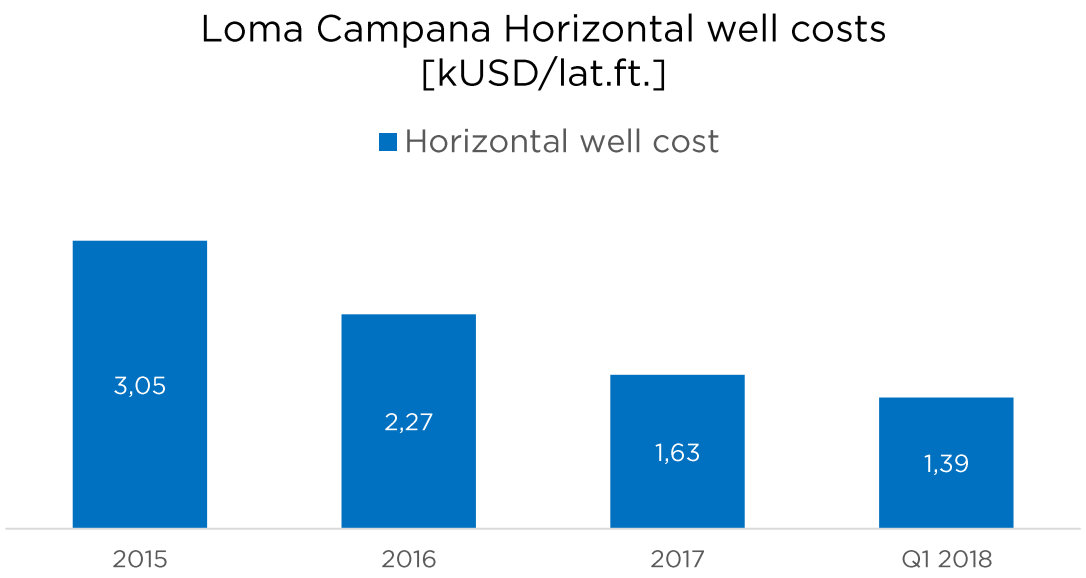
US´ Oil Prices vs Medanito's export parity price (09/13/2018)

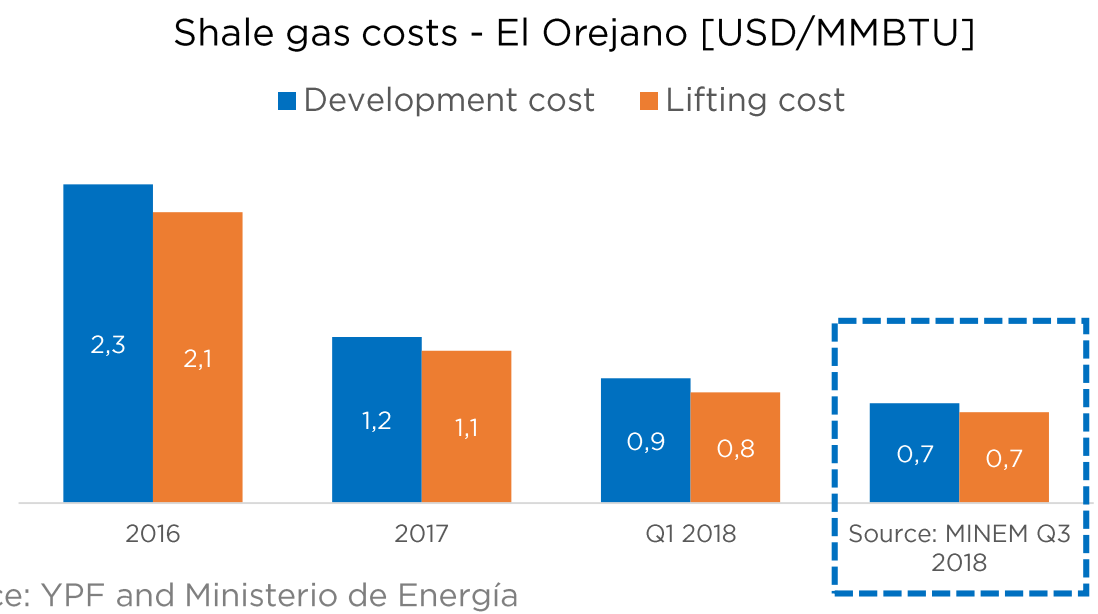


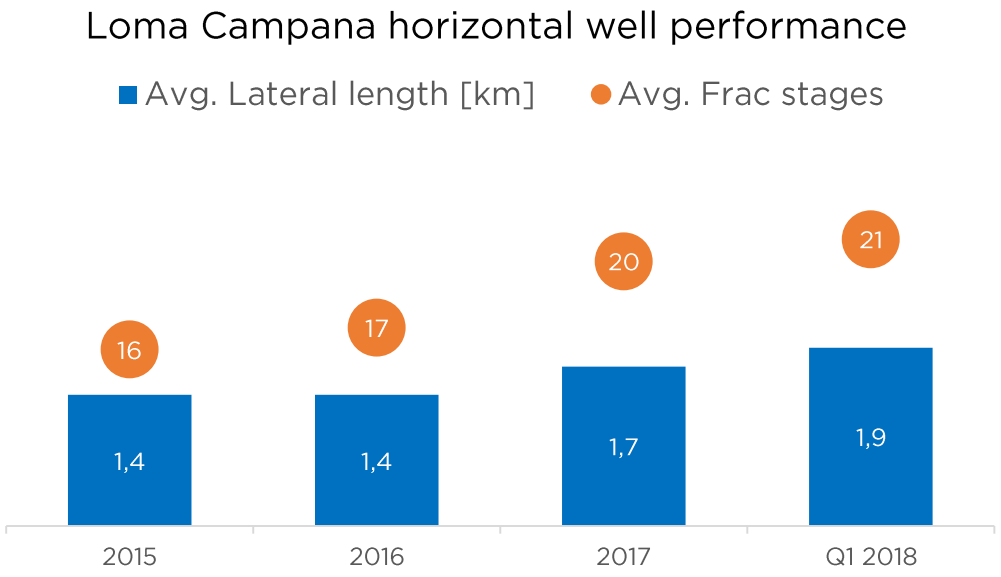
Source: oilprice.com and Secretariat of Energy (Argentina)

Cost decline as performance increases, YPF case



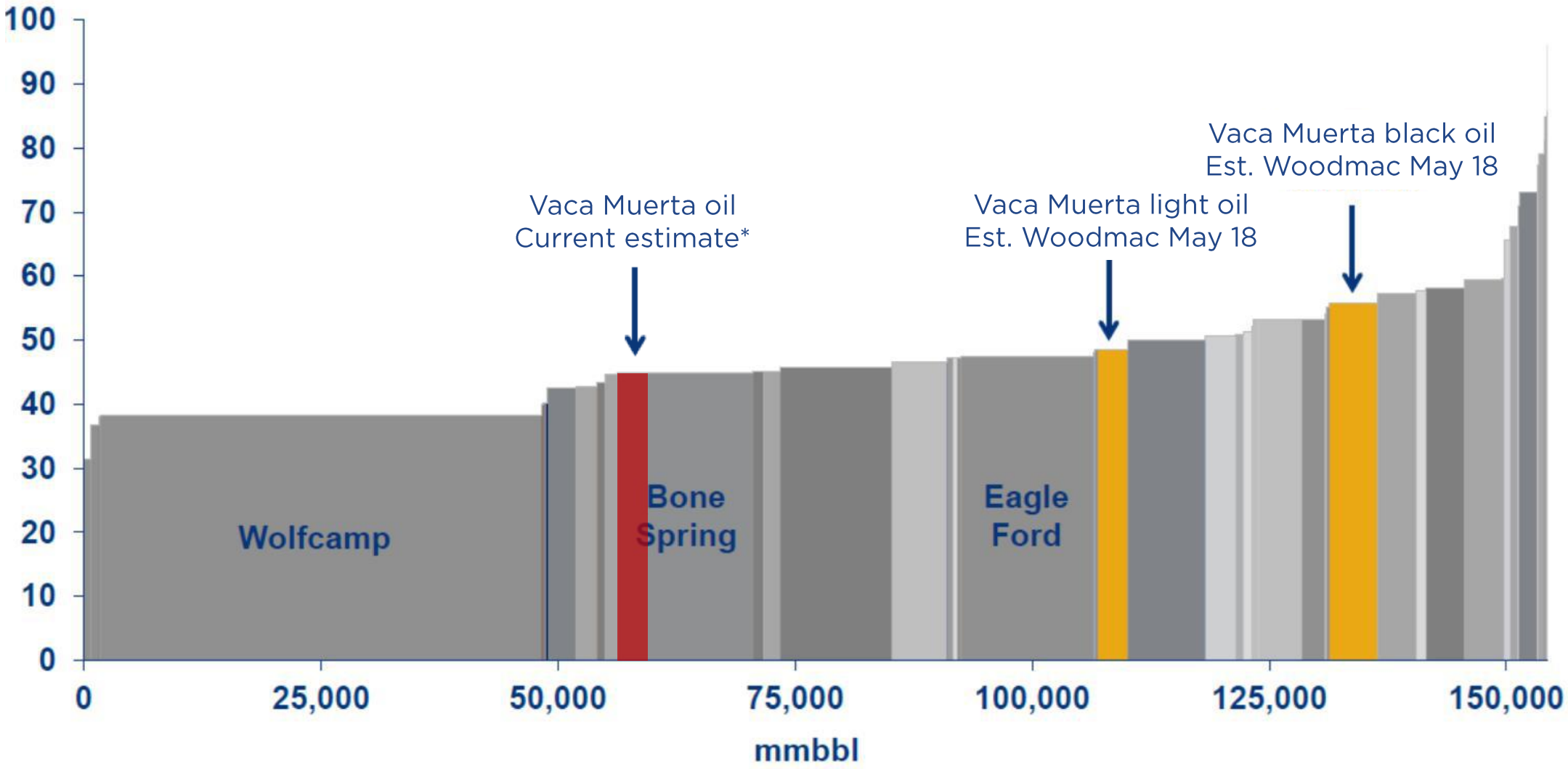






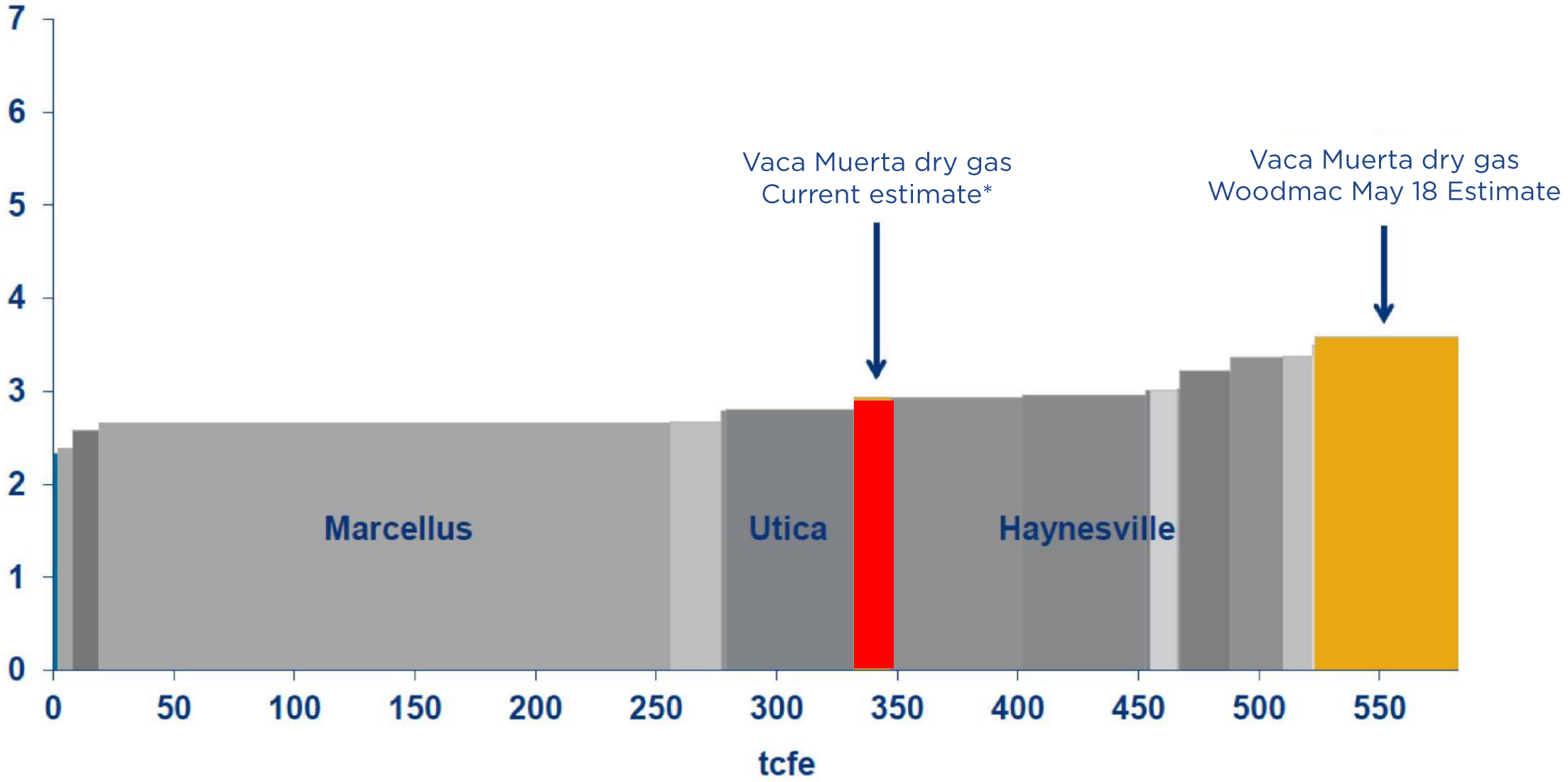
Source: YPF and Ministerio de Energía

Competitive Liquid break-even prices in Vaca Muerta compared with USA plays



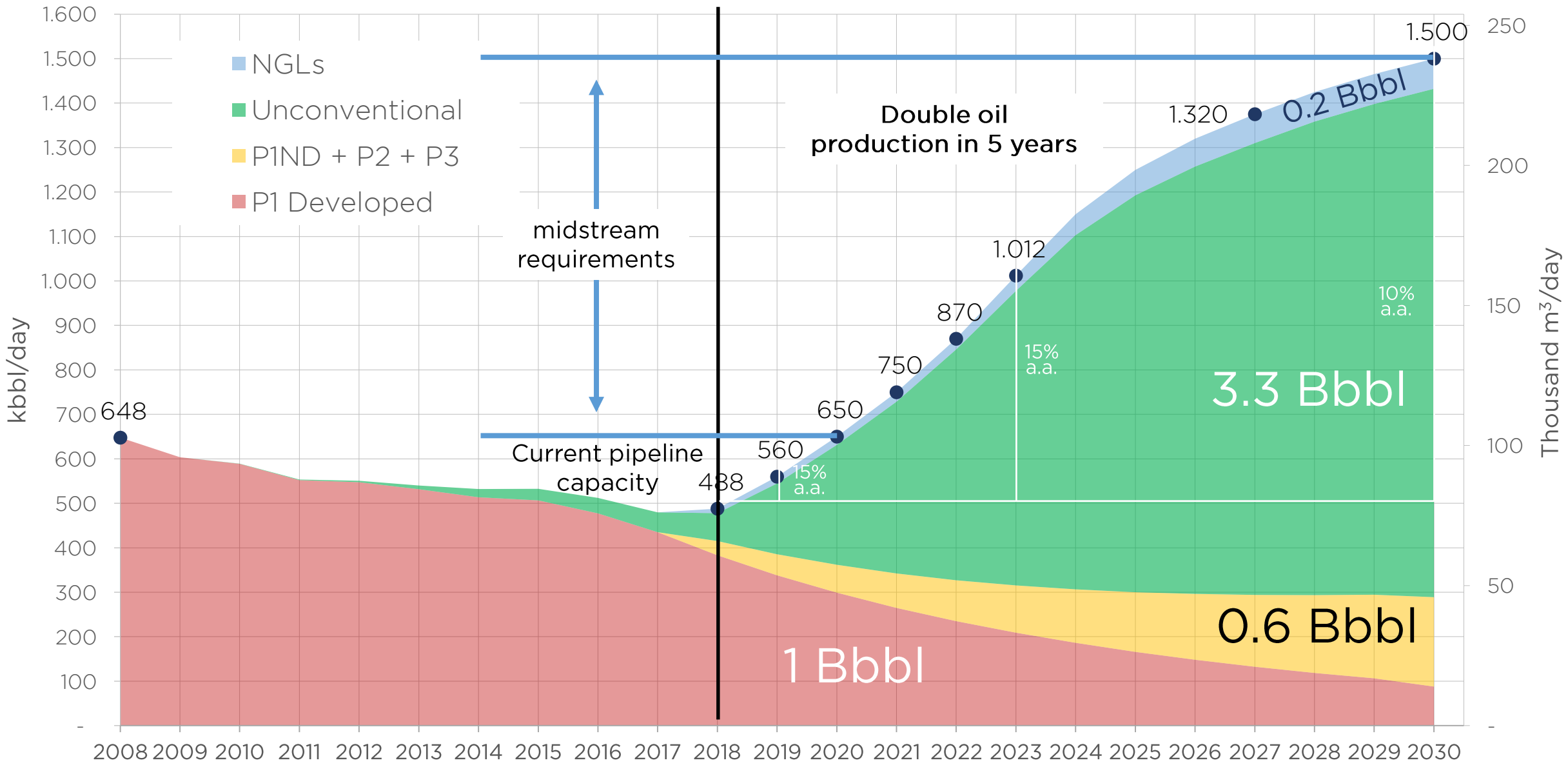
*Sources: Wood Mackenzie | *Current estimate own elaboration*

Also Gas break-even prices in Vaca Muerta are competitive compared USA plays

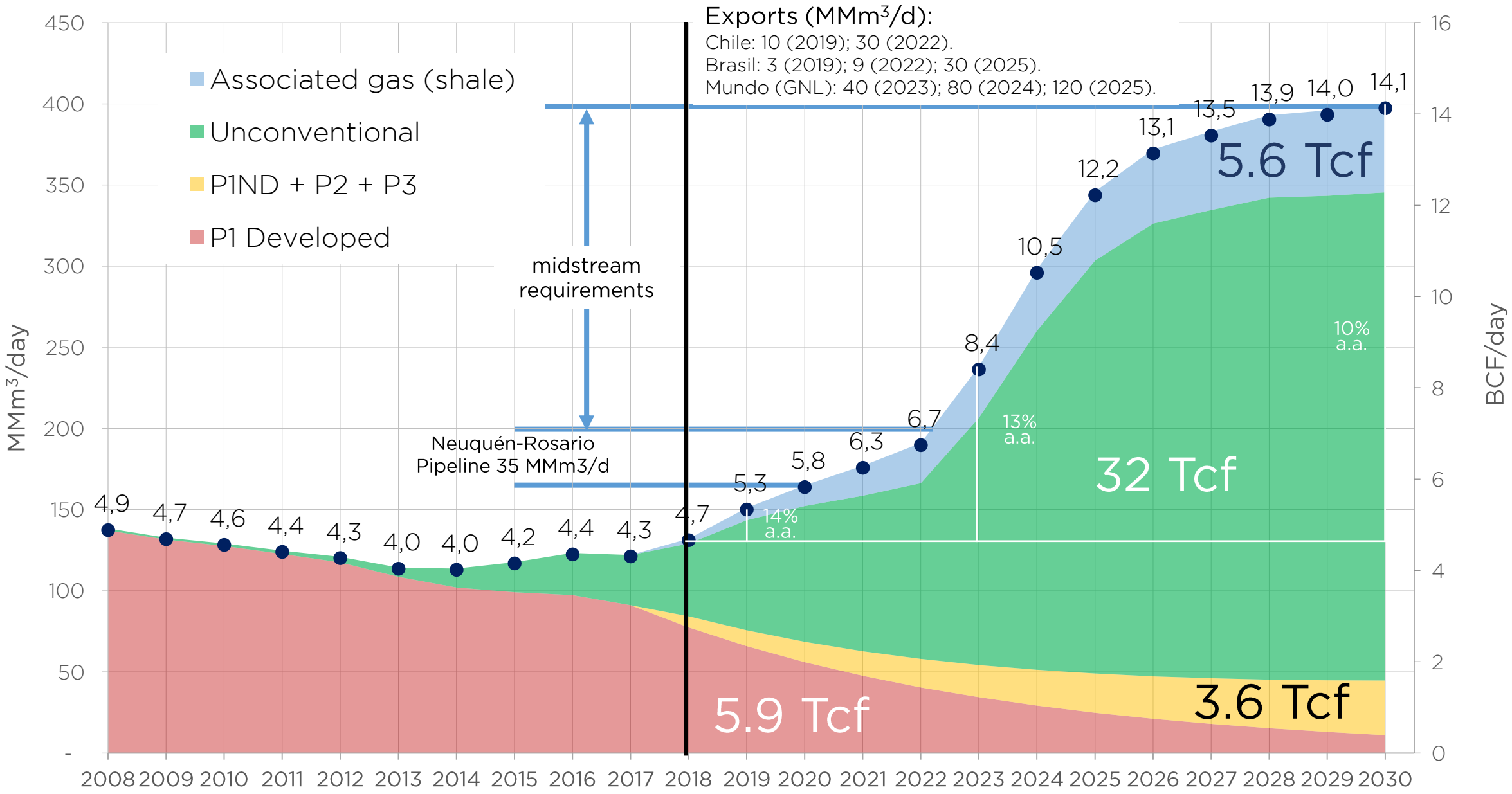


*Sources: Wood Mackenzie | *Current estimate own elaboration*

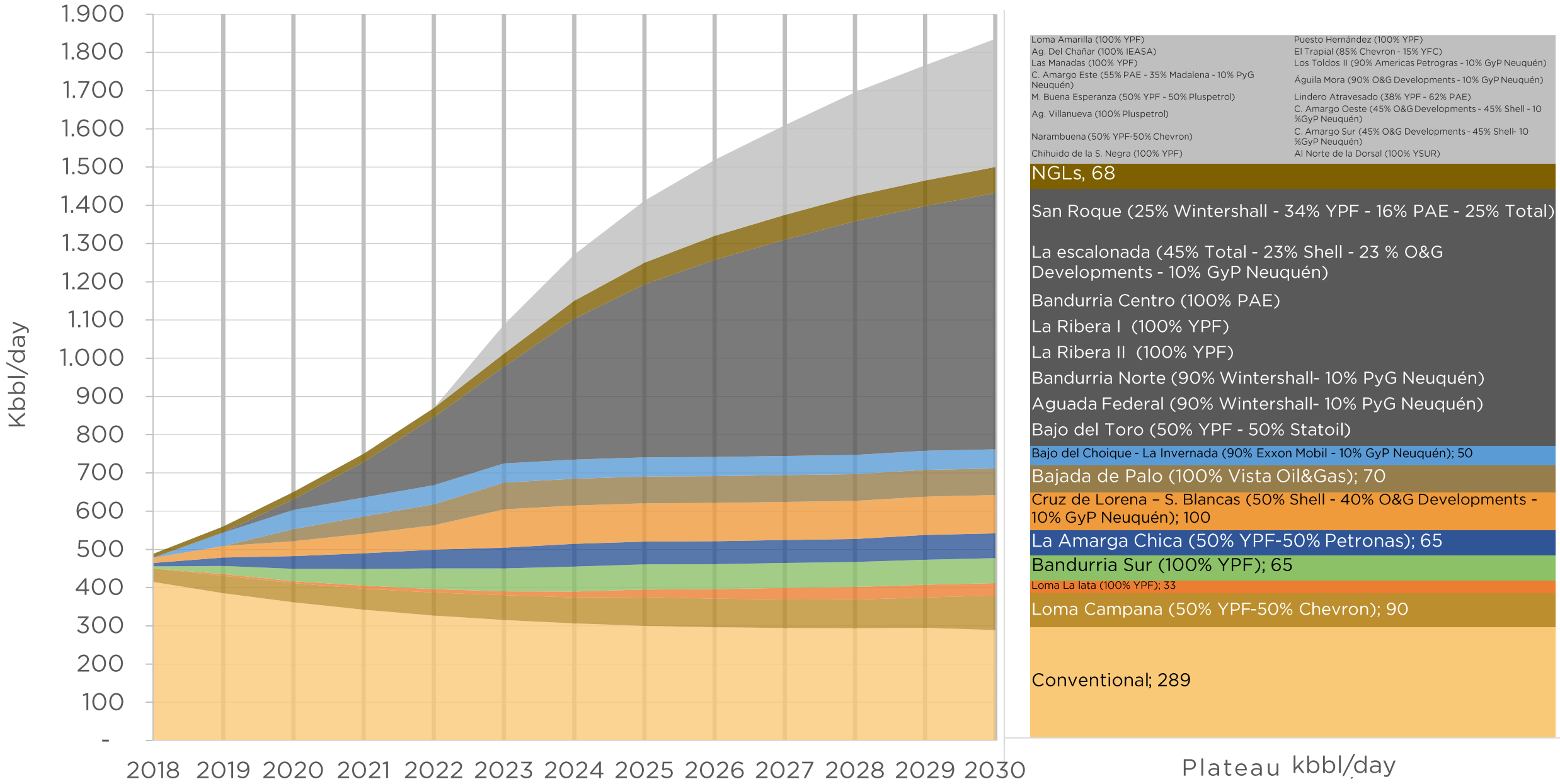
Oil Production Forecast



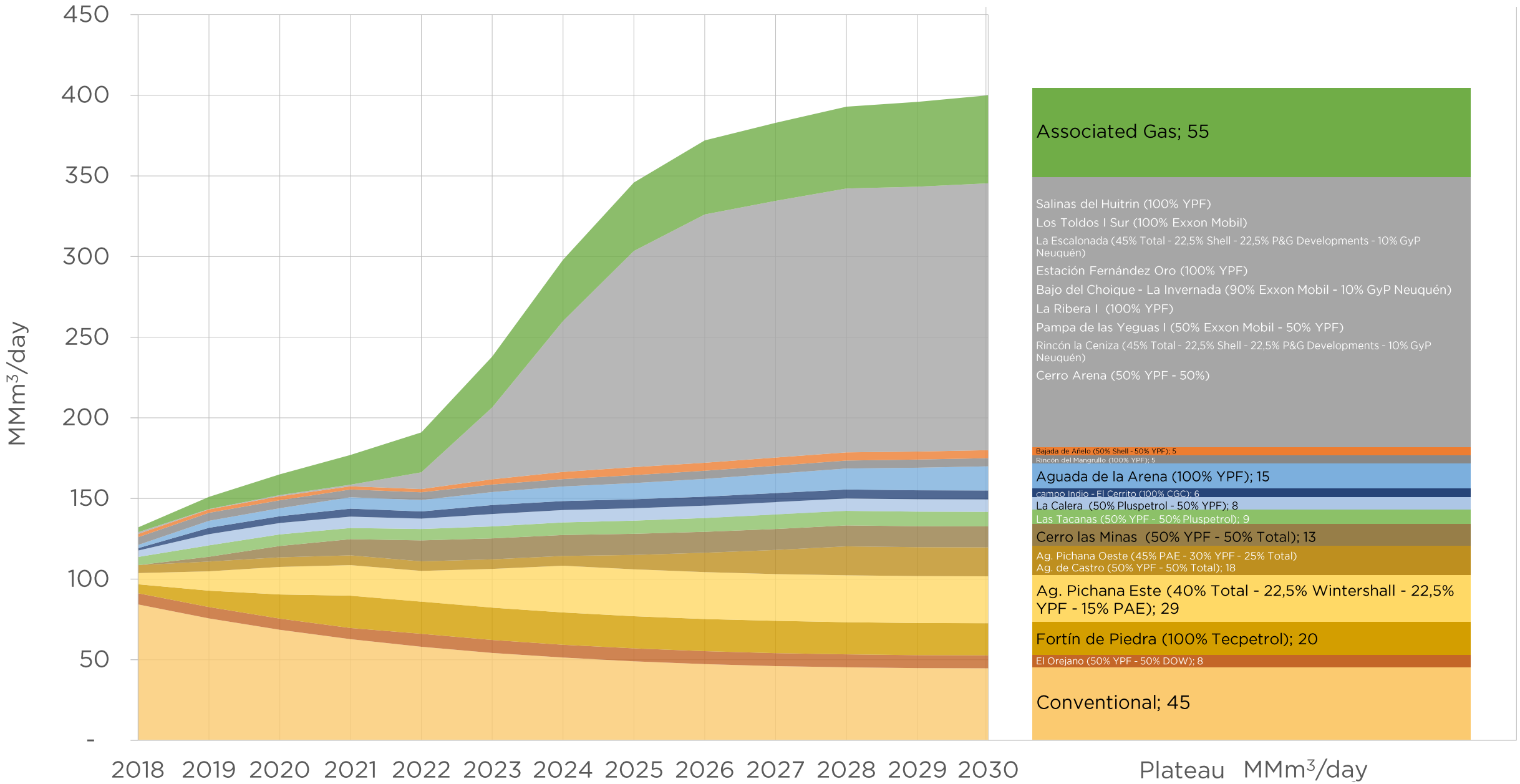
Natural Gas Production Forecast



Key ongoing projects – Oil

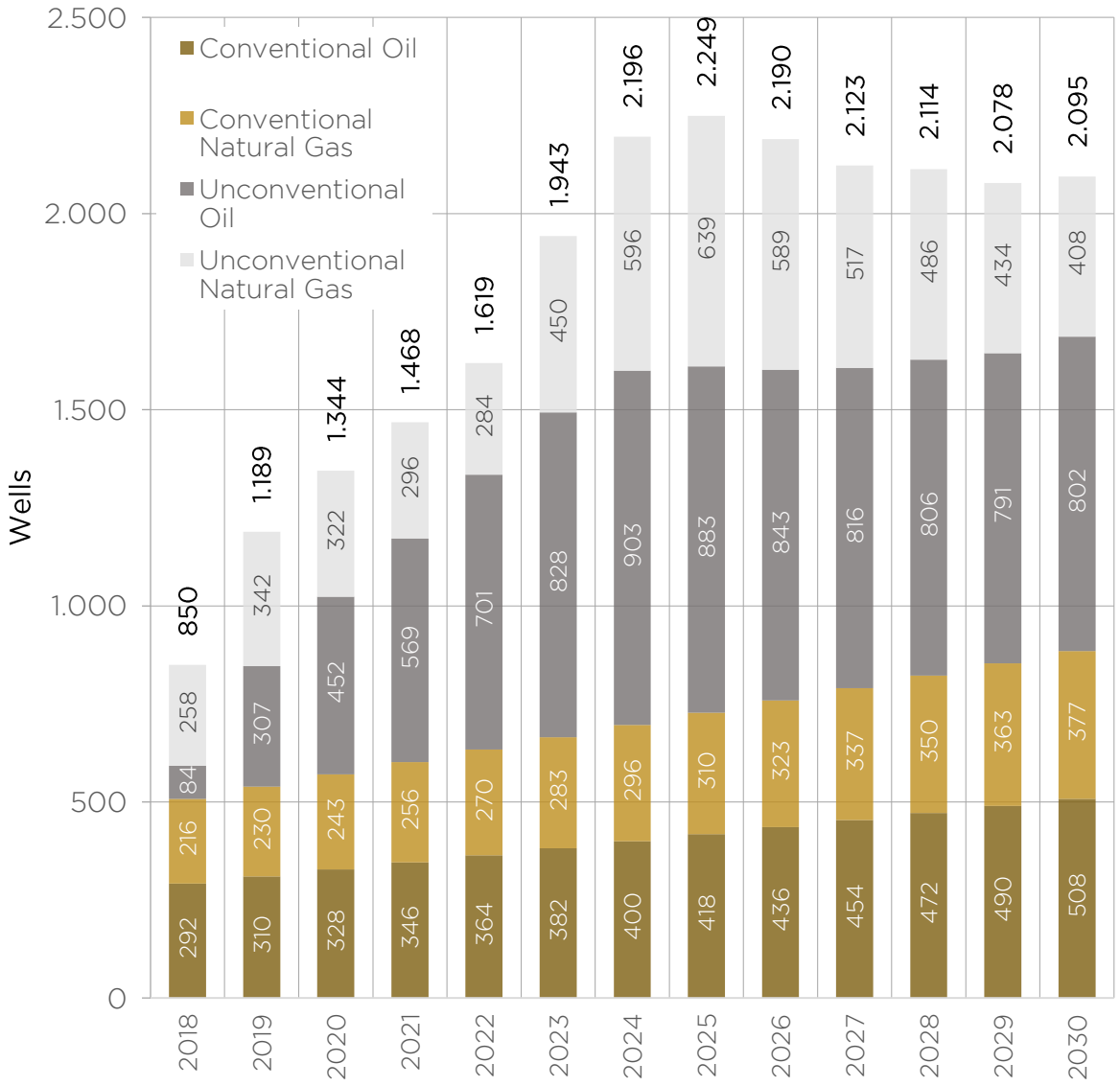


Key ongoing projects – Natural gas

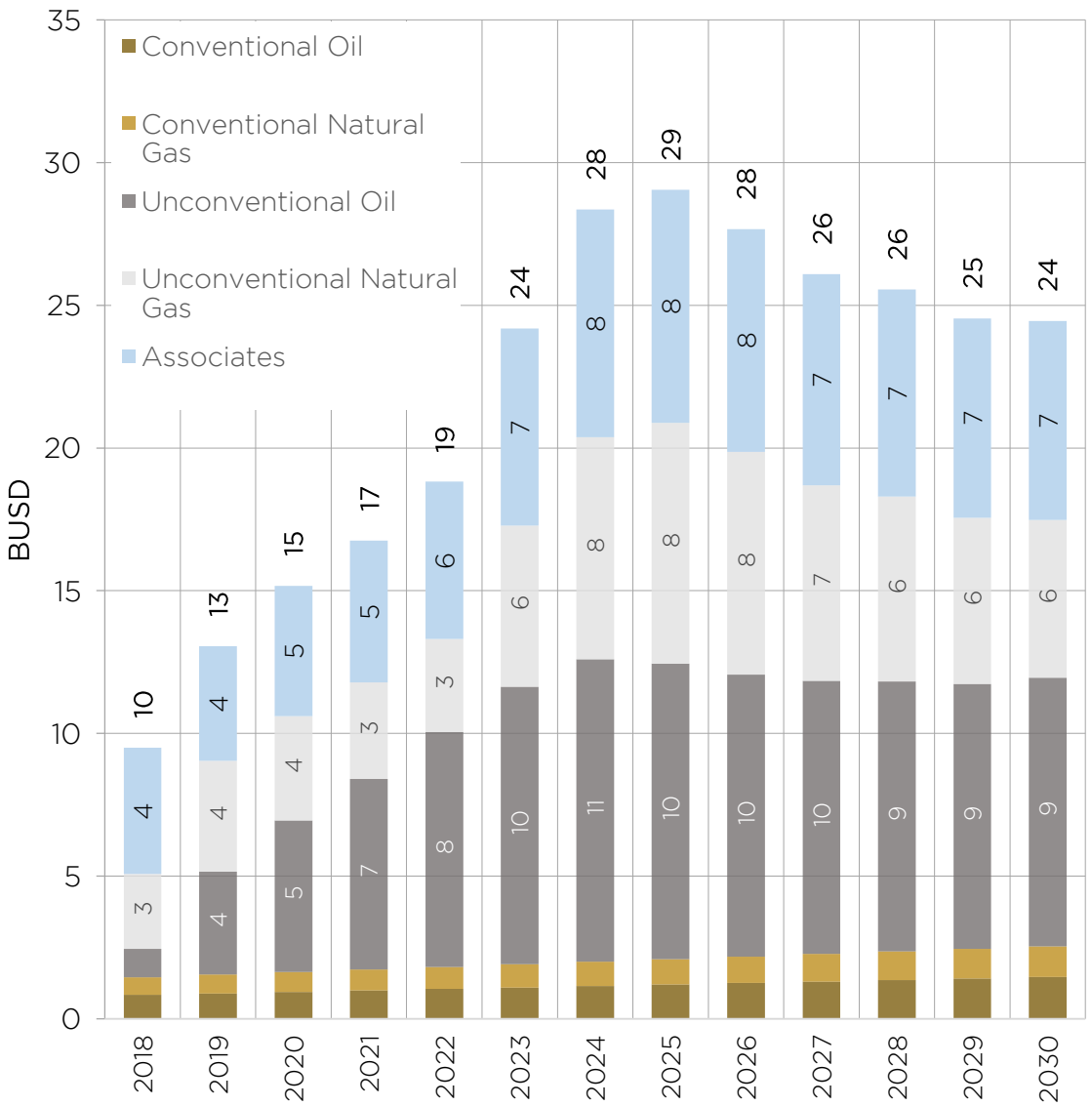


Drilling as driver of a Strong Investment Plan

Completed wells

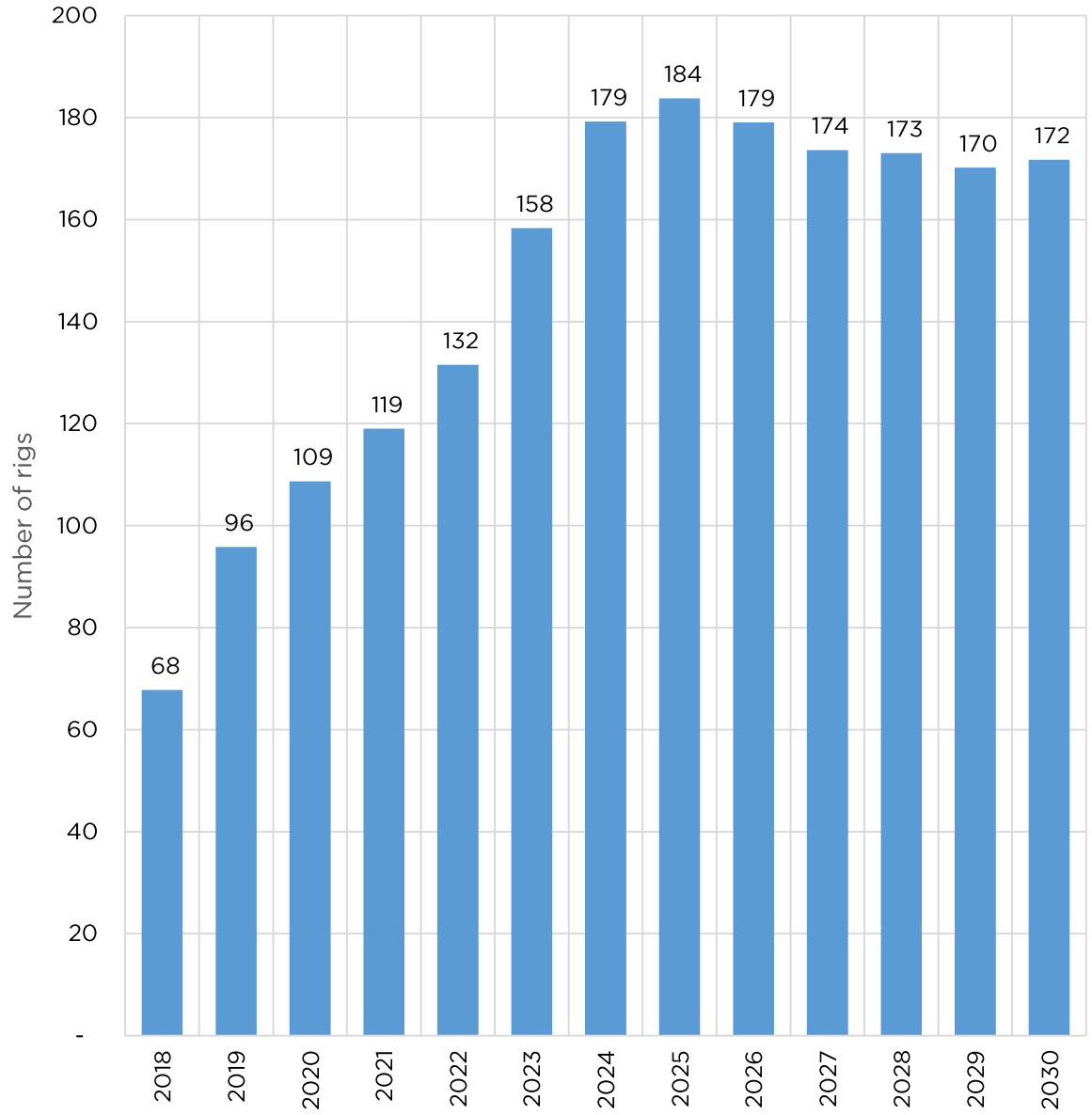


Investments - BUSD

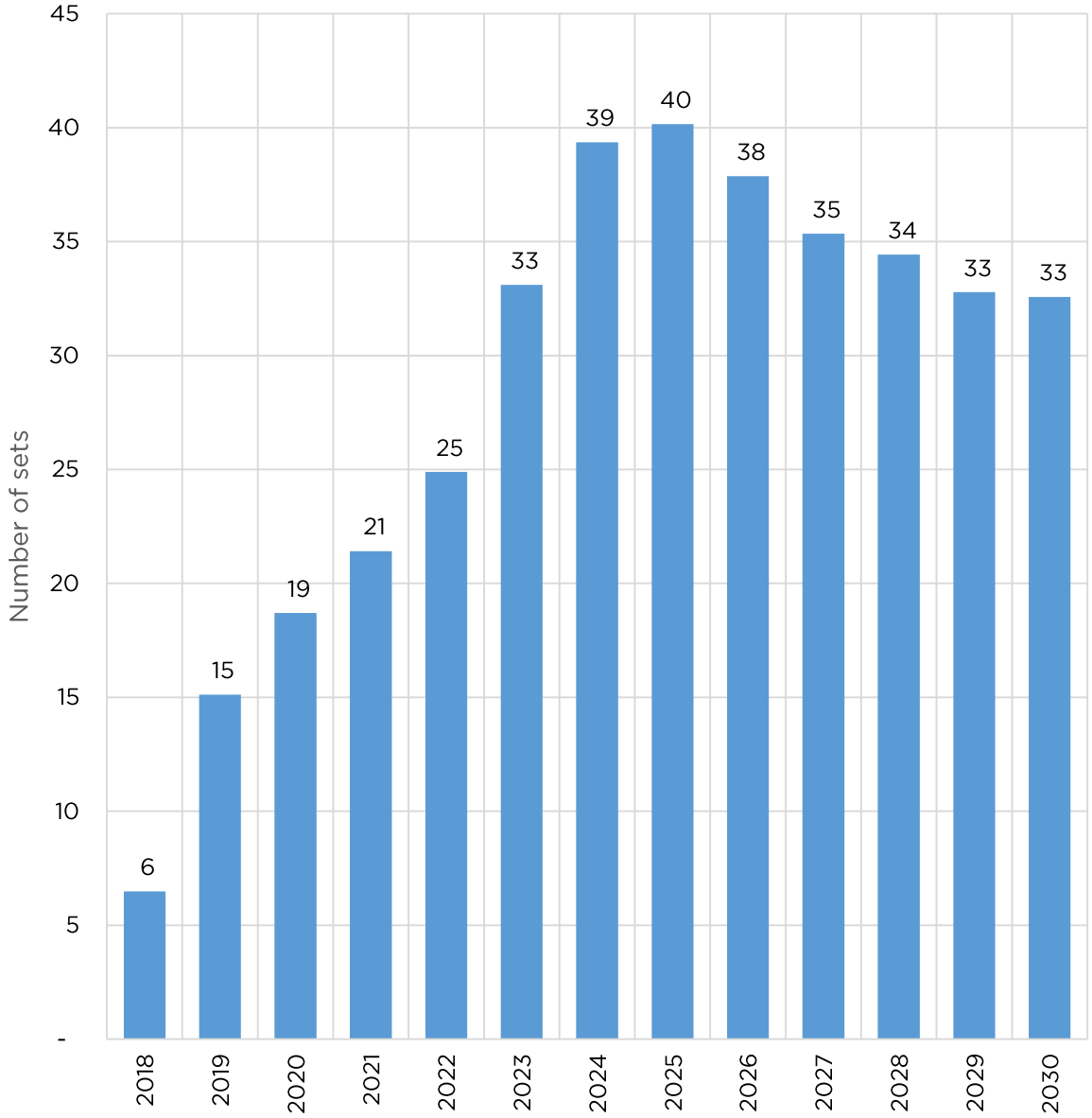


Equipment requirements to develop resources

Drilling rigs



Completion sets



Patagonia LNG: Energy from Argentina to the world

UPSTREAM | **MIDSTREAM** | **DOWNSTREAM**

Gas pipeline

4.2 BCF per day

25 year project to develop:

50 TCF

approximately 3,900 gas wells

(production: 5.5 BCF/day = 2 TCF year)

38 TCF (77%) export

(production:. 4.2 BCF/day)

12 TCF (23%) local market

(production: 1.3 BCF/day)

1.550 km^2 => 12% acreage Vaca Muerta (gas window)

LNG Patagonia 6 trains

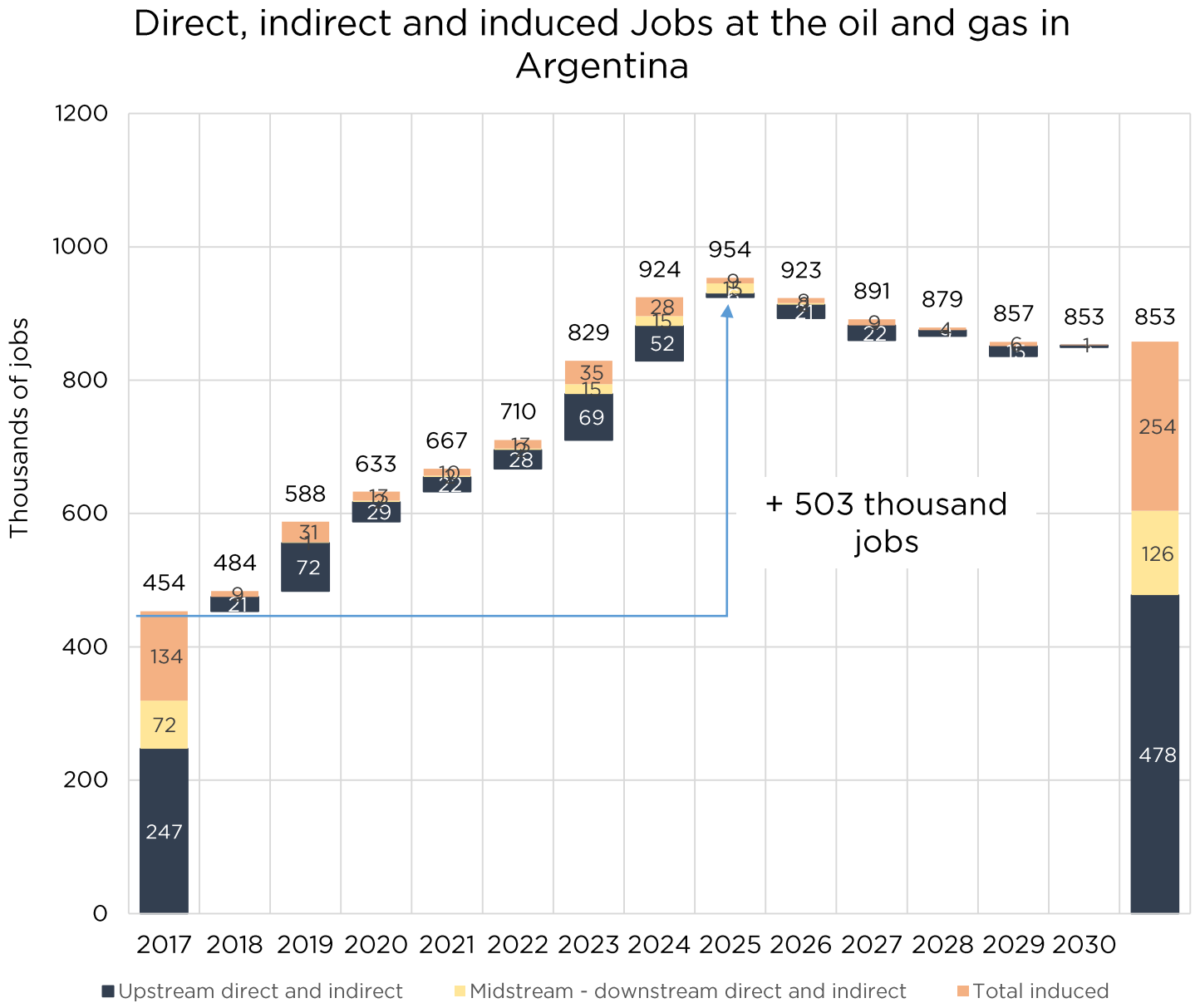
(0.7 BCF/day each)

2023 = 1.4 BCF/day
2024 = 2.8 BCF/day
2025 = 4.2 BCF/day

Estimated ranking:
Installed liquefaction capacity in 2026

#	Country	BCF/day	%
1	USA	27.3	32%
2	Qatar	13.3	15%
3	Australia	10.8	13%
4	Russia	5.4	6%
5	**Argentina**	**4.2**	**5%**

New employment estimation

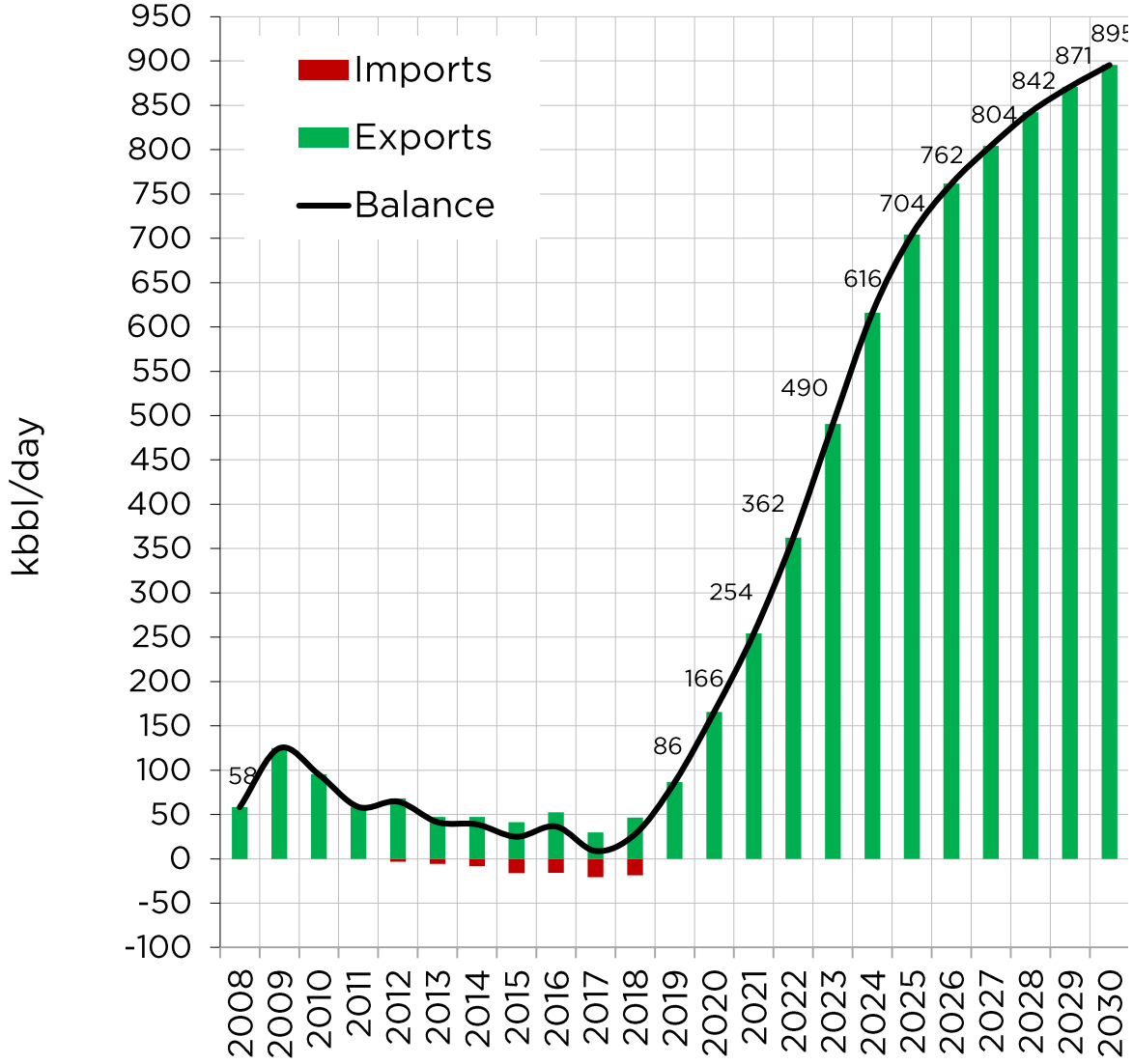


Bottom up estimation:

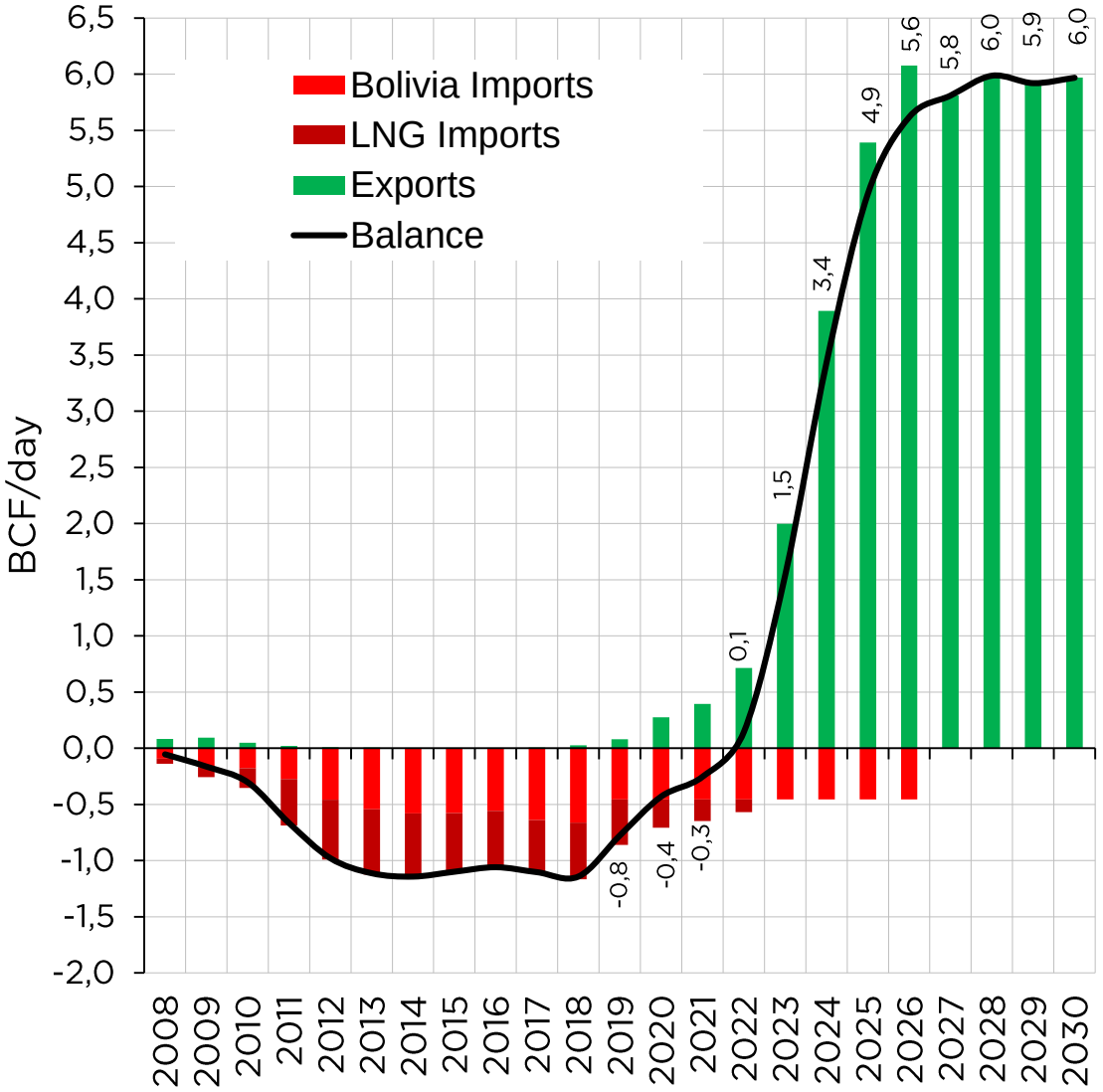
- Overall Jobs 2017 (direct, indirect, induced): 454 thousand jobs
- 500 direct Jobs per rig, 600 Jobs per LNG Train and 20% refinement increase
- Indirect jobs: 3.25 per each direct job in the extraction sector of oil and gas and 9.66 per each job in midstream and downstream (IOT 1997).
- Induced Jobs: +40% (1.7 upstream / 3.9 downstream) per each direct job in Oil and Gas (source: MINEM + MINPROD).

On track to recover the energy trade surplus

Physical Oil international exchange

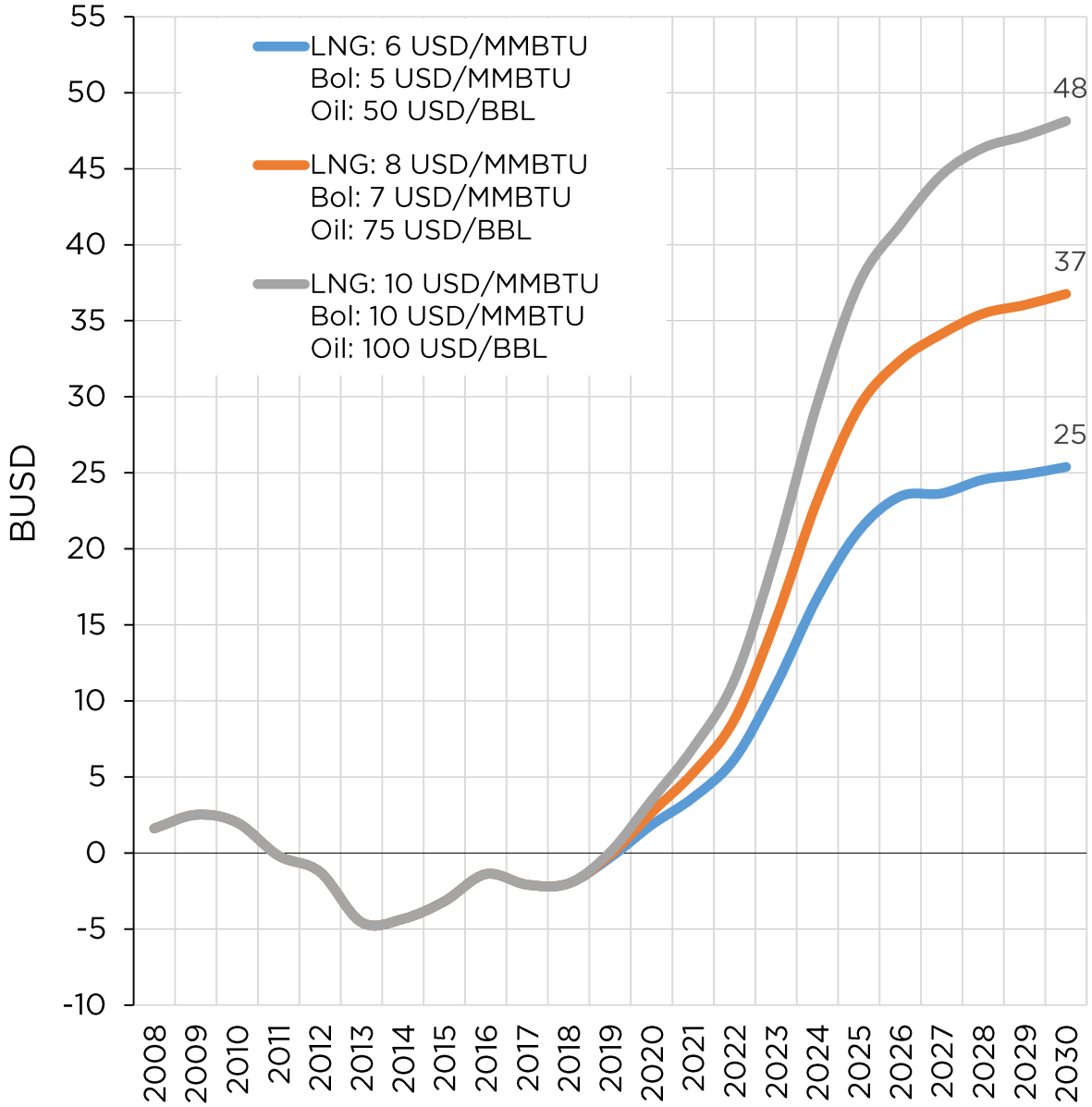


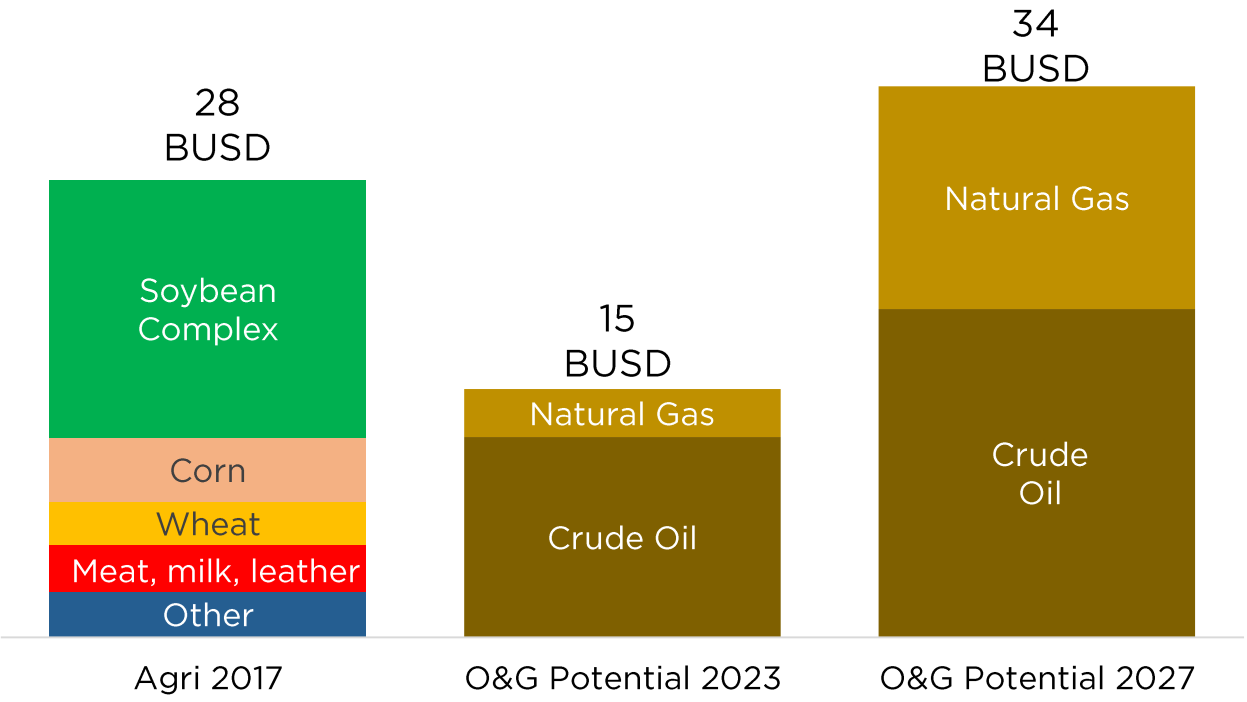
Physical Natural Gas international exchange



O&G's net exports can surpass current agribusiness exports

Trade Balance of O&G





We have the capabilities
We have the knowledge
We have the technology
We took the decision
and we have the people
to develop Vaca Muerta

Norpatagonico Train — PPP project to be bidded soon

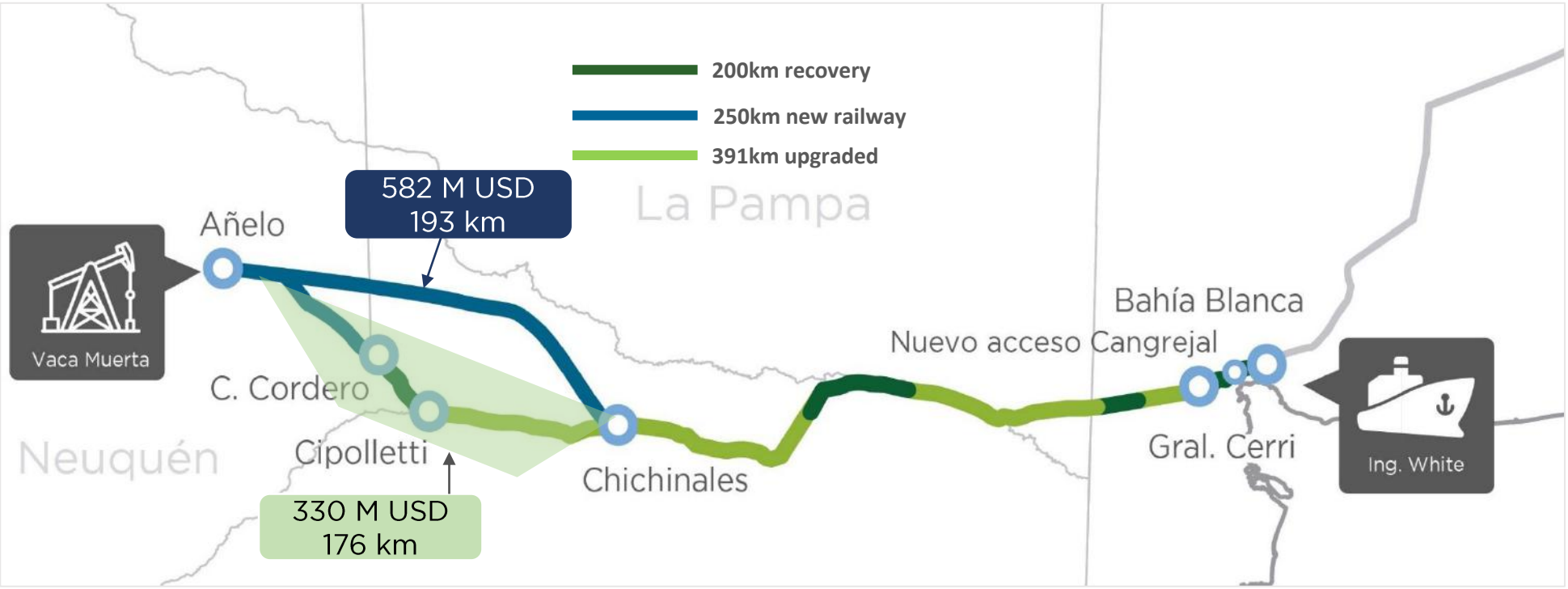
Estimated investments
1,285 M USD

48 months of construction

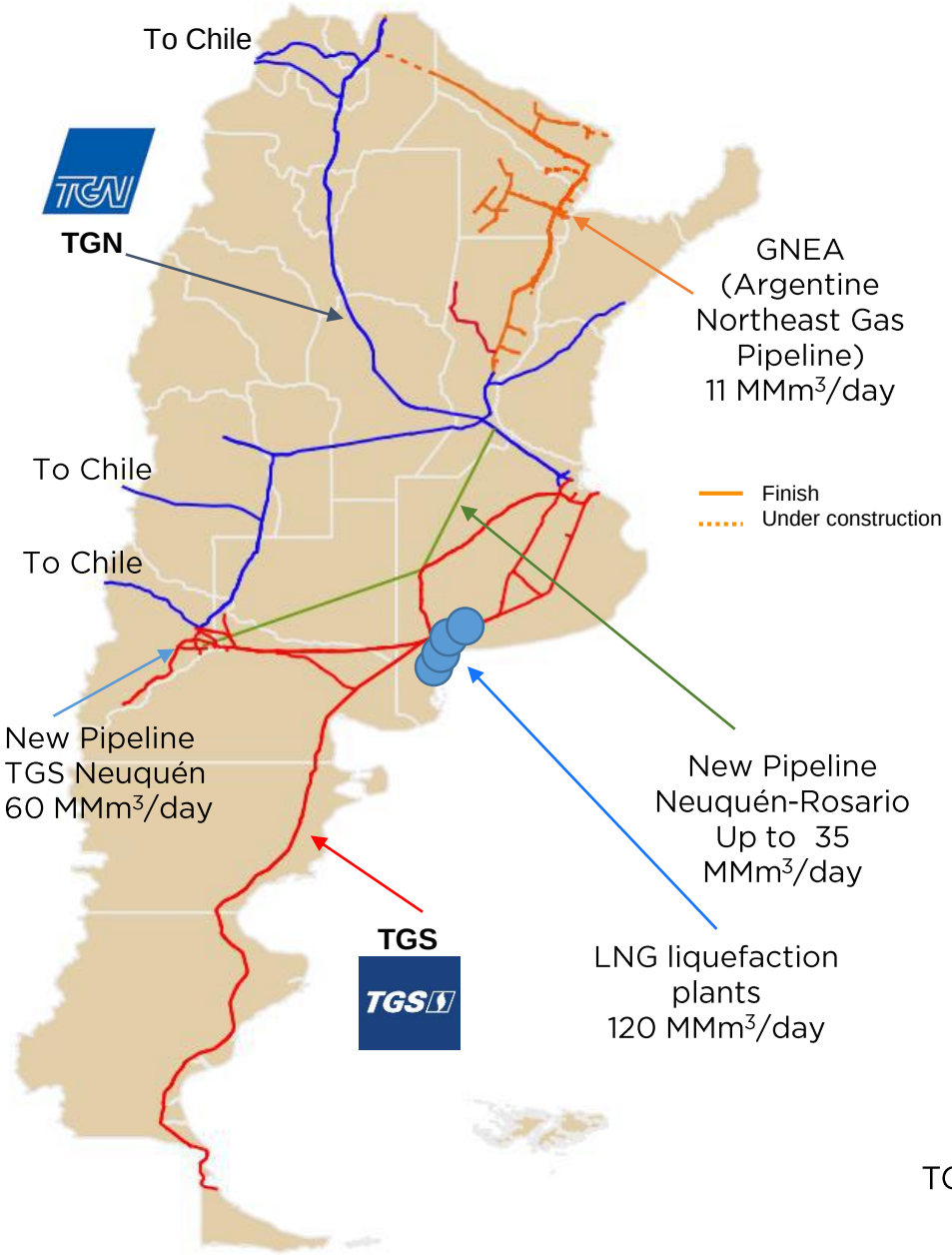
850km recovery
Capacity > 6Mt

Standard of the Railway

- 25 tons/ railway´s axis upgraded
- Maximum speed of 70 km/h
- Crossings´ Deviation for 100 wagons

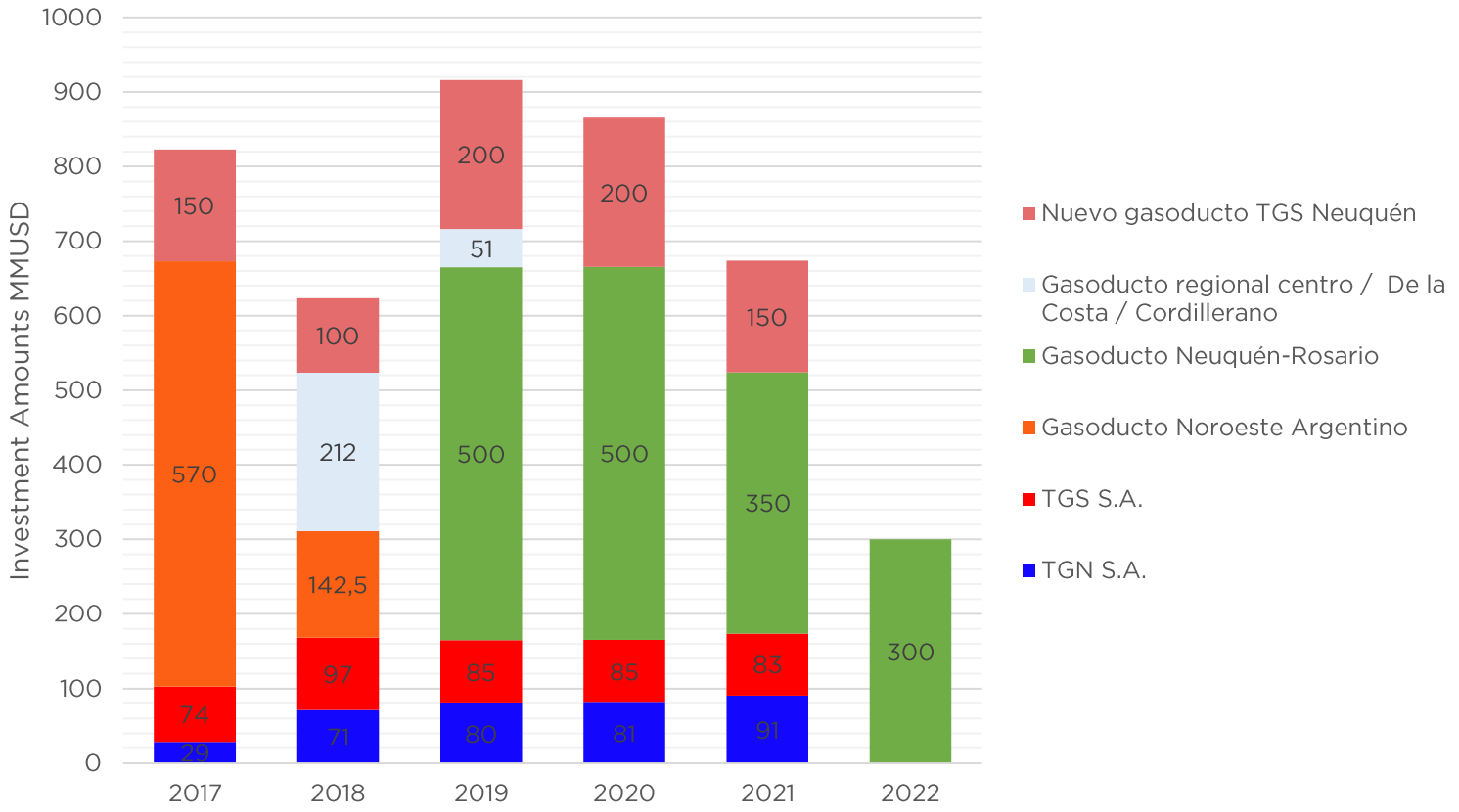


Gas Transport pipelines



Investments in Gas Transport

The investments of TGS and Neuquén-Rosario Pipeline correspond to private investments. GNEA, Regional-Centro II Pipeline, De la Costa Pipeline and Cordillerano Pipeline are carried out by public works regime



Note: Tariff Review values expressed in dollars using 16 ARS/USD exchange rate

TGN y TGS: Infrastructure developed by Tariff Review corresponds to maintenance and improvement of gas pipelines and compressor plants.
TGS: includes 125 km gas pipeline.

Oil Transport pipelines

Allen – Puerto Rosales pipeline expansion. 60MM USD.
- Current capacity: 157 MMbbl/day
- **Expanded capacity: 220 MMbbl/day**

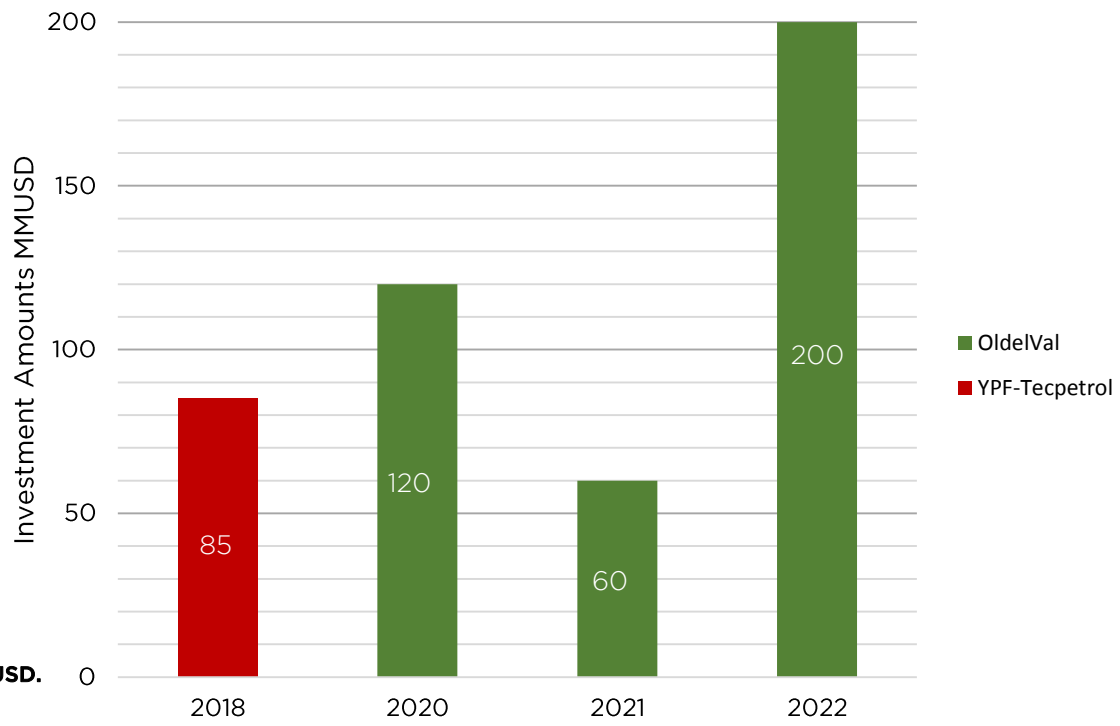
Lago Pellegrini – Allen pipeline expansion. 40km. 30MM USD.
- Current capacity : 145 MMbbl/day
- **Expanded capacity : 289 MMbbl/day**

Lago Pellegrini – Medanito pipeline expansion. 120km. 50MM USD.

Allen – Puerto Rosales pipeline expansion. Approx. 200MM USD.
- 2021 Capacity: 220 MMbbl/day
- **Target capacity: 415 MMbbl/day**

Investments in Oil Pipelines

The main investments correspond to the expansion of the transport capacity of the oil pipelines operated by Oldelval (private investment).



According to the demand forecast, an additional investment of 50MMUSD is estimated in 2026 for the construction of a new section Lago Pellegrini-Medanito.

Vaca Muerta Roundtable

Meeting	Timetable	Subject
	08.30h	Entrance and Registration for Meeting (for the rest of meetings, participants should register 30 min before)
1	9.00 —10.15 hs	Upstream and Midstream (transport of hydrocarbons and LNG)
2	10.30 —11.45 hs	Infraestructure (road / railway / logistics)
3	12.00 —13.15 hs	Value chain / provider development / technology / import management
	13.15 —13.45 hs	Lunch
4	13.45 —15.00 hs	Intensive use of gas to develop the economy: transport, industry, petrochemistry and others, LNG
5	15.15 —16.30 hs	Productivity, safety, training, housing, health and other labor aspects
6	16.45 —18.00 hs	Social and environmental aspects

Meetings frequency: Every 3 weeks (*1 in Buenos Aires and 1 in Neuquén)*
Please confirm your participation via mail to : privadaplaneamiento@minem.gob.ar - +54 11 4349-7581/8624
Please attend exclusively to the corresponding meeting, one person from each organization per meeting

Argentina Bid Round 1 to explore vast Offshore, one of the lasts areas underexplored in the world with high potential.

Argentina Offshore Round 1

- November 6 of 2018: Bidround was launched.
- High interest demonstrated by International and Local players: 12 companies Nominated blocks and 25 are already working.
- Round includes from medium to high risk exploration blocks.
- 2D/3D seismic and well data available in SEN
- 38 Blocks to be included in Round 1:
  - **Austral Basin**: 6 Shallow water blocks (WD < 100 m) from 2,000 to 2,700 Km^2
  - **Malvinas Basin**: 18 Deepwater blocks from (WD 100 to 700 m) from 3,600 to 6,300 Km^2 (Discarded 10 blocks from Nomination process).
  - **Argentina Basin**: 7 Deepwater blocks (WD 200 to 1,300 m) from 6,000 to 9,000 Km^2 & 7 UltraDeepwater blocks (WD 1,200 m to 4,000 m) from 3,000 to 9,000 km^2.

14th March of 2019: Offers to be submitted.

Website: www.costaafuera.energia.gob.ar

Bidding Terms

Bids: On Committed Working Units (WUC) for the 1st Exploration Period. Each block will have (i) Minimum Working Units (equivalent to a 3 x 3 km of 2D in 100% of the Block) and (ii) Basic Working Units (equivalent to 20% to 40% of 3D of the surface of the block).

Formula to be used:

Bid (usd) = WUC x 5000 (usd/WU) + Bonus* (usd)

WUC : Commited Working Units offered for 1st Exploration Period. Must be higher than or equal to Minimum Working Units

**Bonus is accepted only if WU > Basic WU; to be paid 50% upfront + 50% end of 3rd year exchangeable for WU done in the first 3 years in addition to Offered WUs*

Working units in excess of the amount committed in one period may be carried forward to the following period in line with Art. 20 of the Law.

Committed Working Units not fulfilled in one given period shall be paid in cash or Energy Secretariat will execute the guarantee.

Contract Terms

Long Duration Exploration Permit: Three periods of 4 + 4 + 5 years for all blocks except – Shallow waters (Austral Basin): 4 + 3 + 4. Relinquishment of 50% at the end of 2nd Period. Obligation to drill one well in 2nd Period and on Extension Period

- Enough time for Production Concession: 30 years + 10 of extension (successive extensions possible)
- Ability to keep Non Commercial Discoveries: Possibility to keep discoveries for 5 + 5 years after Exploration Permit if discovery appraised and non commercial
- **Reduced Royalties linked to success: Starting in 5 % to 12% based according to:**

R factor = (ΣSales-ΣRoyalties)/(ΣE&A+ΣInvestments+ΣOPEX)


Thank
you.

Appendix

GyP Subannex

VACA MUERTA

Gas y Petróleo del Neuquén S.A.

INVESTMENT OPPORTUNITIES IN THE OIL & GAS SECTOR IN NEUQUEN PROVINCE

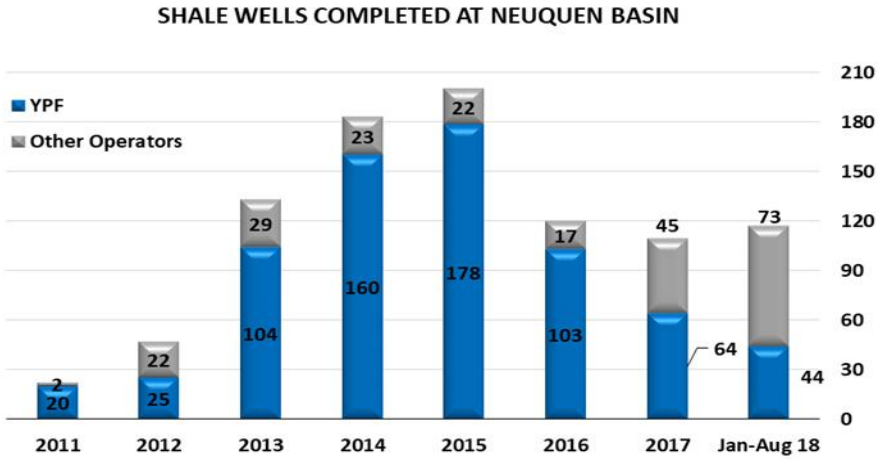
GyP 10 años

November 2018

Neuquén

Argentina

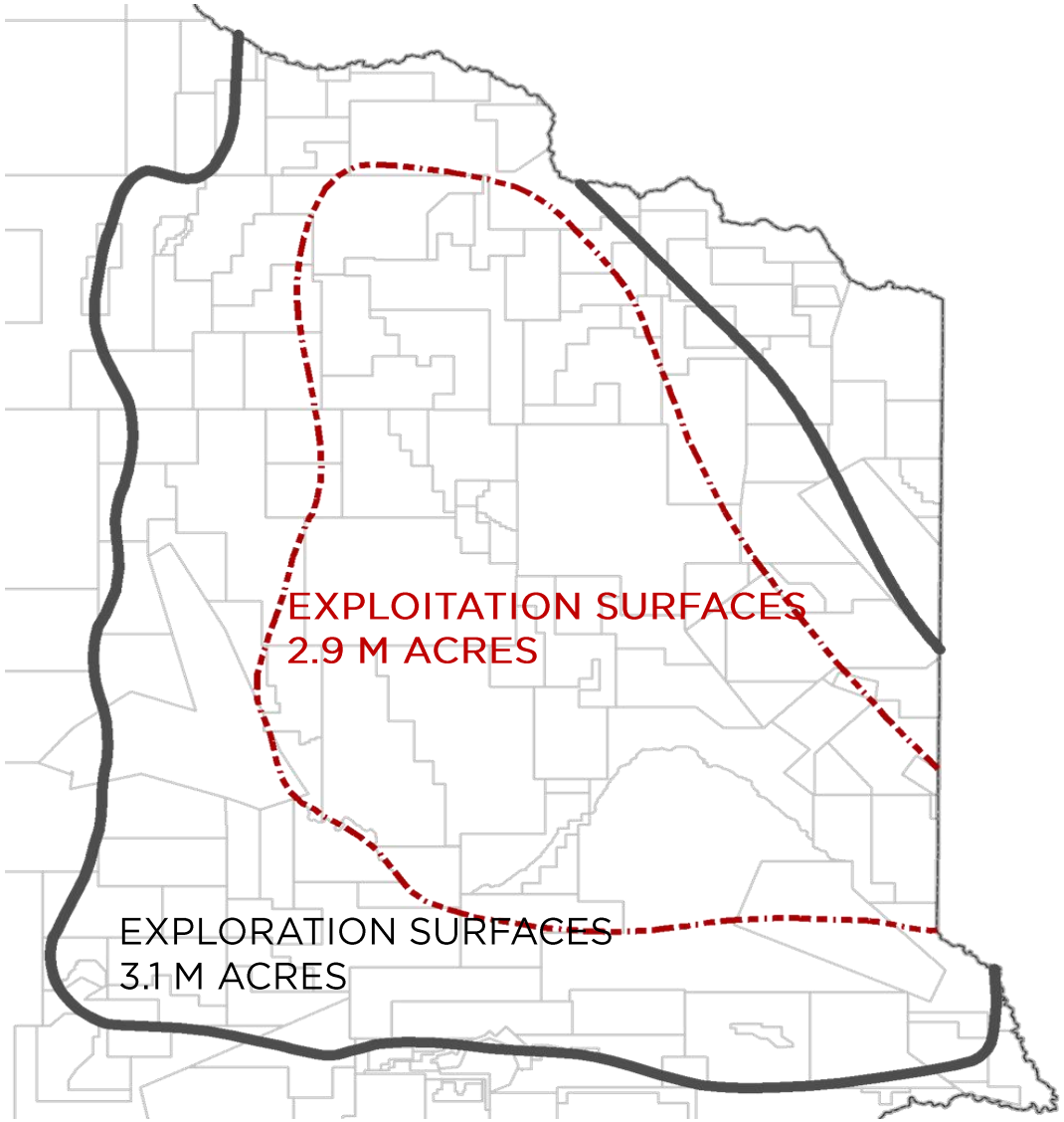
- **GAS**
  - 52 % Neuquén — 18.000.000 m³/d
    - 50% Un Conventional
    - Conventional
  - Rest of Arg.
- **OIL**
  - 23 % Nqn — 8.500 m³/d
    - 50% Un Conventional
    - Conventional
  - Rest of Argentina

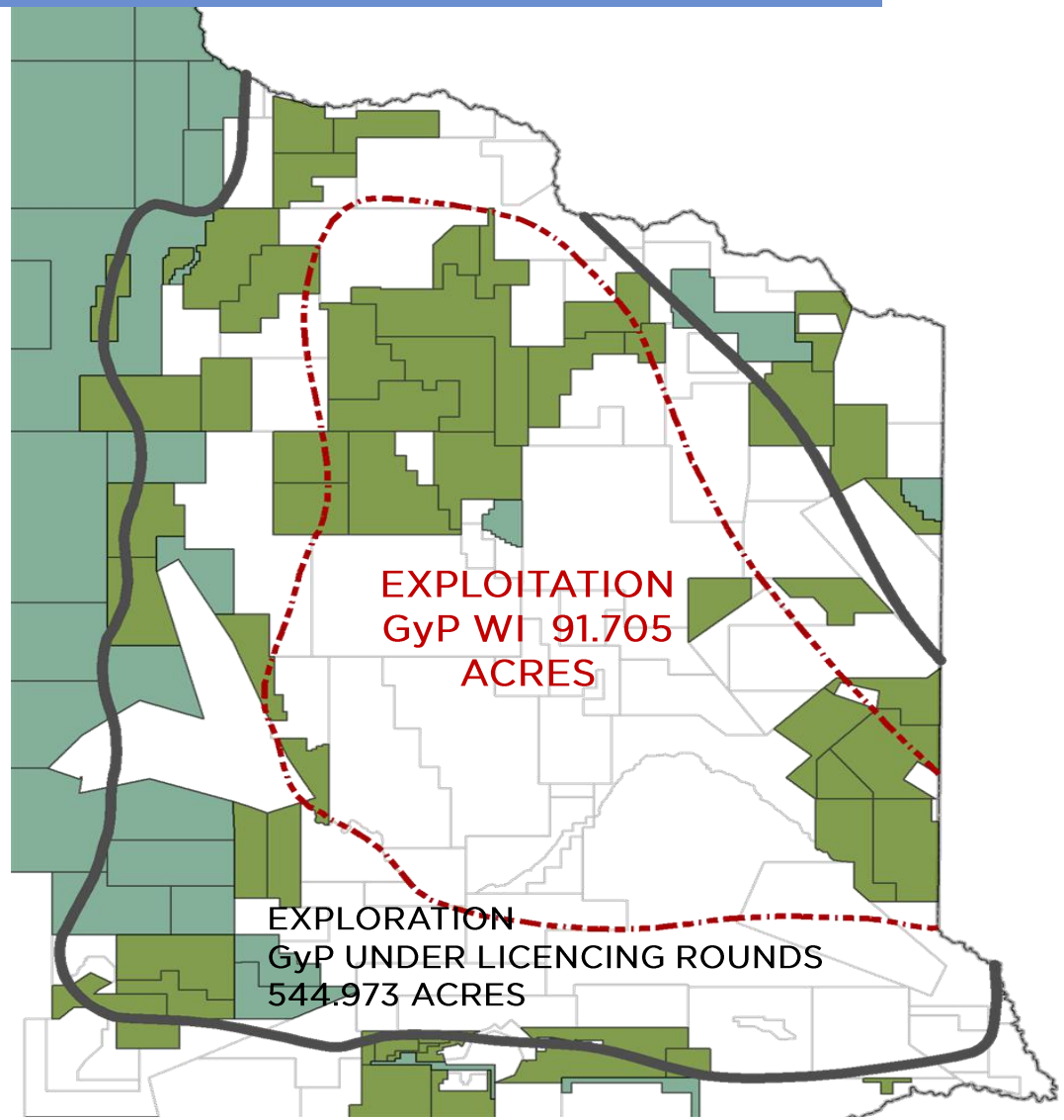


SHALE WELLS DRILLED & COMPLETED			
YEAR	YPF	OTHERS	TOTAL
2011	20	2	22
2012	25	22	47
2013	104	29	133
2014	160	23	183
2015	178	22	200
2016	103	17	120
2017	64	45	109
Jan-Aug 18	44	73	117
TOTAL	698	233	931

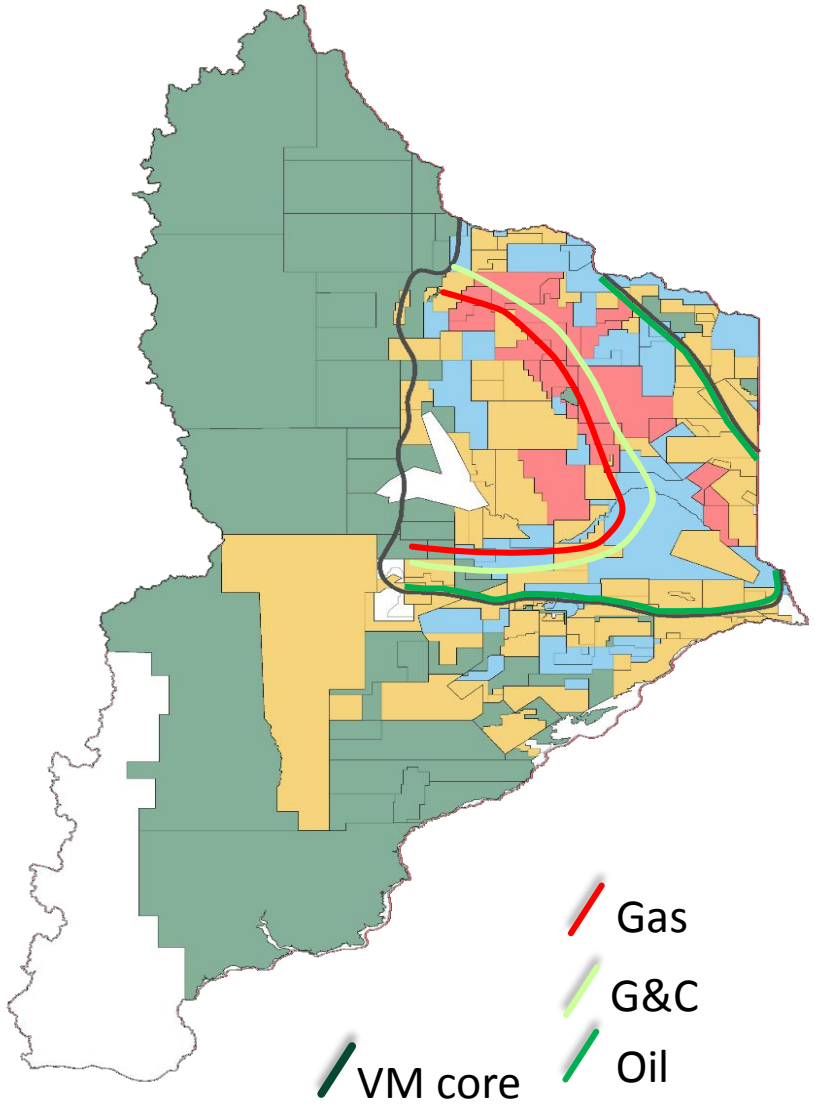
Neuquén Production

WHERE IN VACA MUERTA ?





VACA MUERTA ENTRY OPPORTUNITIES



YPF

INTERNATIONAL OIL COMPANIES

DOMESTIC OIL COMPANIES

GYP

"PLAN EXPLORATORIO NEUQUÉN"

LICENSING ROUNDS

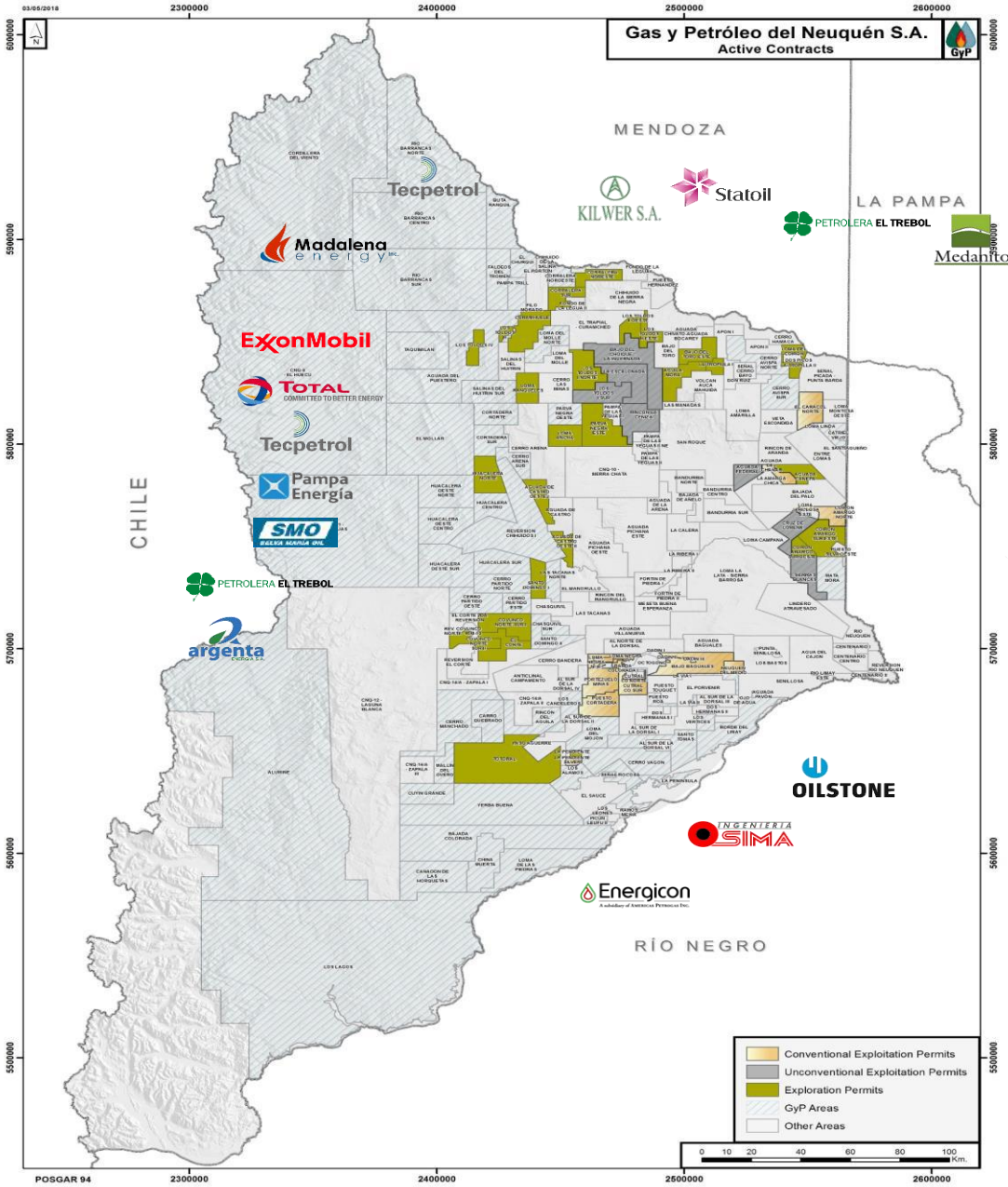
GyP Active Contracts JV's With IOC's or DOC's

Exploration Permits: 23

Exploration & Exploitation Conventional: 1

Conventional Exploitation Permits: 4

Unconventional Exploitation Permits: 9



GyP
Gas y Petróleo del Neuquén S.A.

GYP Unconventional Projects

Aguada Federal

- 181,8 MU$S to assess the potential shale resources. The partners have drilled 6 Wells (2 vertical wells and 4 horizontal Wells).
- **Total Project Wells: 148. Total Project Investment: U$S 2.7 Bn U$S**

Sierras Blancas y Cruz de Lorena

- GyP y Shell have drilled 12 Wells in Vaca Muerta. The investment has reached US$ 535 millions. 4 Wells to be drilled in 2018.
- **Total Project Wells: 577. Total Project Investment: U$S 8.9 Bn U$S**

Rincón la Ceniza y La Escalonada

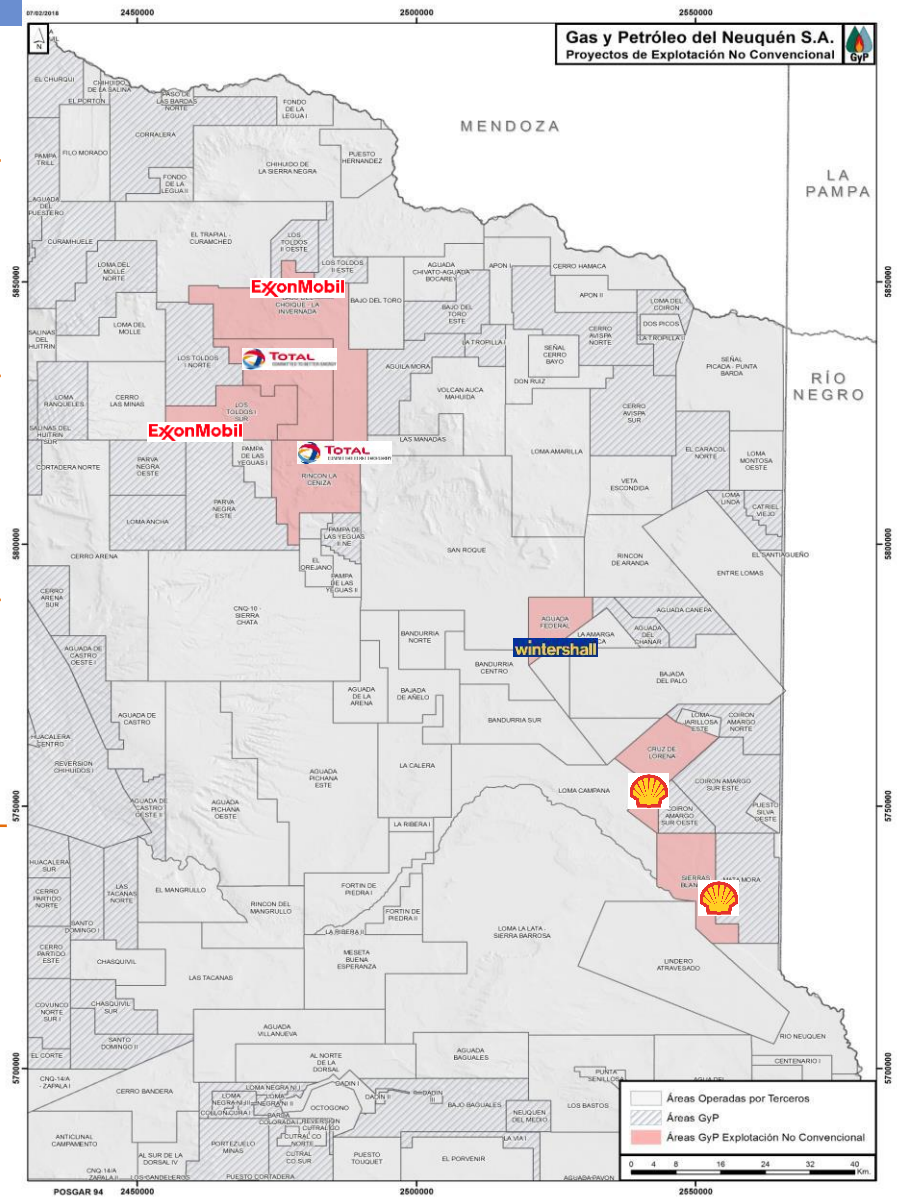
- The partners have drilled 16 Wells. Actual Investment (included 2018): US$ 589 millions.
- **Total Project Wells: 590. Total Project Investment: U$S 12.8 Bn U$S**

Bajo del Choique – La Invernada

- 3 Wells in production, 3 in execution. Investment Commitment (included 2018): US$ 254 millions.
- **Total Project Wells: 561. Total Project Investment: U$S 13.9 Bn U$S**

Los Toldos 1 Sur

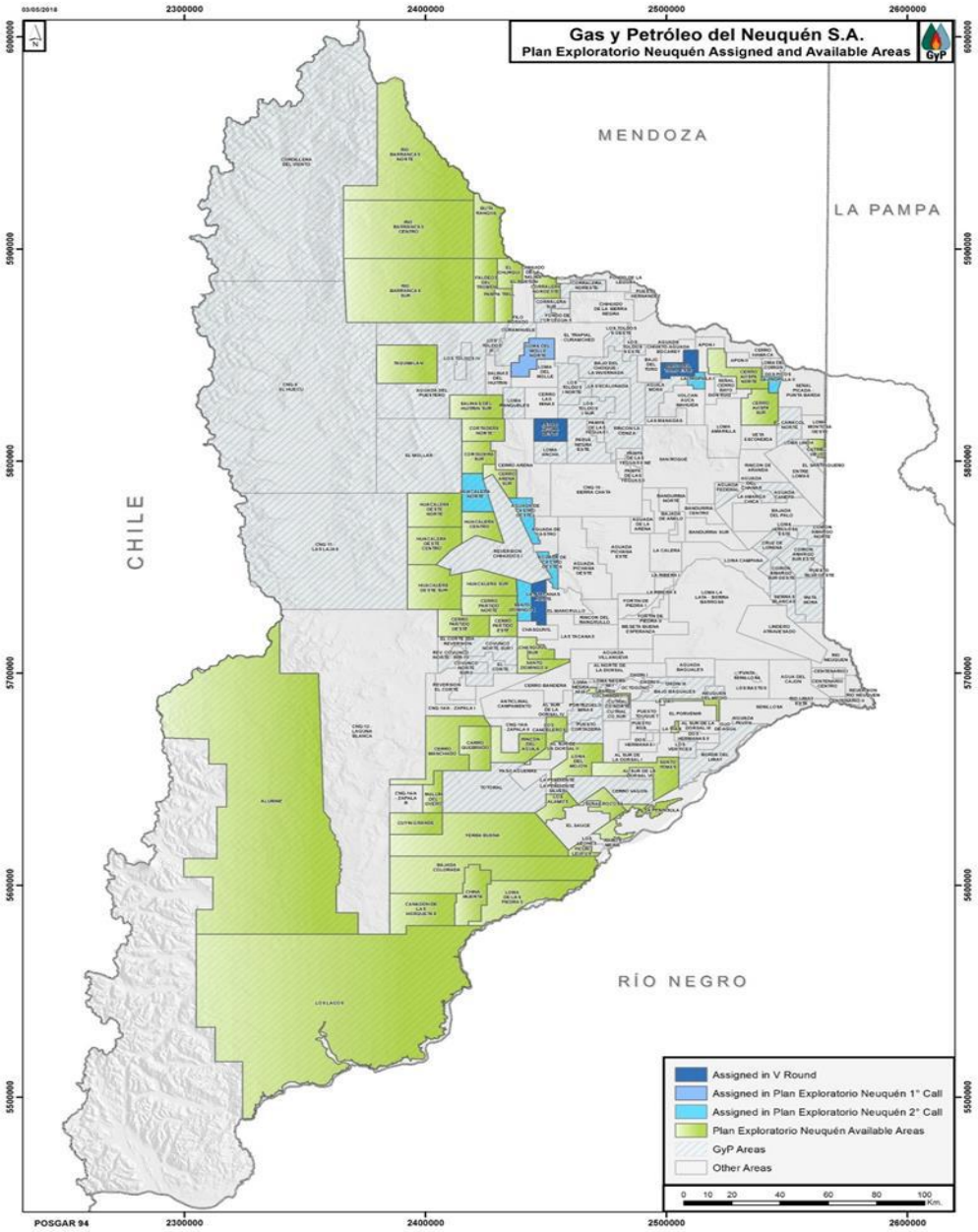
- Exxon has drilled 3 Wells, 5 committed for next 18 months. US$ 252 to be invested (granted 46 resolution)
- **Total Project Wells: 304. Total Project Investment: U$S 7 Bn U$S**



Plan Exploratorio Neuquén

- Availables for quarterly offers under “Plan Exploratorio Neuquén” (43)

Licensing rounds are the lowest cost option and a good fit for companies that desire to operate. Work commitments are not under strict timelines, which allows the operator flexibility in developing its own strategy to prove up the acreage.
GyP’s blocks, offered on an ongoing basis, are generally more peripheral and higher risk contributing to a lower cost per acre on average.



GyP
Gas y Petróleo del Neuquén S.A.

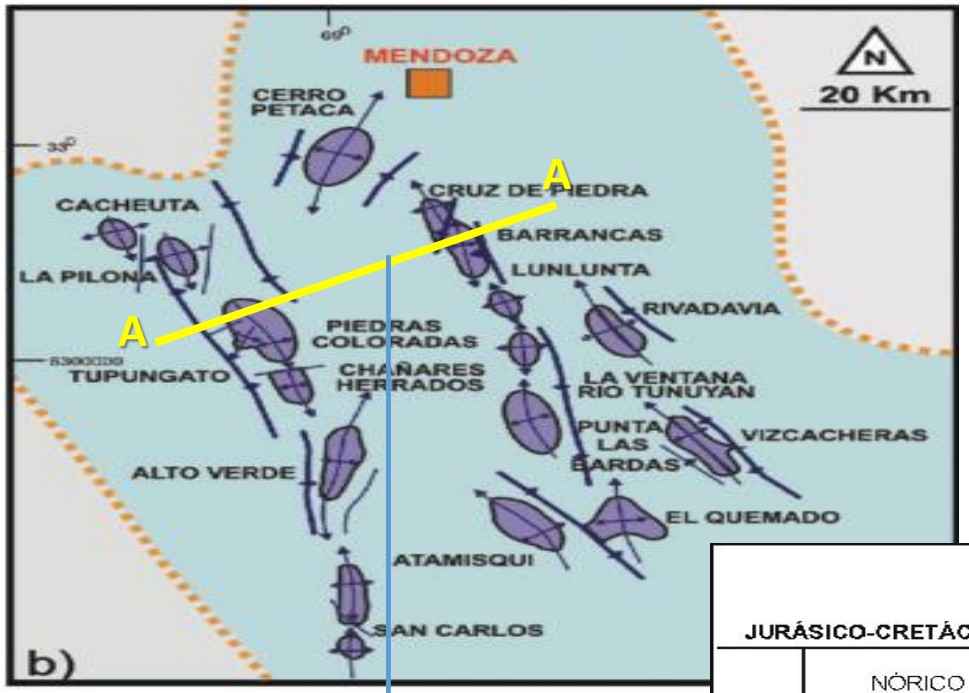
Mendoza Subannex

Not Only Oil Business Opportunities

Mendoza Cuyana Basin

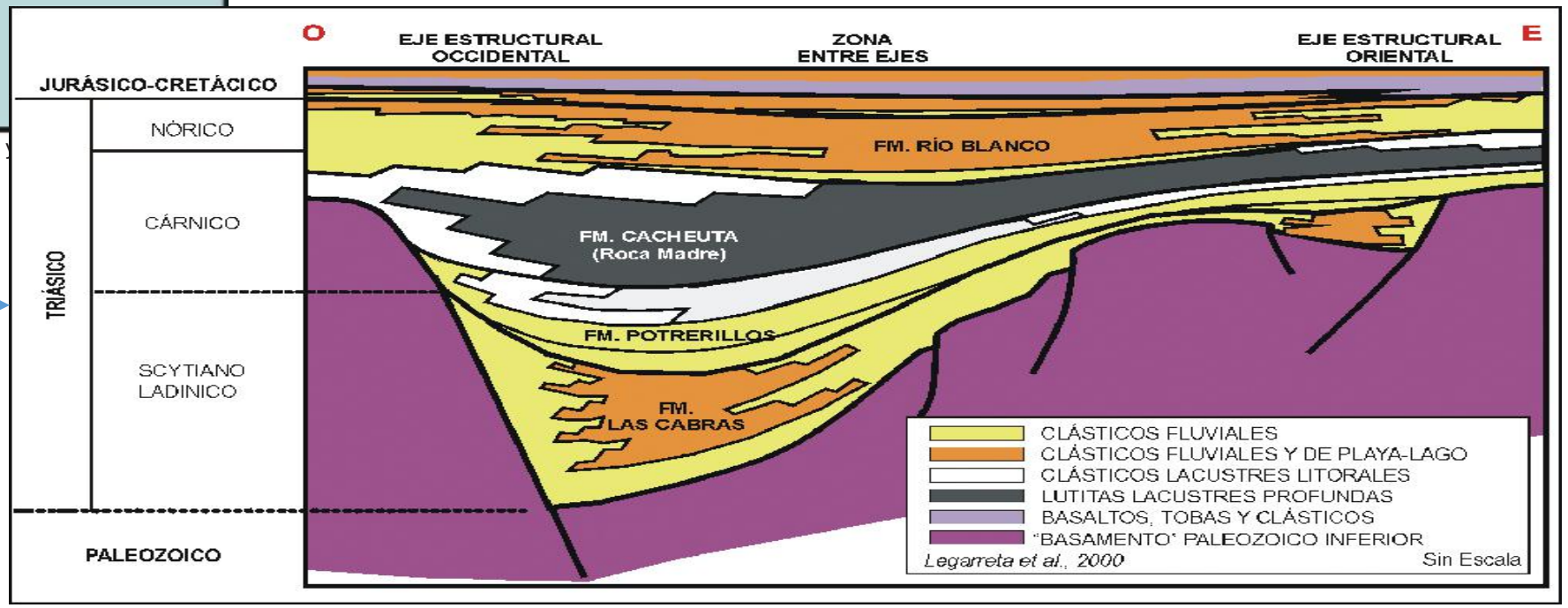
Main Oil Fields and an East-West Structural Layer View

NC Opportunities on Cacheuta and Potrerillos Fm. EOR in current mature areas

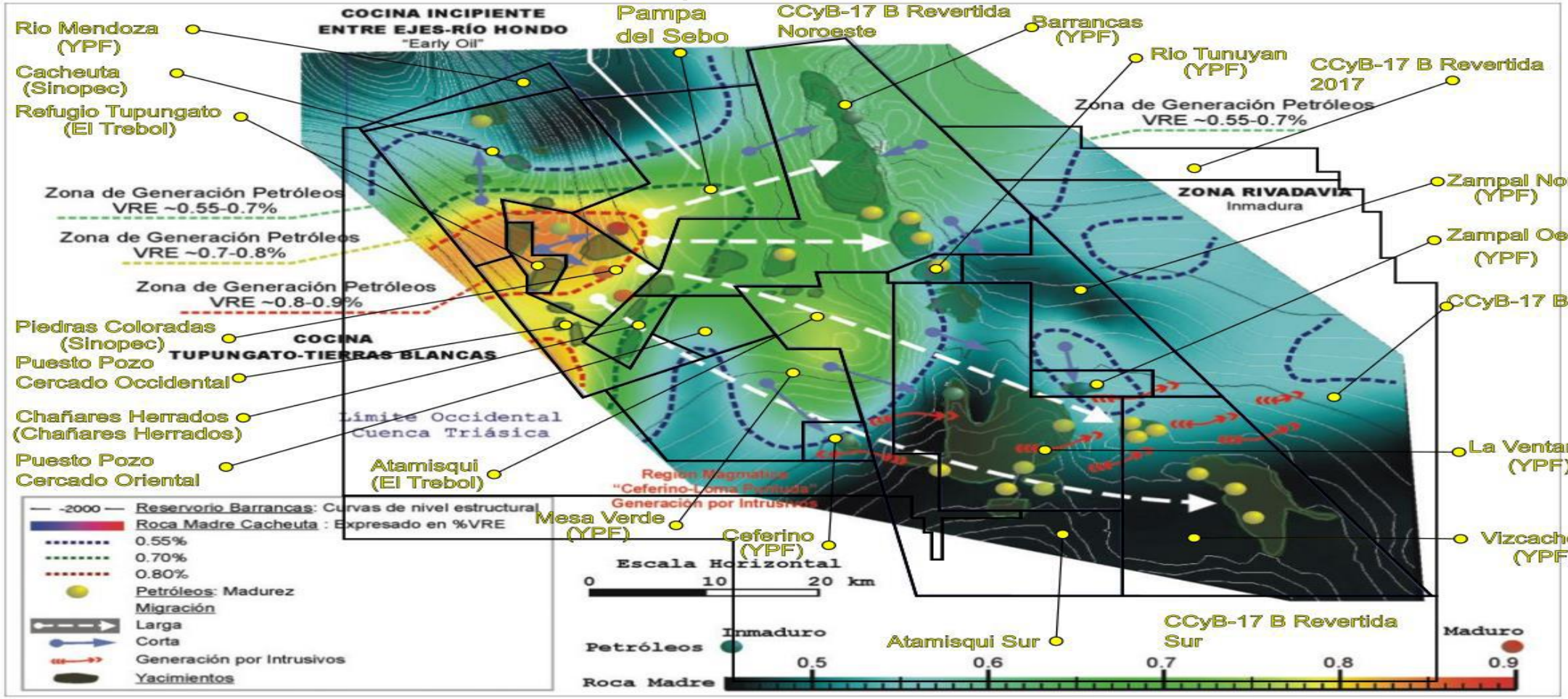


Tomado y modificado de Silvia Zencich1, Héctor J. Villar2 y
IAPG 2014

Tomado y modificado de Silvia Zencich1, Héctor J. Villar2 y Daniel Boggetti3, IAPG 2014



Estructural Levels, Areas and Current Operation Companies on Cuyana Basin

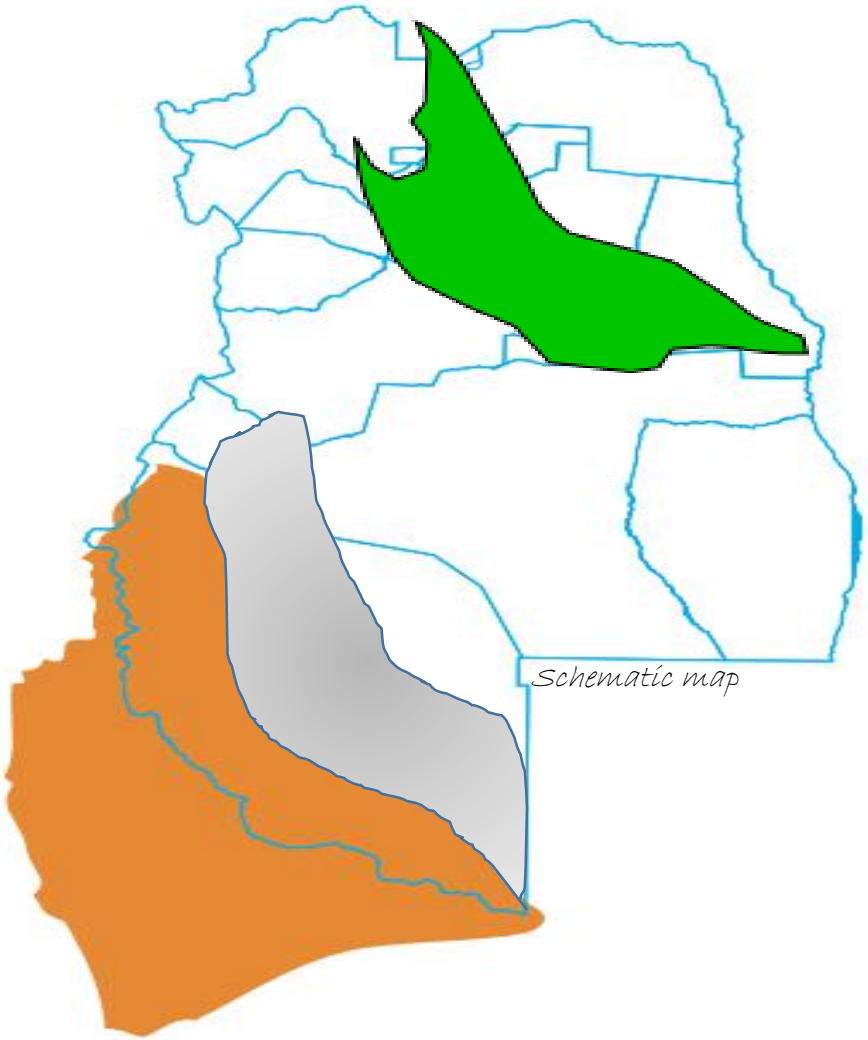


Tomado y modificado de Silvia Zencich1, Héctor J. Villar2 y Daniel Boggetti3, IAPG 2014

Mendoza Neuquina Basin
(Vaca Muerta – Agrio - Heavy Oil)

- ✓ *Vaca Muerta Studies indicate:*
  - ✓ *2500 Km2 VM & Agrio Productive Area*
  - ✓ *300-400 m average thickness*
  - ✓ *2 to 6% TOC*
  - ✓ *0.9 yo 1.1 Ro*
  - ✓ *37 to 55 billion bbl Oil in Place*
  - ✓ *5 to 10% estimated oil Recovery opportunity*
  - ✓ *From 1.9 to 5.5 Bbbl Estimated Production*
- ✓ *Heavy Oil Opportunities:*
  - ✓ *5000 Km2 Basin Edge Heavy Oil Opportunities*
  - ✓ *1.5 to 3.4 Mbbl Estimated Production*

Oil Business Opportunities at Mendoza



- ✓ *Develop of Vaca Muerta Exploitation* *(1.9 to 5.5 Bbbl)*
- ✓ *NC Exploitation on Cacheuta & Potrerillos, in Cuyana Basin* *(1.3 to 2.6 Bbbl)*
- ✓ *Develop of Heavy Oil Exploitation at Neuquina Basin* *(1.5 to 3.4 Bbbl)*
- ✓ *EOR / CEOR in both Basins*
- ✓ *Royalties Reduction to Exploit this Opportunities* *(up to 5% Red.)*
- ✓ *Predictable Government and Unions*
- ✓ *Environmental Approvals Improvements*

OFFSHORE Subannex

Argentina Offshore Round 1

Houston - November 2018

Argentina Oil & Gas – Legal Framework

Main Laws

- 1967: Law 17,319 creates the legal framework for the Oil & Gas Industry
- 2007: Law 26,197 transfers H/C ownership to Provinces for Onshore & Offshore 12 miles
- 2014: Law 27,007 establishes framework mainly for Unconventionals

Legal Framework

- Concession Regime (Royalties + Income tax)
- Subsurface resources are Province / Federal Government property (Offshore >12 miles)
- Exploration Permits & Exploitation Concessions granted on income tax (30%-25% Income Tax) + royalty regime (5 to 12 %)
- Access to acreage through bid rounds or farm-in agreements with existing rightsholders
- Federal Government sets H/C policies, controls marketing activities and inter-province transport
- Provinces in charge of onshore supervision and control
- Minimum environmental regulations set by Federal Government and specific legislation set by Provinces

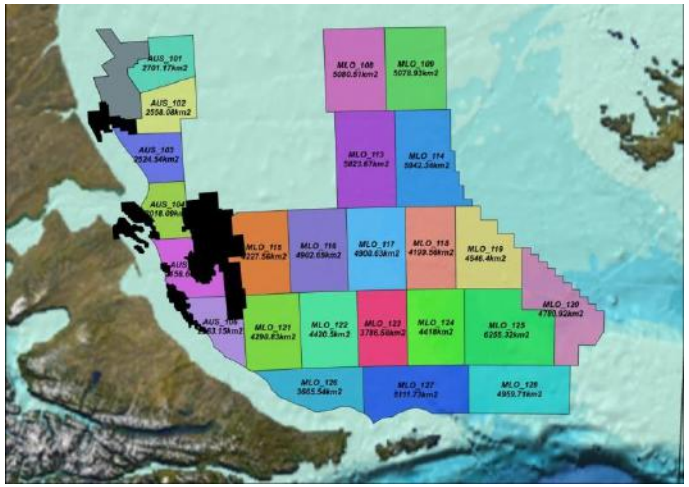
Argentina Offshore Round 1 - Context

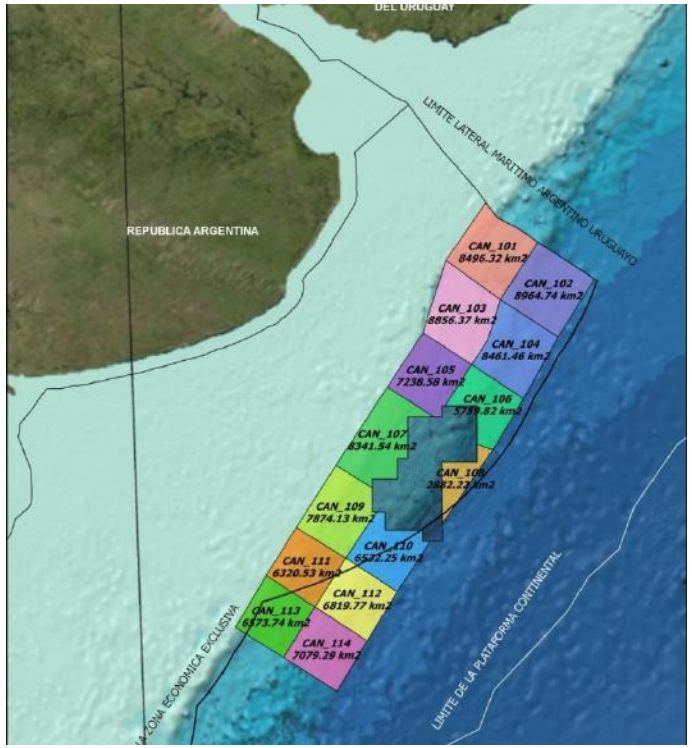
Argentina Offshore Context:

- **Offshore Cuenca Austral produces 800 MMscfd - 20% of the gas of Argentina**
- **Very large under explored area** (200000 Km2 in Round 1 only)
- **Very limited exploration activity in last 20 years** (6000 Km2 of 3D outside Concessions and no wells on >500 m. WD, last well in 2011)
- **Medium to high risk** (Size of Structures in Malvinas and Austral / Source Rock in Argentina)
- **Limited infrastructure & long distances**
- **Large distances to developed areas**
- **Developed local oil & gas industry** (increasing with Vaca Muerta)
- **Competitive legal framework**

Main Goal of the Round:

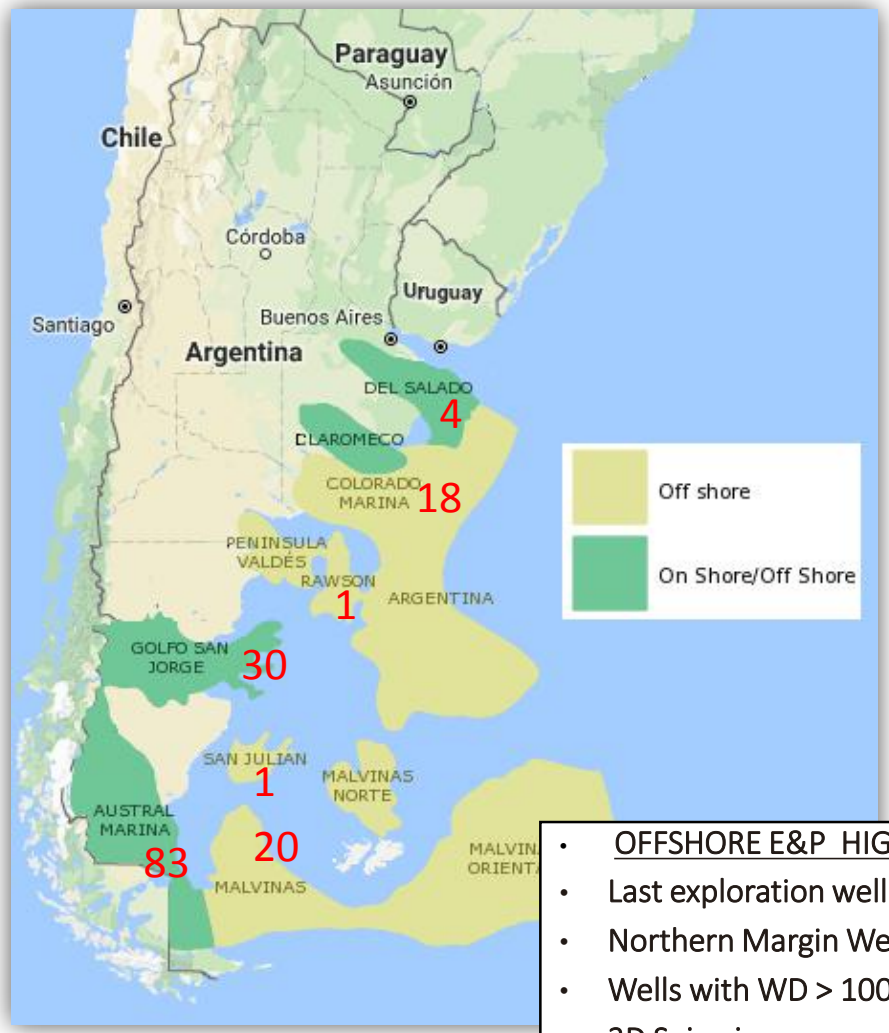
Increase awareness of Argentine Offshore through real investments in Exploration, carried out by companies with the technical and financial capability to fulfil the objectives.

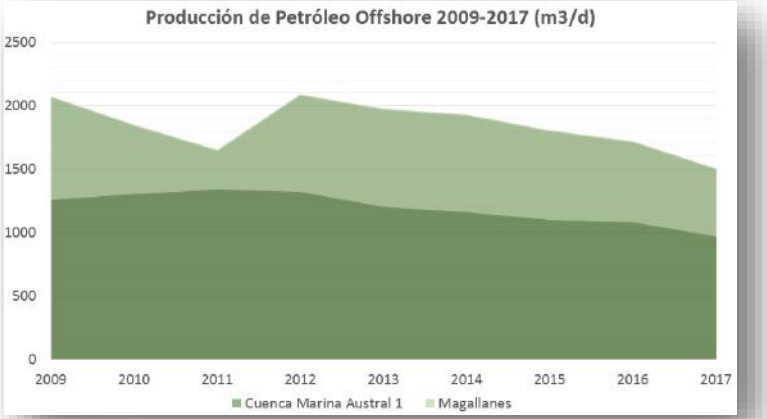


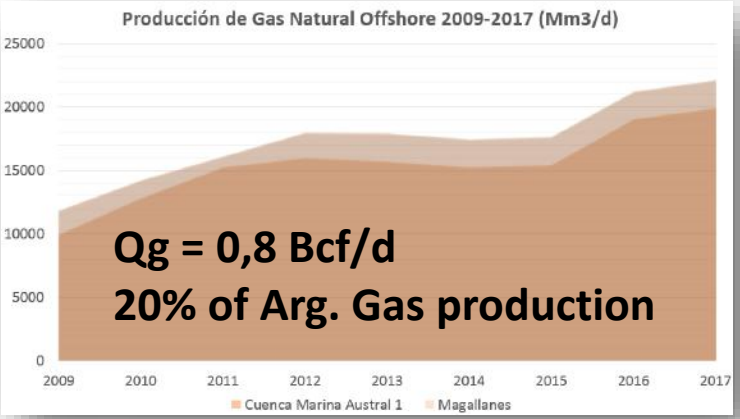


Argentina Offshore – General Review

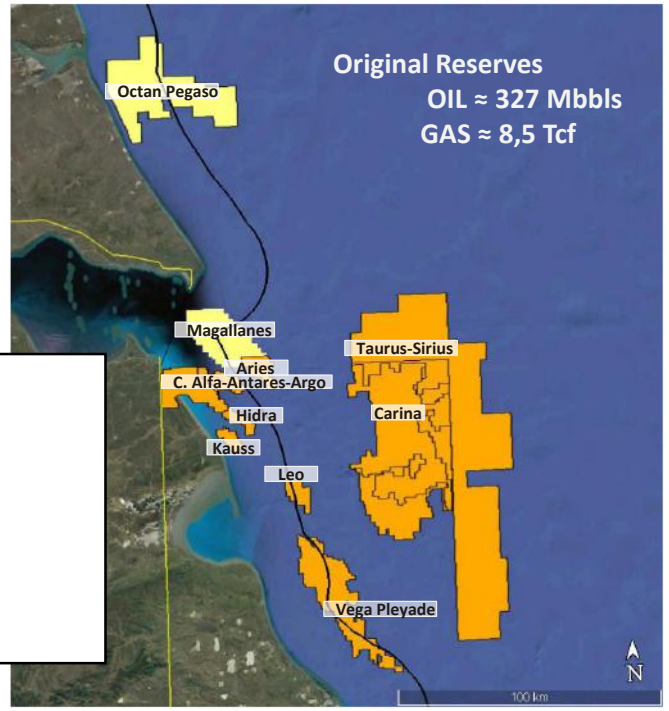
Secretaría de Gobierno de Energía
Secretaría de Planeamiento Energético







Cuenca	Pozos Exploratorios y Delineación	Período
Salado	*4*	1969 - 1994
Colorado	*18*	1969 - 1997
Rawson	*1*	1990
Golfo San Jorge	*30*	1970 - 2009
San Julián	*1*	1994
Malvinas	*20*	1979-2004
Austral	*83*	1980-2018
Total	**157**	**1969-2018**

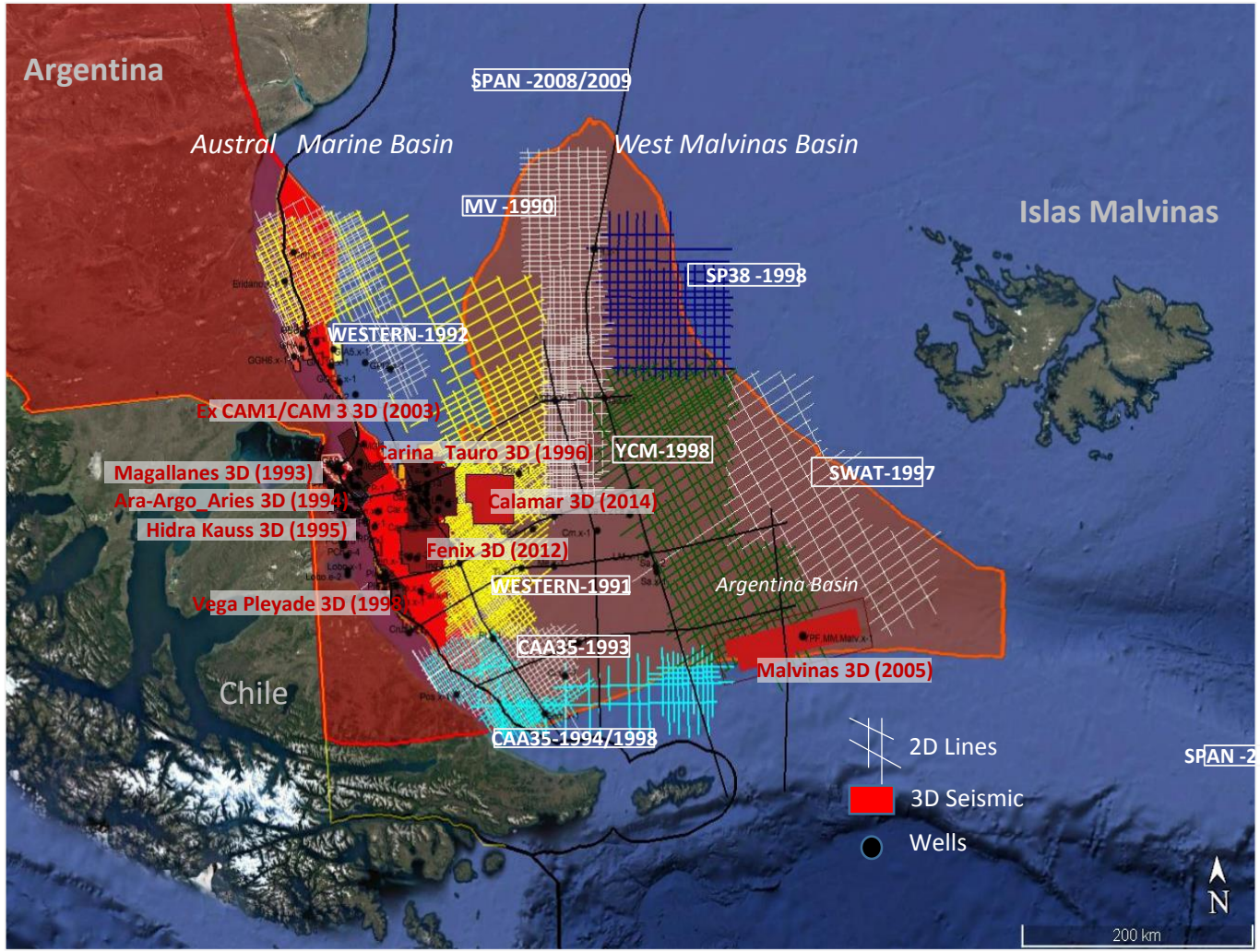


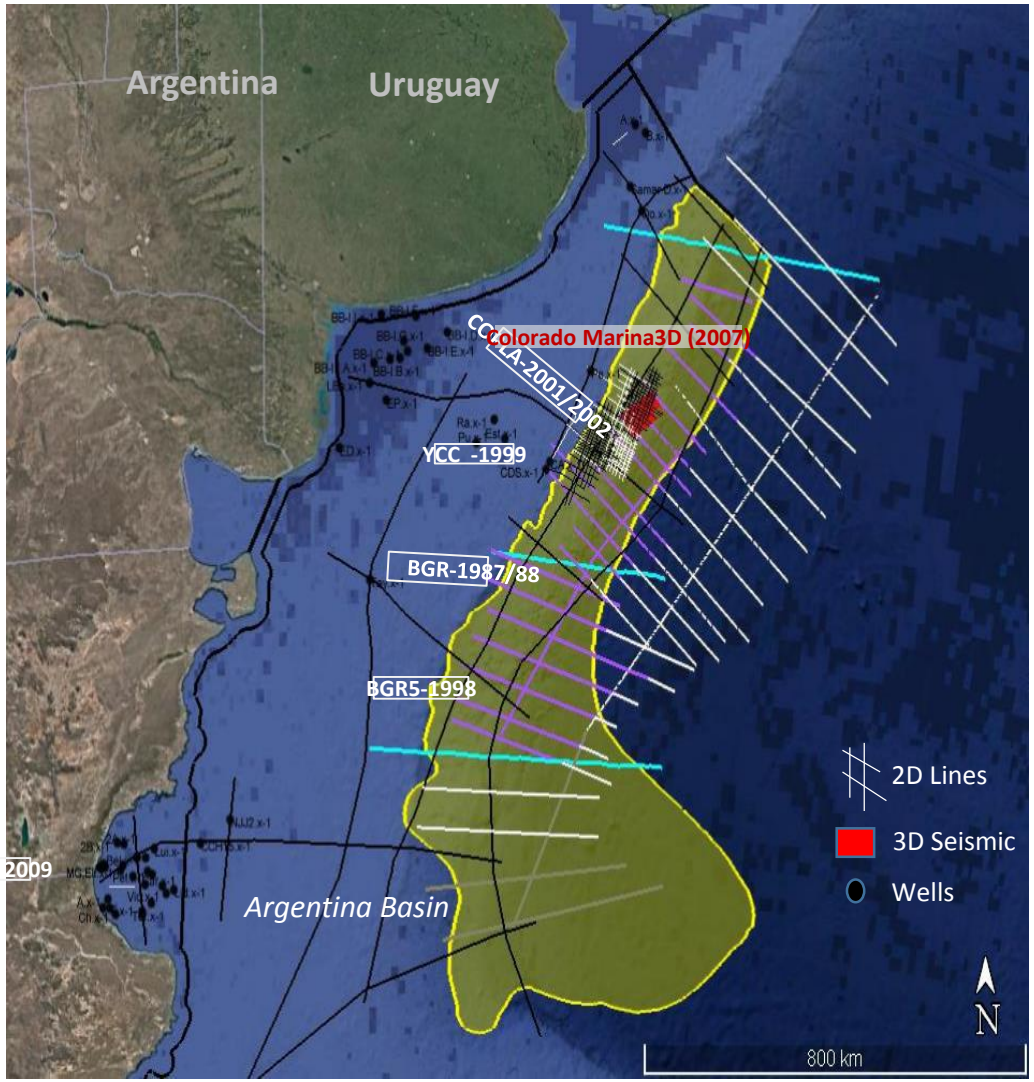
- <u>OFFSHORE E&P HIGHLIGHTS</u>
- Last exploration well drilled Malvinas-1 2011 YPF
- Northern Margin Wells 22 Last one 1997- all <110m wd
- Wells with WD > 100 m. 3 All in the Malvinas Basin
- 3D Seismic only 15000 Km2 (10000 km2 in Austral)
- Current Exploration Permits 1 + 1 under renegotiation

Argentina Offshore Round 1 - Planning

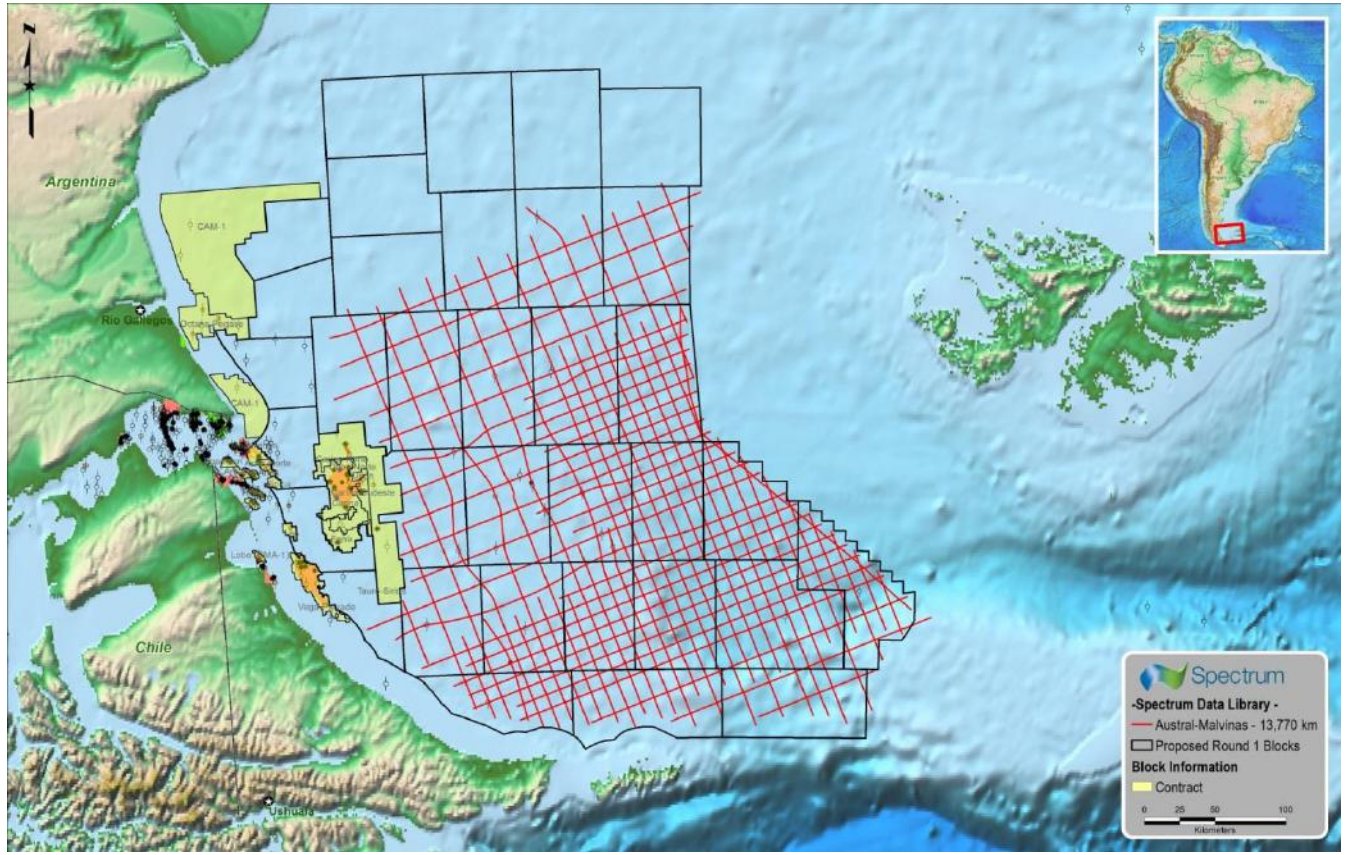
- Launched November 6th 2018.
  - Site of the Round – https://costaafuera.energia.gob.ar
  - Decree 872/2018. Defines blocks, royalties and arbitration clause.
  - Resolution 65/2018 SEN. Includes Terms & Conditions of Round 1.
- Offers to be submitted by March 14th 2019.
- Around 25 companies already working in the Round.
  - 6 Workshops from January to July 2018 – Open discussion on general conditions of the Round.
  - Processed 2D and 3D Seismic and wells data available in SEN Databank.
  - Acquisition of Multiclient 2D seismic shot by Spectrum (around 35000 Km in Argentina Basin and 15000 Km in Malvinas Basin) - Several studies performed by various companies through reprocessing and interpretation of existing data in the Data Bank

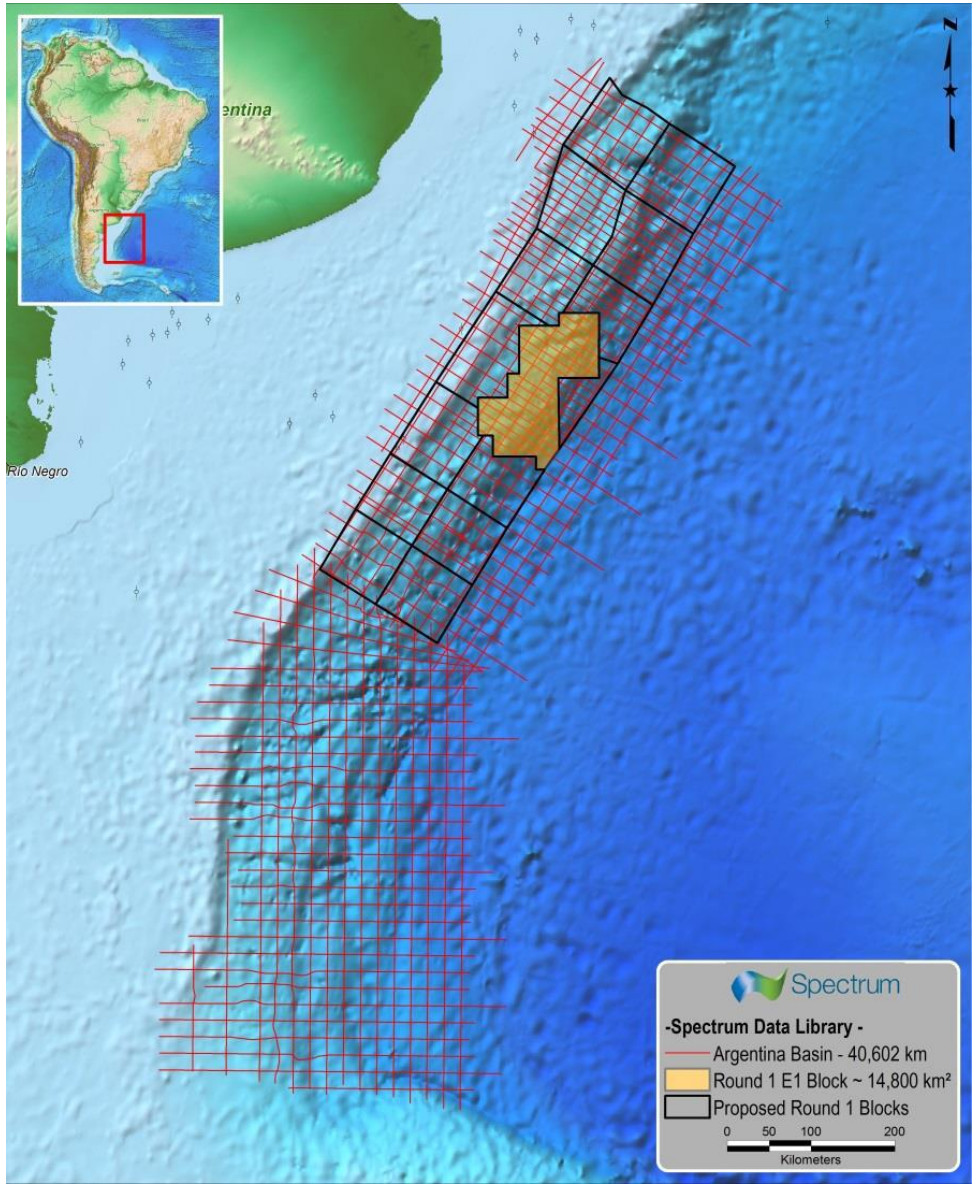
Main processed seismic available in the MINEM Data Bank





2D Multiclient Seismic aqcuired by Spectrum 2017/18 (around 50000 Km)



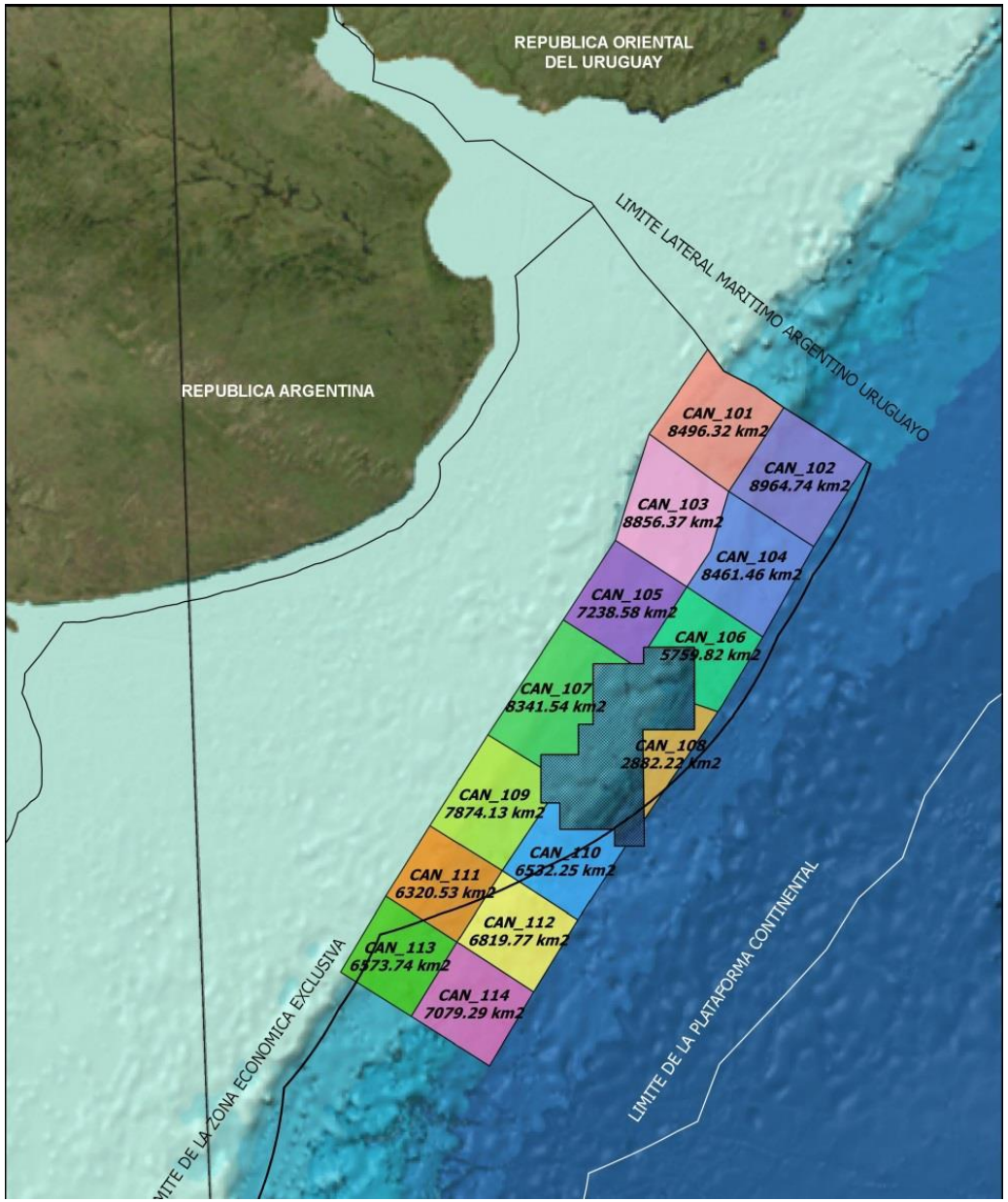


Argentina Offshore Round 1 – Blocks

Argentina North Basin
100000 Km2

- **7 Deepwater blocks** (WD 200 to 1300 m.)
  Blocks surface from 6000 to 9000 Km2

- **7 UltraDeepwater blocks** (WD 1200 m. to 4000 m.)
  Blocks surface from 3000 to 9000 km2



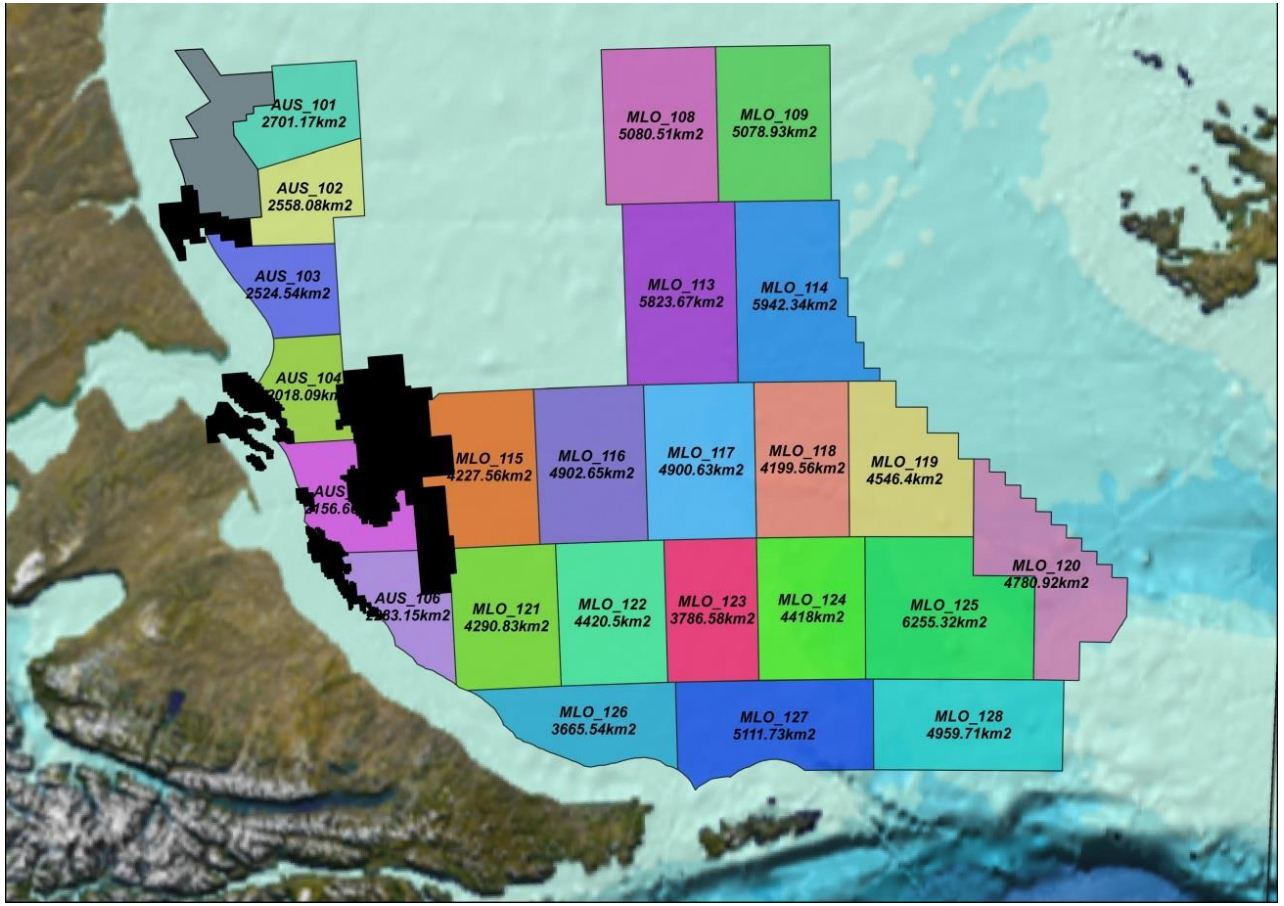
Argentina Offshore Round 1 – Blocks

Malvinas West Basin
86000 Km2

18 Deepwater blocks (WD 100 to 600 m.)
Blocks Surface from 3600 to 6300 Km2

Austral Basin
14000 Km2

6 Shallow water blocks (WD < 100 m.)
Blocks Surface from 2000 to 2700 Km2



- **Exploration Permit: Periods and Surface relinquishment :**
  - Three periods of 4 + 4 + 5 years for all blocks except – Shallow waters (Austral Basin): 4 + 3 + 4.
  - No relinquishment after 1st period and only 50% relinquishment after 2nd period
  - Relinquishment available at any time provided commitments have been fulfilled
  - Obligation to drill one well in 2nd Period and on Extension Period
- **Production Concession:** 30 years + 10 of extension (successive extensions possible)
- **Non Commercial Discoveries**: Possibility to keep discoveries for 5 + 5 years after Exploration Permit if discovery appraised (at least 2 wells in the structure) and need to demonstrate non commerciality.
- **Offers:** On Committed Working Units (WUC) for the 1st Exploration Period.

Offer = WUC x 5000 usd/WU + Bonus*

- Minimum WU (equivalent to 2D of 3 x 3 Km in 100% of the block) If WUC < Minimum WU offer discarded
- Basic WU (equivalent to 3D in 20 to 40% of the block): *If WUC < Basic WU no Bonus accepted
- *Bonus: 50% when obtaining the Permit + 50% at the end of 3rd year (can be compensated with additional WU to WUC)

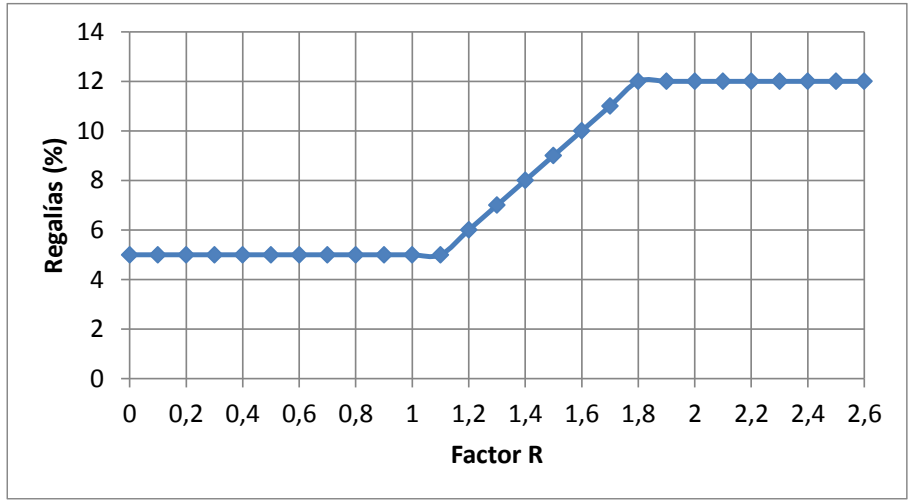
- **Royalties**: Law 17.319 => 12% may be reduced to 5% for Offshore.

$$\text{R Factor} = \frac{Cum\ (Sales - Royalties)}{Cum\ (E\&A + CAPEX + OPEX)}$$

R <= 1,1 => Royalties = 5%

R > 1,1 and < 1,8 = > Royalties = (R * 10)% - 6%

R >=1,8 => Royalties = 12%



- "E&A" will include all historical Exploration activities in the Permit + all wells delineating discovery
- R factor calculation will be done by Production Concession

- **Surface fee:** In line with the Hydrocarbons Law.
  - 1st Period = AR$ 250 /km2/y & 2nd Period = AR$ 1000 /km2/y
  - Extension (3rd Period) = AR$ 17500 /km2/y increasing 25% each year.
  - For the 2nd and 3rd Periods the Surface fee may be exchanged (maximum deduction of 90% of the Surface Fee) for new investments above those already committed.
  - Production Concession Fee = AR$ 4500 /km2/y

Argentina Offshore Round 1 – Bidders Qualification &Registration Process

- **Registration for the Round - Bidders qualification**: Technical & Financial. Individual Registration by company is opened until 30 days before the Bidding date. Payment of 50 Kusd to start Registration and get a HD with the information prepared by Schlumberger.
- **Operator types** :
  - Operator/Non Operator = A / for all blocks (In TEIT 50 & 100 ranking)
  - Operator/Non Operator = B / for Deep y Shallow (< 100 m.)
  - Operator/Non Operator = C / only Shallow

- **Automatic qualification** as Operator/Non Operator A for companies demonstrating they are included in "The Energy Intelligence Top 50 of 100: Ranking the World's Top Oil Companies".

- **Financial requirements:** (i) Avg. Capital Investments 2015/16/17 or (ii) Last Balance Net equity

Operator	Investments Avg 2015/16/17 MMusd	Net Equity MMusd last Balance
A	750	250
B	300	100
C	100	30

Non Operators 50% of requirements of Operators

- **Operator – Technical requirements:**
  - Requirements Operator A:
    - Production > 20000 boe/d average 2015/16/17. This requirement may be also achieved demonstrating the operation of at least 3 exploration wells in water depth of more than 1000 m. in the last 10 years
    - Operated at least in one block in the last 15 years in waters deeper than 500 m. depth (Exploration or Exploitation)
  - Requirements Operator B:
    - Production > 10000 boe/d average 2015/16/17. This requirement may be also achieved demonstrating the operation of at least 3 exploration wells in water depth of more than 100 m. in the last 10 years
    - Operated at least in one block in the last 15 years in waters deeper than 100 m. depth (Exploration or Exploitation)
  - Requirements Operator C:
    - Production > 5000 boe/d average 2015/16/17. This requirement may be also achieved demonstrating the operation of at least 3 offshore exploration wells in the last 10 years.
    - Operated at least in one block in the last 15 years in offshore (Exploration or Exploitation)

- **% Minimum Working Interest**: Operator 30 % / Partner 5%

Argentina Offshore Round 1 – Preliminary Additional Conditions

- **Unitization:** obligation to reach a unitization agreement between the parties, scheme to be included
- **External Guarantee:** Covering pending Working Units commitments. Calculated on a yearly basis. Given by the Operator but partners solidary responsible. Letter of Credit, Bank Guarantee or a Surety Bond will be accepted.
    - 1st Period: 100% of Minimum WU + 25% of WUC Additional to minimum WU + 50% of Bonus.
    - 2nd Period and Extension Period: 10 MMusd (Shallow Blocks) / 17 MMusd (Deep) / 22 MMusd (Ultra Deep) until obligation to drill the well is fullfilled
- **Bidding :** Bid Guarantee of US$ 100K for 120 days
    - Foreign companies will be able to bid, with the commitment to open a Local vehicle if one of the blocks is Pre Awarded to them (they will have 30 days to show they have started the process)
    - **Working Program Flexibility:** The winner of a block will have to pursue the Working program proposed in the bid and fulfill 100% of the number of WU proposed. Changes to the program can be done with the approval by the SEN, changes to the program without SEN approval of up to 40% of the WU committed, only in the case that 40% is fulfilled either with 2D seismic, 3D seismic, or drilling of a well (including casing, coring, testing).
    - **Multiclient WU (Acquisition date before bidding):** 100% of Multiclient Working Units can be applied for the Bid if work was acquired in the last 3 years before the Bidding date, and it is bought by the Bidder up to 18 months after the Permit is awarded. Multiclient WU cannot be considered for the fulfillment of the Minimum Working Units.

- **Arbitration Clause:**
  - Any lawsuit of ≤ than 20 MMusd => Local justice for > 20 MMusd then Arbitration Clause
  - 3 Arbitrators defined one by each Party, and the 3rd one in Agreement between two Parties from the Permanent Court of Arbitration of La Haye (PCA) , if no Agreement then the 3rd Arbitrator will be chosen by the President of the Supreme Court (Hydrocarbon Law Art. 86) from the same PCA panel within 60 days. If the President of the Supreme Court does not appoint the third arbitrator then the parties may request the PCA Secretary-General to carry out such appointment of the third arbitrator (under consideration)
  - Arbitration by agreed rules or otherwise UNCITRAL rules
  - Foreign Shareholder of a Party and the Party should choose between claiming through this Arbitration Clause or by using any Bilateral Investment Treaty
  - Place of Arbitration: Buenos Aires for local companies or otherwise to be agreed by the two Parties in a city of a country having signed the Convention on the Recognition and Enforcement of Foreign Arbitral Awards (New York, 1958) (the "New York Convention") if no agreement, then the Arbitrators should agree on a place in line with Arbitration rules, excluding any of the countries of the Parties
  - Each company in a UTE has the possibility to demand individually

- **Local content:** No local content commitment on investments resulting from the bidding documents.
  - The only commitment will be that included in Laws of general application ("*Compre Nacional*"; "*Contrate Nacional*") whereby local providers may enjoy certain price preferences.
  - The Hydrocarbon Law requires a minimum of 75% of local employees but states that "*this minimum shall be reached within the timeframe set by the regulations or tenders*".
  - Round 1: In Production Phase: 1st year of production 50% of local employees, increasing 5% every year until reaching 75% in the 6th year.

- **Argentina Offshore Round 1 offers a great opportunity for both industry and country**
  - Vast underexplored area (200,000 km2).
  - Little done in the last 20 years, nearly nothing in Deep and Ultra Deep waters while it was one of the main drivers of the industry worldwide.
  - Increasing new technologies show good potential and there are still many others to be applied.
  - High oil prices increase appetite from industry for Offshore plays and Risked Exploration.
  - High awareness of the government on the need to set Competitive conditions.
  - 20 to 25 big offshore players are working on the Round since 1st half of 2018

Argentina Offshore Round 1

www.costaafuera.energia.gob.ar

Argentina Offshore Round 1

Houston - November 2018

Working Units Tables

Value of the WU = 5000 USD

Activity	Units	usd/unit	UT
Acquisition 3D Seismic	km^2	11000	2,2
Acquisition 2D Seismic	km	1200	0,24
Reprocessing 2D TIME Domain	km	200	0,04
Reprocessing 2D DEPTH Domain	km	100	0,02
Reprocessing 3D TIME Domain	km^2	1000	0,2
Reprocessing 3D DEPTH Domain	km^2	500	0,1
Acquisition Potential Methods - Ship (grav/mag)	km	500	0,1
Acquisition Potential Methods - Air (grav/mag)	km	60	0,012
Acquisition CSEM	km^2	5000	1
Acquisition Multibeam	km^2	100	0,02
Drop Cores (includes geochemistry)	N°	17000	3,4

For methods having Km2 as Units, a maximum of 120% of the acquired activity inside the block will be recognized as WU

All acquisitions includes processing

Working Units Tables

	Estimated cost of a dry well without casing (MMusd)							
	Water depth (m.)*							
Total TD BRT (m.)*	Jack up	100 (Floating)	500	1000	1500	2500	3500	4500
500	7,2	15,0						
1000	9,9	21,1	16,5					
2000	13,9	29,7	25,1	24,0	19,0			
3000	17,9	38,5	33,8	32,8	27,8	21,5		
4000	22,0	47,4	42,7	41,8	36,7	30,5	24,0	
5000	26,2	56,5	51,7	50,9	45,8	39,7	33,2	26,5
6000	34,2	65,8	60,9	60,2	55,1	49,0	42,6	35,9
7000	42,2	75,2	70,2	69,7	64,5	58,4	52,1	45,5
8000	47,6	84,7	79,7	79,3	74,0	68,0	61,8	55,3
9000	53,0	94,4	89,3	89,0	83,7	77,8	71,6	65,2
10000	58,5	104,3	99,1	98,9	93,6	87,7	81,6	75,2

*For all values exceeding this table extrapolation following the line tendencies will be used

* The final WU of a well should be obtained by linear interpolation of both parameters WD and TD. With the following procedure:

*For WD <100 m., this UT should be used for any well drilled with a Jackup in shallow waters.
Example: a well drilled in 120 m. of WD with a Jack up should use this <100 m. values

Casing of the well to TD: Increase the above values by 5%

Coring: Increase the above values by 0,5% for every 4,5 m of recovered core.

DST (cased or openhole): Increase the above values by 20%

Working Units Tables

Value of the WU = 5000 USD

	WUs of a dry well without casing							
	Water depth (m.)*							
Total TD BRT (m.)*	Jack up	100 (Floating)	500	1000	1500	2500	3500	4500
500	1440	3000						
1000	1980	4220	3300					
2000	2780	5940	5020	4800	3800			
3000	3580	7700	6760	6560	5560	4300		
4000	4400	9480	8540	8360	7340	6100	4800	
5000	5240	11300	10340	10180	9160	7940	6640	5300
6000	6840	13160	12180	12040	11020	9800	8520	7180
7000	8440	15040	14040	13940	12900	11680	10420	9100
8000	9520	16940	15940	15860	14800	13600	12360	11060
9000	10600	18880	17860	17800	16740	15560	14320	13040
10000	11700	20860	19820	19780	18720	17540	16320	15040

*For all values exceeding this table extrapolation following the line tendencies will be used

* The final WU of a well should be obtained by linear interpolation of both parameters WD and TD. With the following procedure:

*For WD <100 m., this UT should be used for any well drilled with a Jackup in shallow waters.
Example: a well drilled in 120 m. of WD with a Jack up should use this <100 m. values

Casing of the well to TD: Increase the above values by 5%

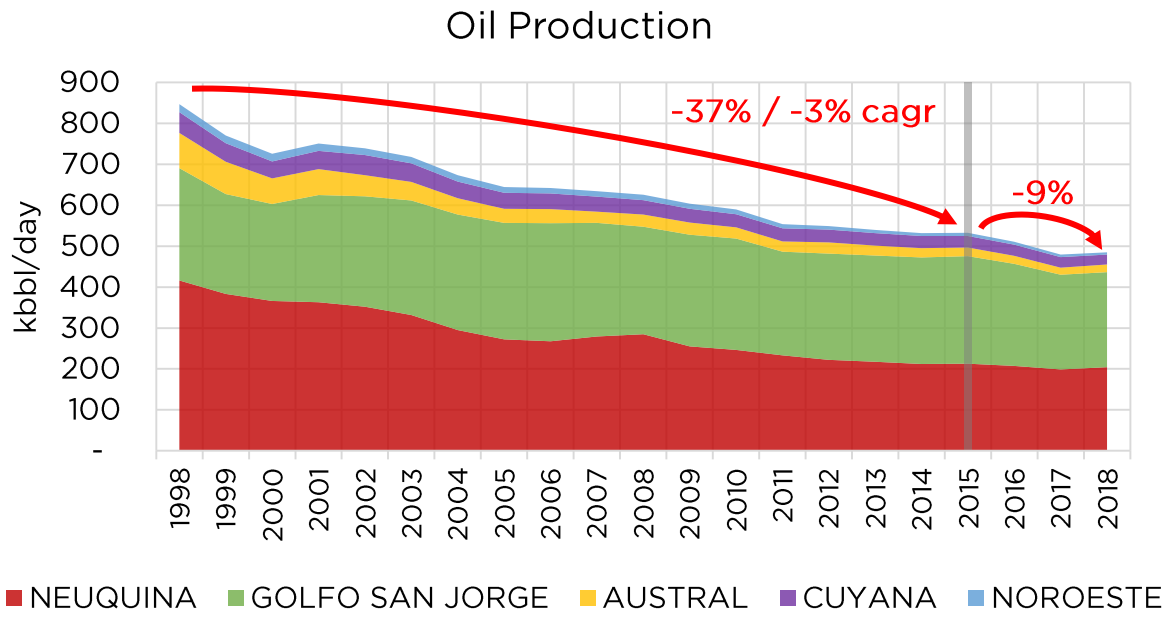
Coring: Increase the above values by 0,5% for every 4,5 m of recovered core.

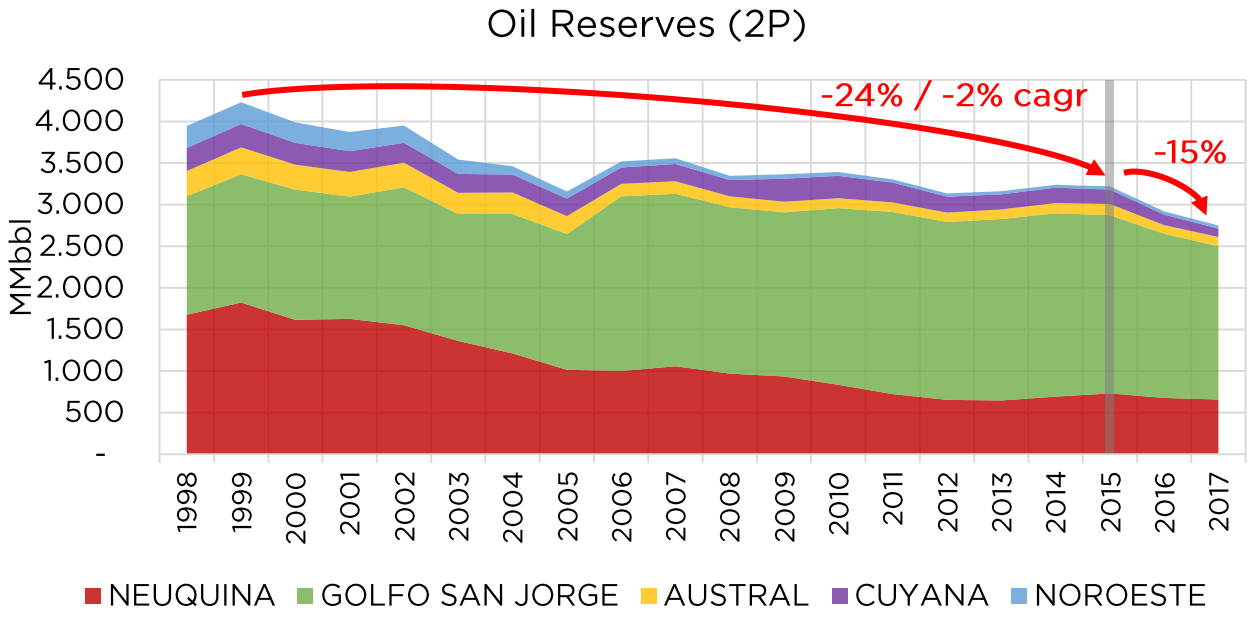
DST (cased or openhole): Increase the above values by 20%

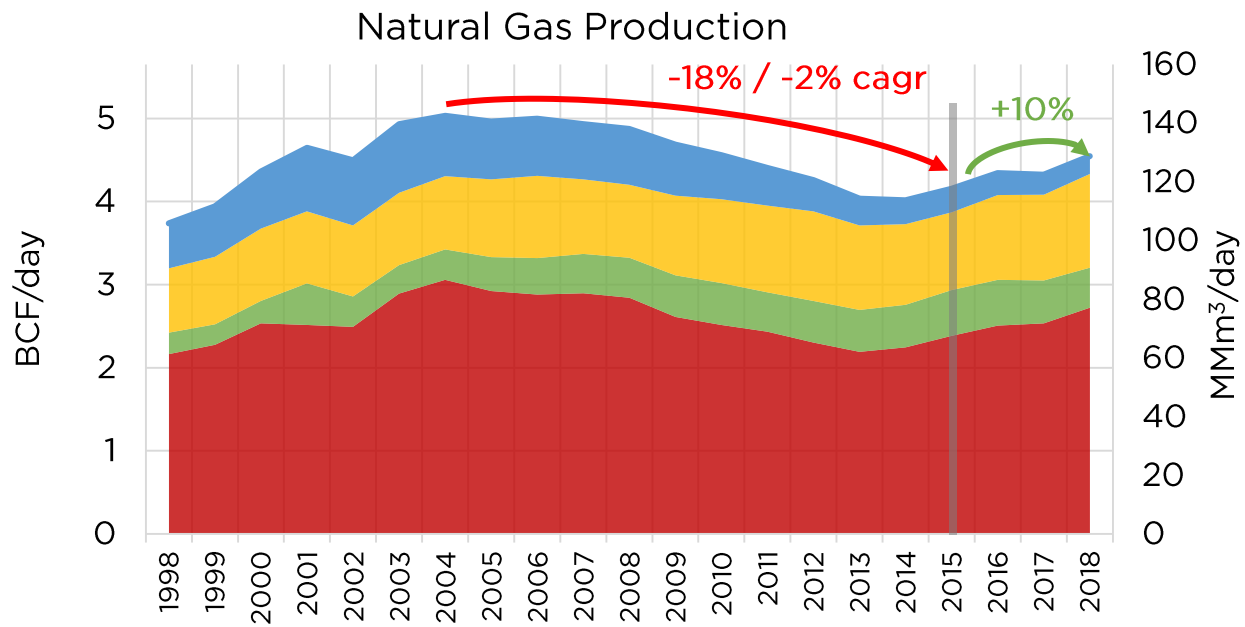
Methodological Subannex

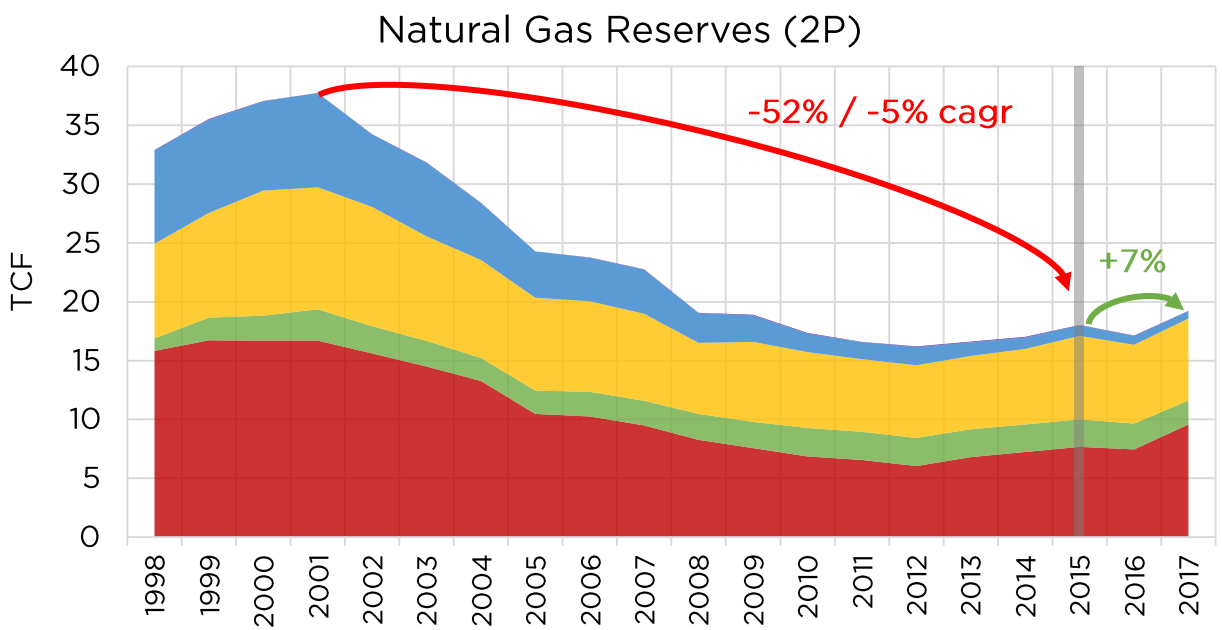
Historical Production and Reserves of Oil and Natural Gas

Secretaría de Gobierno de Energía
Secretaría de Planeamiento Energético





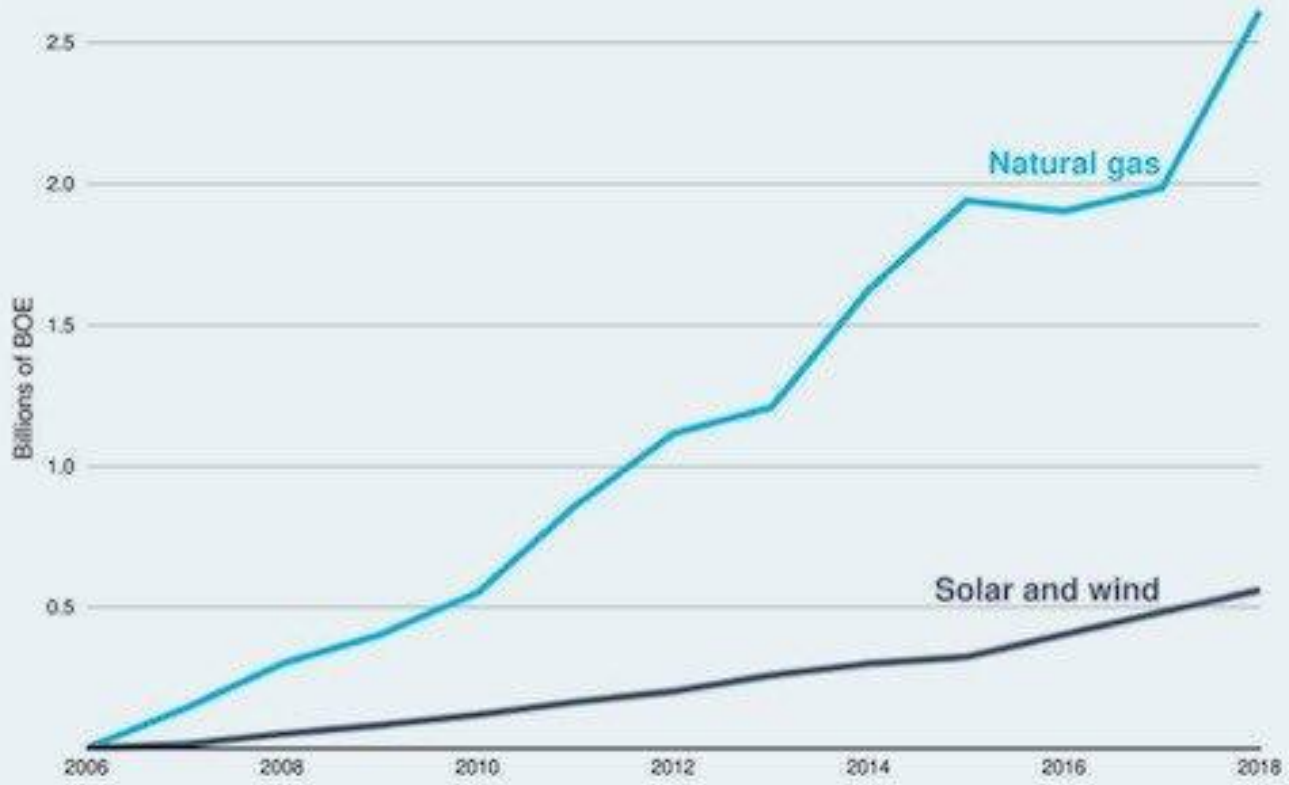




Natural Gas consumption improving as energy supplier

FIGURE 2.

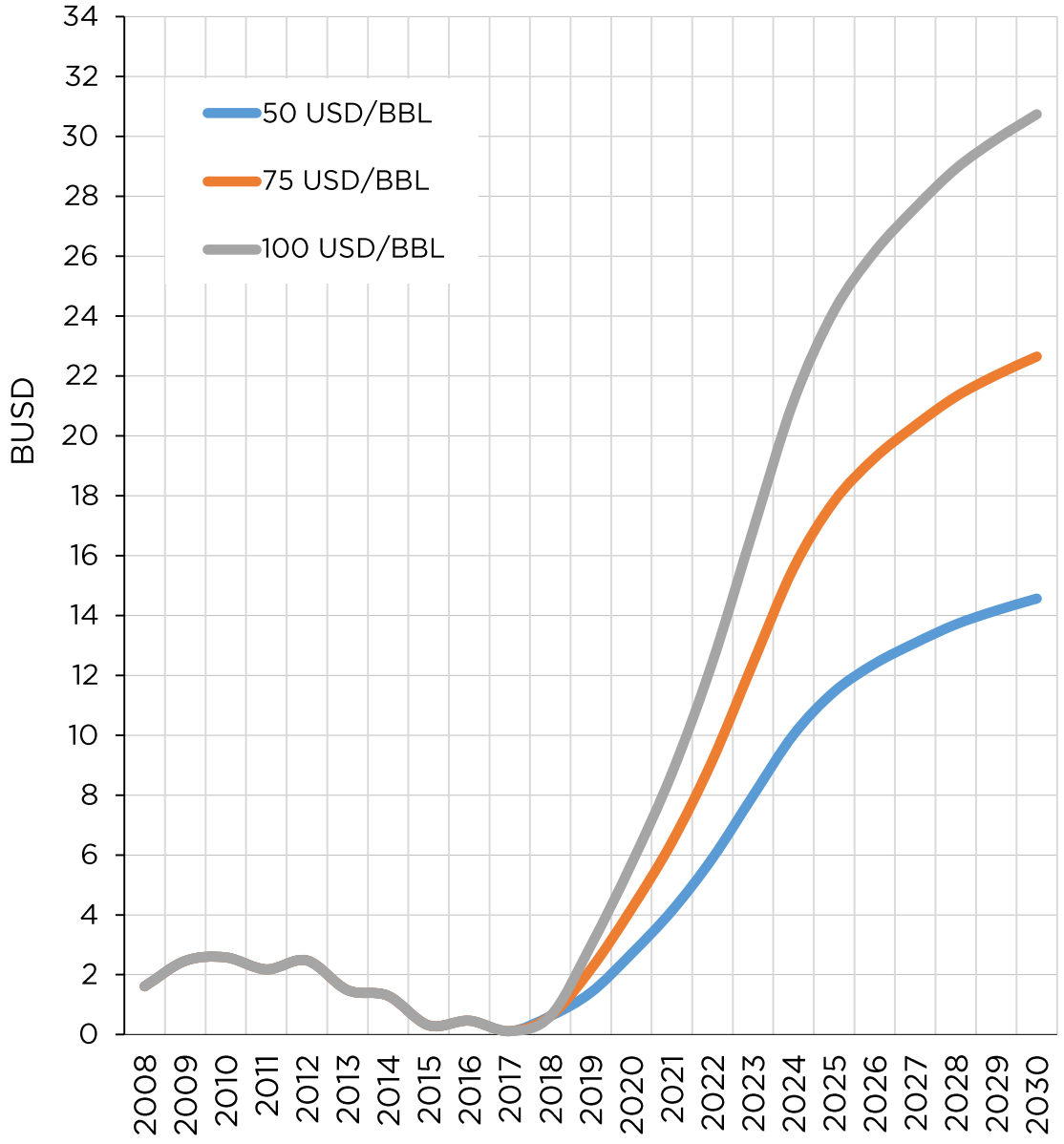
Growth in U.S. Energy Supply: Natural Gas vs. Solar and Wind



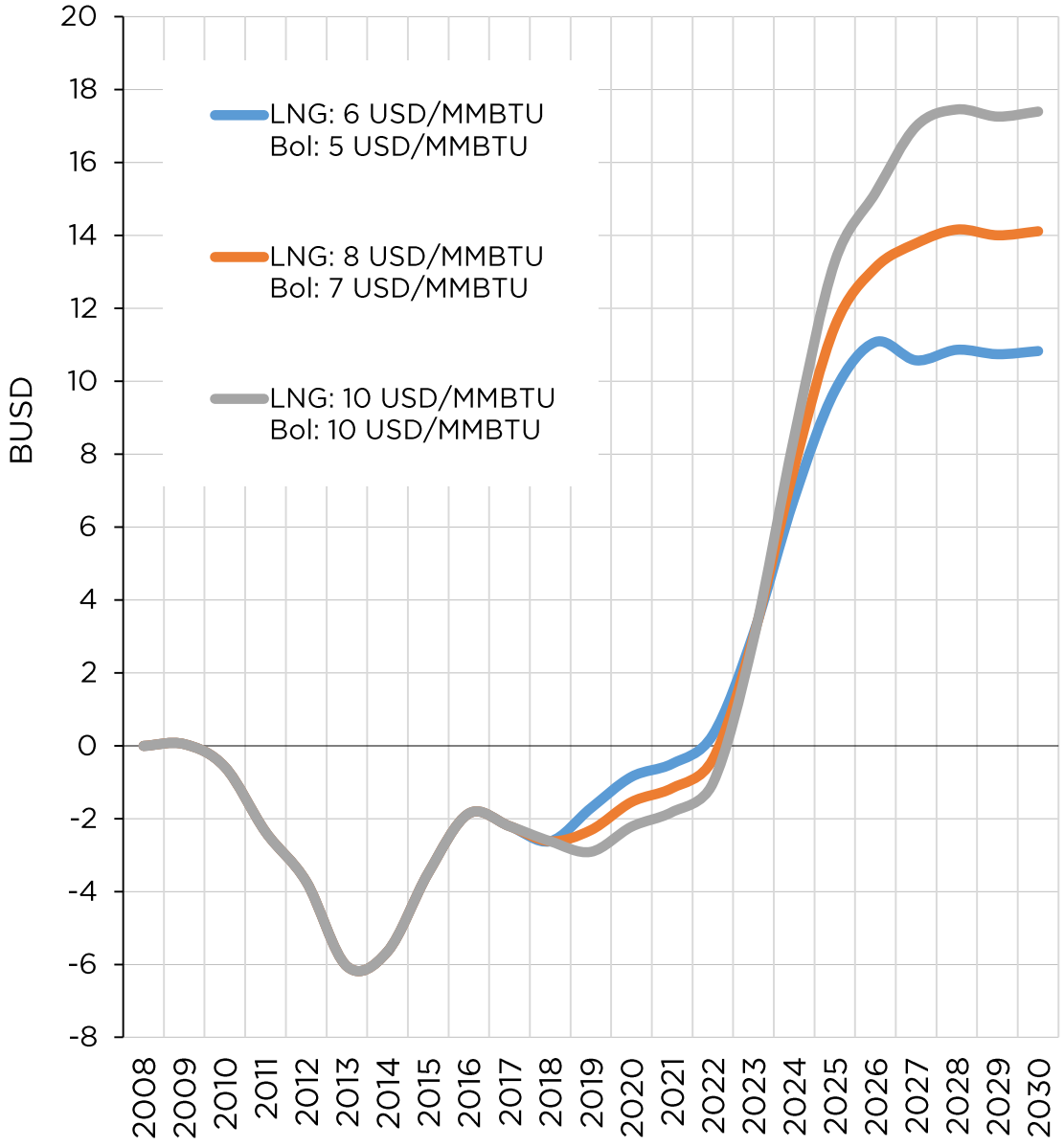
Source: Data drawn from EIA, Monthly Energy Review, July 2018

On track to recover the energy trade surplus

Trade Balance of Oil

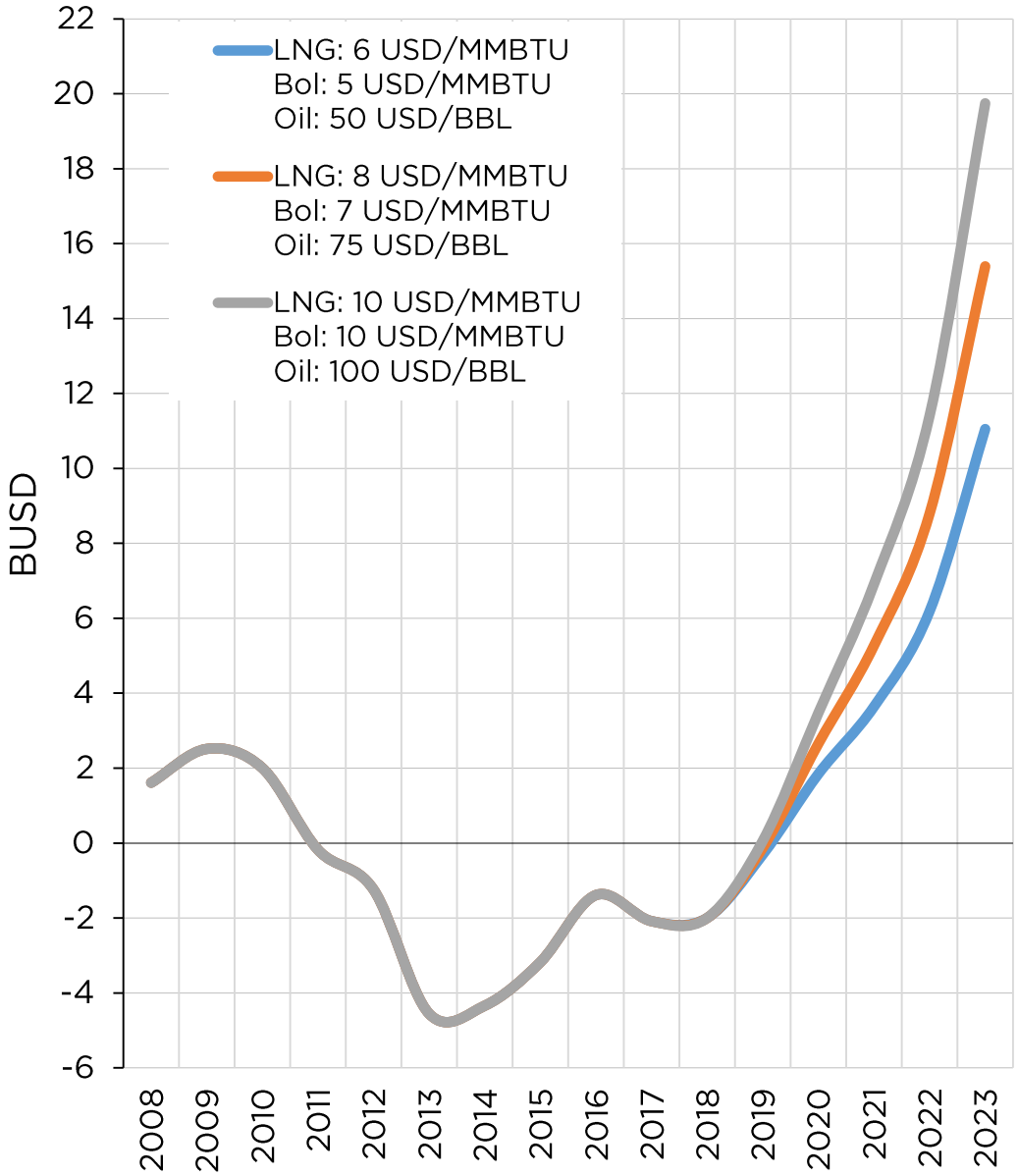


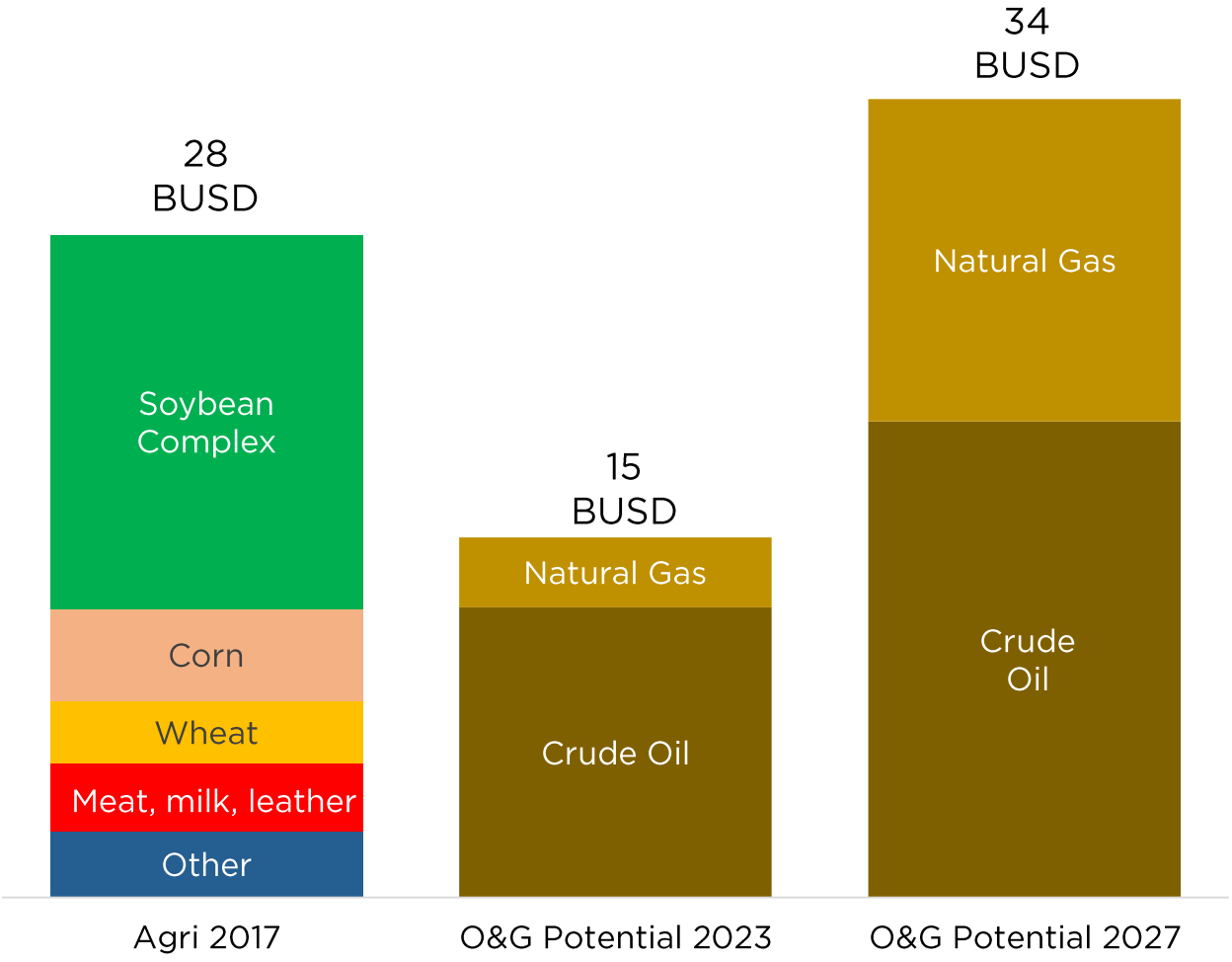
Trade Balance of Natural Gas



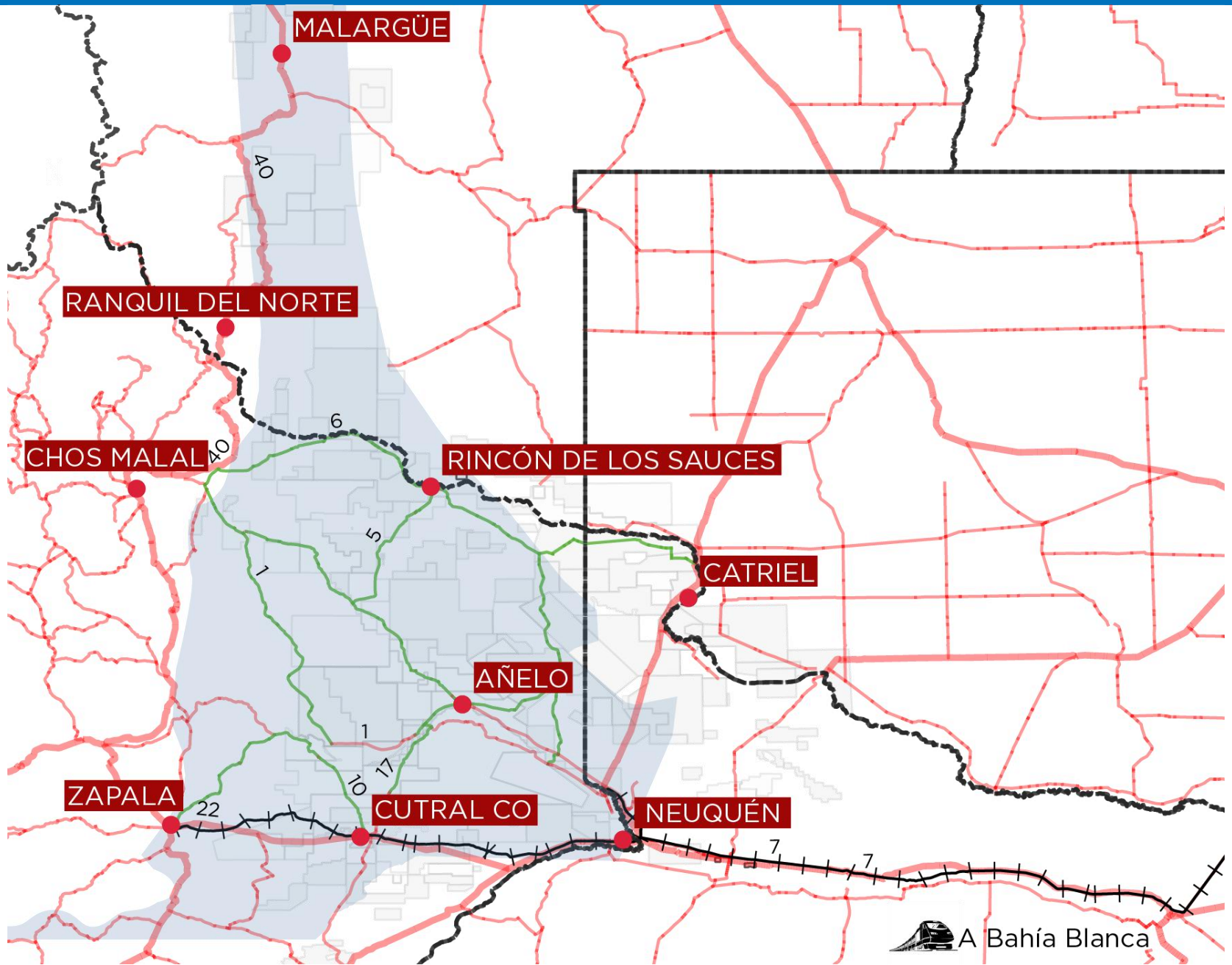
O&G's net exports can surpass current agribusiness exports

Trade Balance of O&G



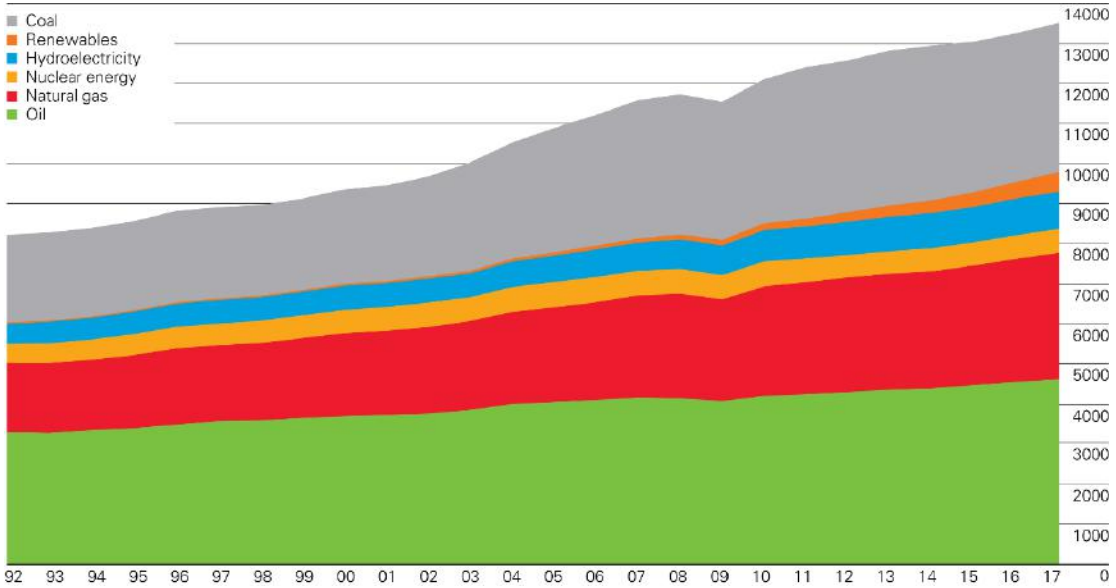


Cities and Interconnections - Resources from Res. 46/2017

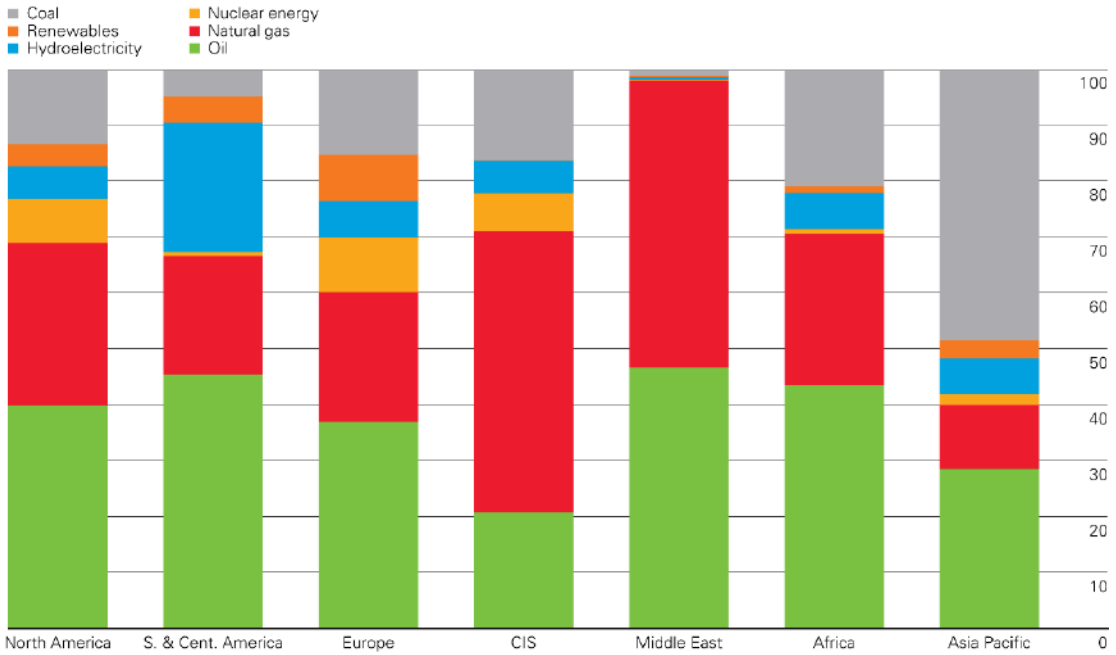


World Energy Matrix - Primary Energy Offer (MMTOE)

GLOBAL



BY REGION

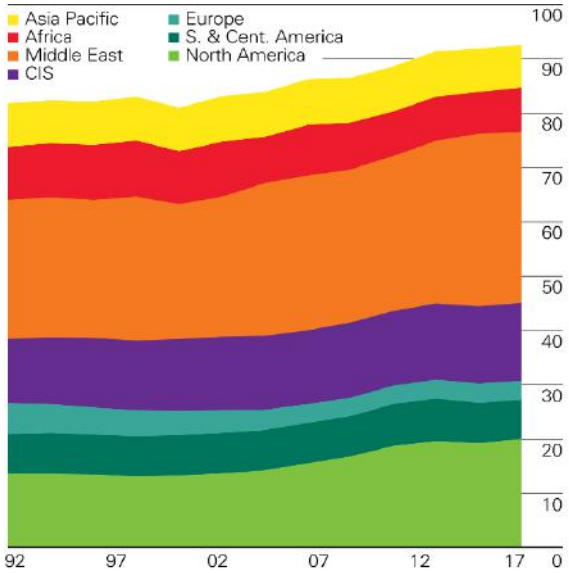


- Coal
- Renewables
- Hydroelectricity
- Nuclear energy
- Natural gas
- Oil

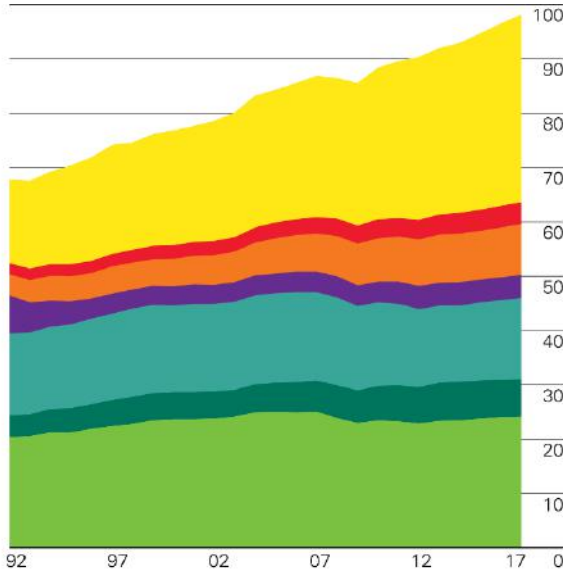
Global energy context - Production, demand and reserves

OIL

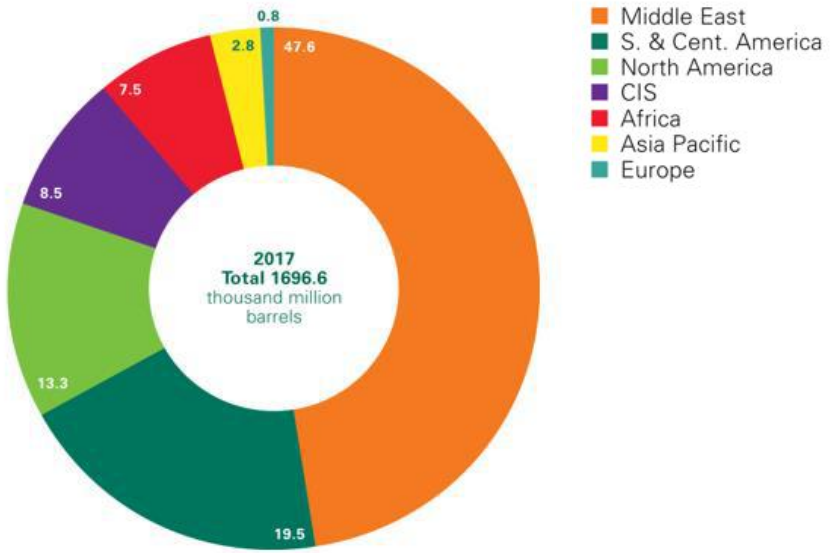
Production – MMBBL/d



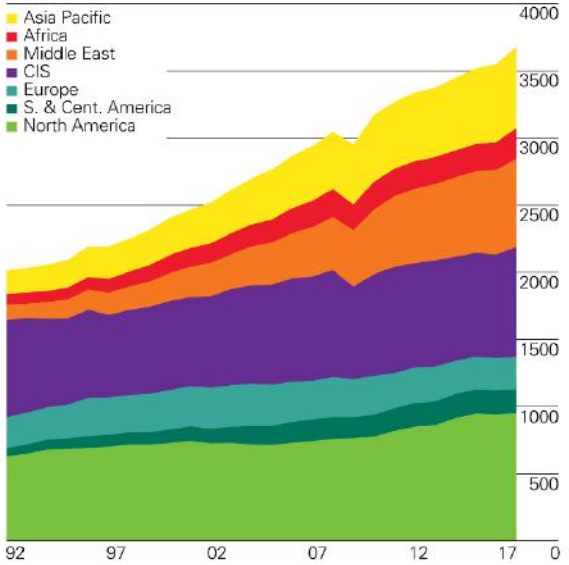
Demand – MMBBL/d

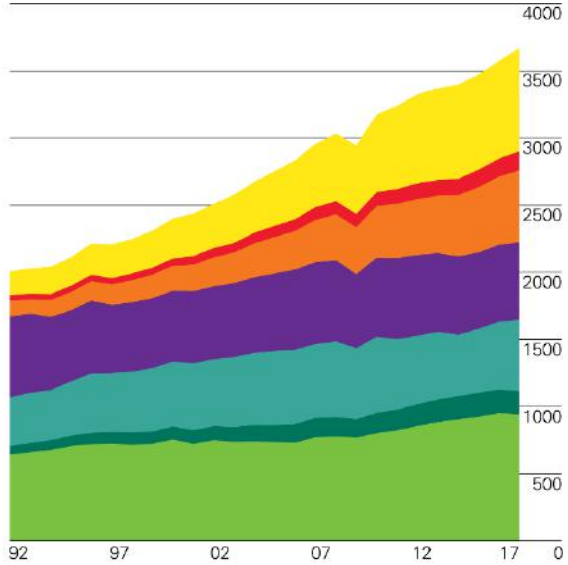


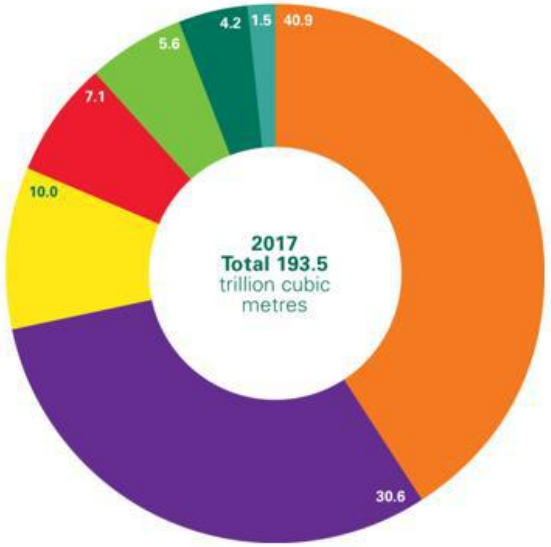
Reserves – %



GAS





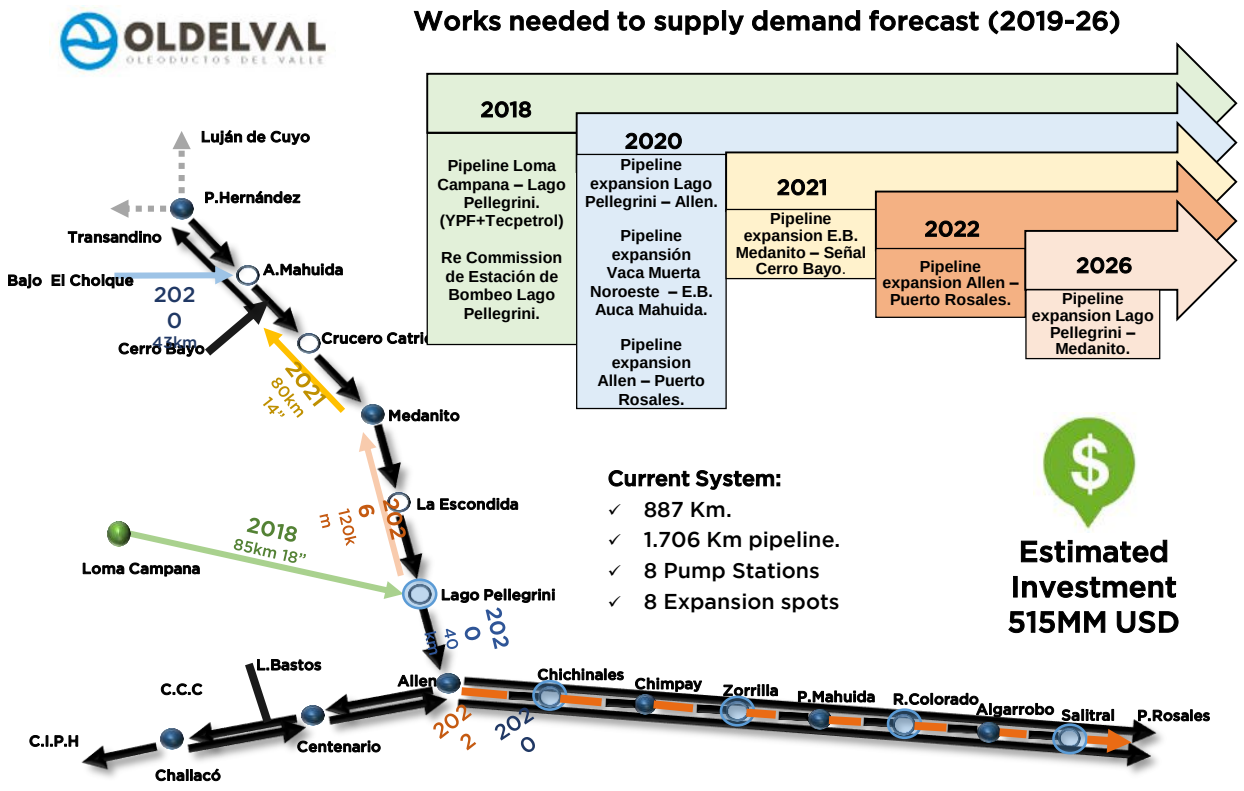


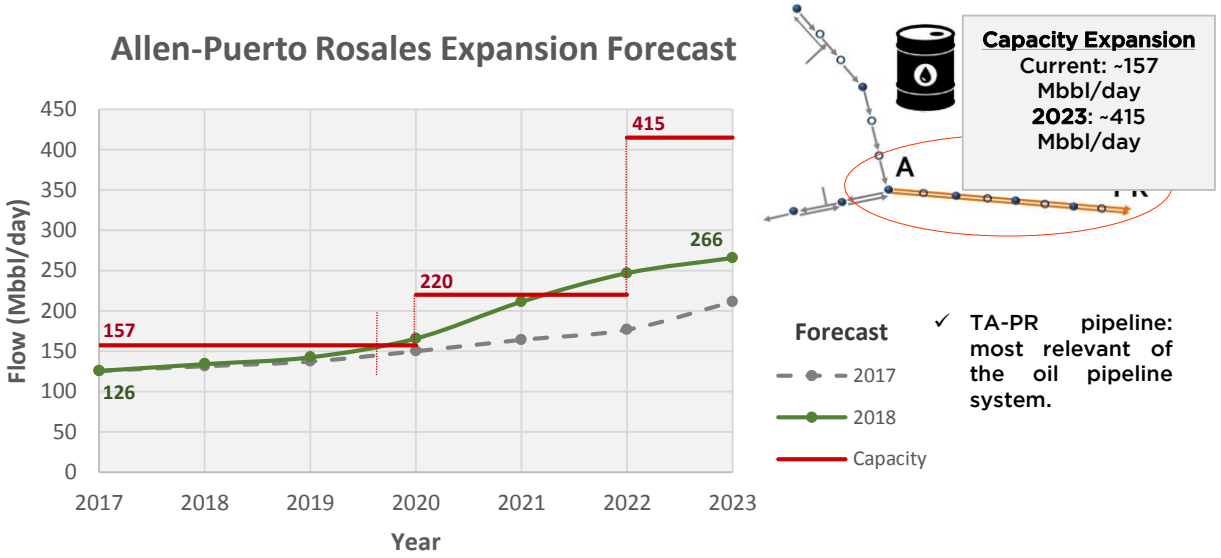
Oil Transport System Expansion (OldelVal)

Current situation

- The exponential growth of non-conventional Oil production in Argentina motivates the study of the transportation system to identify possible bottlenecks and guarantee an adequate infrastructure planning.
- Demand forecast for the period 2019-2023 shows the need to carry out expansion works on the oil transport system.

Oil Transport System Expansion (OldelVal)





✓ TA-PR pipeline: most relevant of the oil pipeline system.

Next Steps

OldelVal Proposition

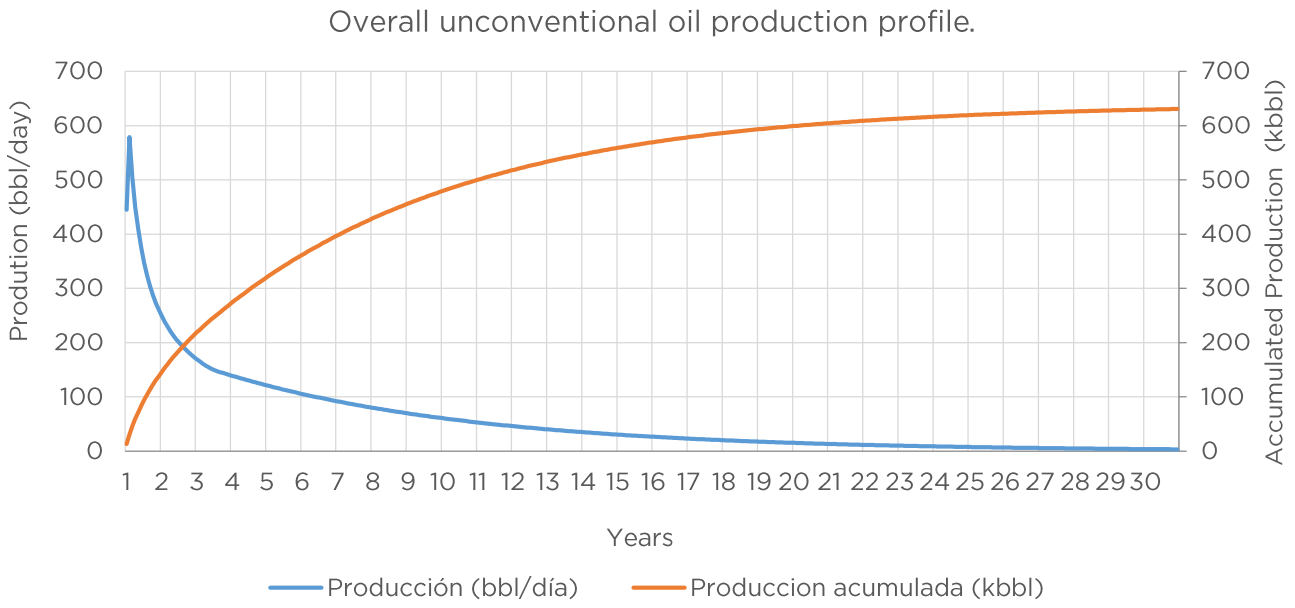
- New Contract Carrier regulation to enable firm offer transport contracts.
- Time extension of Oldelval concession to match investment amortization period.

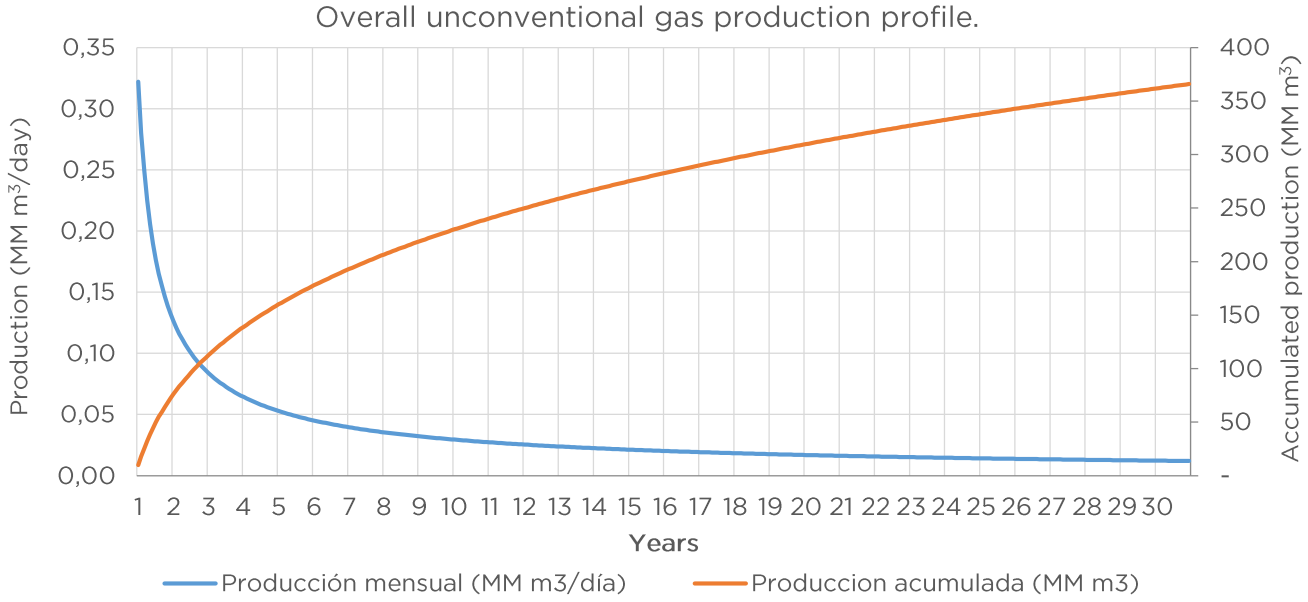
Expected Results

- Financial viability of oil pipeline expansions.
- More flexibility for producers to match transport contracts with upstream projects.

Main assumptions about profiles

	Natural Gas	Oil
	Conventional assumptions	
EUR (y15)	1.5 BCF	180 kbbl
Declination	-15%	-9%
Risked P1ND/P2/P3	100% / 50% / 10%	100% / 50% / 10%
Incorporation of reserves in the first year	5%	5%
Incremental incorporation reserves	+0.3% per year	+0.3% per year
Production in the first year of the reserves incorporated	16.4%	11.9%
Capex	2.5 MM USD	2.5 MM USD
Total reserves incorporated	6 TCF	25 MM BBL
	Unconventional assumptions	
EUR (y30)	12,9 BCF	631 kbbl
EUR total (y30)	2,388 kboe	820 kboe
Condensed	1 m3 oil per 28,000 m3 gas	-
GOR	-	300 m^3 gas per m^3 oil
Capex	12,2 MM USD + 15% facilities	10,2 MM USD+ 15% facilities
Opex	5.9 USD/BOE (1 USD/MMBTU)	7 USD/BOE
Fractures	33	33
Total reserves incorporated	55 TCF	5.5 Bbbl
EIA 2013	7%	21%
Breakeven	4 USD/MMBTU	46.7 USD/BBL





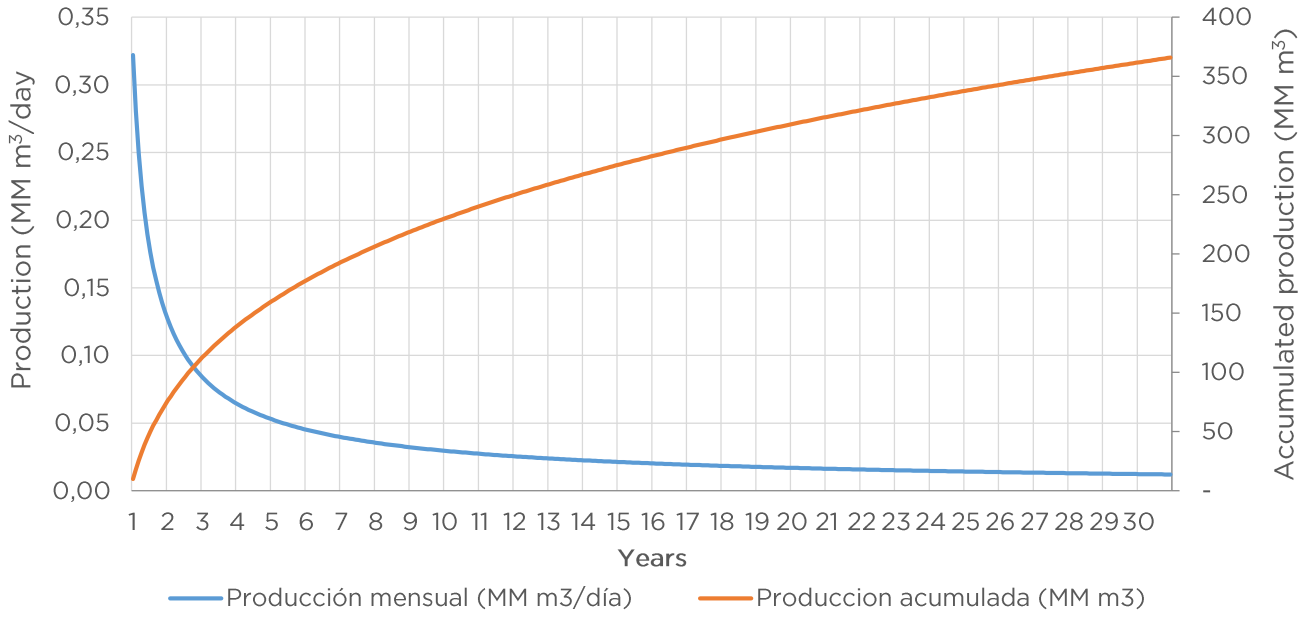
Main assumptions about Natural Gas production

Conventional production:

- P1D (72%): declines @ 15%
- P1ND (100%) + P2 (50%) + P3 (10%):

Total incorporated reserves: 172 Billion m^3 (6 TCF).

- Incorporation of reserves in the first year: +5%
- Incremental incorporation reserves: +0.3%
- The production in the first year is 16.4% of the incorporated reserves, then decline equal to developed reserves (-15%).
- Accumulated production per well: 42 Million m^3 (1.5 BCF)
- Cost per well: 2.5 MM USD



Overall unconventional production profile

- EUR_{y30} = 366 Million m^3 gas (12.9 BCF).
- Total EUR = 2,388 kboe
- Capex = 12.2 MM USD + 15% of *facilities.*
- Opex = 5.9 USD/boe (1 USD/MMBTU)
- IP 30: 0.33 MM m^3/day gas
- Condensed: 1 m^3 de oil per 28,000 m^3 of gas
- Horizontal well with 33 fracture stages, 250 tons of sand per fracture
- 40 perforation´s days

Profile of 30% of the best shale gas horizontal wells

Break-even: 4 USD/MMBTU

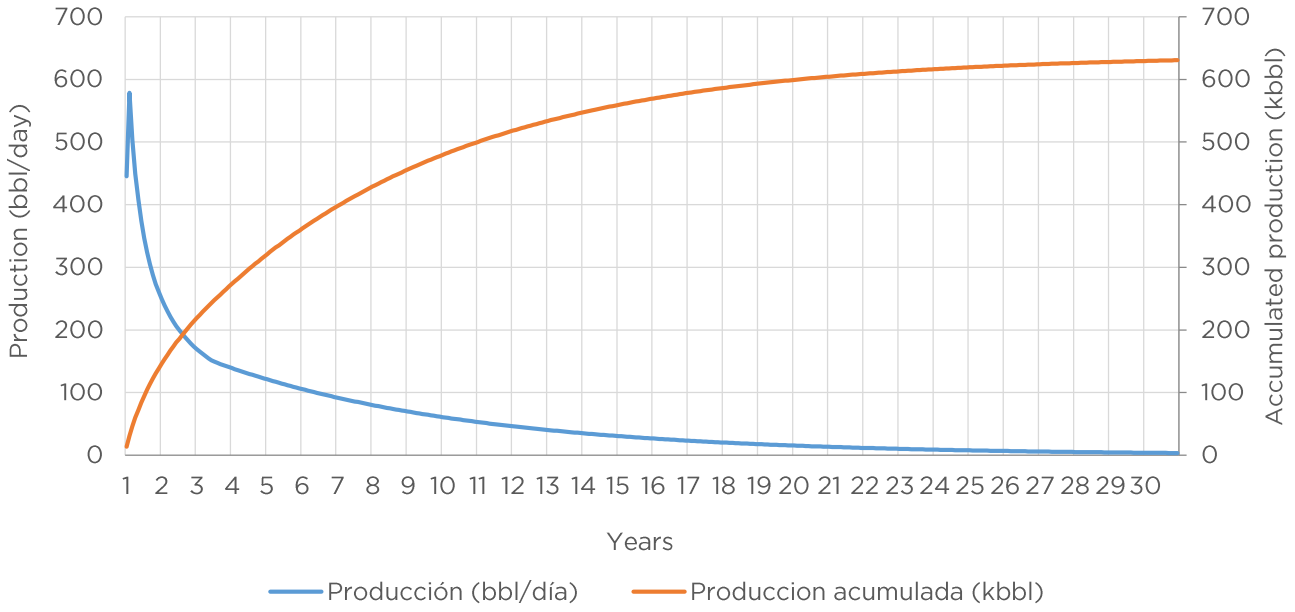
Main assumptions about Oil production

Conventional Production:

- P1D (72%): declines @ 9%
- P1ND (100%) + P2 (50%) + P3 (10%):

Total incorporated reserves : 157 Million m^3 (25 MM bbl).

- Incorporation of reserves in the first year: +5%
- Annual incremental incorporation reserves : +0.3%
- The production in the first year is 11.9% of the incorporated reserves, then decline equal to developed reserves (-9%).
- Accumulated production per well: 28.6 thousand m^3 (180 kbbl)
- Cost per well: 2.5 MM USD.

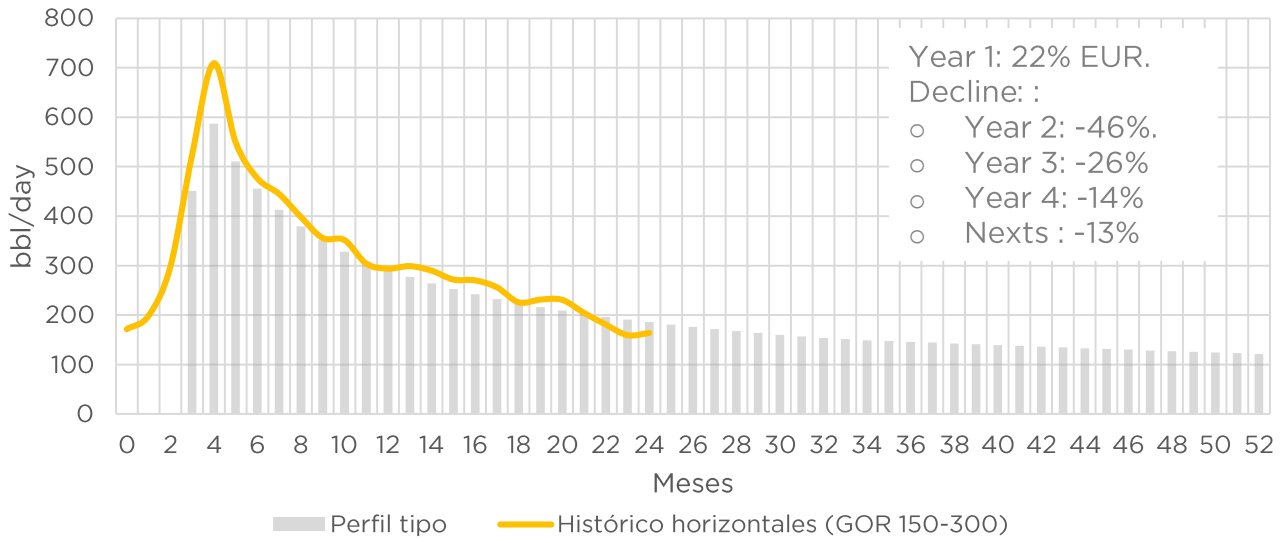


Overall unconventional production profile

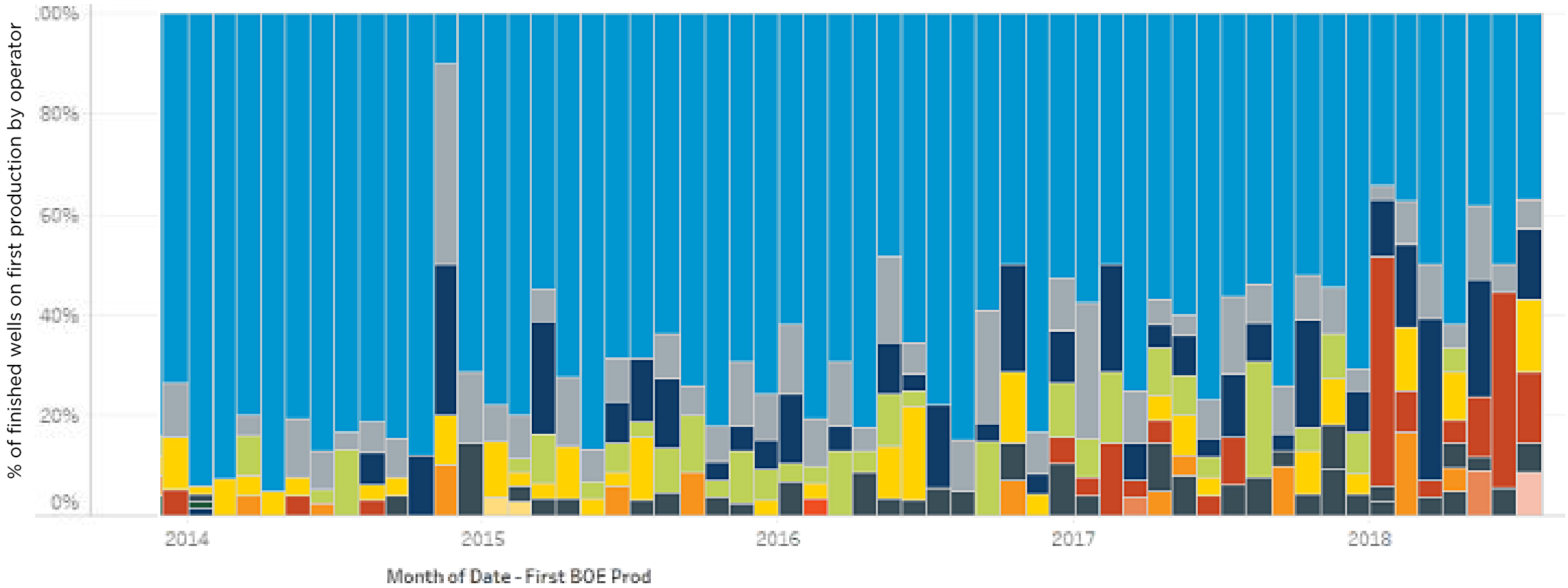
- EUR_{y30} = 100.3 mil m^3 oil (631 kbbl).
- EUR Total = 820 kboe.
- Capex = 10.2 MM USD + 15% de *facilities.*
- Opex = 7 USD/boe
- IP 30: 92 m^3/d oil (579 bbl/day)
- GOR = 300 m^3 gas/m^3 oil
- Horizontal well with 33 fracture stages, 250 tons of sand per fracture
- 40 perforation´s days

Break-even: 46.7 USD/BBL

Profile of 30% of the best shale oil horizontal wells



Activity is increasingly driven by new players (IHS – Markit)

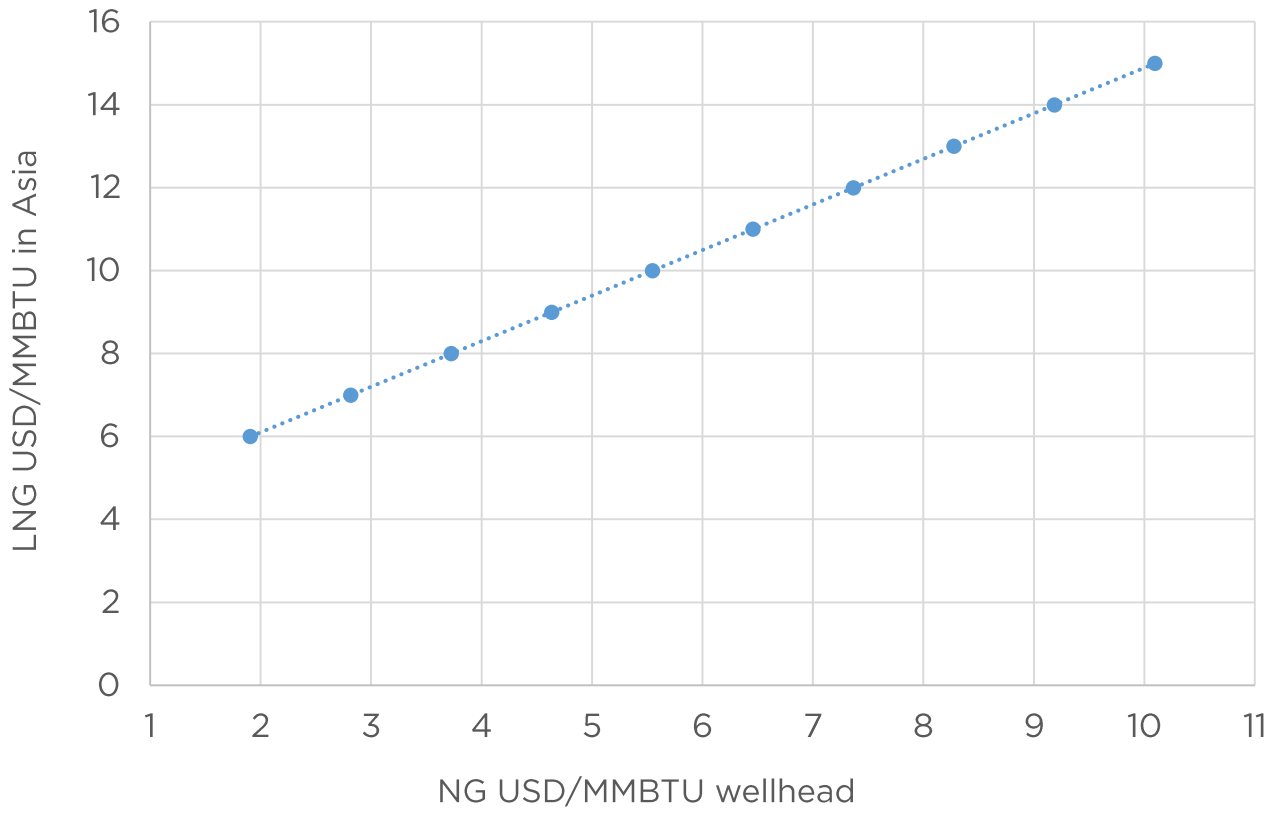


YPF
Petrobras/Pampa
Capex
Chevron
PAE
Total
Shell
Wintersall
Pluspetrol
Tecpetrol
ExxonMobil

Natural gas liquefaction plant analysis

- Gradual incorporation: 40 MMm³/day in 2023, 80 MMm³/day in 2024 and 120 MMm³/day in 2025.
- The cost of liquefaction ranges between USD 2.5 / MMBTU and USD 3.6 / MMBTU, depending on the price of gas in PIST (for each USD that increases local gas, the cost of liquefaction increases 0.1 USD).

Gas price at the wellhead that makes the project viable



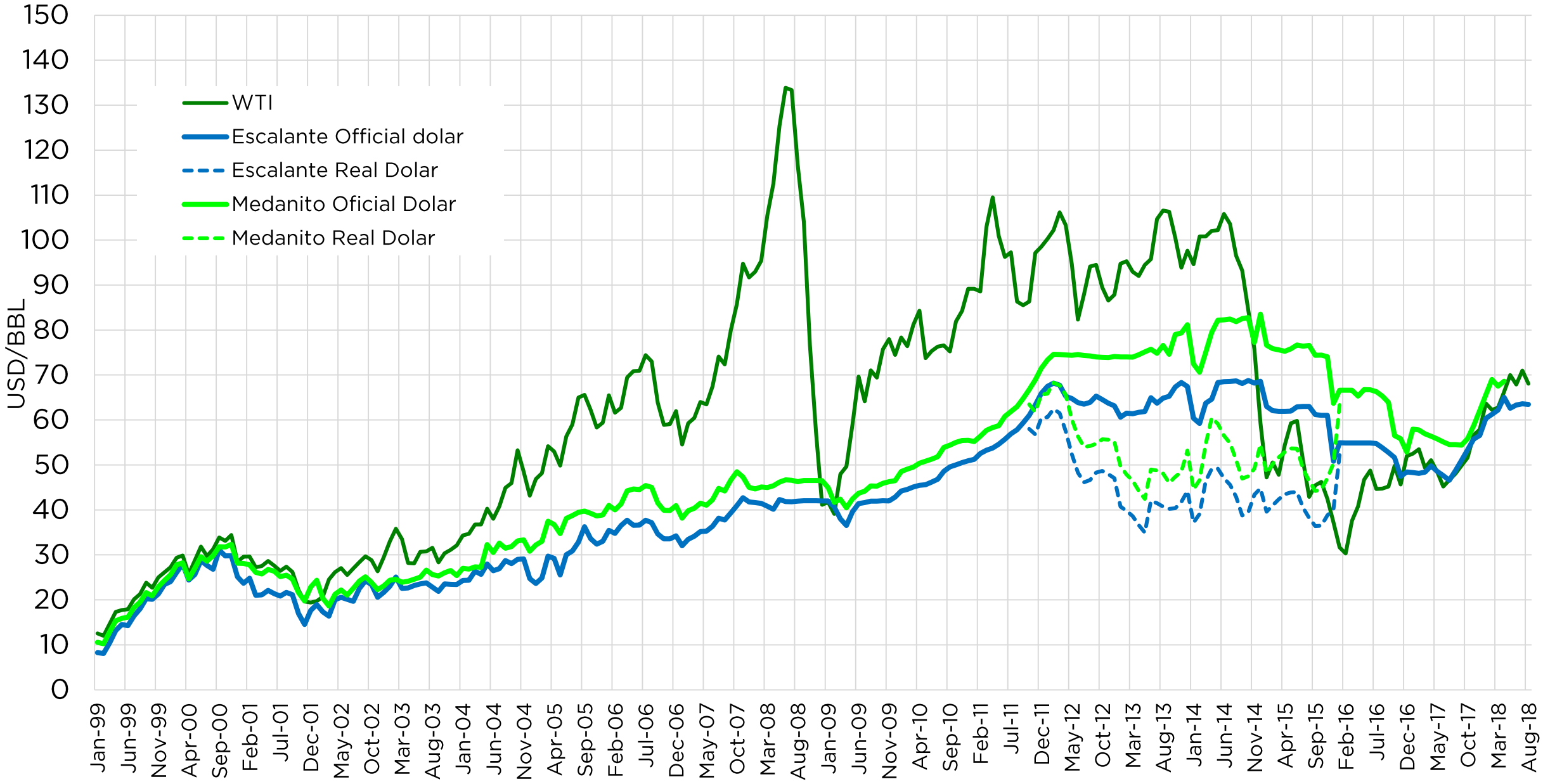
Plant assumptions:

- Capacity per train: 5 MMmtpa (20 MMm³/day)
- Number of trains: 6
- Total capacity: 30 Mmmtpa (120 MMm³/day)
- CAPEX: 600 USD/tpa installed
- Total investment: 18 thousand MMUSD
- Discount rate: 9% in USD
- Amortization period and useful life: 25 years
- Natural gas own consumption: 9%
- OPEX: 0.65 USD / MMBTU

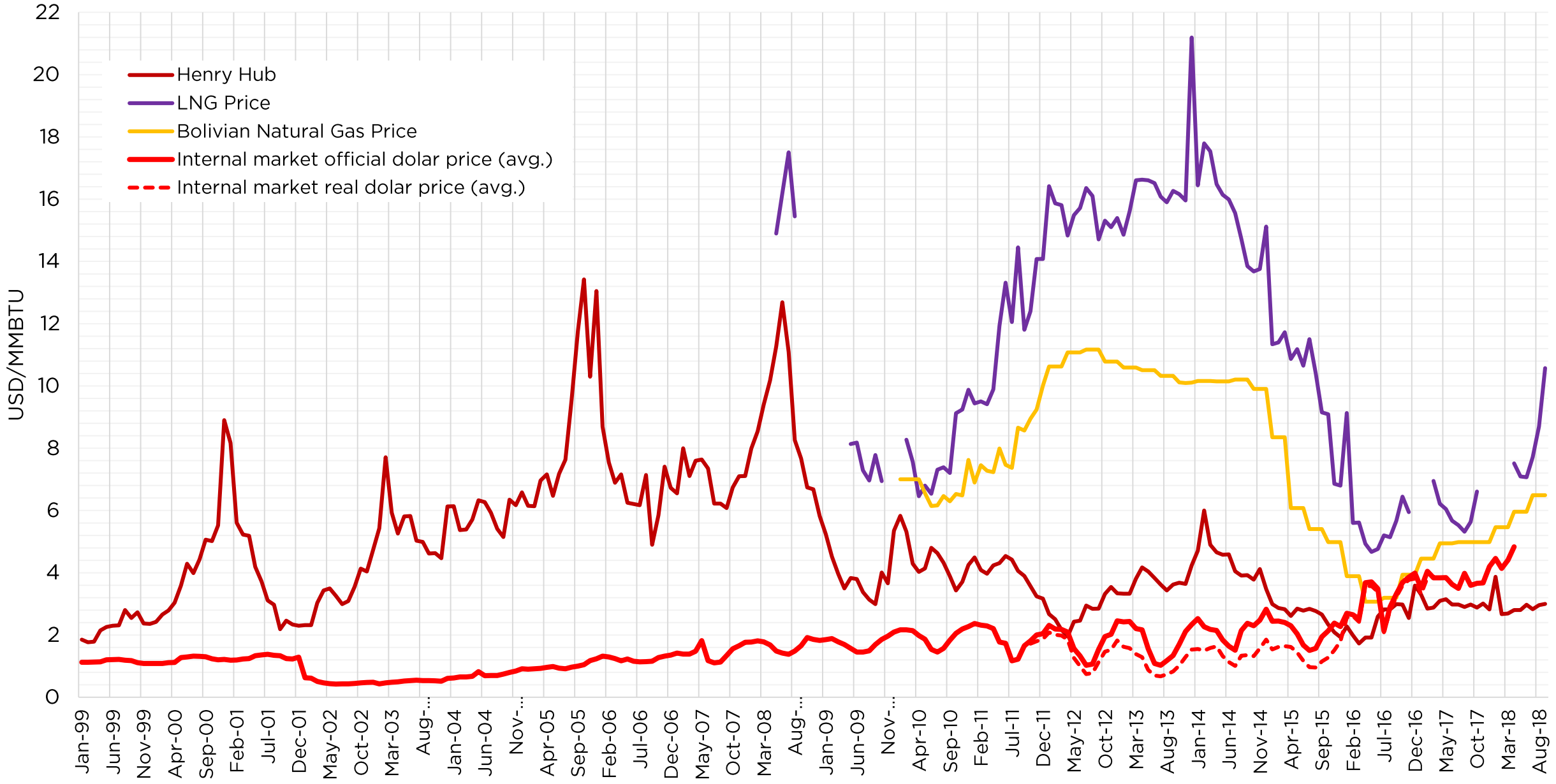
Transportation assumptions:

- Local Transportation – new gas pipeline-: 0.75 USD/MMBTU
- GNL shipping:
  - USA – Argentina: 1.0 USD/MMBTU
  - USA – Asia: 1.8 USD/MMBTU
  - Argentina – Asia: 1.6 USD/MMBTU

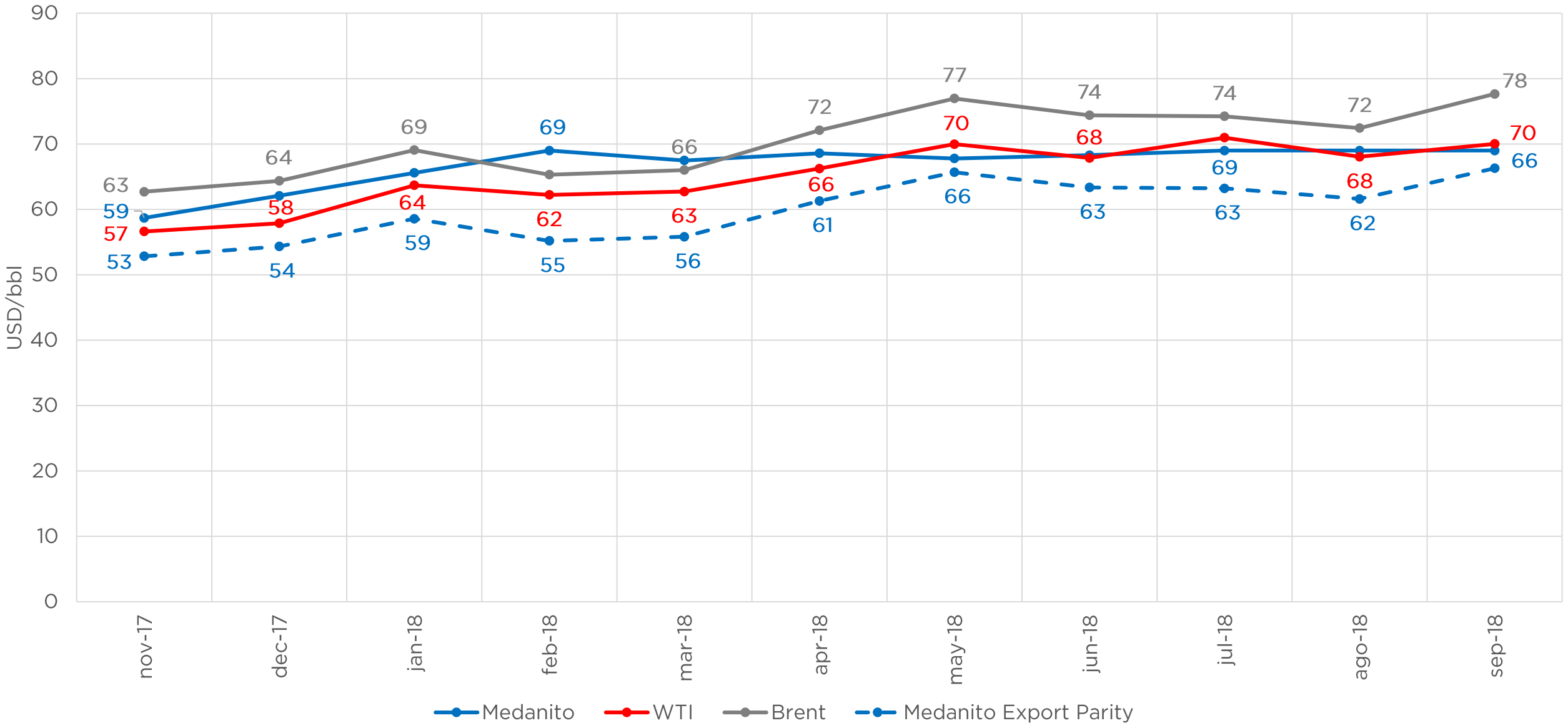
World context and Argentina: Crude oil prices



World context and Argentina: Natural gas prices



WTI and Brent vs Medanito



Note: Medanito Export Parity was estimated using Brent -4 USD/bbl (transport) -10% (export tax).

Medanito vs. Brent

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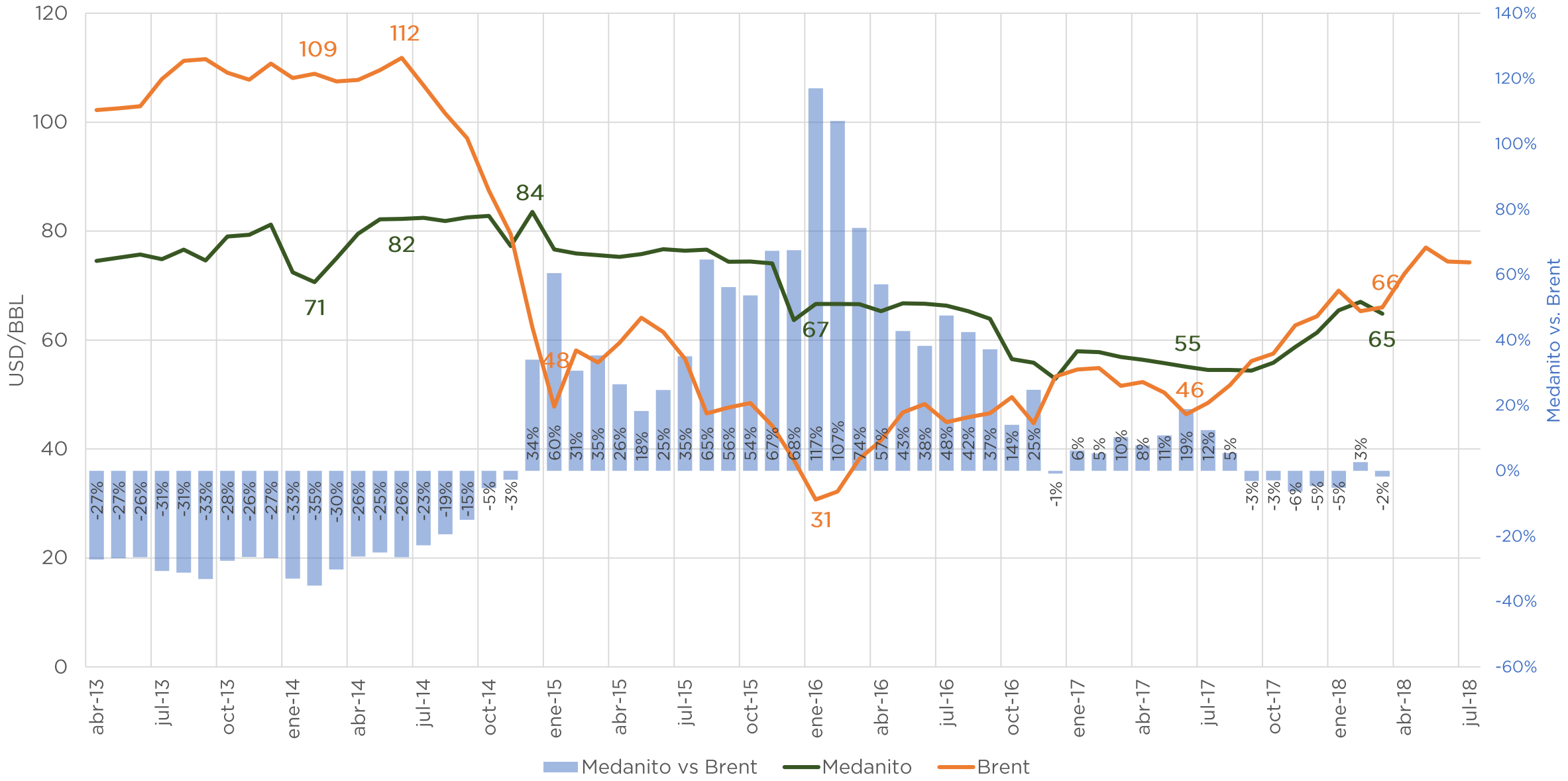
Secretaría de Planeamiento Energético

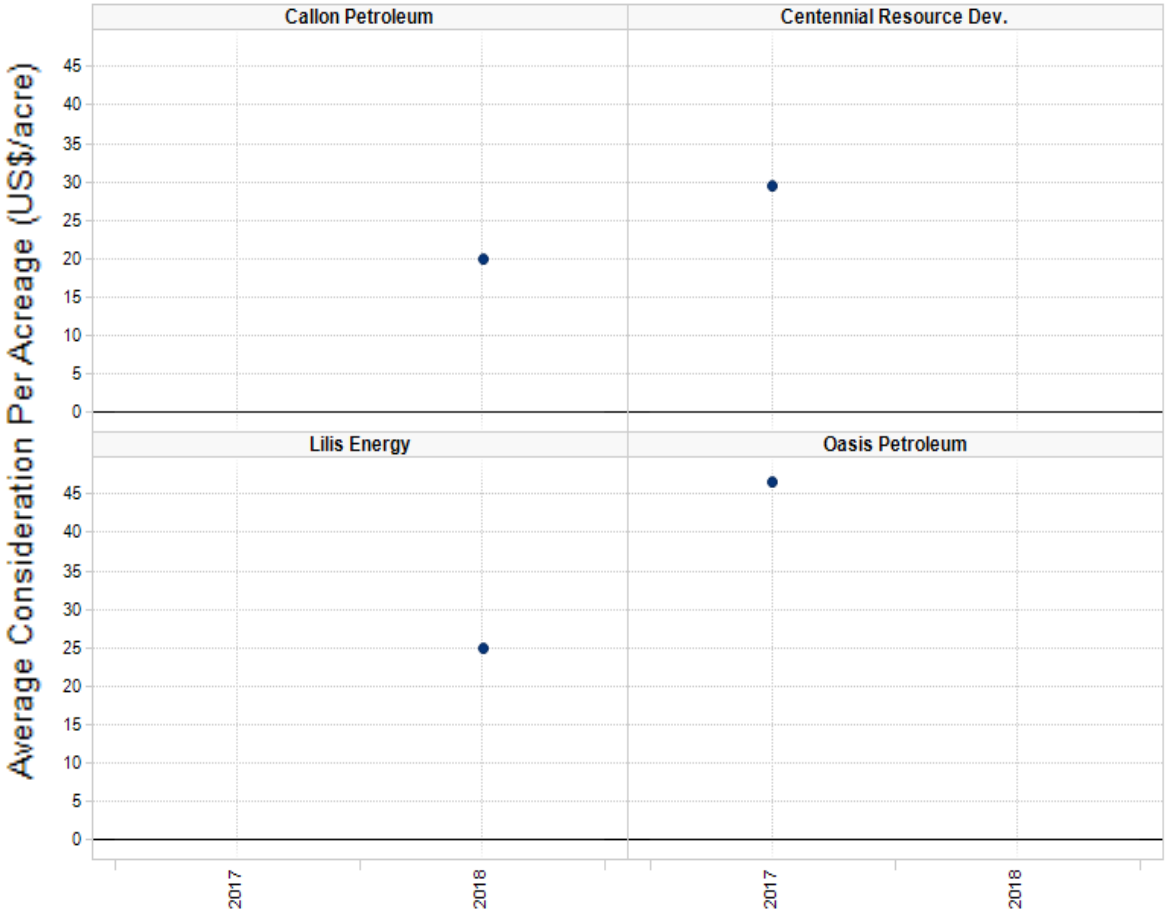


Sources: Energy Information Administration (EIA) y Ministerio de Energía de la Nacion

Anadarko's Delaware Wolfcamp Northeast Extension position used as base asset to benchmark across regions (Wood Mackenzie)

- Anadarko holds approximately 240,000 net acres in the Delaware Wolfcamp NE Extension.
- Remaining PV post-tax of this acreage is US$ 4,286 million.
- 2017 and 2018 M&A deals in the same sub-play closed between US$ 25,000 and 40,000 per acre.
- Assuming US$25,000/acre for a potential new entry in 2019, the cost of acquiring this position would be US$ 6,000 million.
- A US$15,000/acre price, reflective of earlier entries, equals to a US$ 3,600 million acquisition cost (used in the benchmarking exercise).

2017/2018 M&A transaction prices in Wolfcamp A NE Extension



Fiscal regime and product pricing assumptions (Wood Mackenzie)

Argentina fiscal terms and oil pricing assumptions

Royalty:	12%
Sales Tax:	2%
Income Tax	
2018	35%
2019	30%
2020	25%

Oil price

Brent – 10% export retention (assumes ARS4/USD exported)

Anadarko Delaware Wolfcamp Northeast Extension asset assumptions

Lease Information

Basin	Gross Acres ('000 acres)	Net Acres ('000 acres)
Delaware	590	240

Type Well Assumptions

EUR (mmboe)	Initial Production Gas (mmcfd)	Initial Production Oil (b/d)	Initial Production NGLs (b/d)	Royalty Rate (%)
1.1	1.54	770	173	18.00

Remaining Recoverable Reserves (at 01/01/2018)

Proved Developed			Proved + Probable (2P)		
Liquids (mmbbl)	Gas (bcf)	Total (mmboe)	Liquids (mmbbl)	Gas (bcf)	Total (mmboe)
36.50	75.56	49.80	916.37	1,571.67	1,192.98

Net Development Drilling in the play

2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
25	33	16	80	77	46	46	62	46	31

Applicable Tax Rates by State

State		Severance	Ad Valorem	Income
New Mexico	Oil	8.24%	2.50%	7.60%
	Gas	9.09%		
Texas	Oil	4.60%	4.00%	n/a
	Gas	7.50%		