



# Argentina Energy Plan

## — Guidelines —



Secretaría de Gobierno de Energía

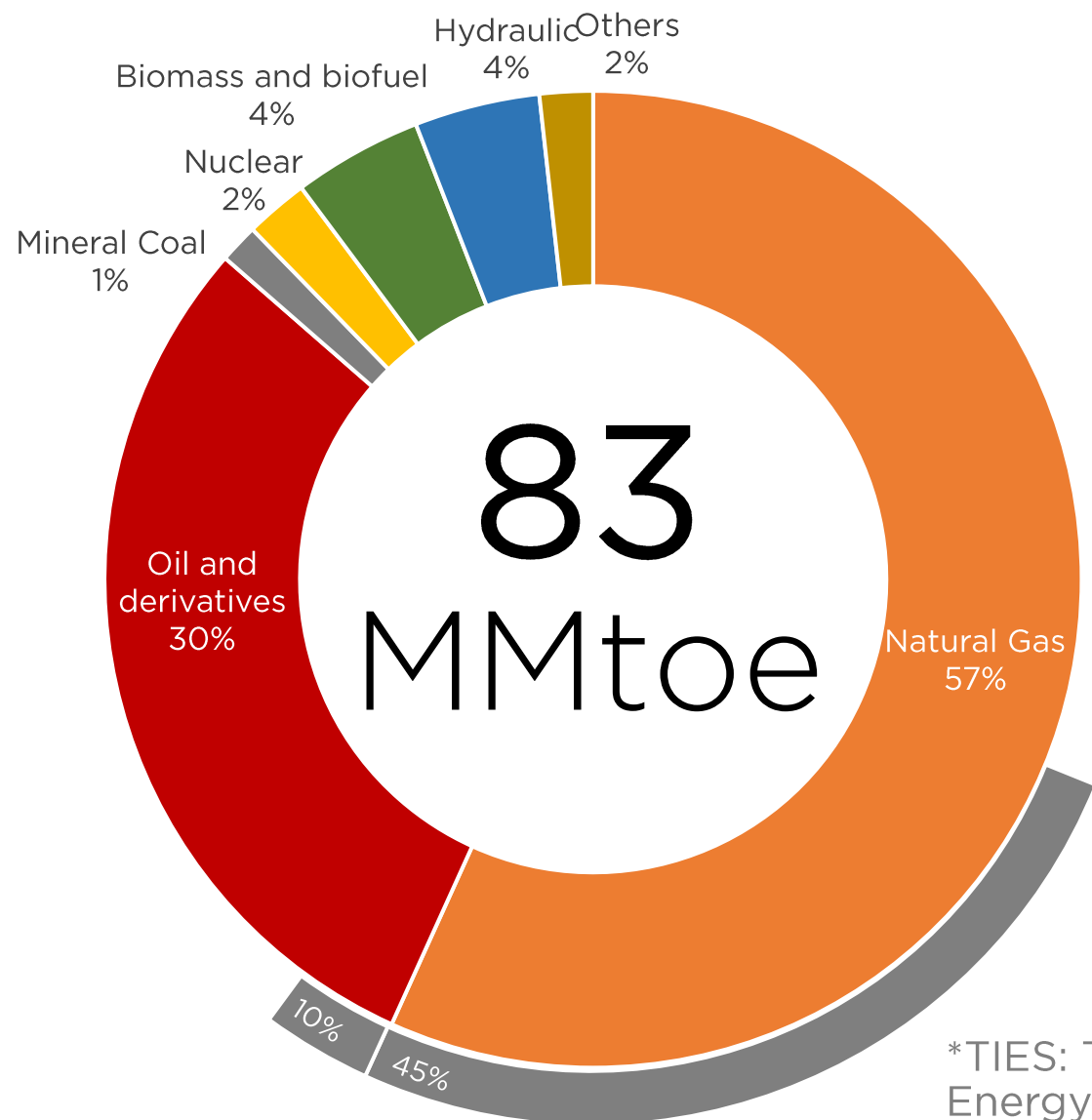
Secretaría de  
Planeamiento  
Energético

Provide Argentiniains 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.

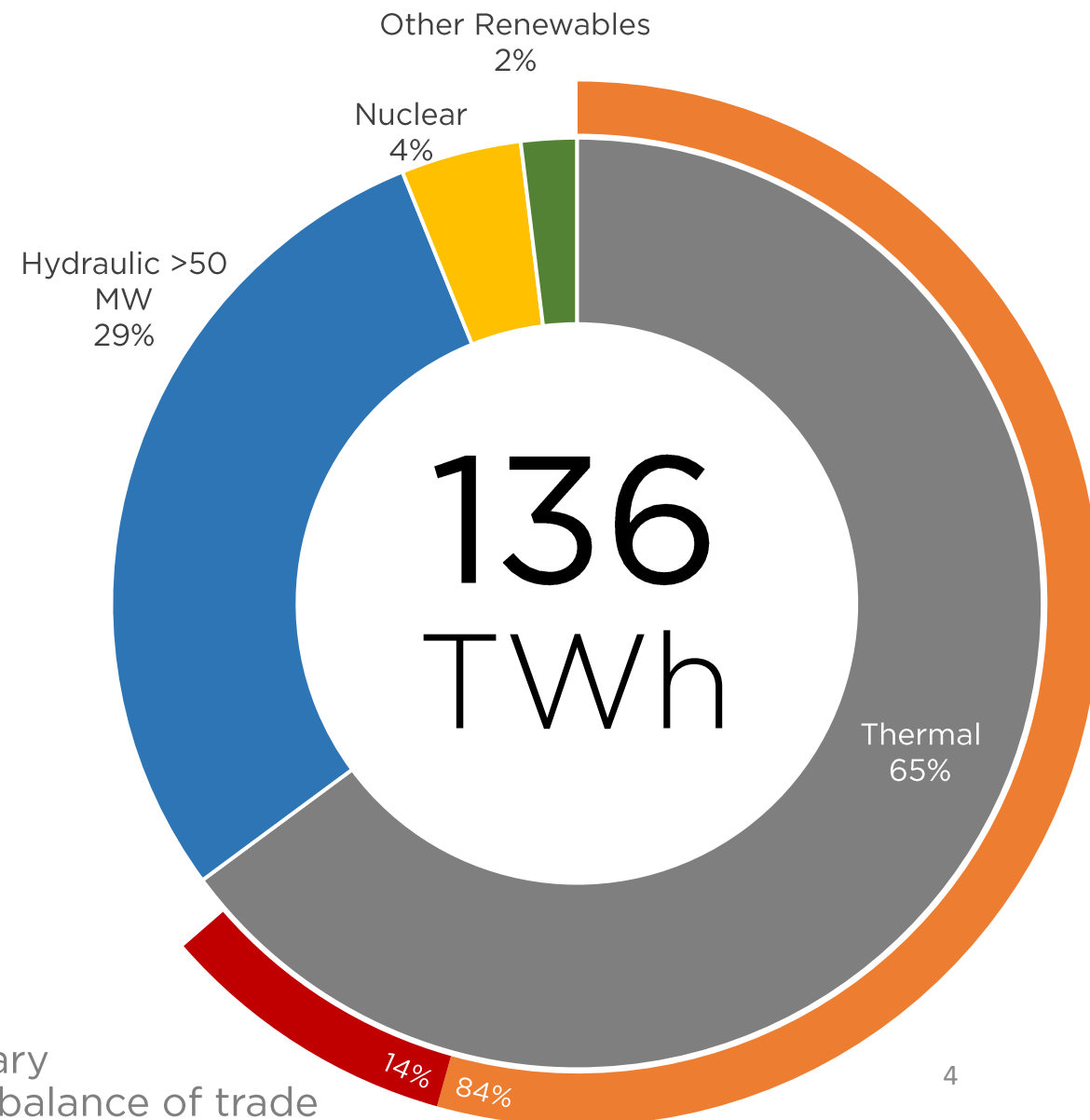


1. Double natural gas production in 5 years, to achieve 260 MMm<sup>3</sup> (9.2 Bcf) per day and to export 100 MMm<sup>3</sup> (3.5 Bcf) daily.
2. Double oil production in 5 years, reaching 1 million barrels per day and to export 500 thousand daily.
3. Create 500 thousand new jobs associated with the 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.

## Internal energy supply\* - 2017



## Power generation matrix - 2017

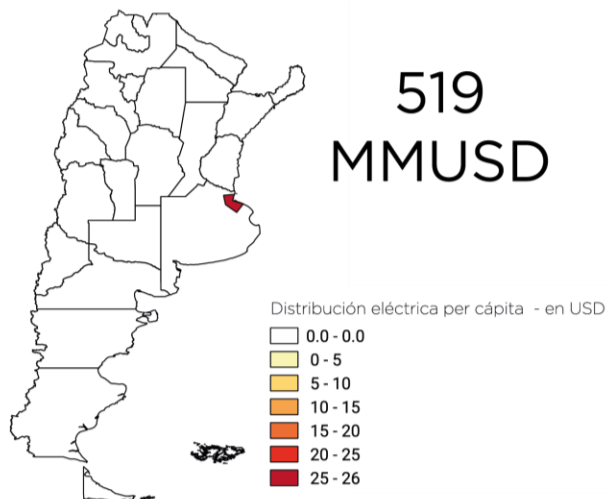


\*TIES: Total Primary Energy Supply + balance of trade

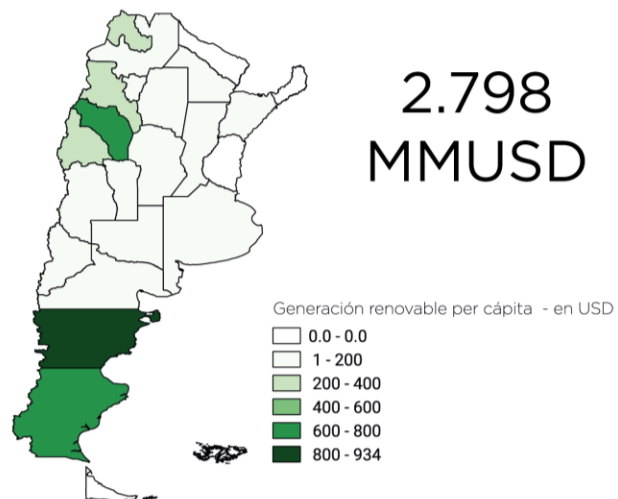


# Private investment in the energy sector – 2018 est.

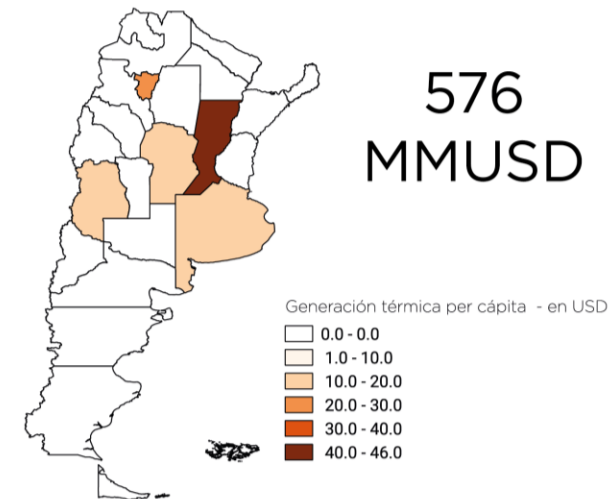
Power distribution (data for AMBA)



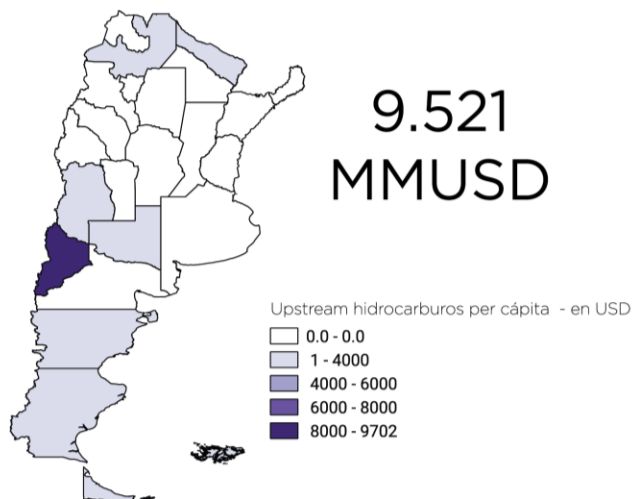
Renewable generation



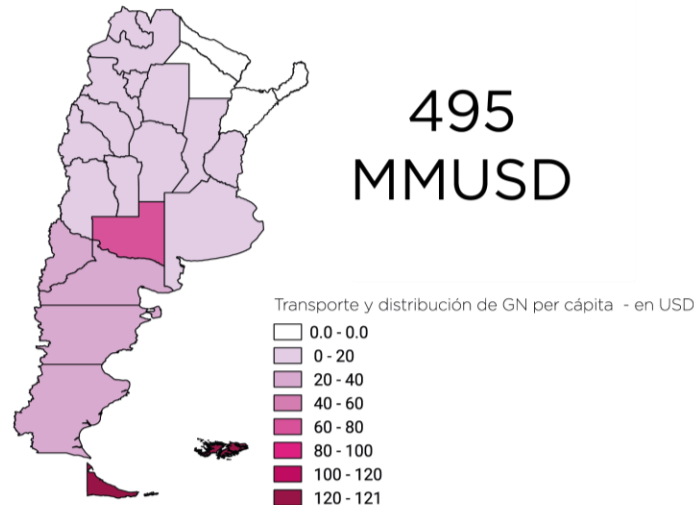
Thermal power generation



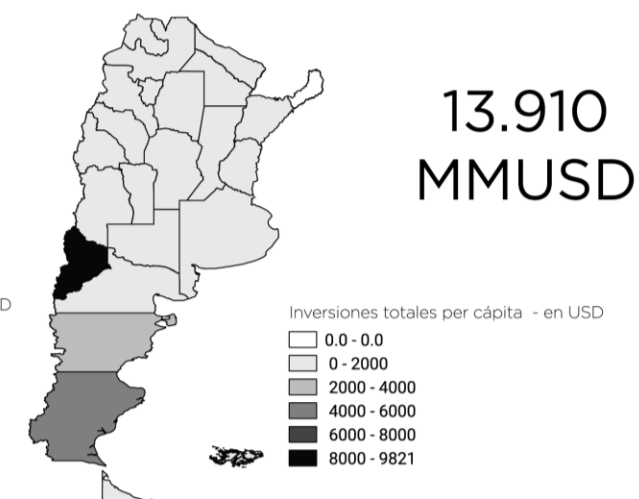
Upstream O&G



Transport and distribution of Oil and Gas

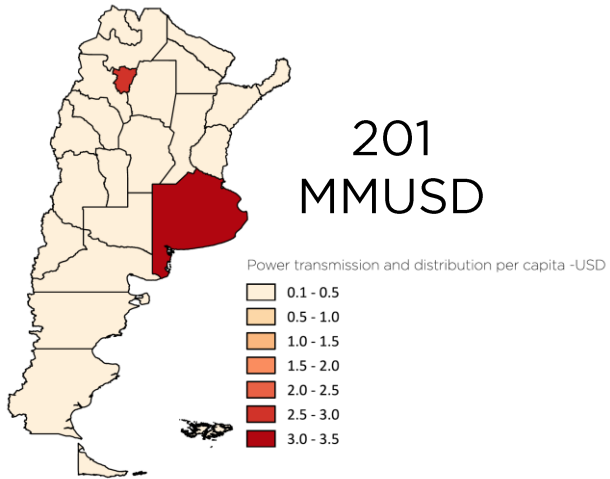


Total private investment

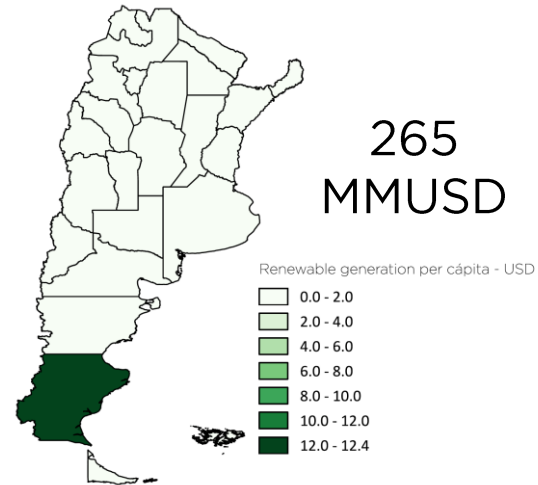


# Public investment in the energy sector – 2018 est.

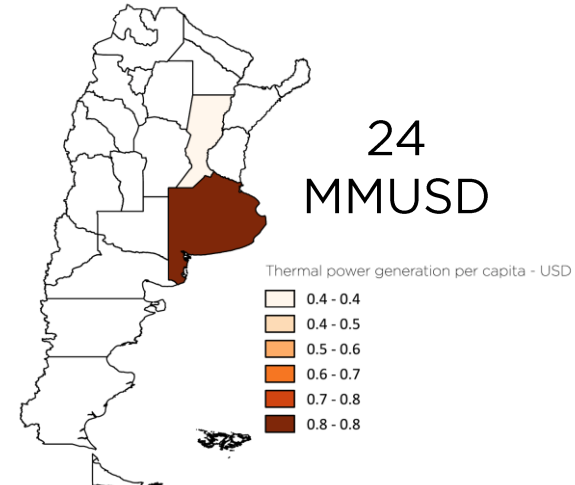
Power transmission and distribution



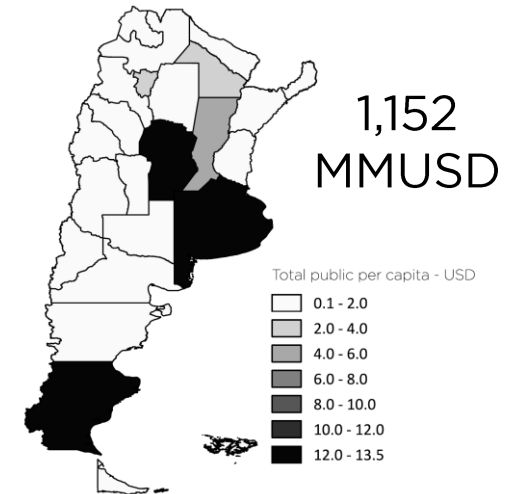
Renewable energy



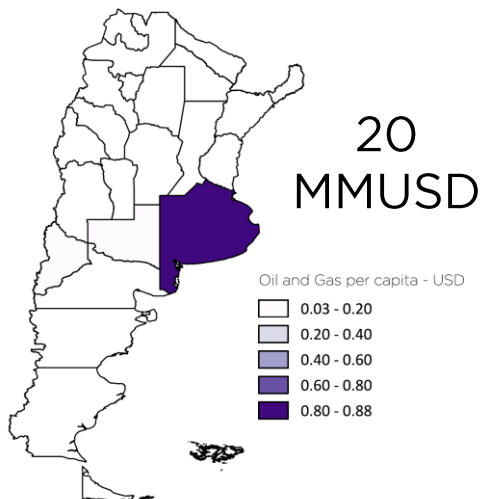
Thermal power generation



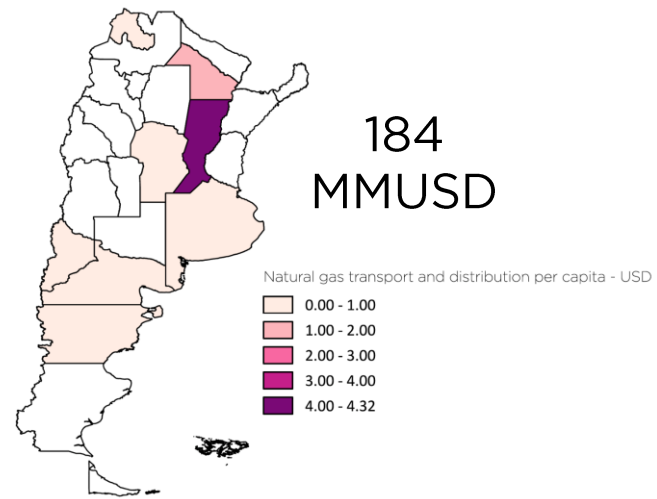
Total public



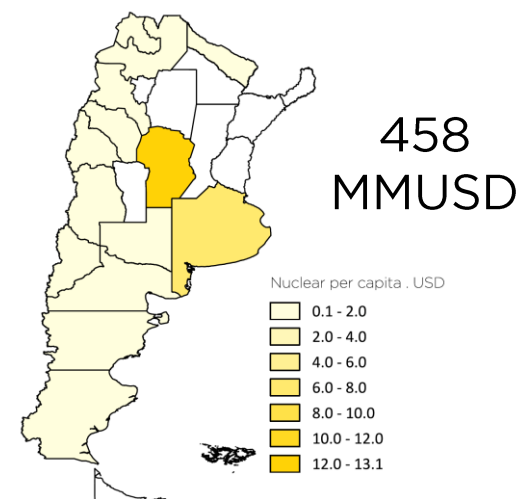
Other O&G

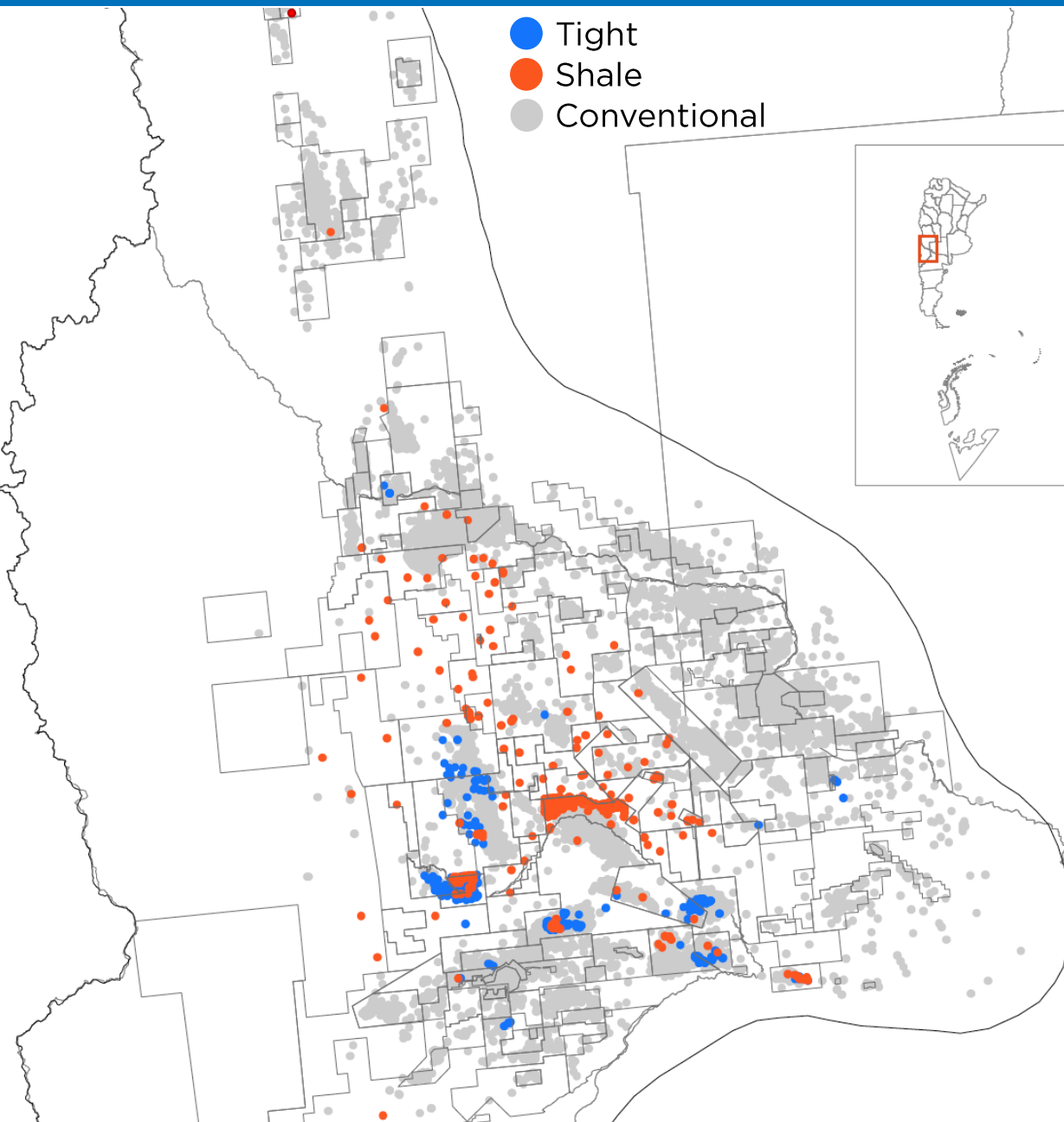


Transport and distribution of natural gas



Nuclear





Neuquén Window:  
22,000 km<sup>2</sup>

EUR / Well	631 kbbbl/well
Landing points/area	2.5/km <sup>2</sup> (2.5/247 acres)
MMbbl/Area	1.6 MMbbl/km <sup>2</sup> (6.5 kbbbl/acre)
Unconventional Production <i>Plateau</i> 2030	1,143 kbbbl/day
Reservoir to exploit in 25 years	10,434 MMbbl
Exploited Area	6,614 km <sup>2</sup> / 1.6 MM acres (30%)

## Oil

5.4+ MM Acres

## Gas

Neuquén Window:  
13,000 km<sup>2</sup>

EUR / Well	12.9 BCF/well
Landing points/area	2.5/km <sup>2</sup> (2.5/247 acres)
BCF/area	32.25 BCF/km <sup>2</sup> (0.13 BCF/acre)
Unconventional Production <i>Plateau</i> 2030	14.1 BCF/day
Reservoir to exploit in 25 years	128.6 TCF
Exploited Area	3,990 km <sup>2</sup> / 987,643 acres (31%)

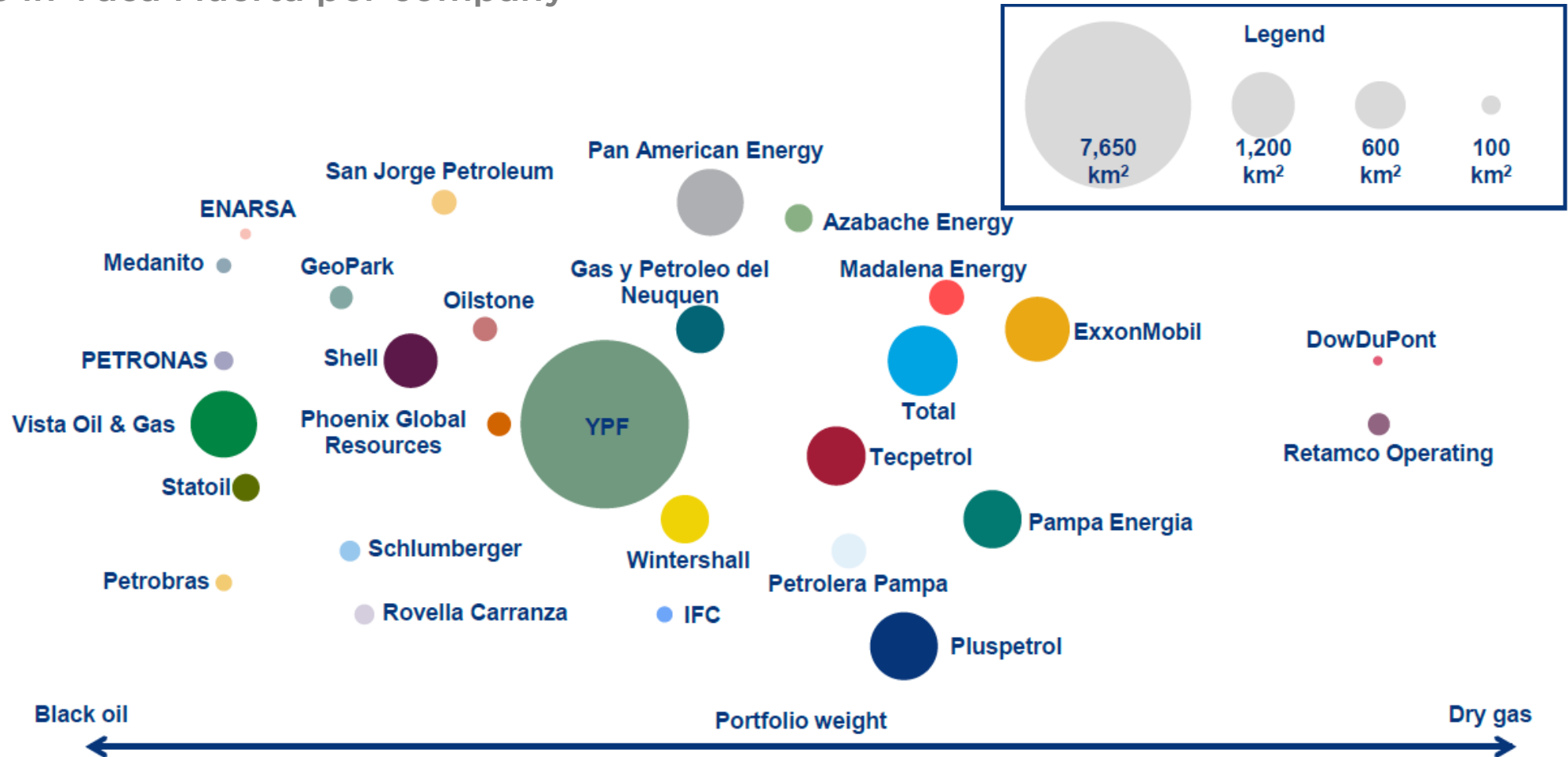
3.2+ MM acres



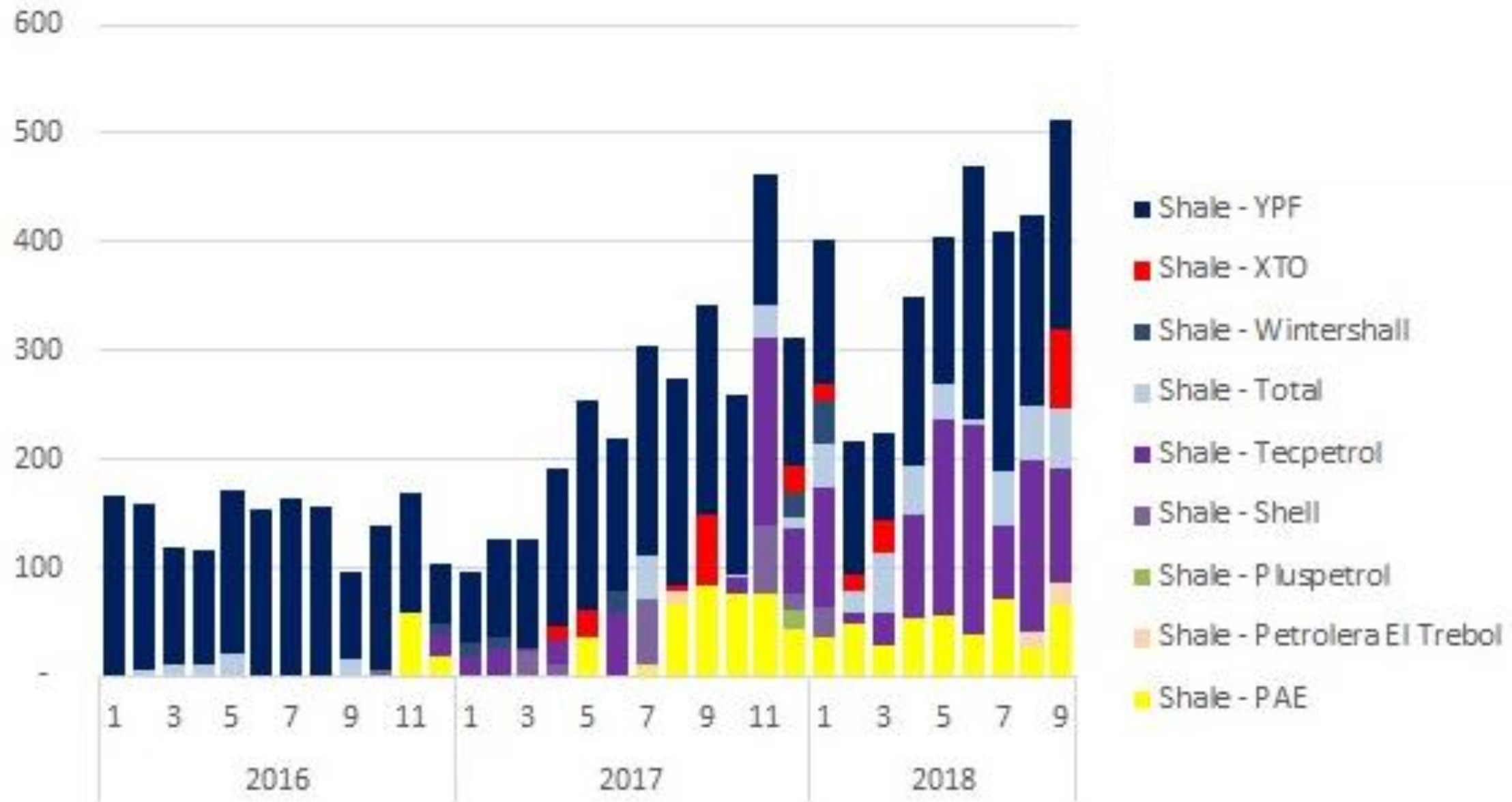
# Current players in Vaca Muerta (Wood Mackenzie)

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

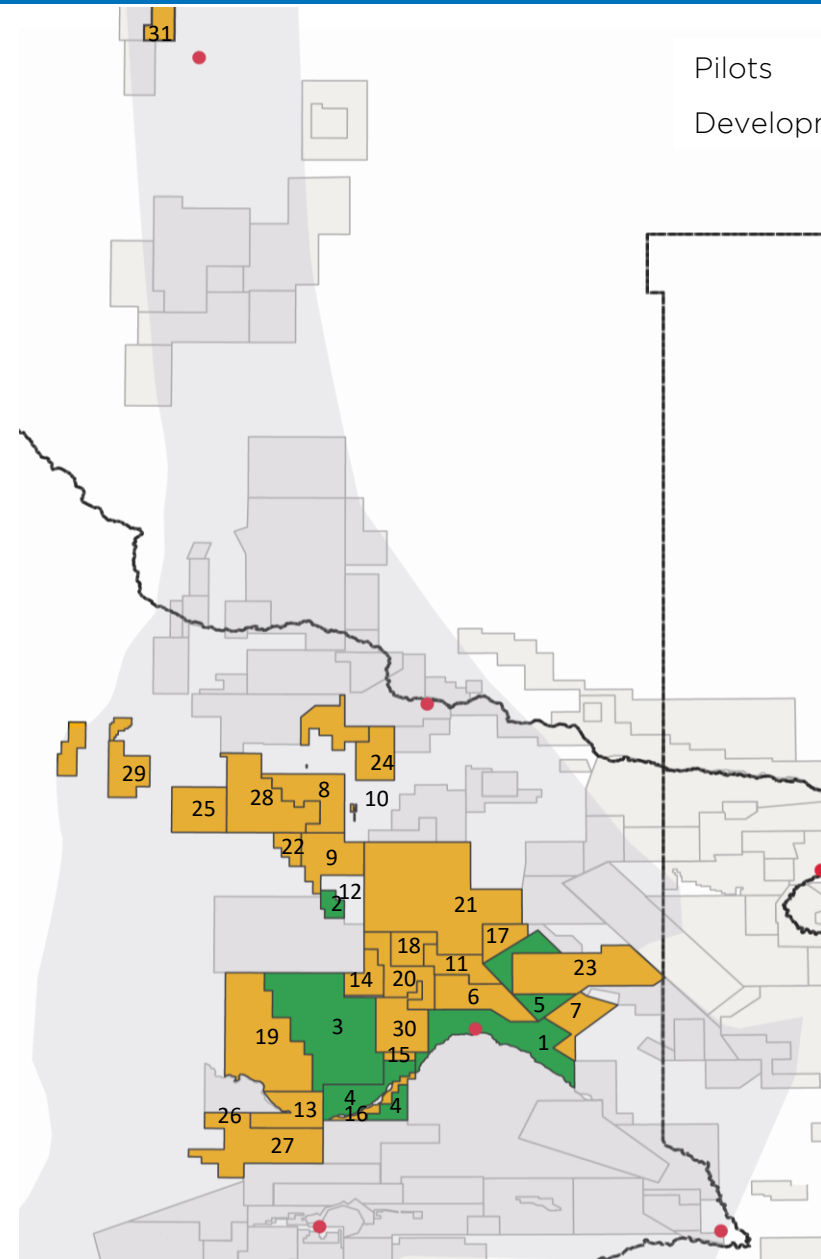
## Acreage in Vaca Muerta per company



# Fractures stages by month - SHALE



# 31 key projects



Pilots  
 Development



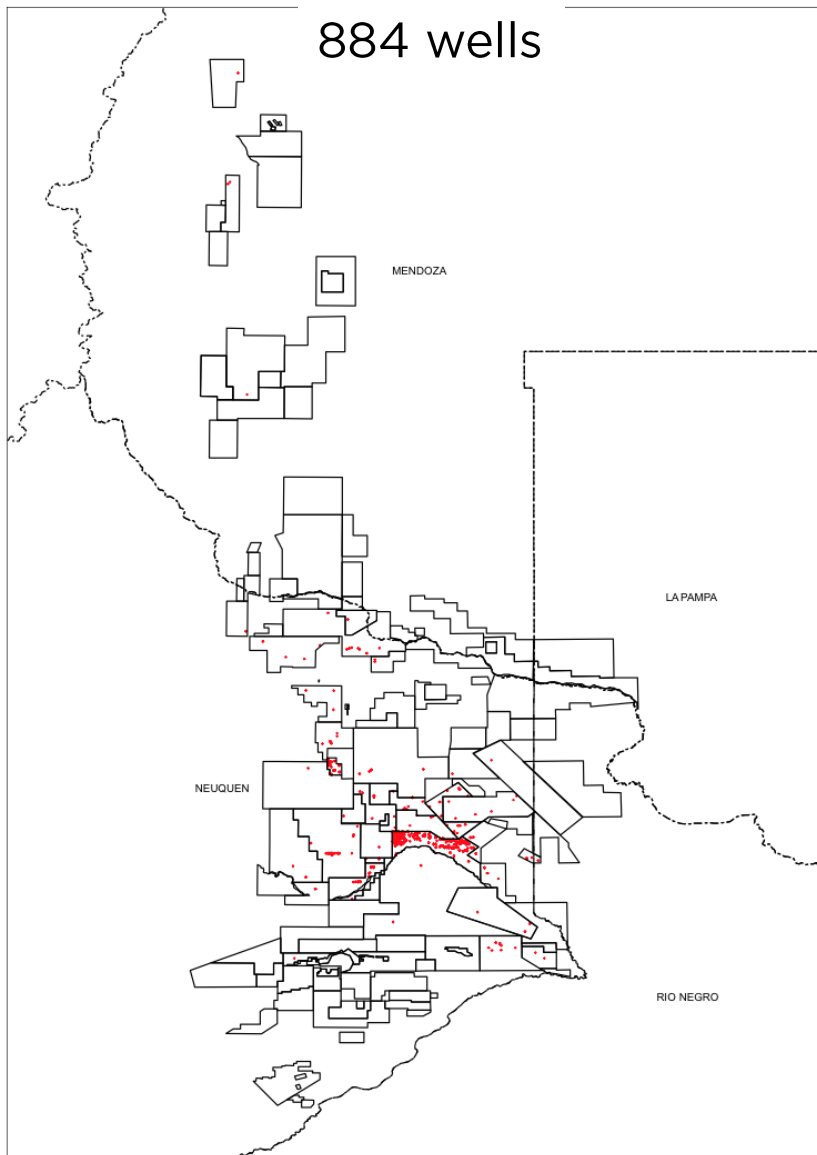
	Area	Operador	Black Oil	Light Oil	Wet Gas	Dry Gas	Cond	2010	11	12	13	14	15	16	17	18
1	Loma Campana	YPF														
2	El Orejano	YPF														
3	Aguada Pichana Este	Total														
4	Fortín de Piedra	Tecpetrol														
5	La Amarga Chica	YPF														
6	Bandurria Sur	YPF														
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														



# What would Vaca Muerta look like at full development?

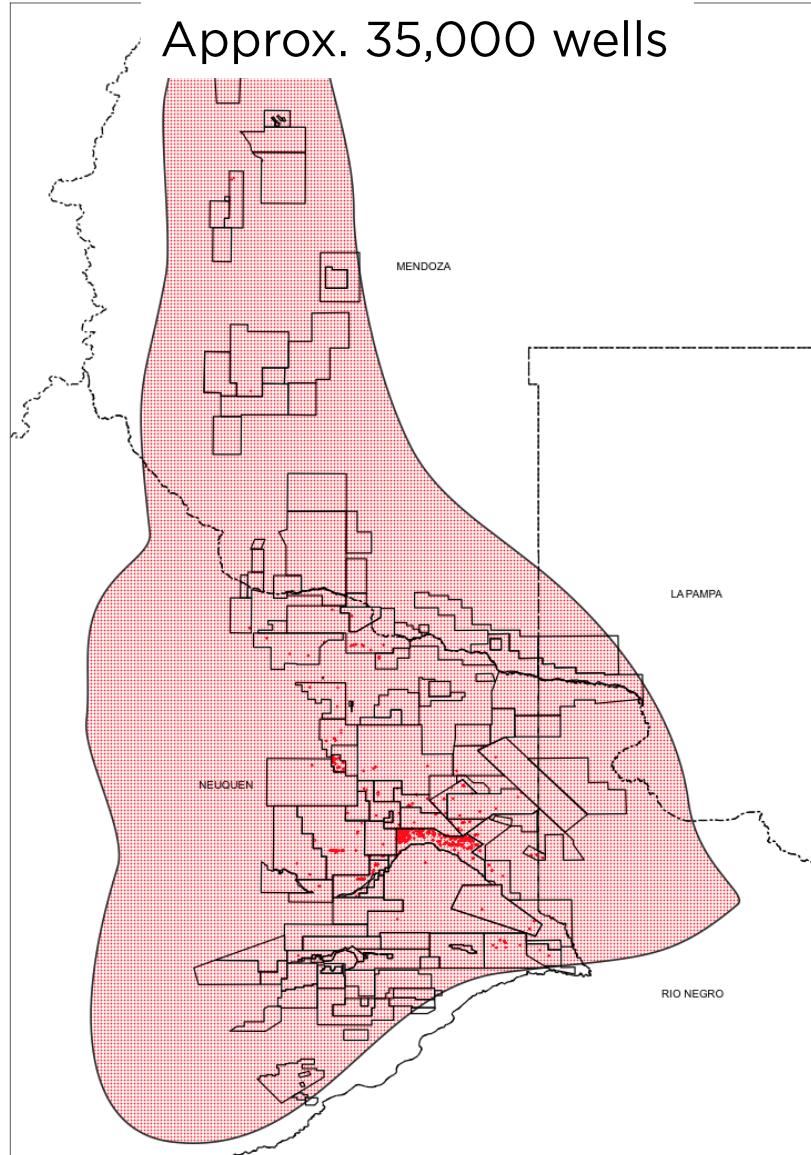
Current Vaca Muerta shale wells •

884 wells



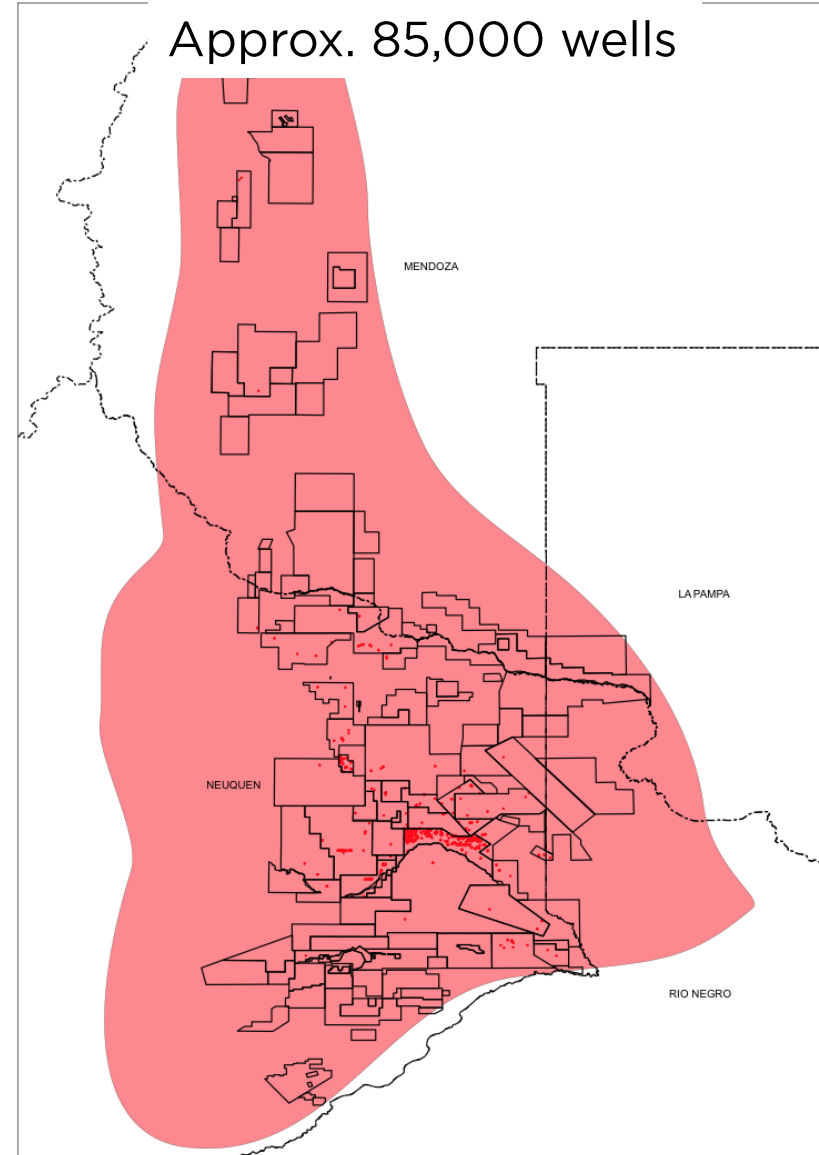
Vaca Muerta shale wells • @ Loma Campana's density

Approx. 35,000 wells

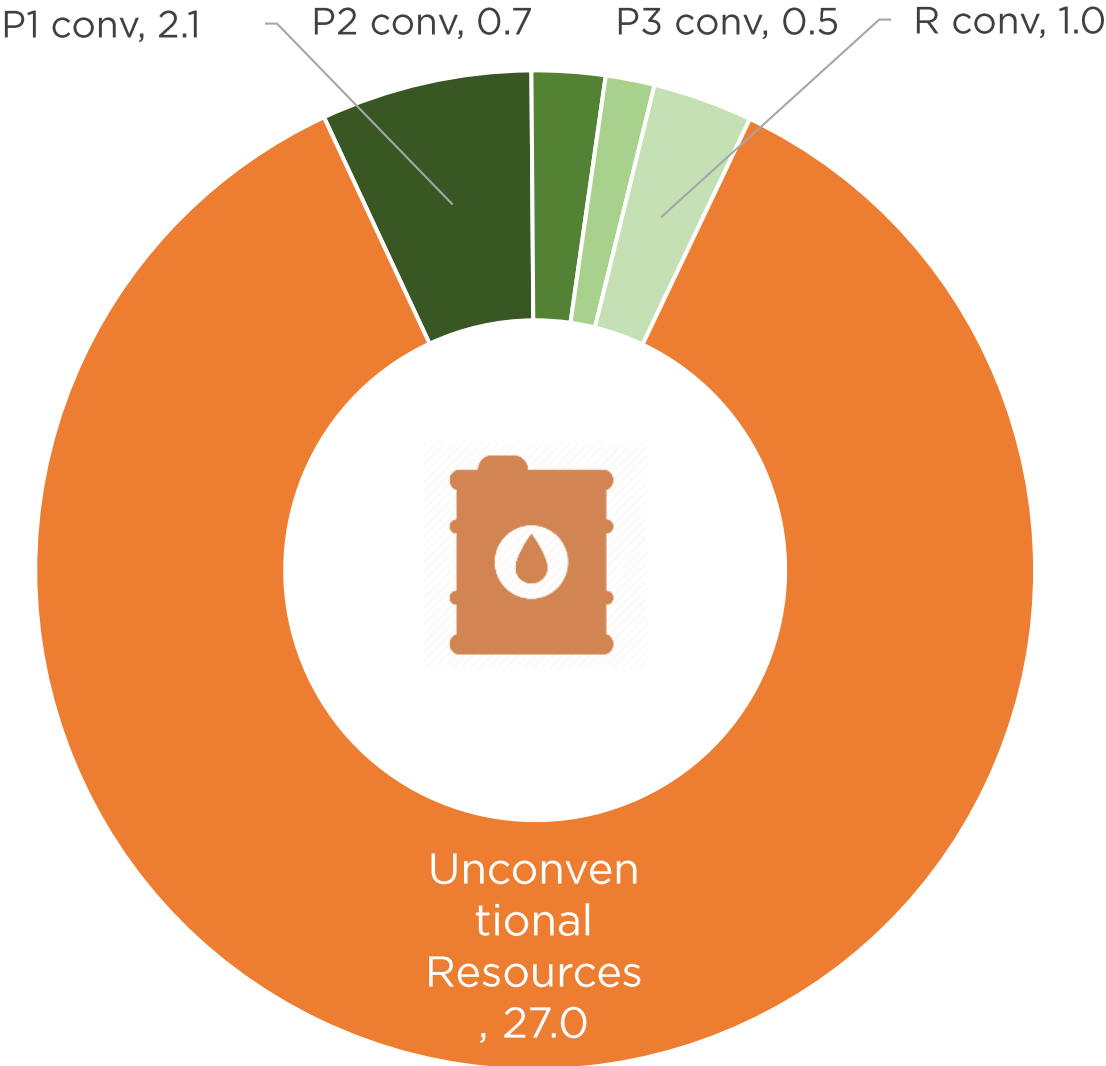


Vaca Muerta shale wells • @ 2,5 landing points/km<sup>2</sup>

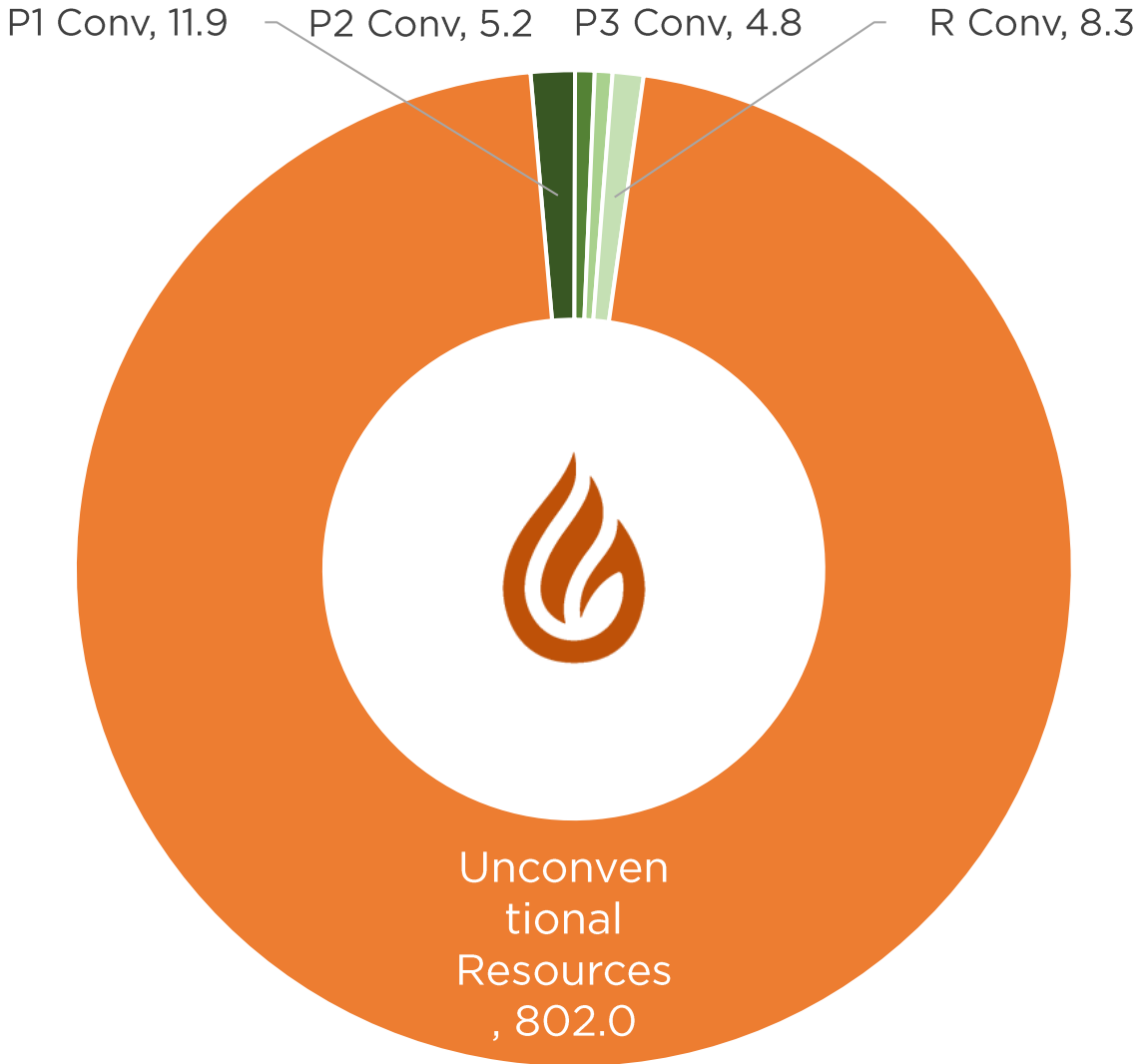
Approx. 85,000 wells



### Oil Reserves and Resources (Bbbl)



### Natural Gas Reserves and Resources (Tcf)



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

## One of the best resources in the world

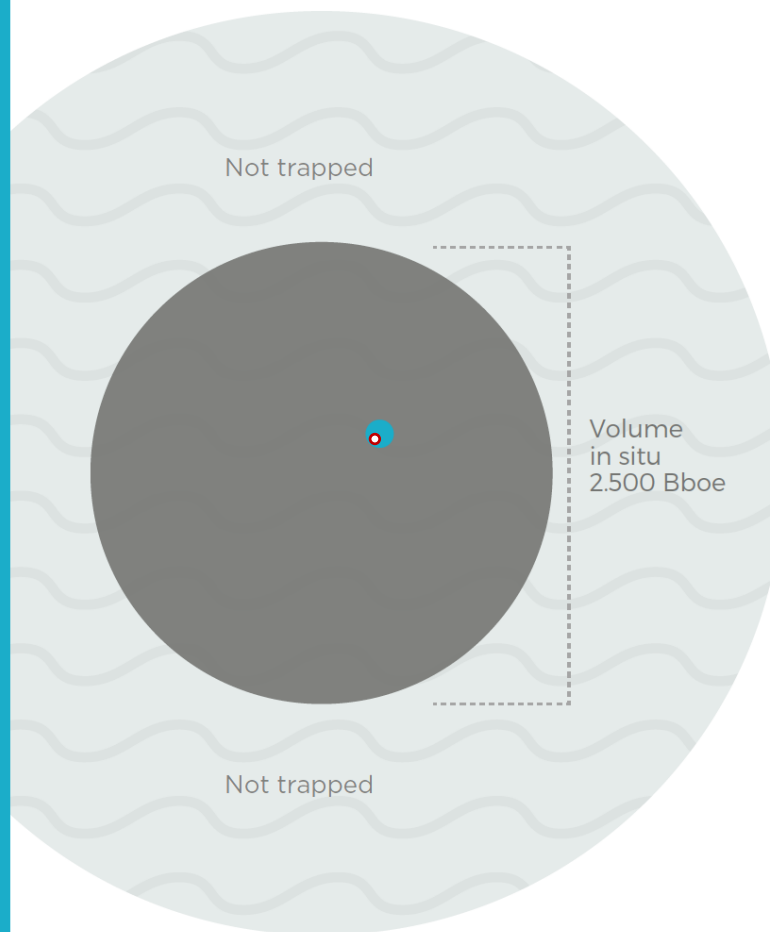


Unconventional Gas Resources



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



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

Acreage  
Vaca Muerta  
~8.65 MM acres  
35.000 km<sup>2</sup>

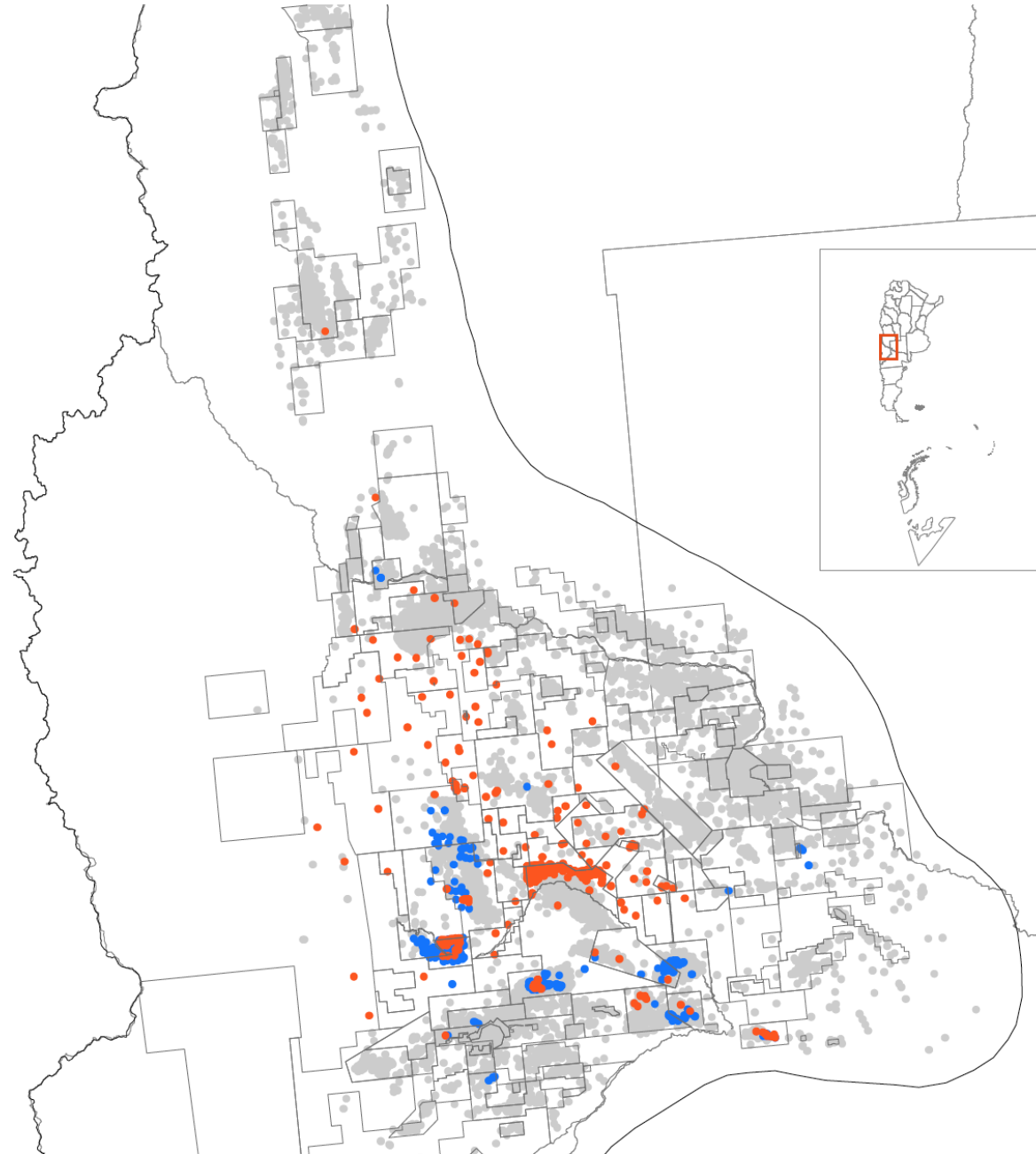
Acreage  
Eagle Ford  
~9.4 MM acres  
38.000 km<sup>2</sup>

Max Thickness  
Vaca Muerta  
~1,480 feet

Max Thickness  
Eagle Ford  
~330 feet

# Completed wells in Vaca Muerta by resource type

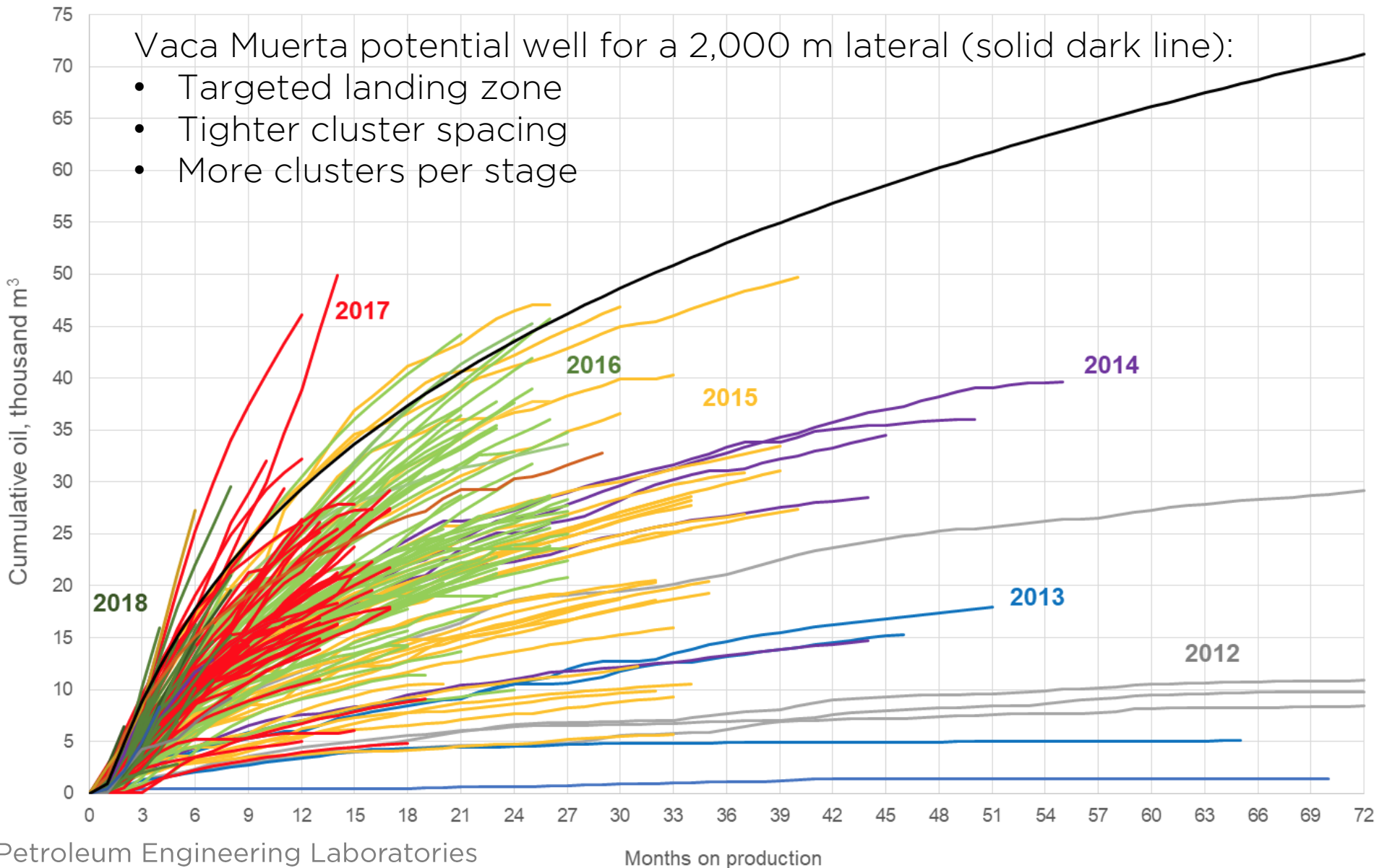
There is plenty of room in Vaca Muerta for new players



- Tight
- Shale
- Conventional

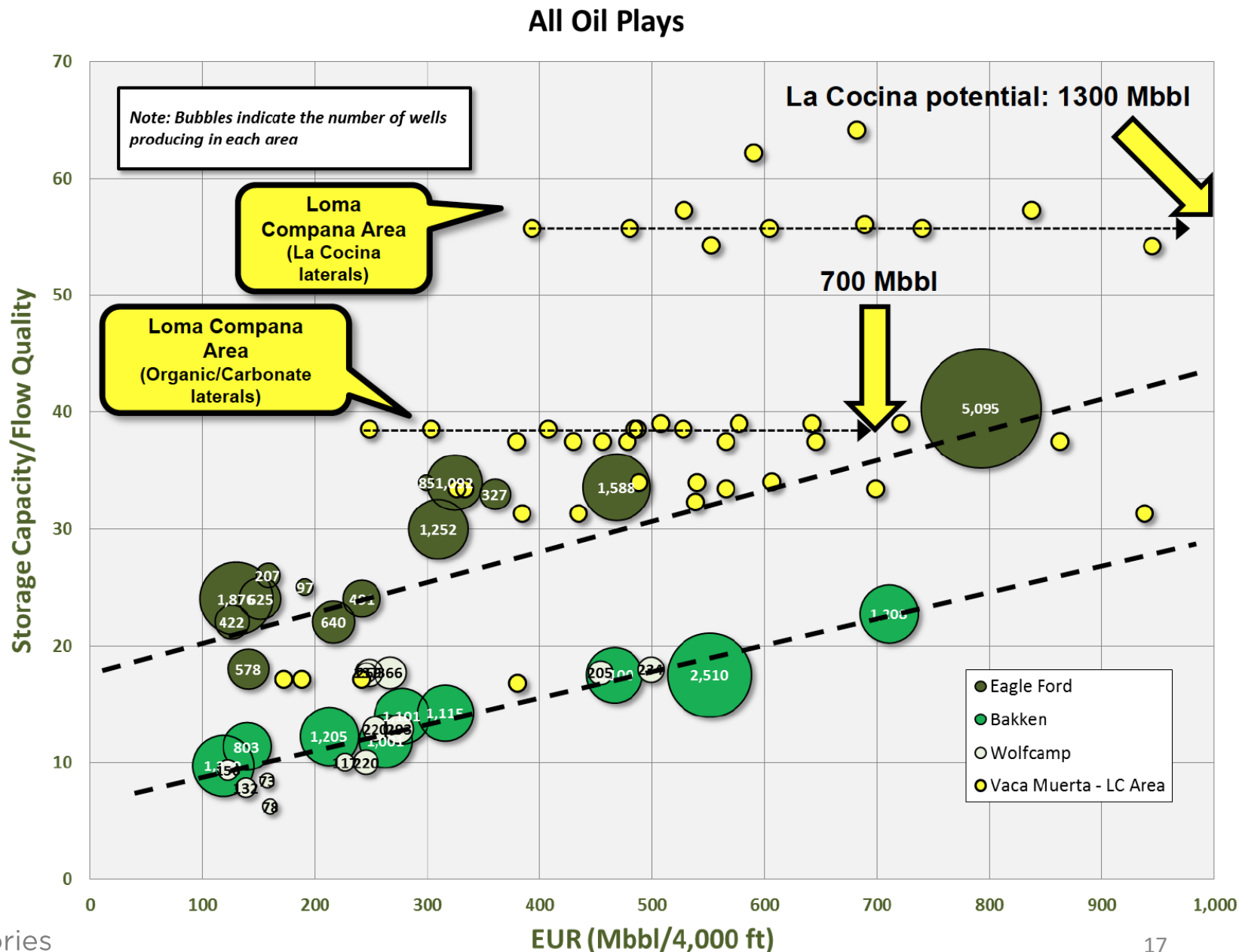
# Vaca Muerta horizontal well performance (WDVG)

Relentless progress through the years but still below potential



## WDVG Production Analysis:

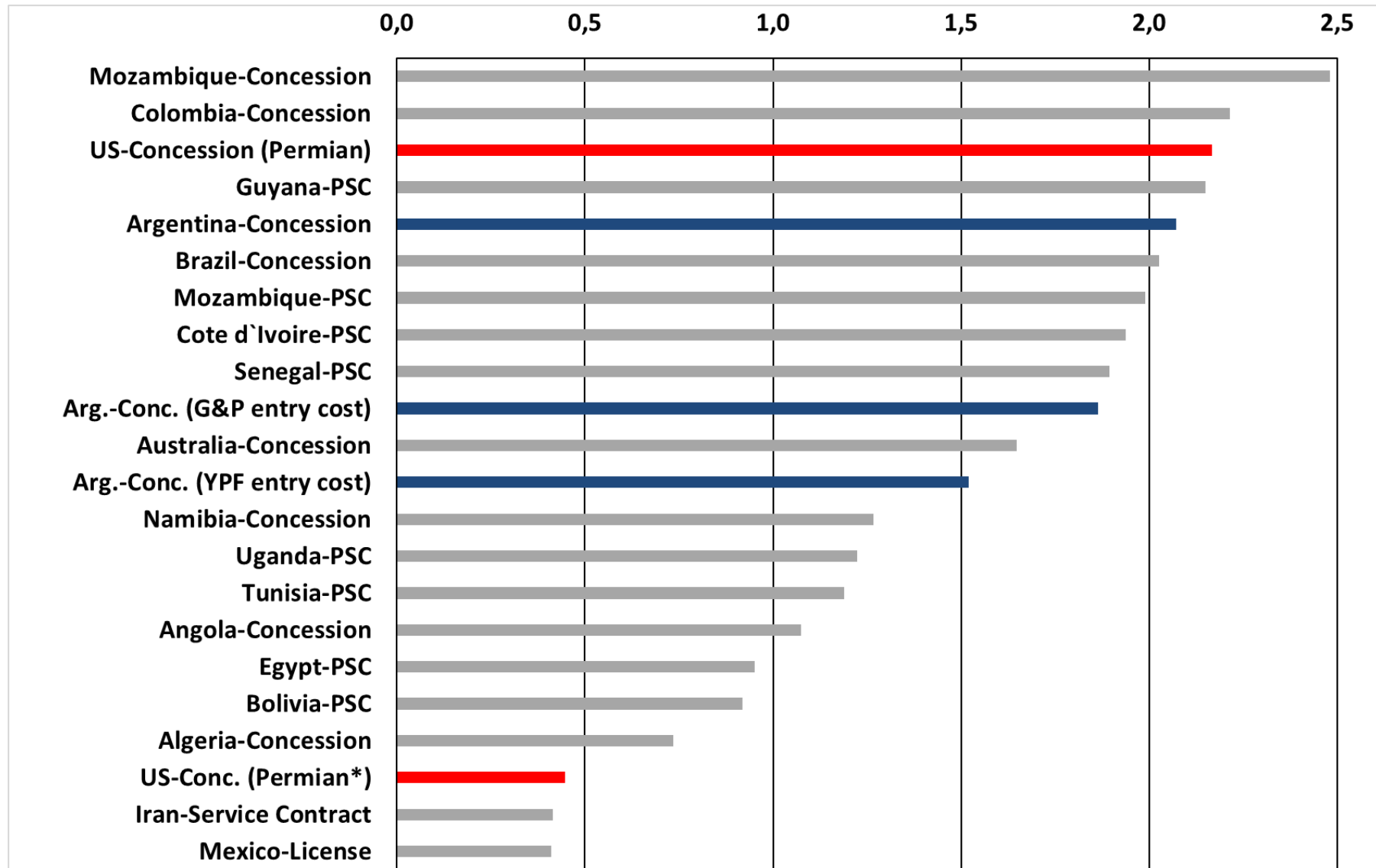
- Methodology -the plot shows the Original Oil in Place per Section vs the EUR normalized to effective lateral length for various areas of the different plays





# Argentina's concession terms are competitive against its peer group, even when including the Vaca Muerta cost of entry (Wood Mackenzie)

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



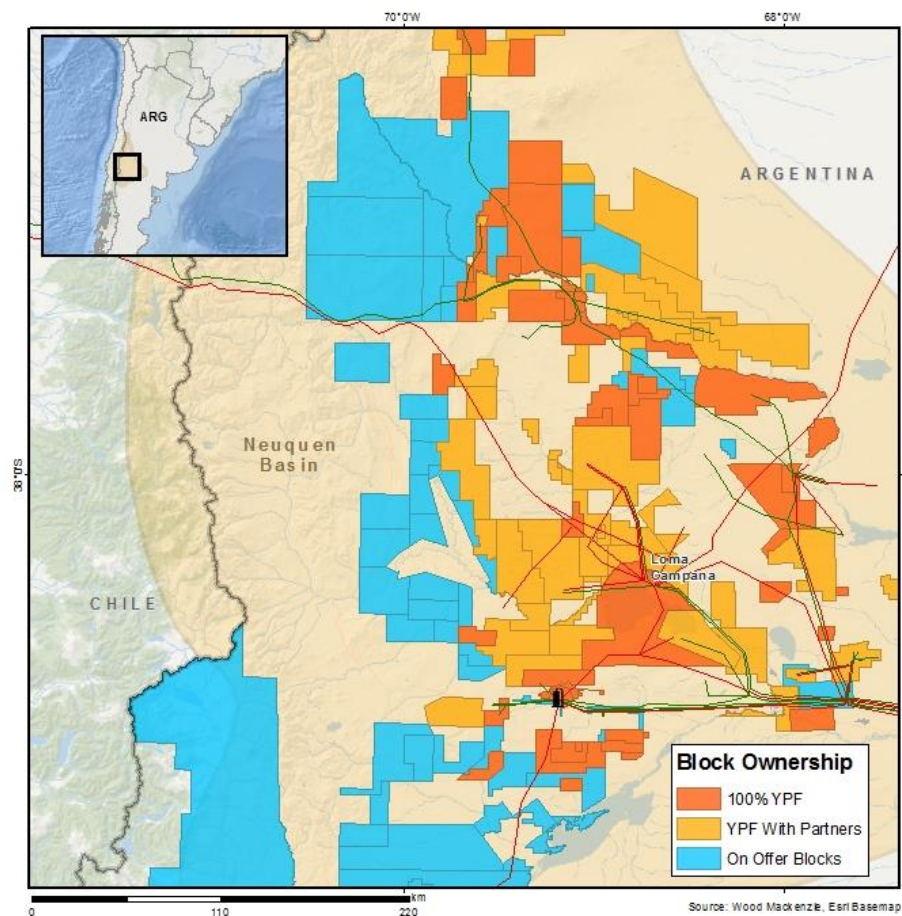
Notes: \*Permian including original entry cost at US\$15,000/acre | \* Vaca Muerta entry costs based on recent YPF and GyP transactions

Source: Wood Mackenzie

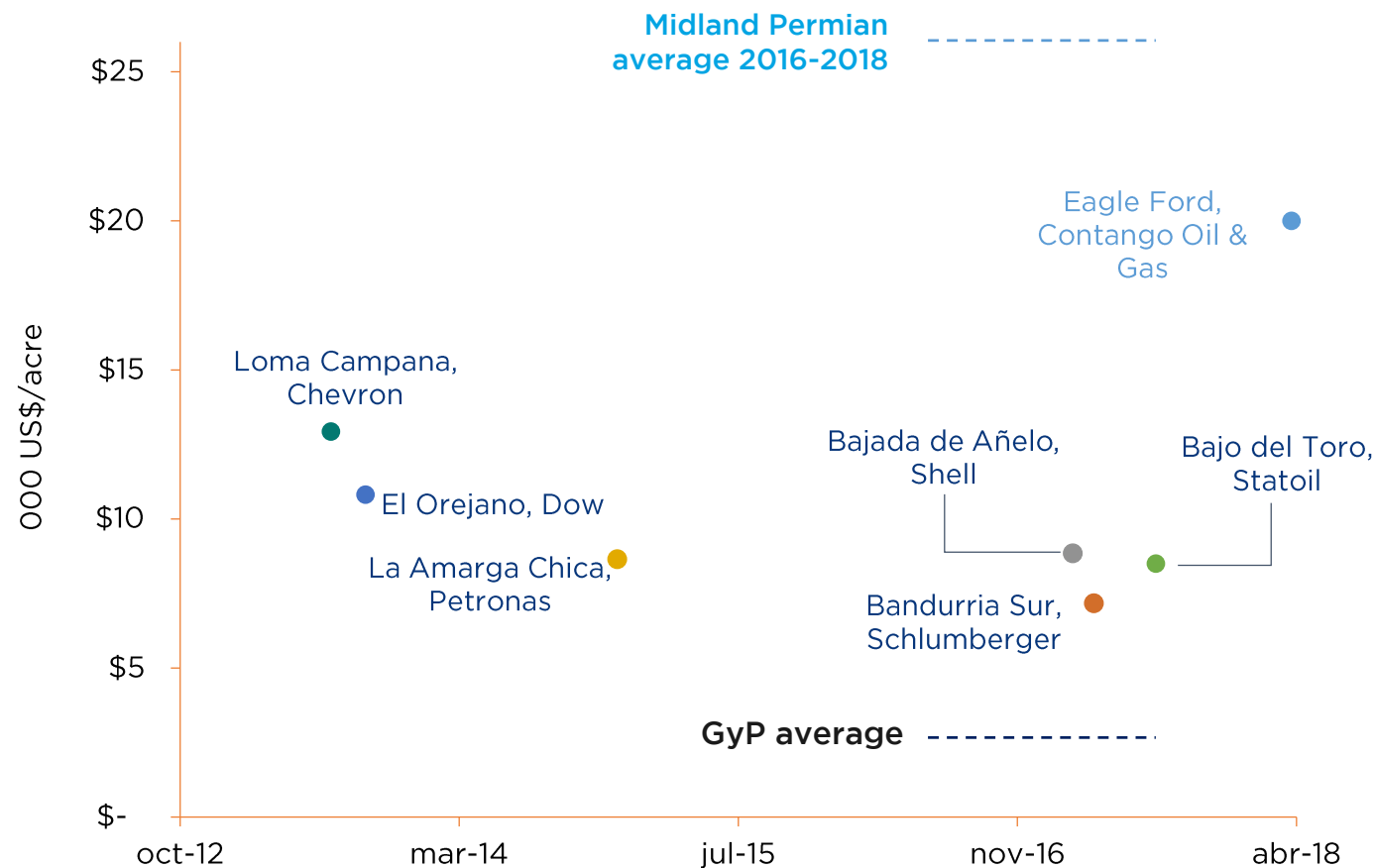
YPF farm-ins have averaged US\$8,000/acre, less than half L48 costs of US\$20,000-30,000 per acre (Wood Mackenzie)

GyP Neuquen license round entry costs (signature bonus and work commitments) have equated to US\$3000/acre.

### Neuquen basin ownership

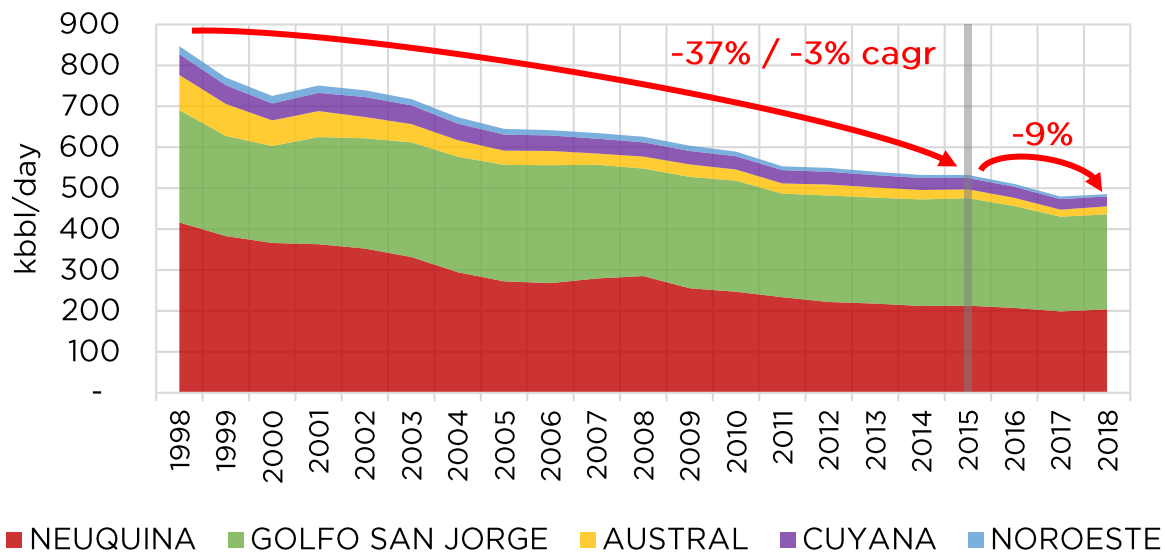


### Cost per acre, YPF farm-ins

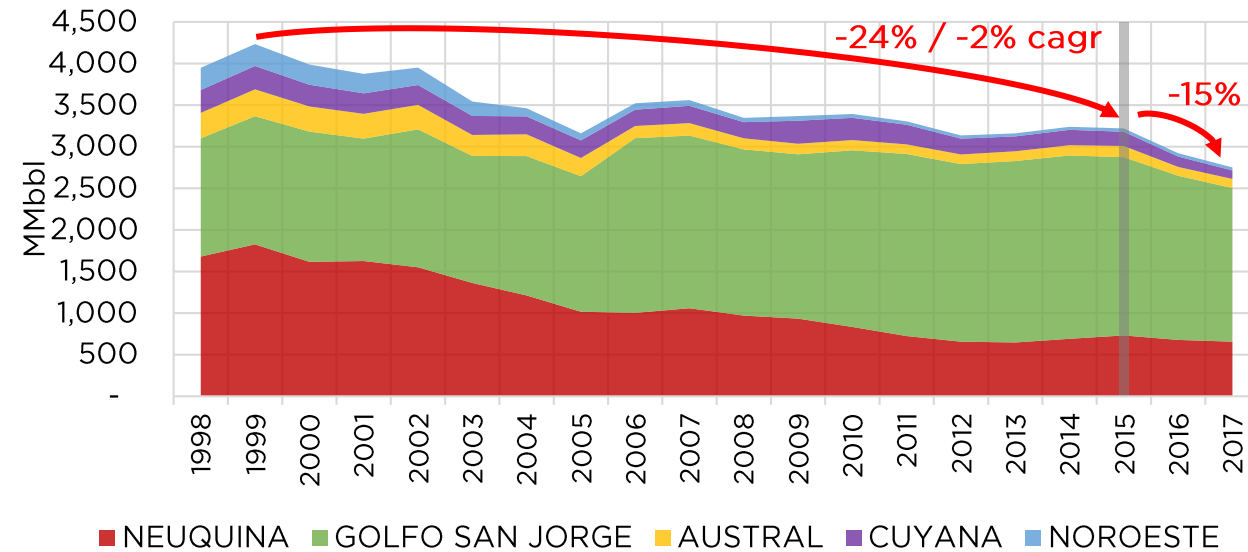


# Production and reserves of oil and natural gas

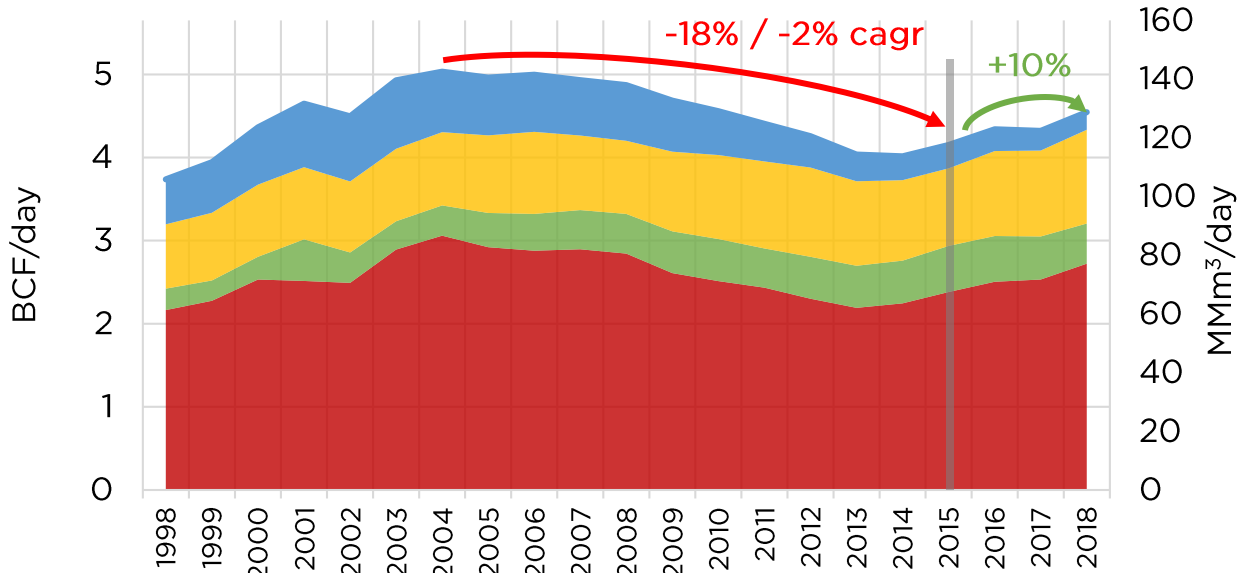
### Oil Production



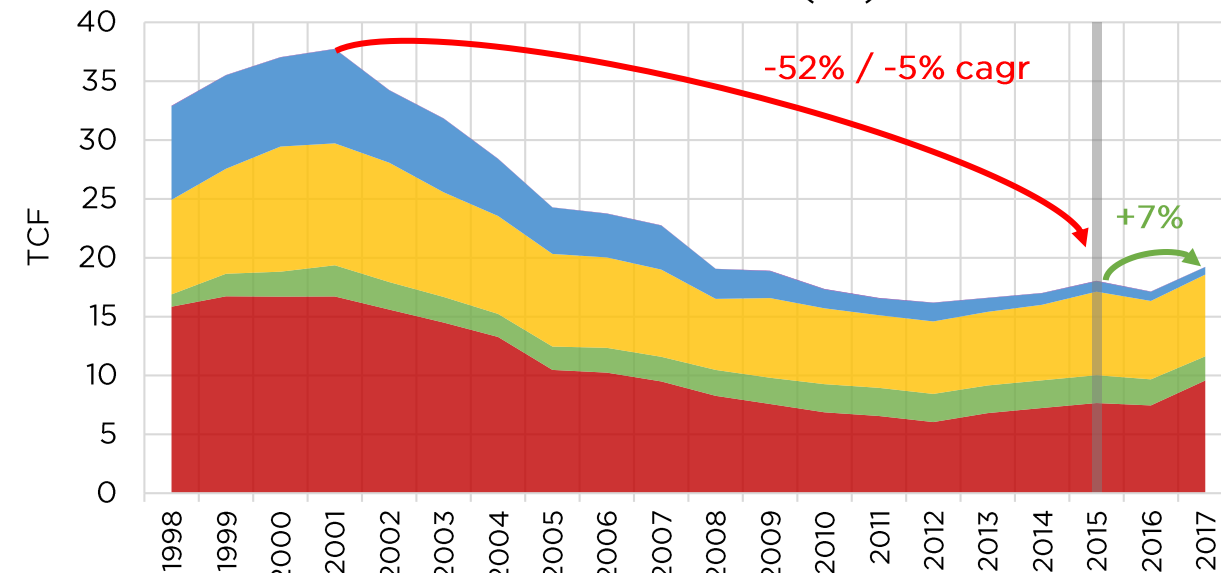
### Oil Reserves (2P)



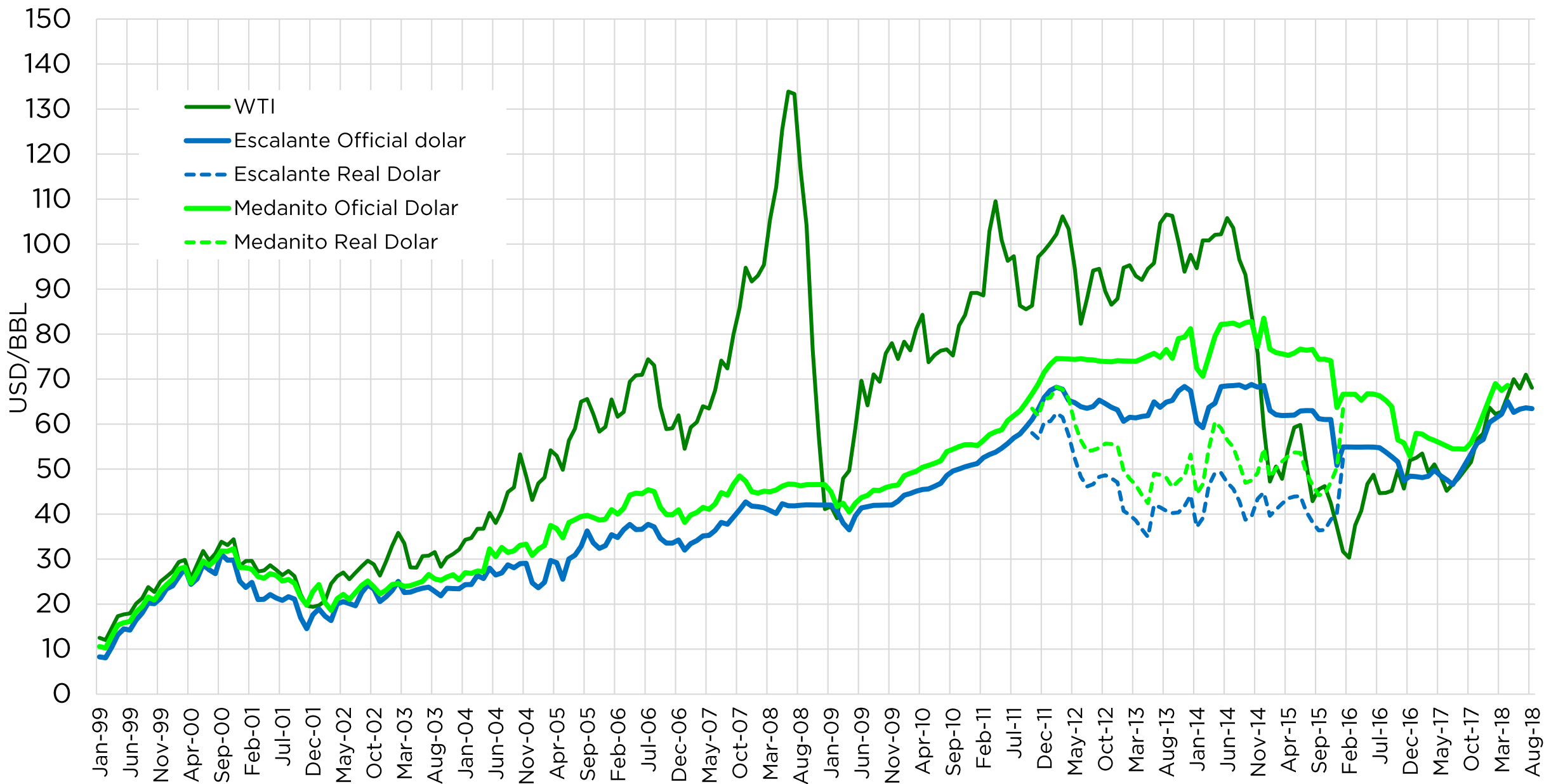
### Natural Gas Production



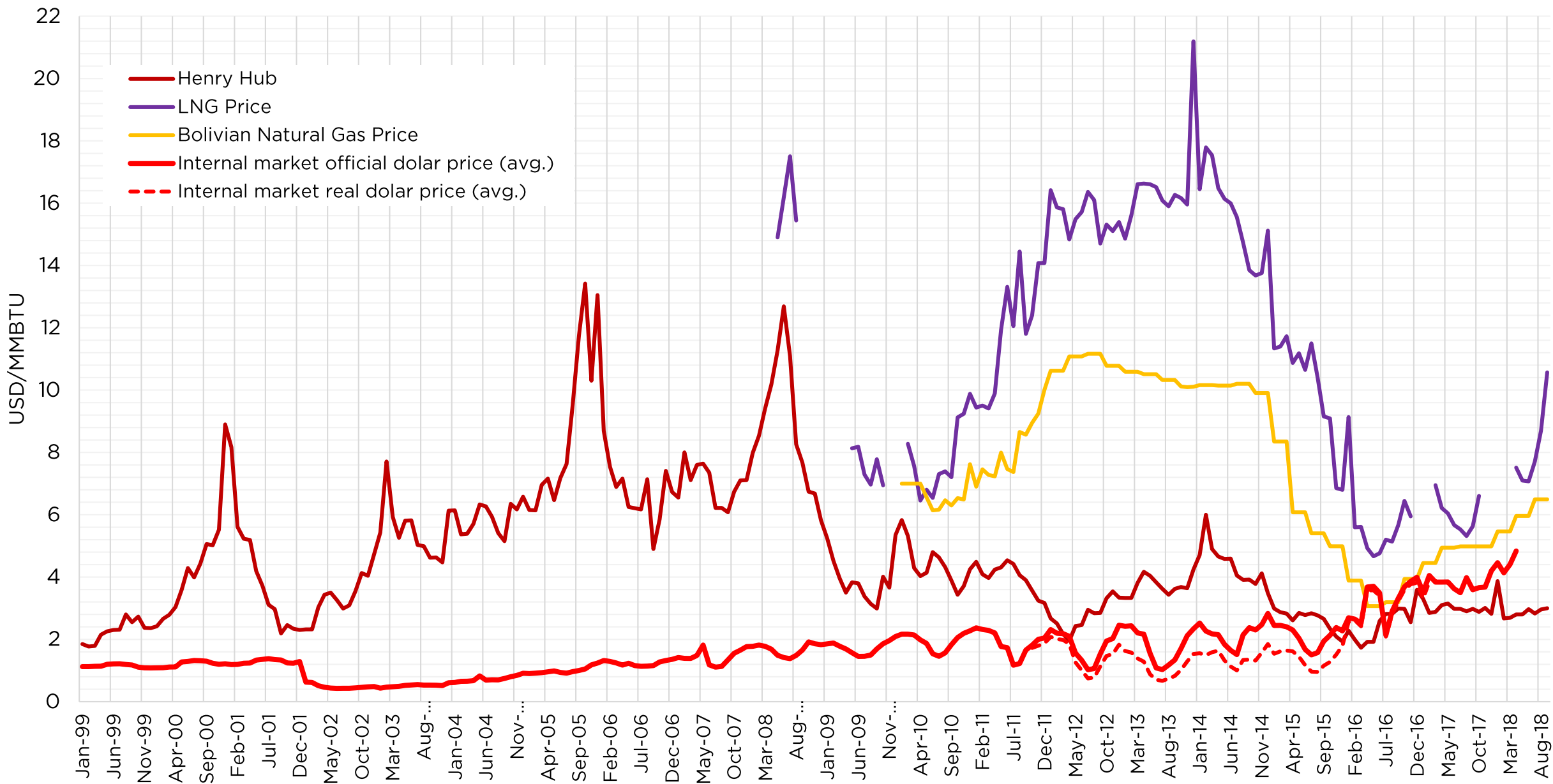
### Natural Gas Reserves (2P)



# World context and Argentina: Crude oil prices



# World context and Argentina: Natural gas prices





## Natural Gas: a unique, transparent and competitive market

- ✓ MEGSA: electronic platform for spot transactions and contracts.
- ✓ Complete and real time information.
- ✓ Business opportunities: liquefaction and storage.

## Power markets: an efficient and competitive system

- ✓ More natural gas availability for power generation at lower prices.
- ✓ Lower generation costs due to fuel optimization.
- ✓ 5.000+ MW of renewable energy.
- ✓ Operation efficiency: PPP for power transmission.

## Transport: more supply options

- ✓ Gasoline and Diesel oil.
- ✓ vs. LNG, GNC.
- ✓ vs. biodiesel, bioethanol.
- ✓ vs. electric vehicles.

# OIL

485  
kbbbl/day

Production  
increased

+3%

VS SEPTEMBER 2017

499  
kbbbl/day

+1,5%  
VS LAST MONTH

SEPTEMBER 2017

SEPTEMBER 2018

# SHALE OIL

+68%

+7%  
VS LAST MONTH

SEPTEMBER 2018 VS SEPTEMBER 2017

65  
kbbbl/day

2013

2015

2018

# UNCONVENTIONAL OIL

SHALE + TIGHT

REPRESENTS

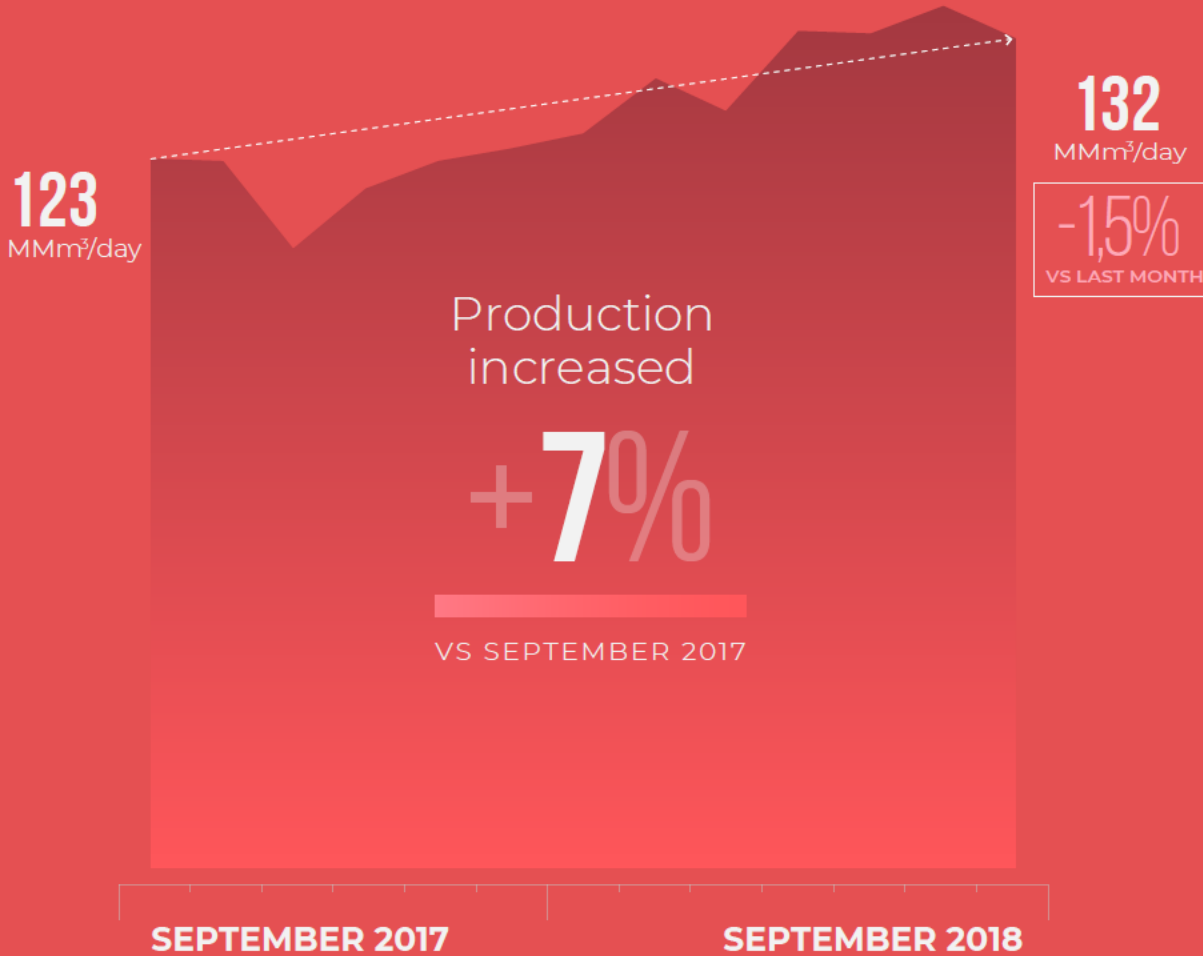
15%

OF TOTAL  
PRODUCTION



Conventional  
Shale oil  
Tight Oil

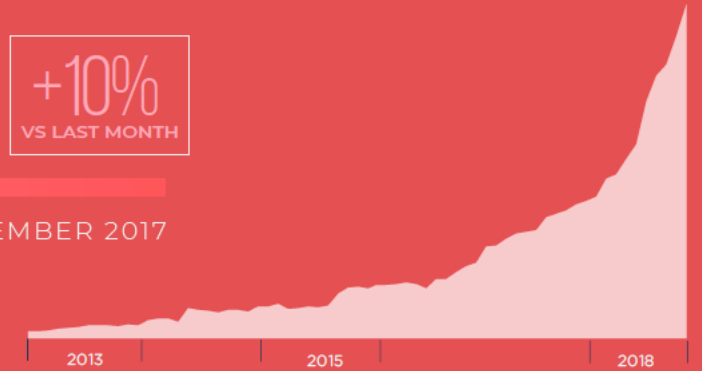
# NATURAL GAS



# SHALE GAS



22  
MMm<sup>3</sup>/day



# UNCONVENTIONAL GAS

SHALE + TIGHT

REPRESENTS

**37%**

OF TOTAL  
PRODUCTION



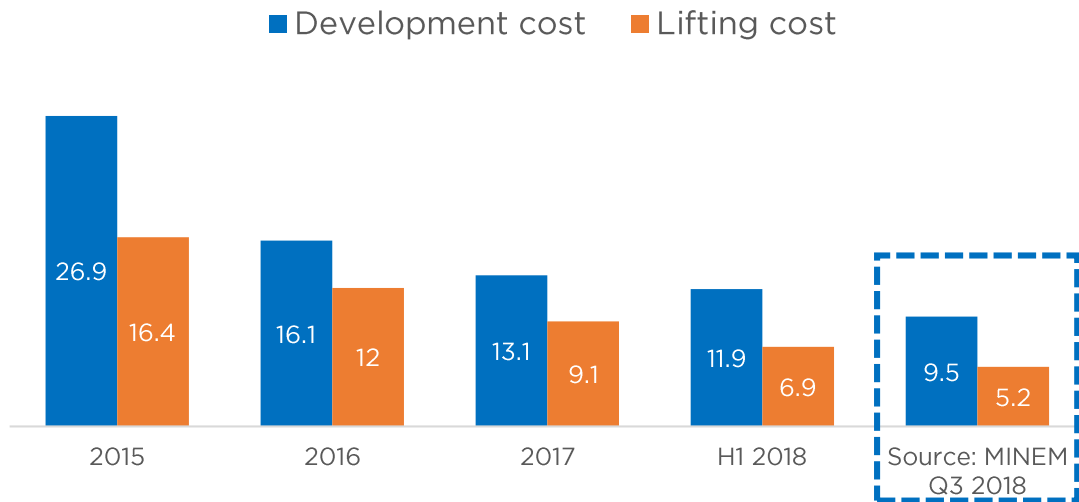
Conventional  
Shale gas  
Tight gas



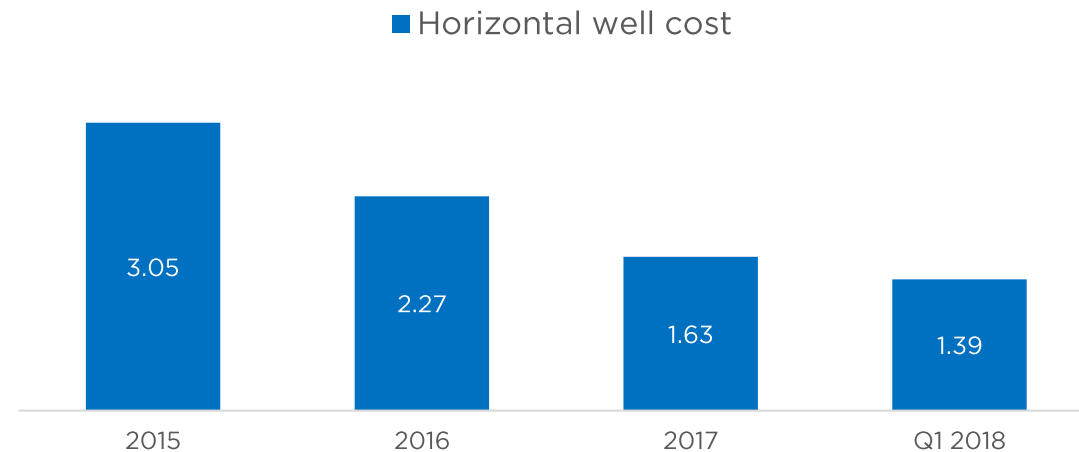
Argentina is one of the four countries in the world which are commercially developing unconventional resources.

# Cost decline as performance increases (source YPF)

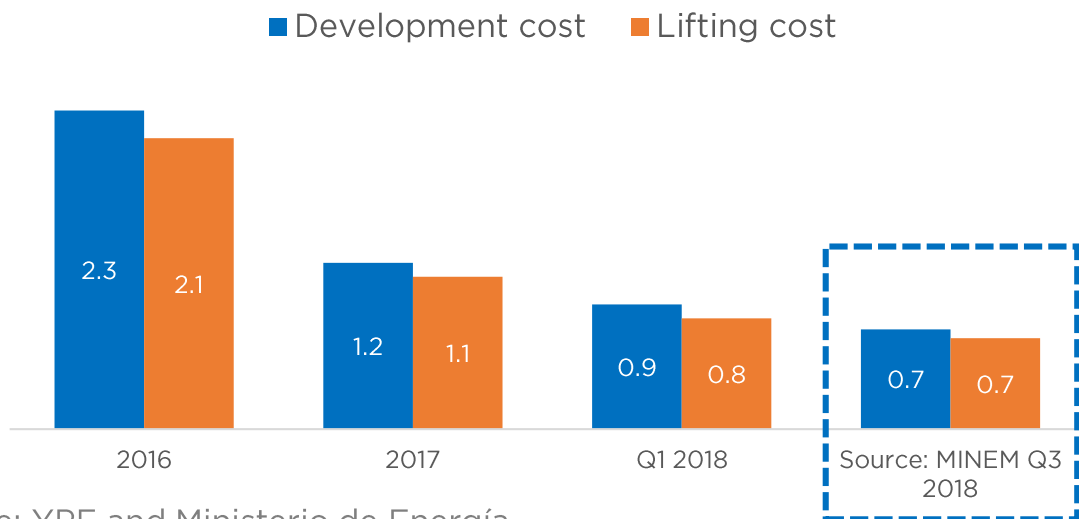
### Shale oil costs - Loma Campana [USD/boe]



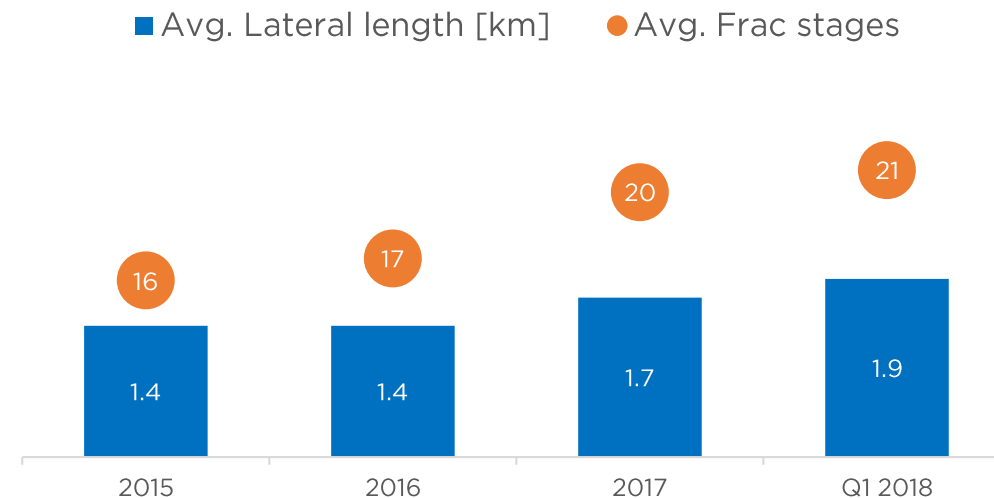
### Loma Campana Horizontal well costs [kUSD/lat.ft.]



### Shale gas costs - El Orejano [USD/MMBTU]

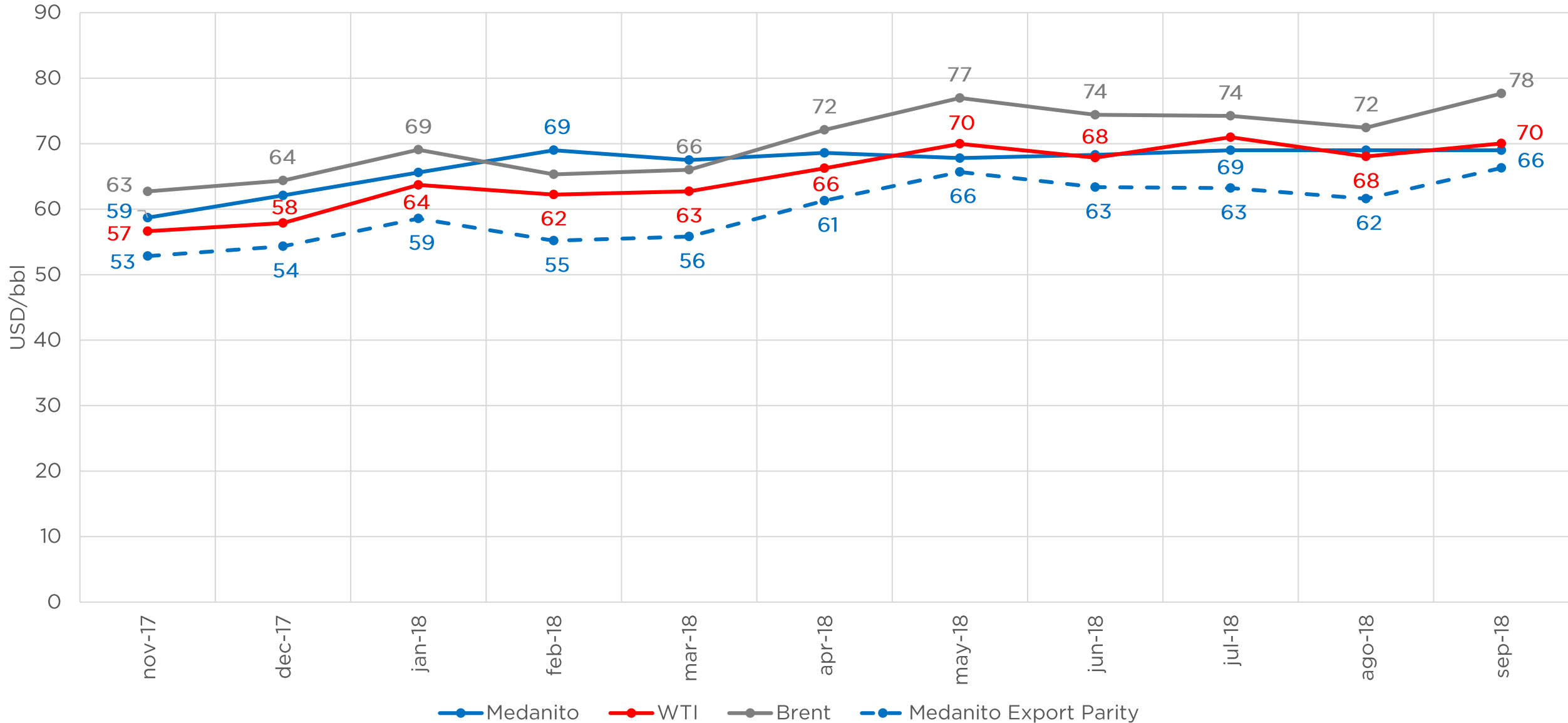


### Loma Campana horizontal well performance



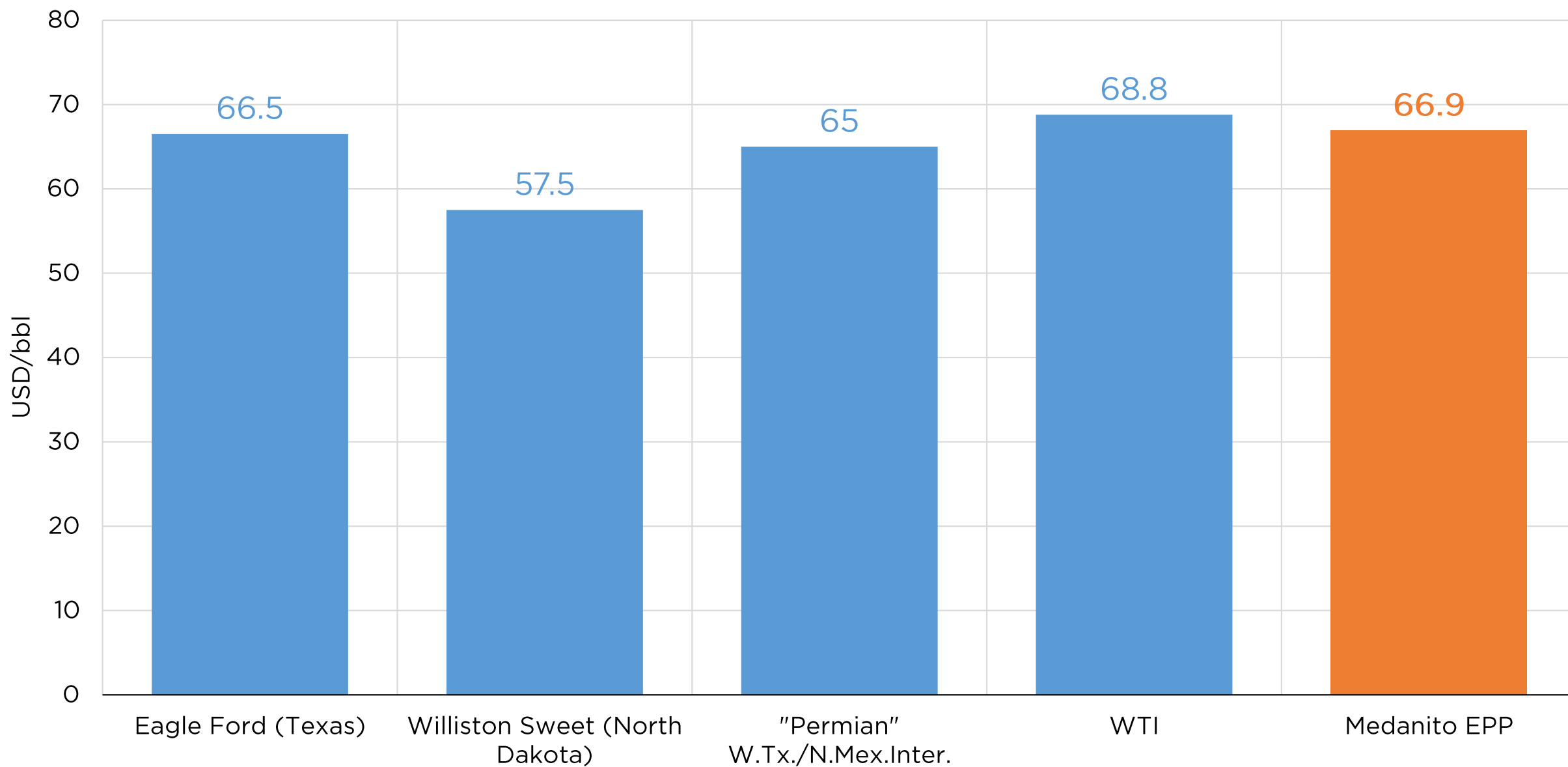


# WTI and Brent vs Medanito

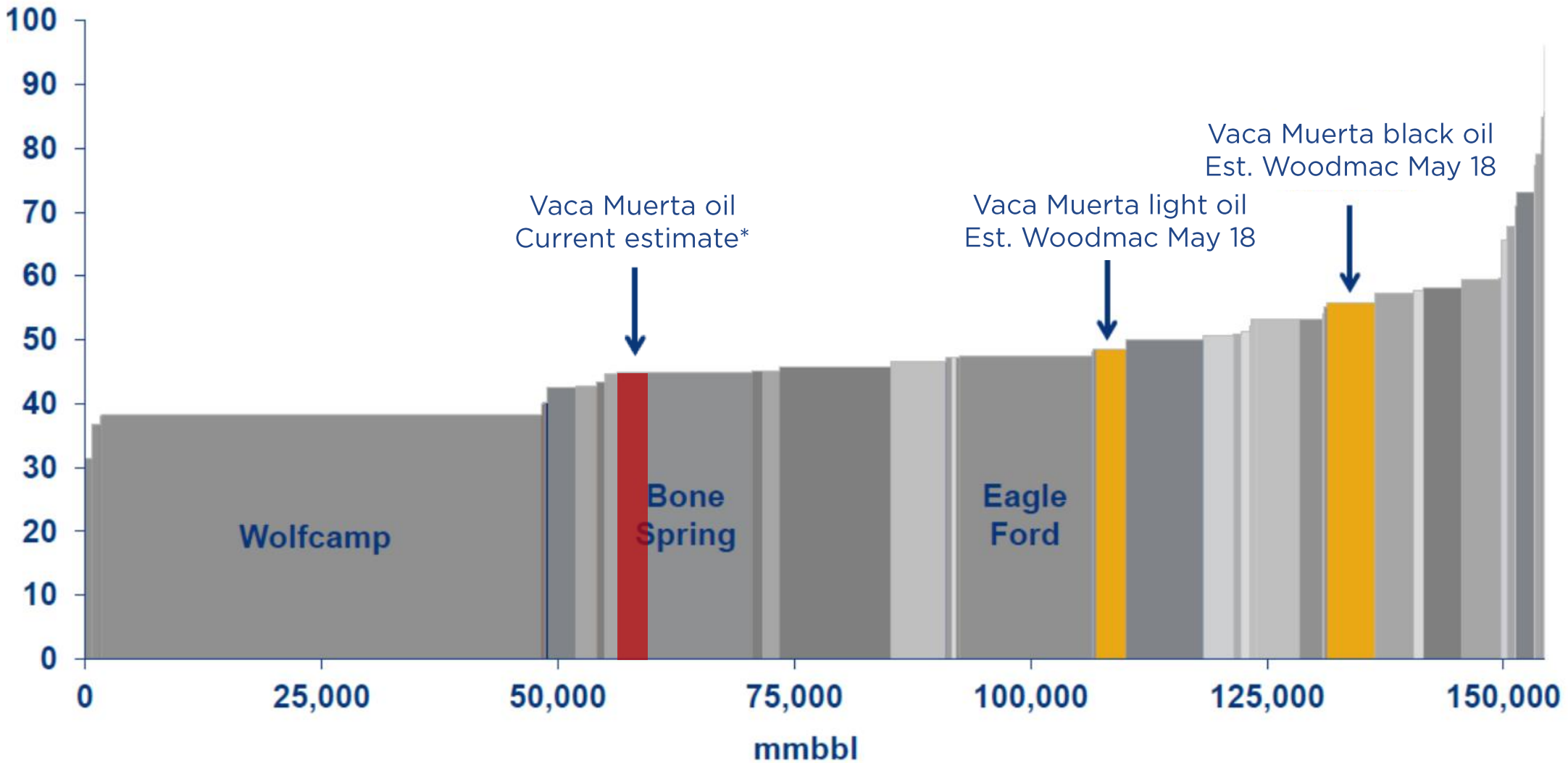


Note: Medanito Export Parity was estimated using Brent -4 USD/bbl (transport) -10% (export tax).

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

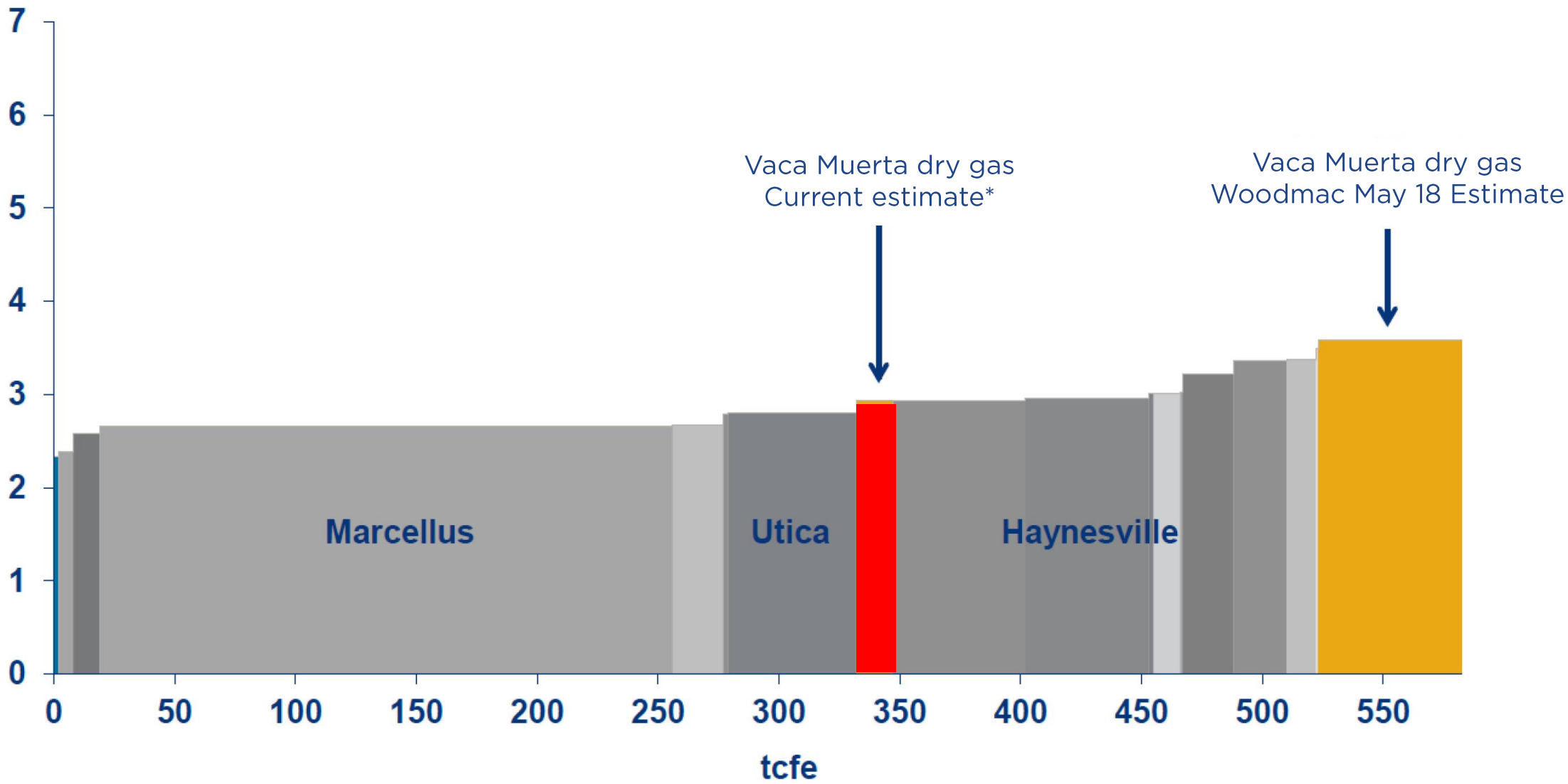


# Liquid break-even prices in Vaca Muerta vs. USA plays

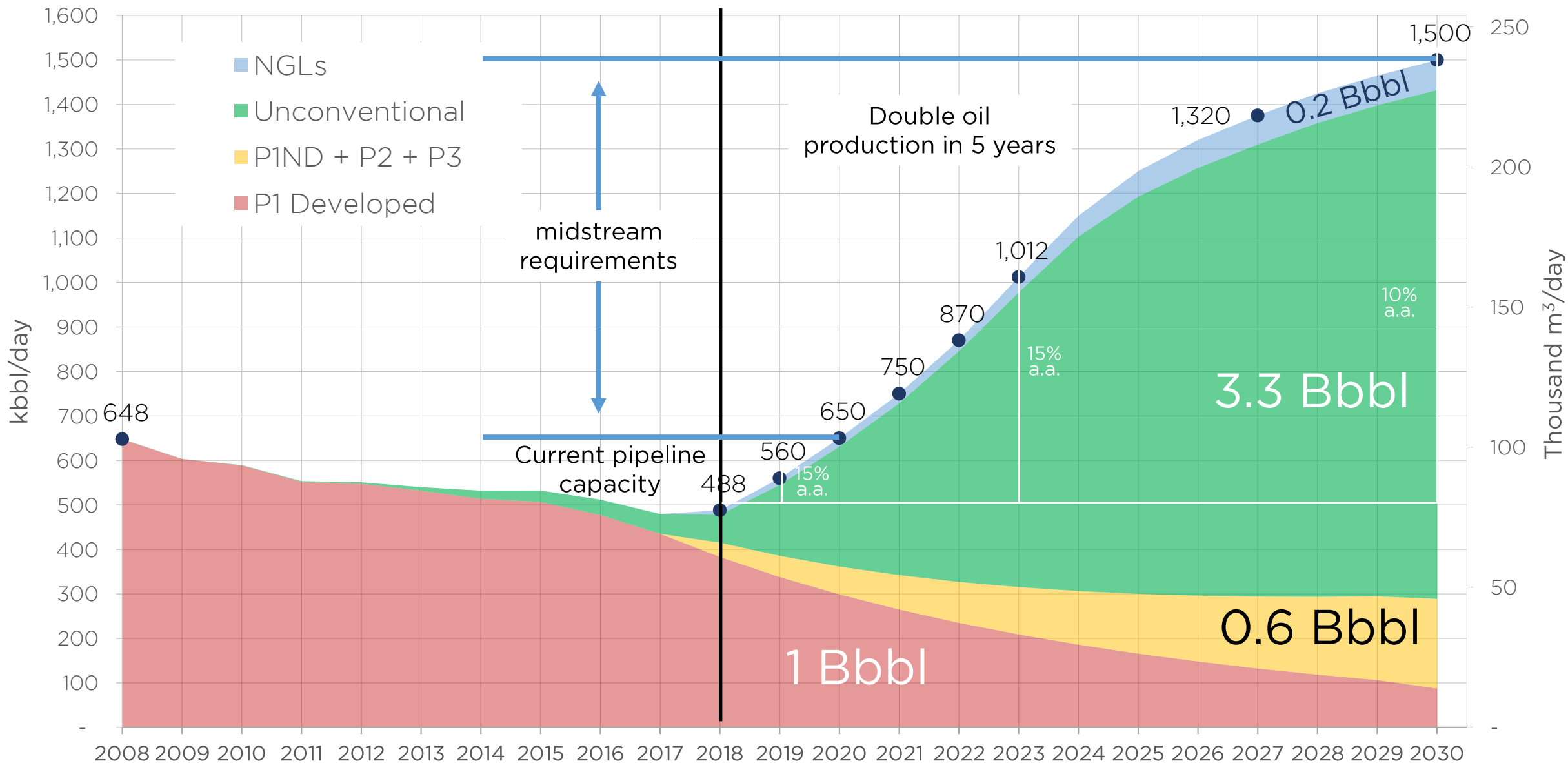


Sources: Wood Mackenzie / \*Current estimate own elaboration

# Gas break-even prices in Vaca Muerta vs USA plays

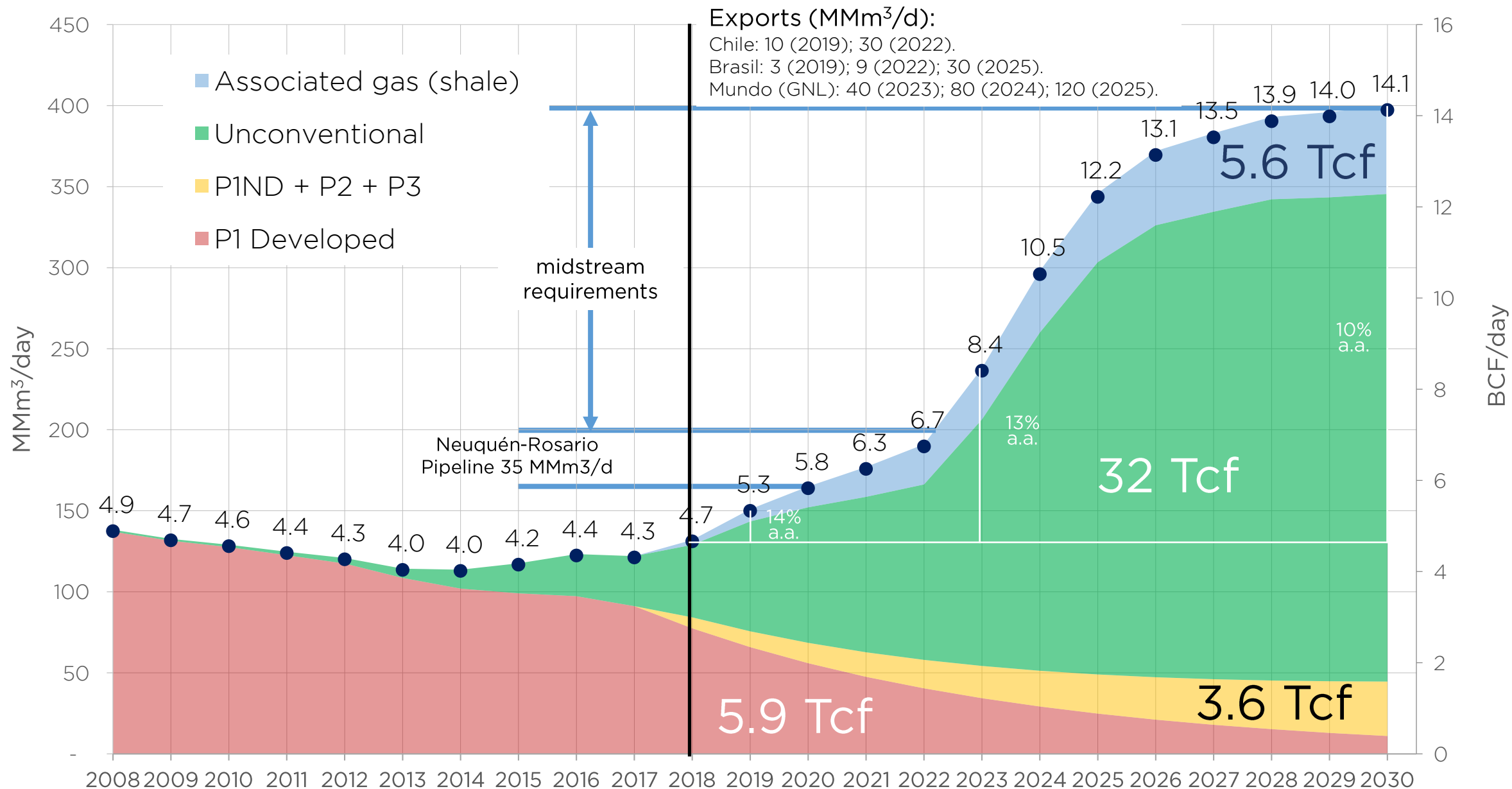


Sources: Wood Mackenzie / \*Current estimate own elaboration

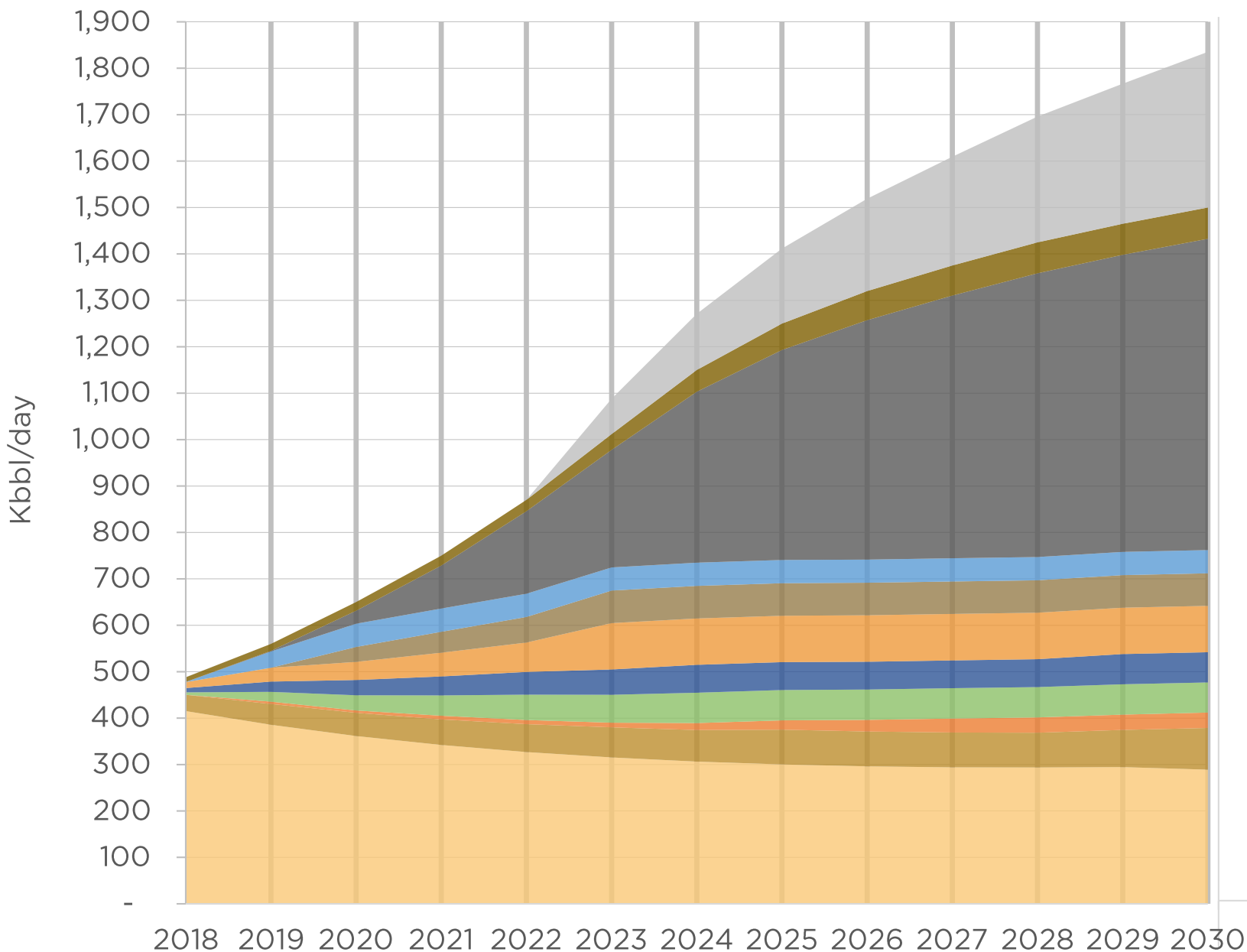




# Natural Gas Production



# Key ongoing projects - Oil

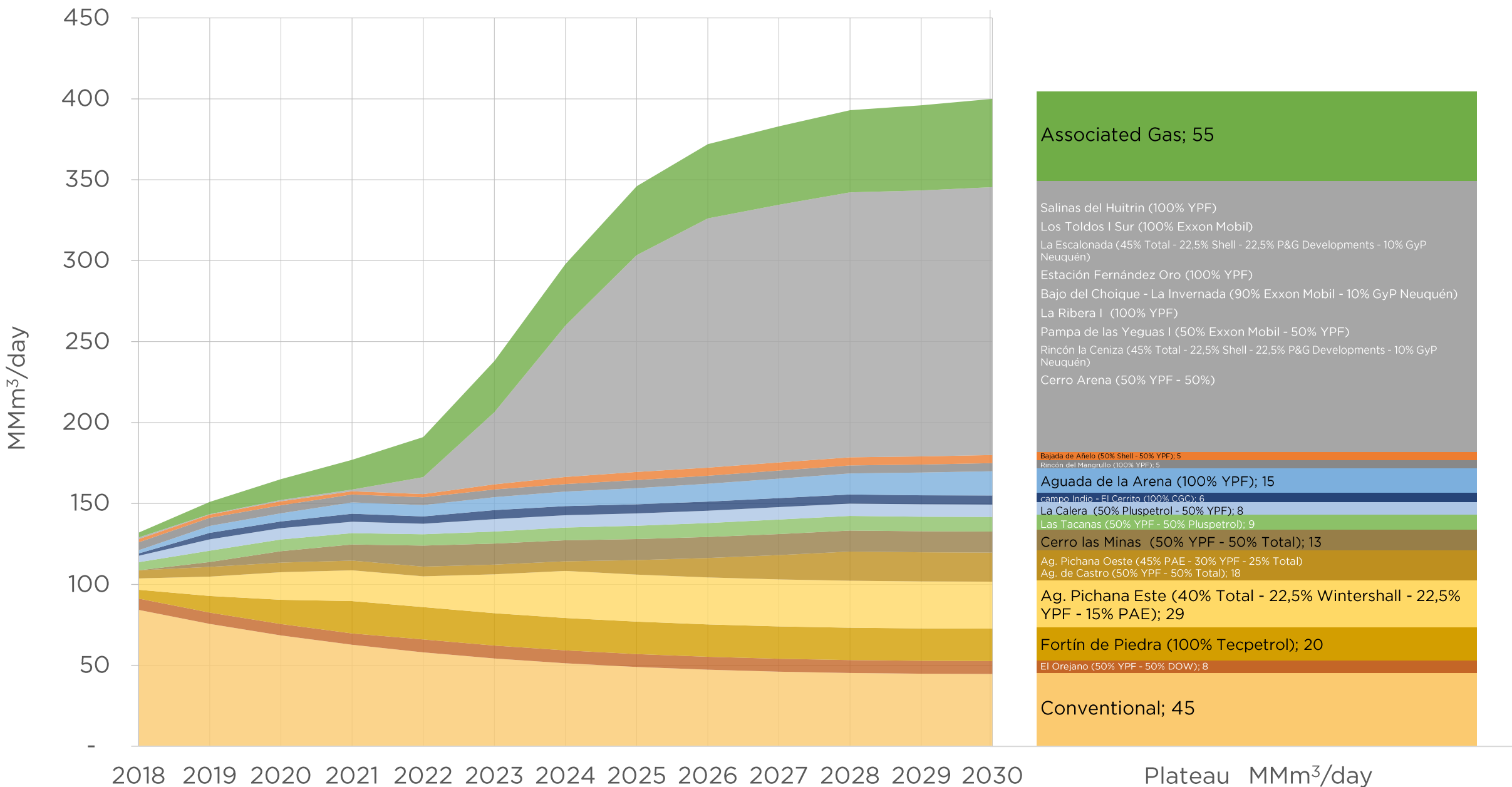


- |   |  |
|---|--|
| Loma Amarilla (100% YPF)                                  | Puesto Hernández (100% YPF)  |
| Ag. Del Chañar (100% IEASA)                               | El Trapial (85% Chevron - 15% YFC)                                   |
| Las Manadas (100% YPF)                                    | Los Toldos II (90% Americas Petrogras - 10% GyP Neuquén)             |
| C. Amargo Este (55% PAE - 35% Madalena - 10% PyG Neuquén) | Águila Mora (90% O&G Developments - 10% GyP Neuquén)                 |
| M. Buena Esperanza (50% YPF - 50% Pluspetrol)             | Lindero Atravesado (38% YPF - 62% PAE)                               |
| Ag. Villanueva (100% Pluspetrol)                          | C. Amargo Oeste (45% O&G Developments - 45% Shell - 10% GyP Neuquén) |
| Narambuena (50% YPF-50% Chevron)                          | C. Amargo Sur (45% O&G Developments - 45% Shell - 10% GyP Neuquén)   |
| Chihuido de la S. Negra (100% YPF)                        | Al Norte de la Dorsal (100% YSUR)                                    |

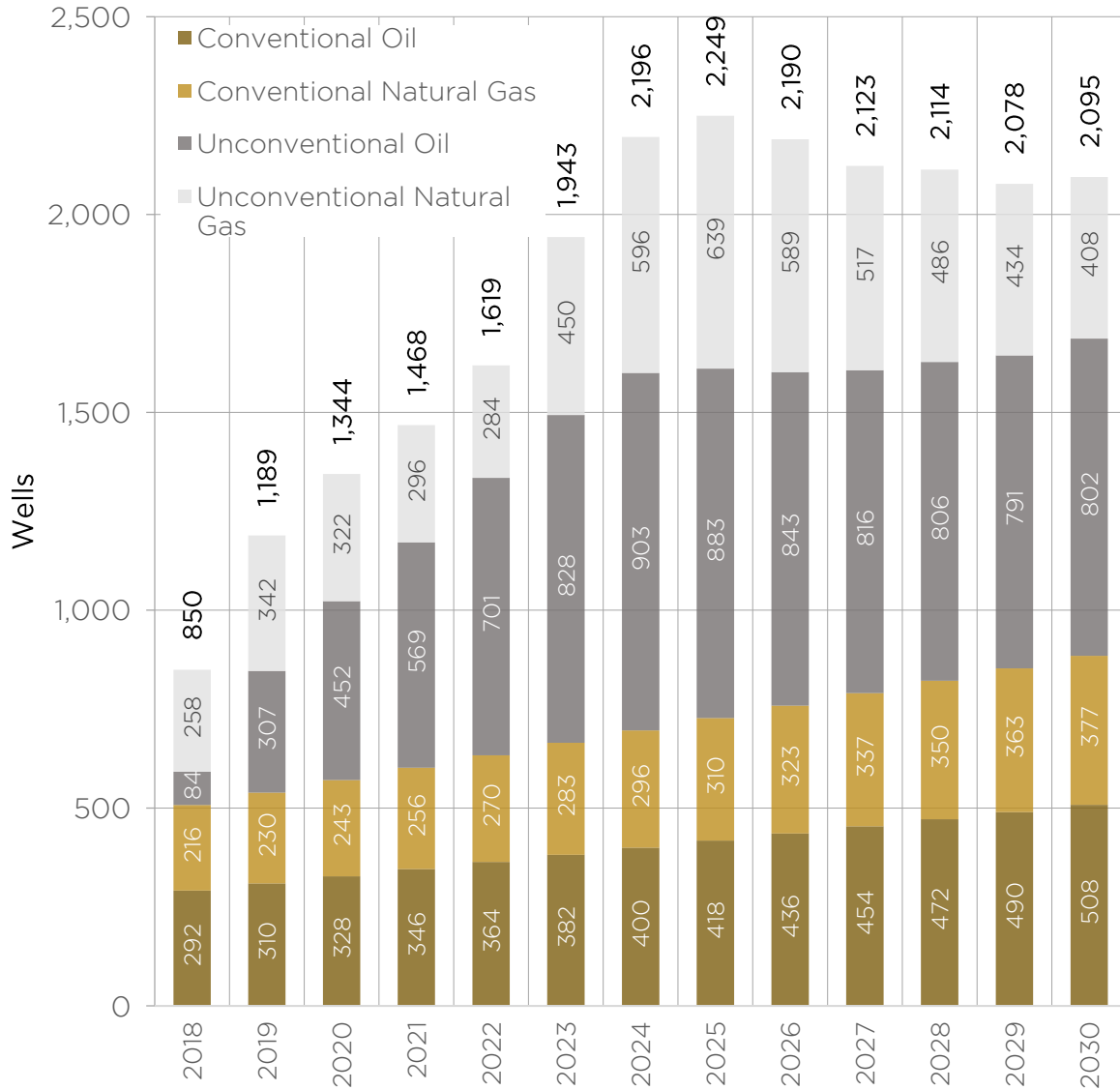
- NGLs, 68**
- San Roque (25% Wintershall - 34% YPF - 16% PAE - 25% Total)**
- La escalonada (45% Total - 23% Shell - 23 % O&G Developments - 10% GyP Neuquén)**
- Bandurria Centro (100% PAE)**
- La Ribera I (100% YPF)**
- La Ribera II (100% YPF)**
- Bandurria Norte (90% Wintershall- 10% PyG Neuquén)**
- Aguada Federal (90% Wintershall- 10% PyG Neuquén)**
- Bajo del Toro (50% YPF - 50% Statoil)**
- Bajo del Choique - La Invernada (90% Exxon Mobil - 10% GyP Neuquén); 50**
- Bajada de Palo (100% Vista Oil&Gas); 70**
- Cruz de Lorena - S. Blancas (50% Shell - 40% O&G Developments - 10% GyP Neuquén); 100**
- La Amarga Chica (50% YPF-50% Petronas); 65**
- Bandurria Sur (100% YPF); 65**
- Loma La lata (100% YPF); 33**
- Loma Campana (50% YPF-50% Chevron); 90**

Conventional; 289

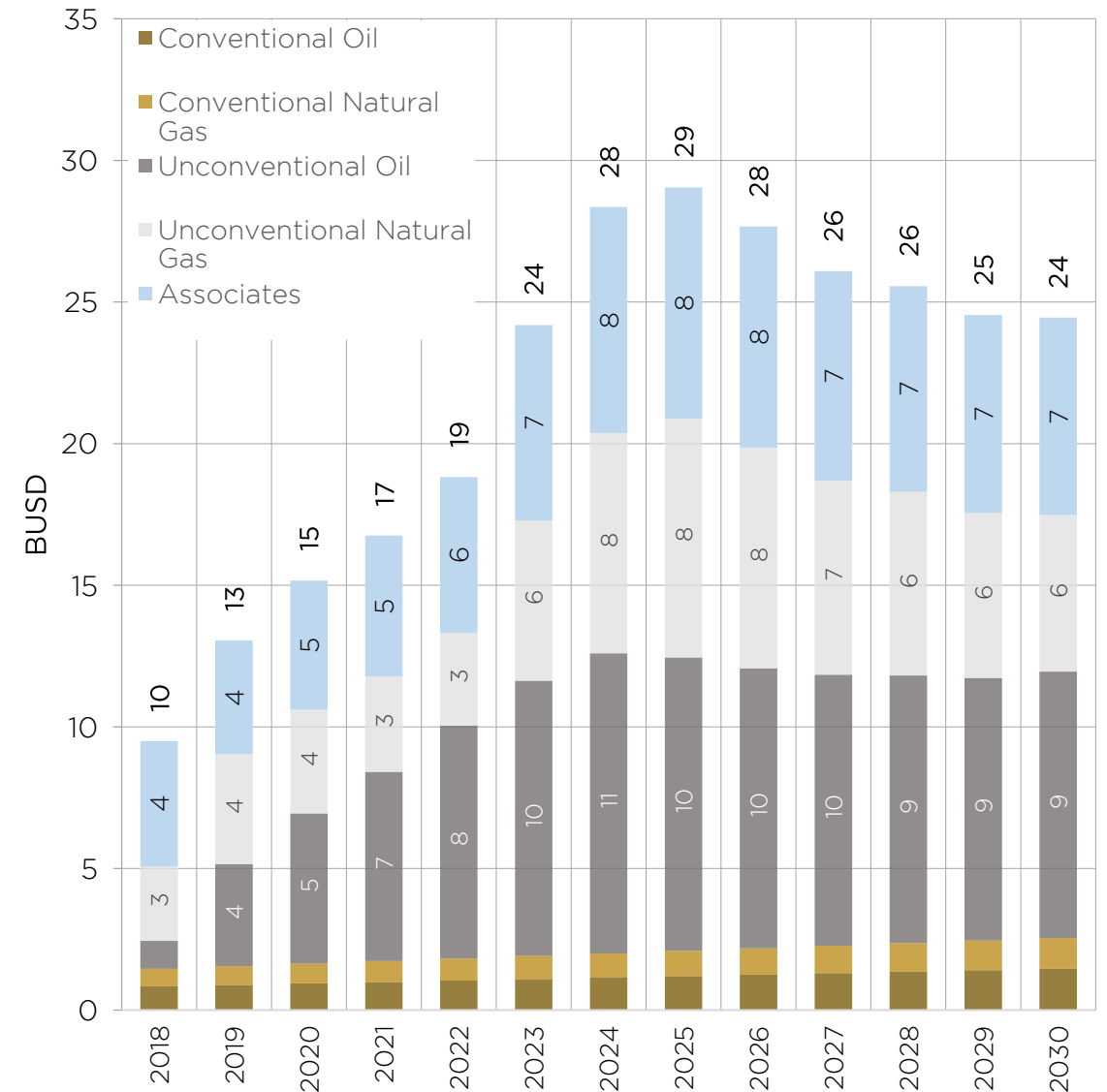
# Key ongoing projects – Natural gas



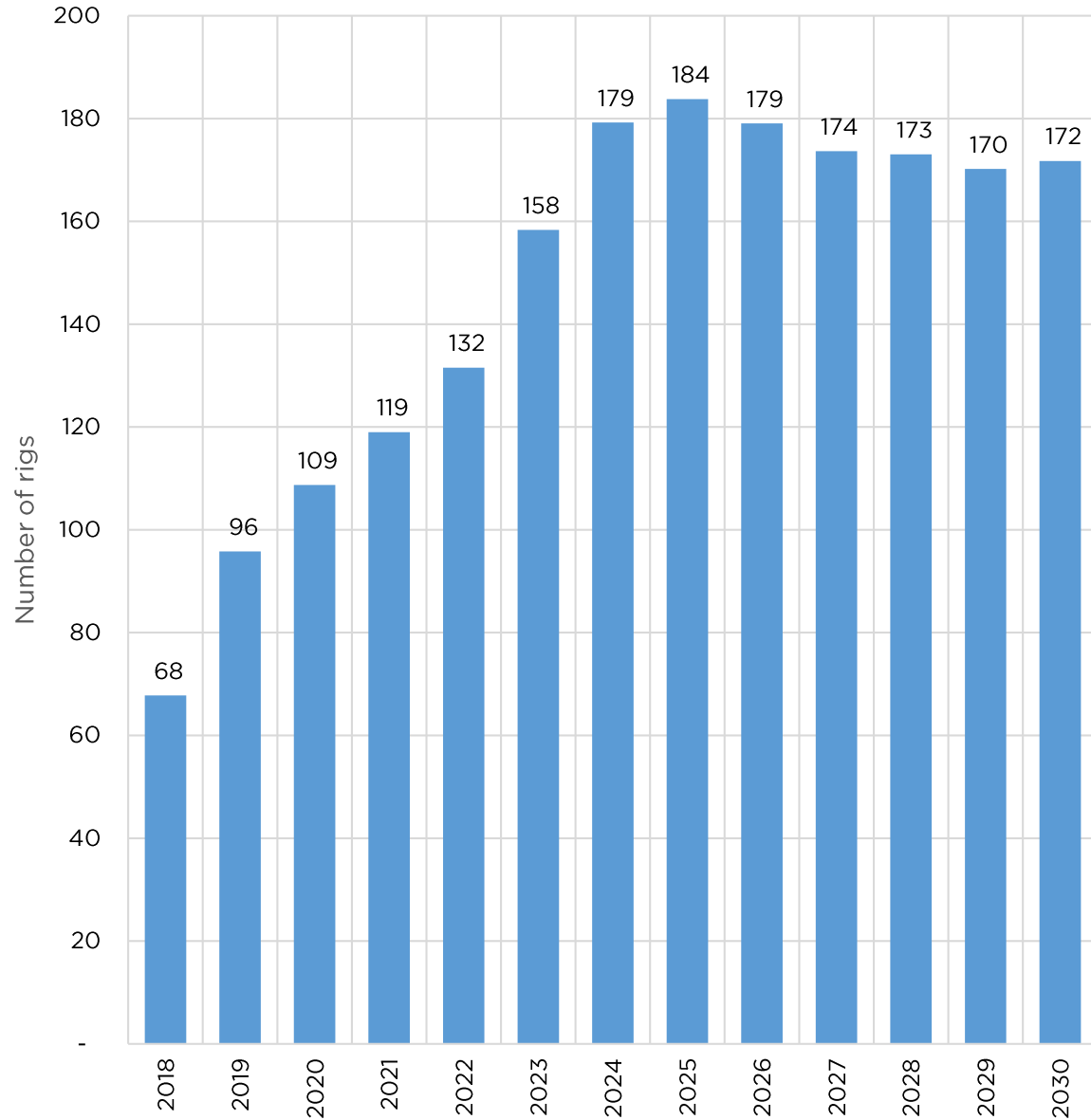
## Completed wells



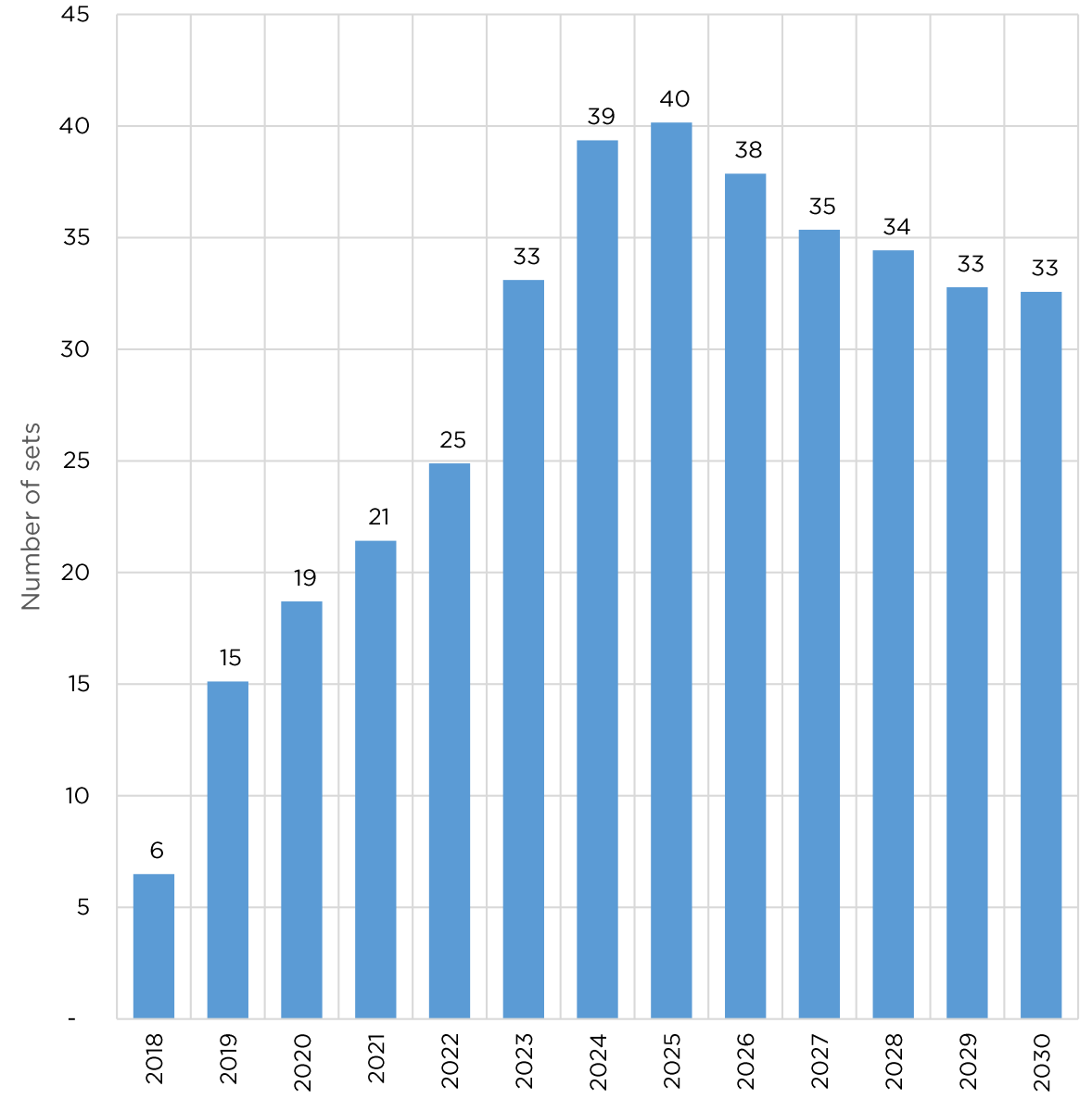
## Investments - BUSD



## Drilling rigs



## Completion sets





## 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)

LNG Patagonia 6 trains

(0.7 BCF/day each)

2023 = 1.4 BCF/day

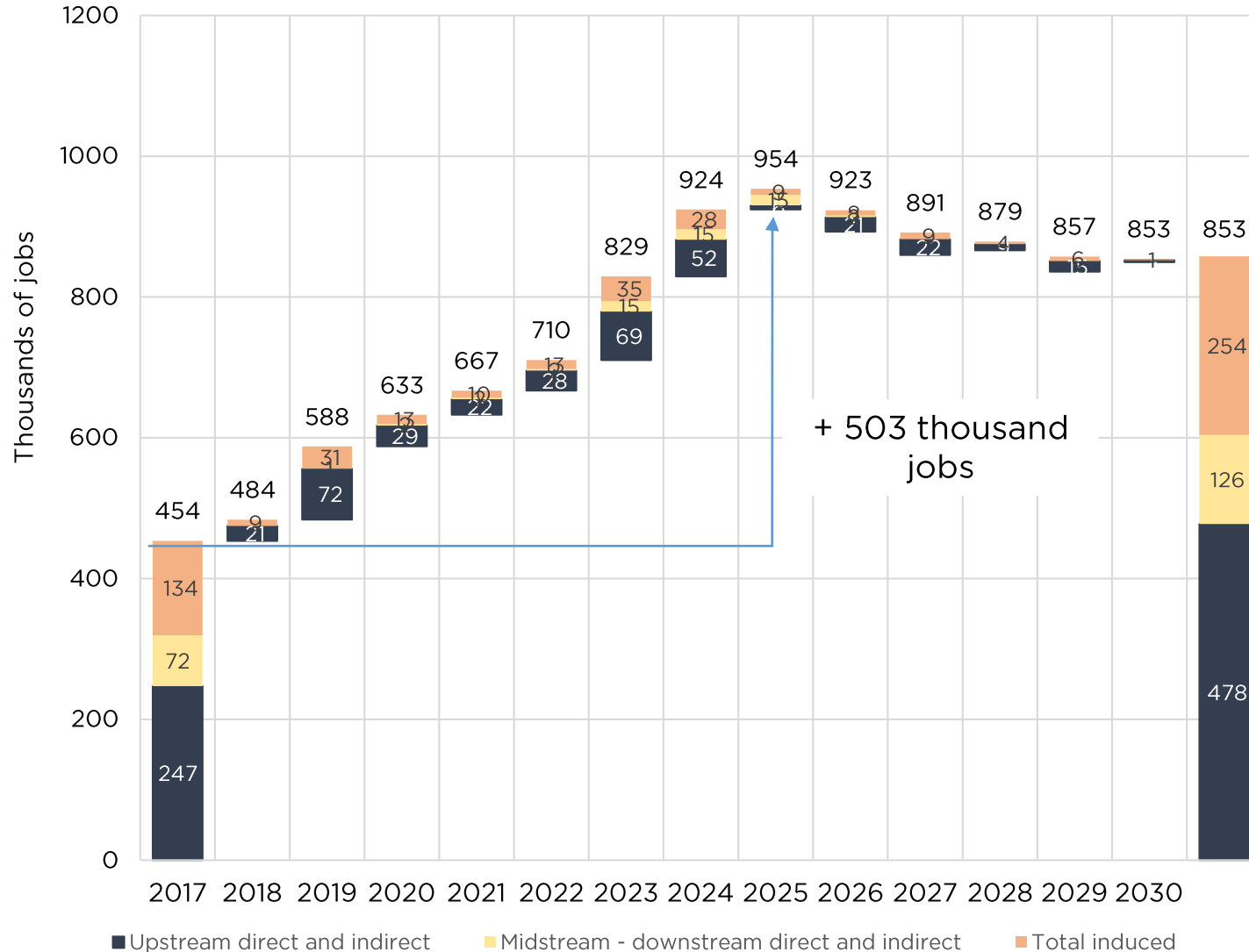
2024 = 2.8 BCF/day

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	<b>Argentina</b>	<b>4.2</b>	<b>5%</b>

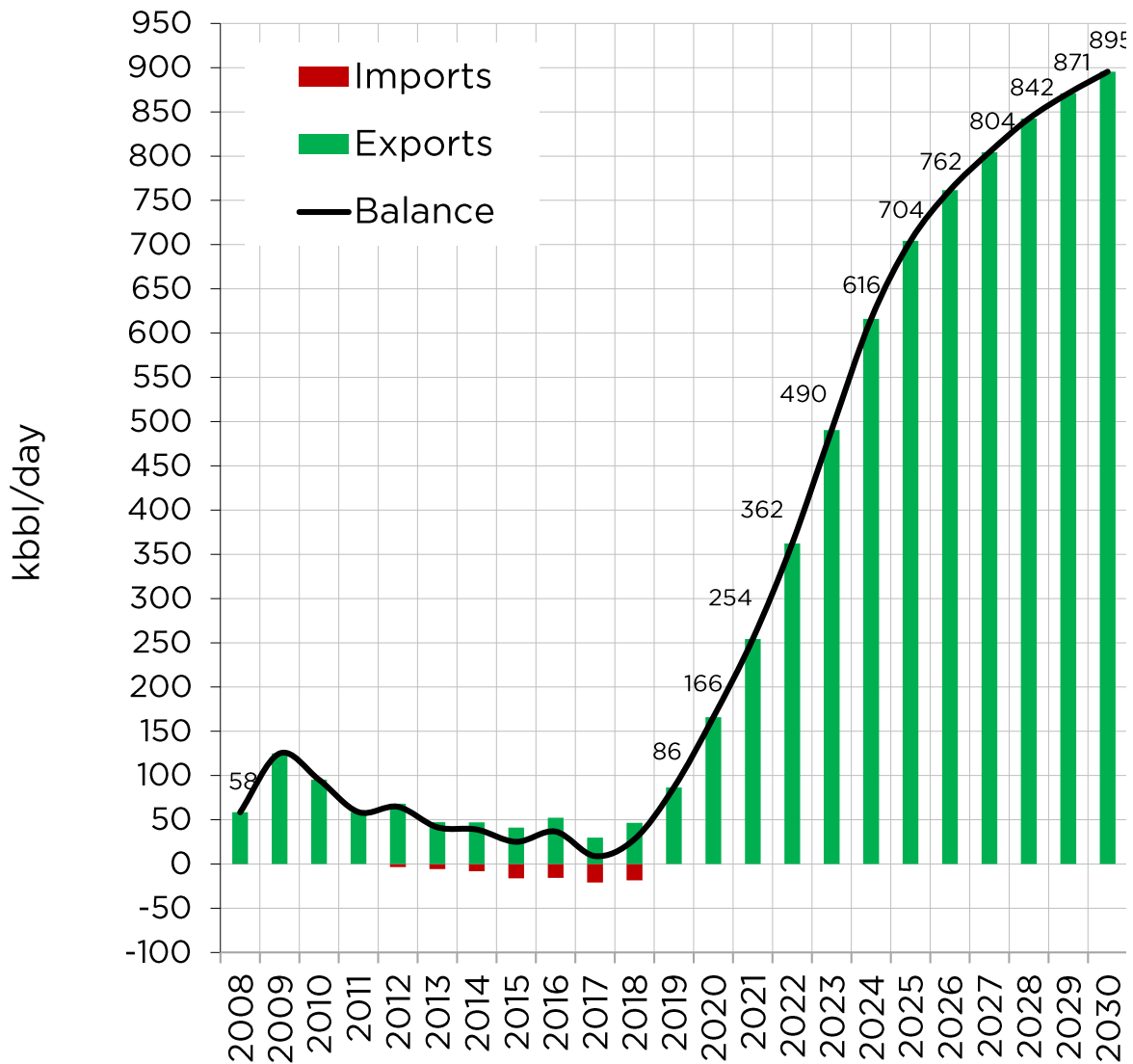
## Direct, indirect and induced Jobs at the oil and gas in Argentina



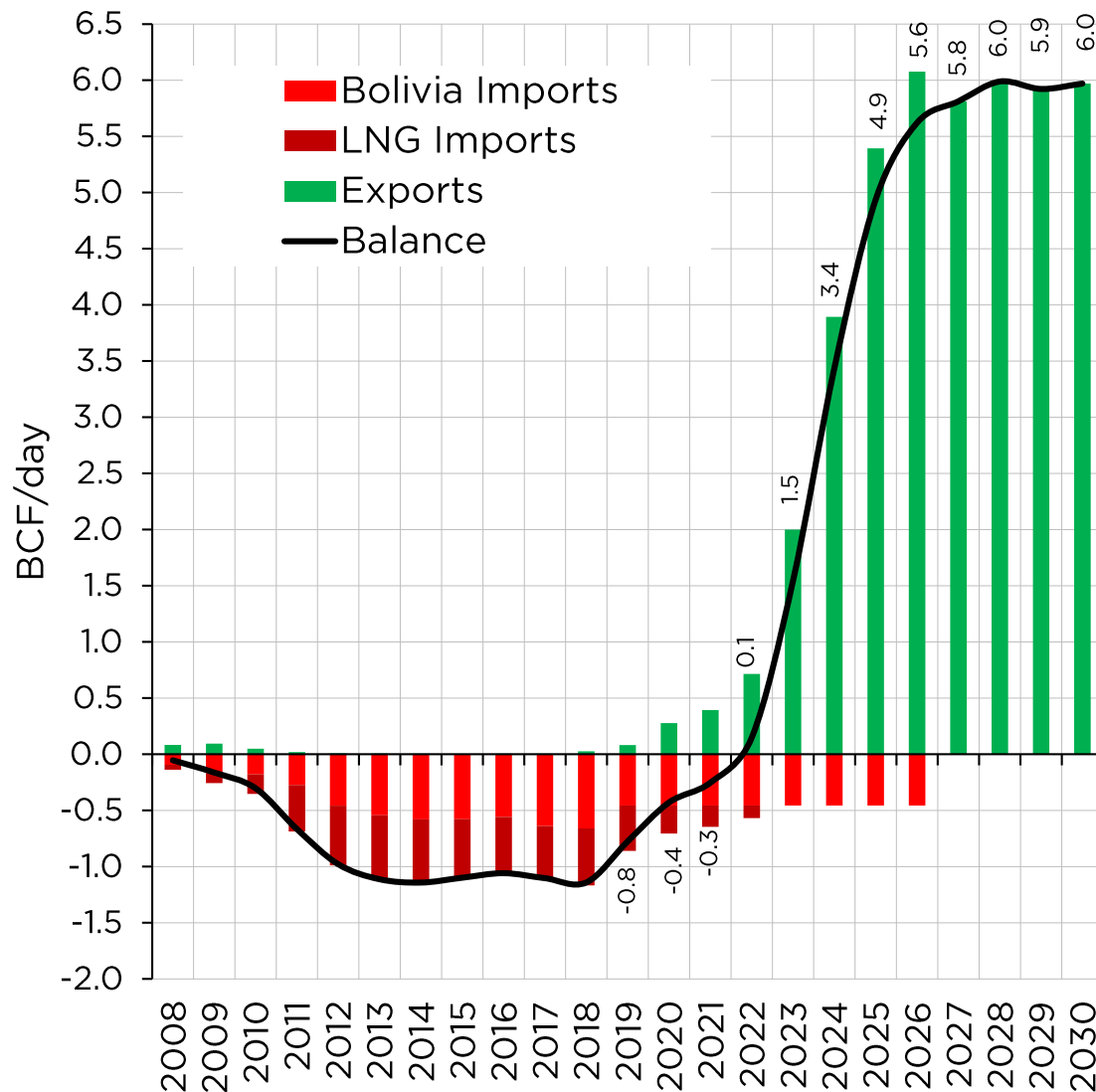
### Bottom up estimation:

- 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).

## Physical Oil international exchange

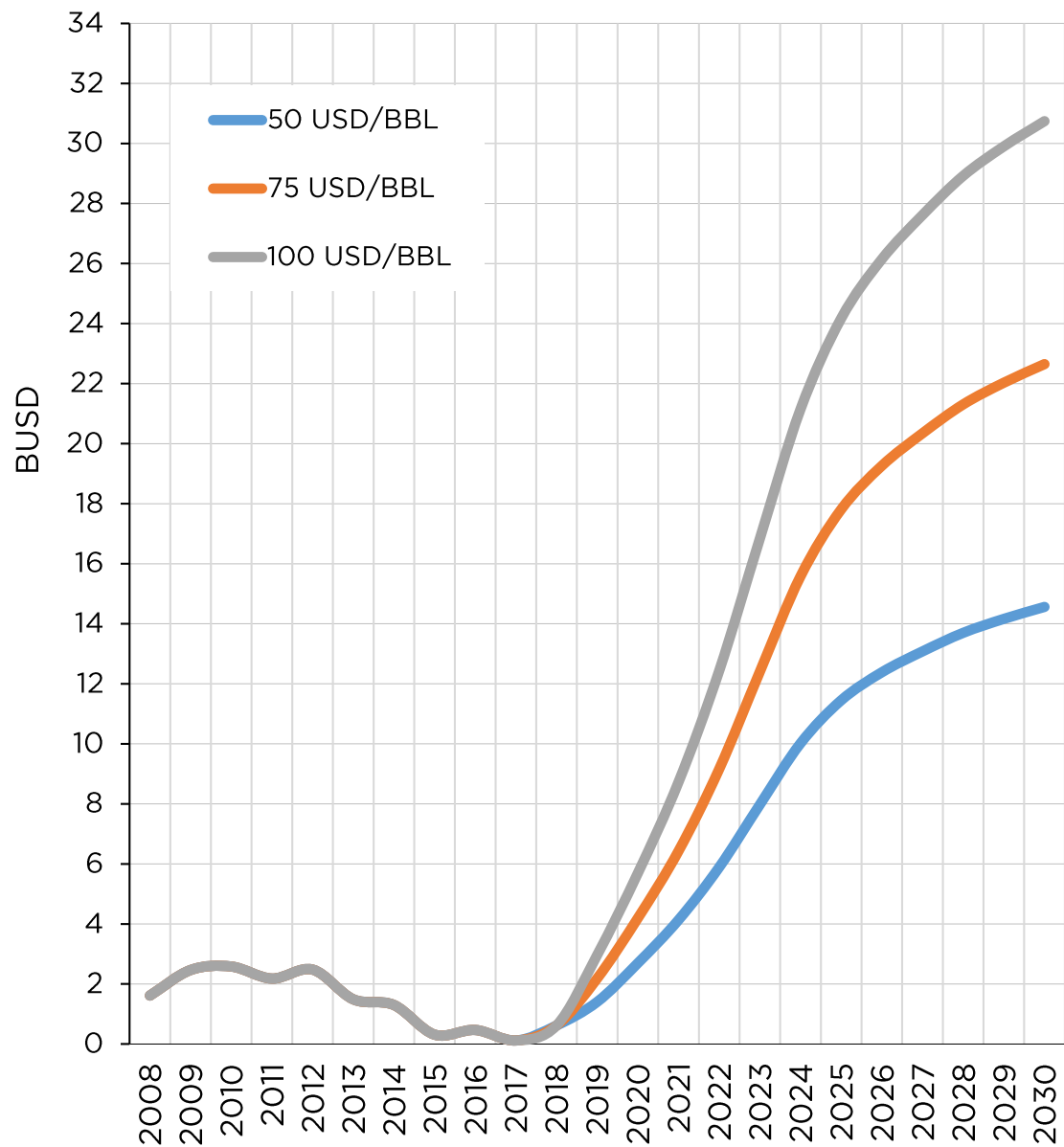


## Physical Natural Gas international exchange

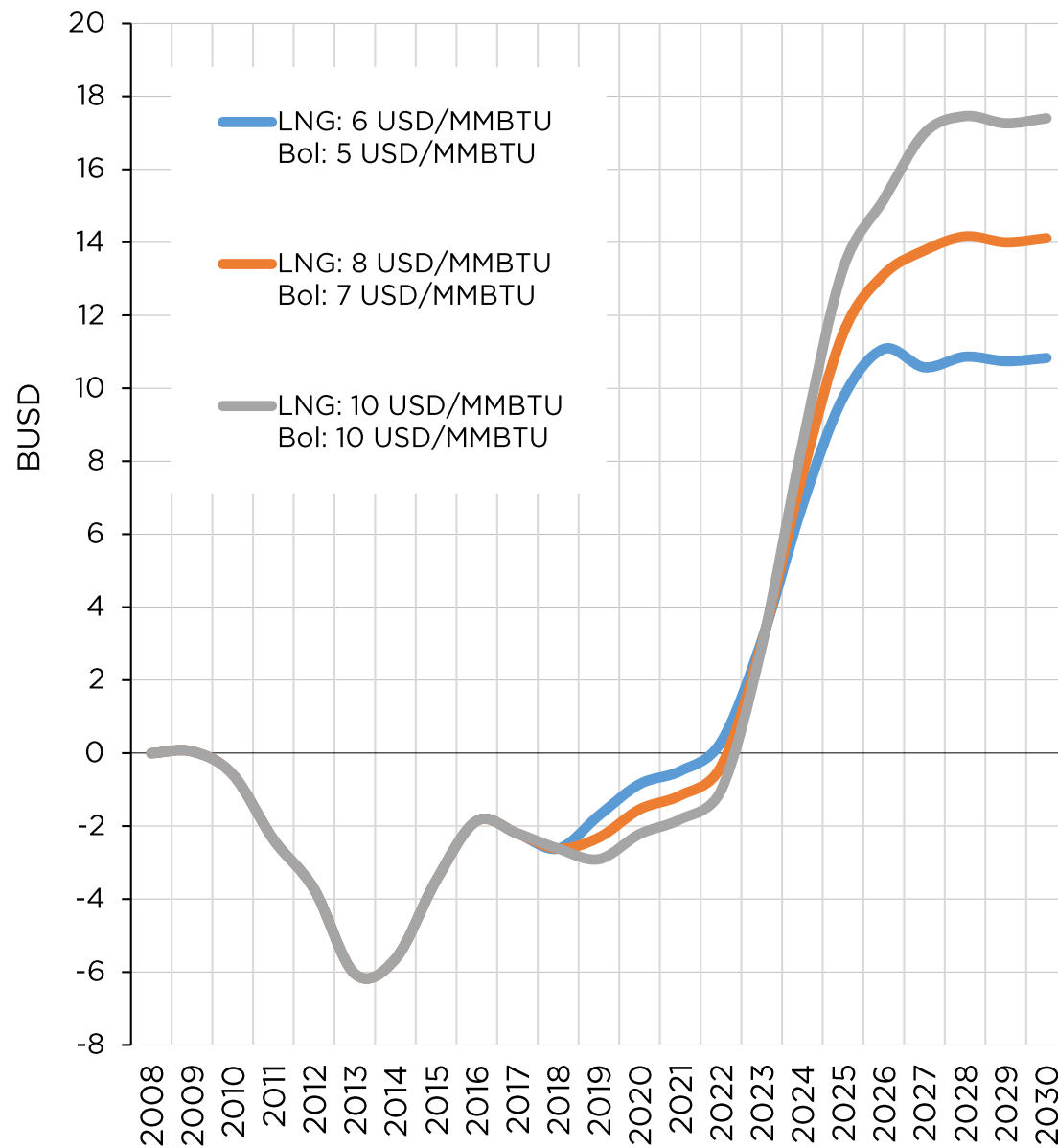


# On track to recover the energy trade surplus

## Trade Balance of Oil

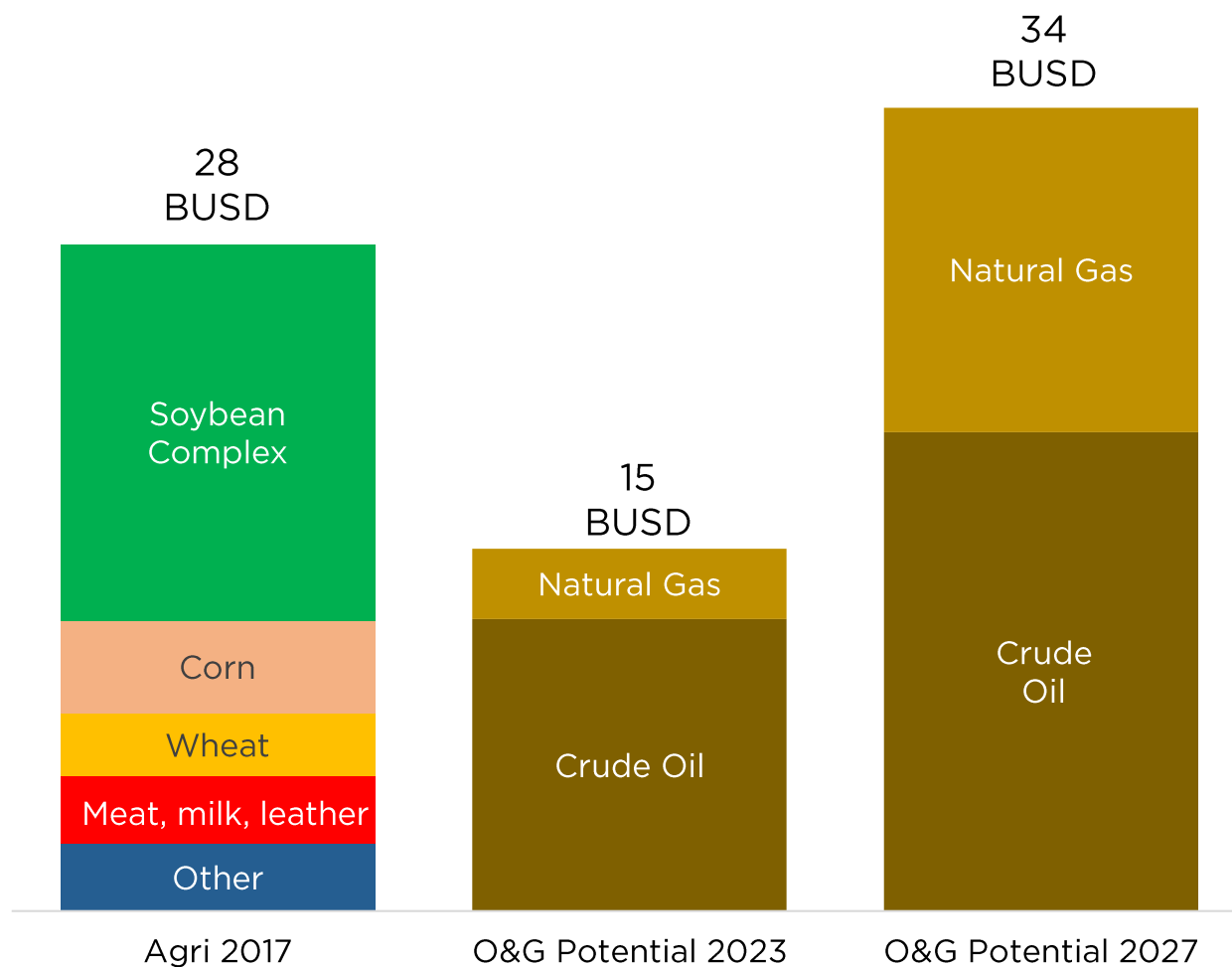
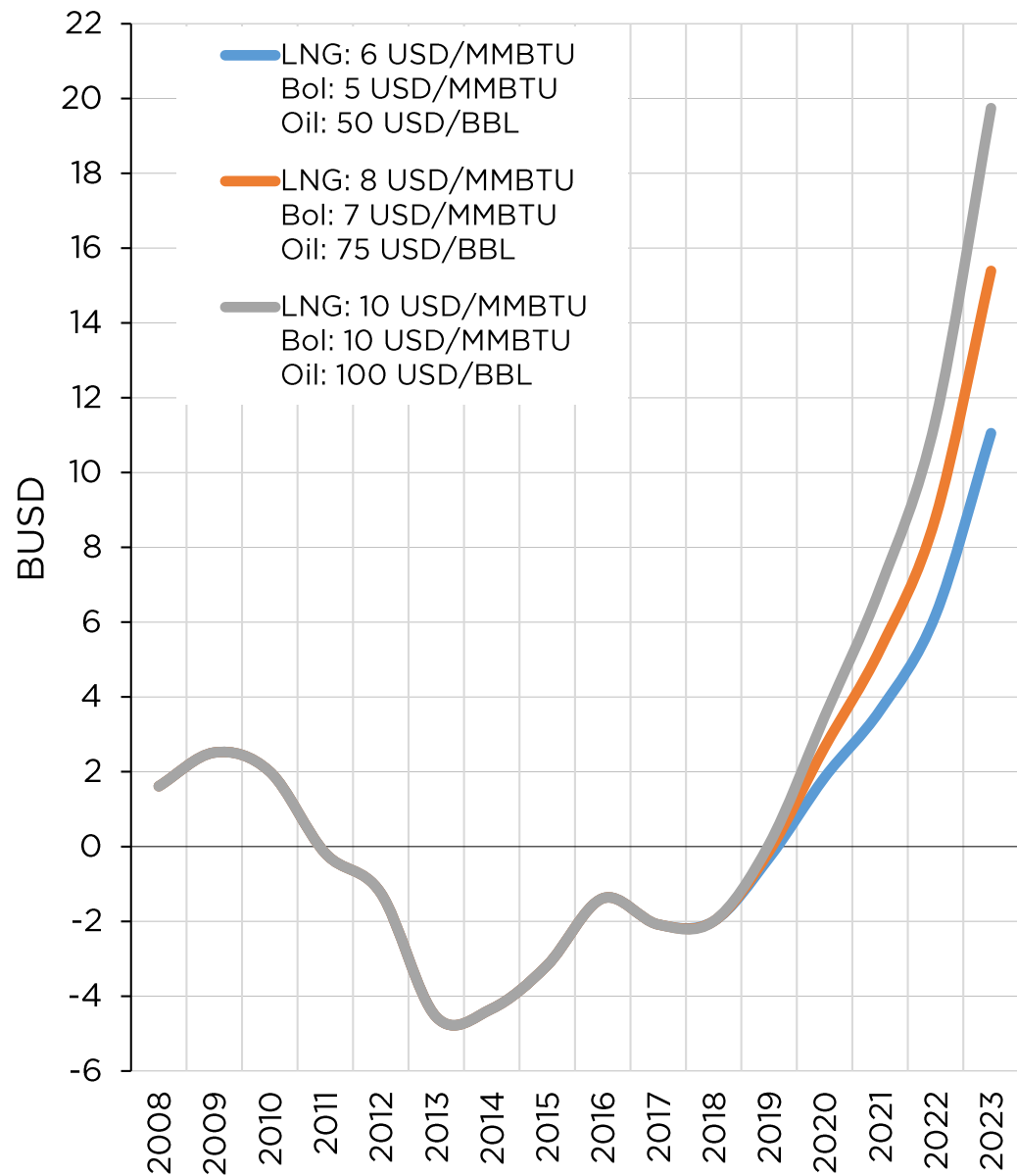


## Trade Balance of Natural Gas



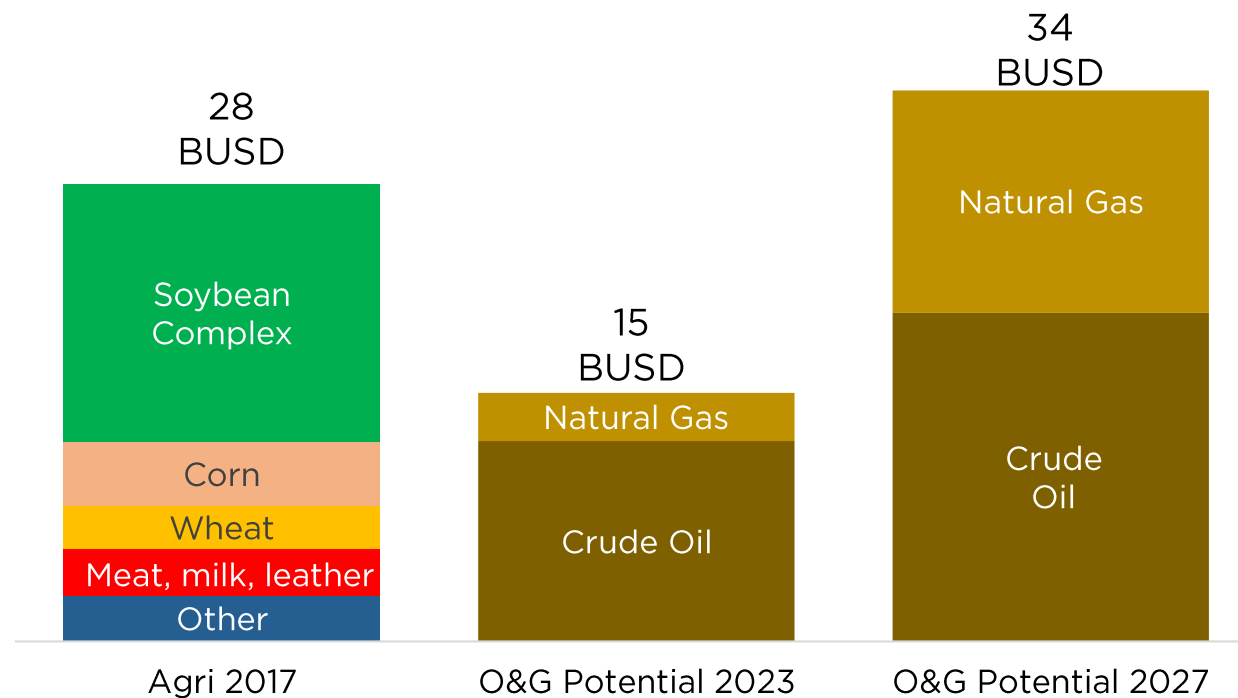
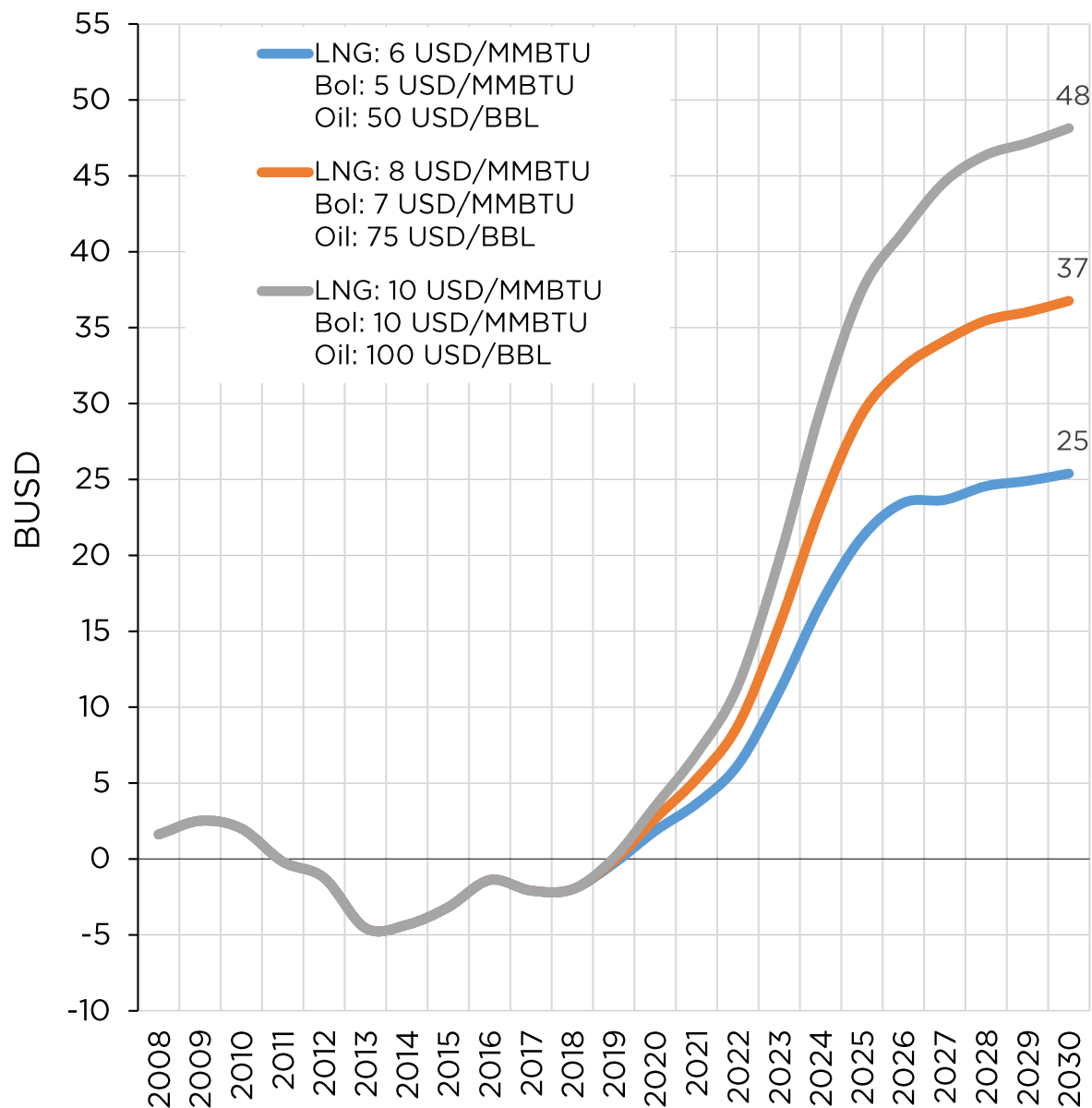
# O&G's net exports can surpass current agribusiness exports

## Trade Balance of O&G

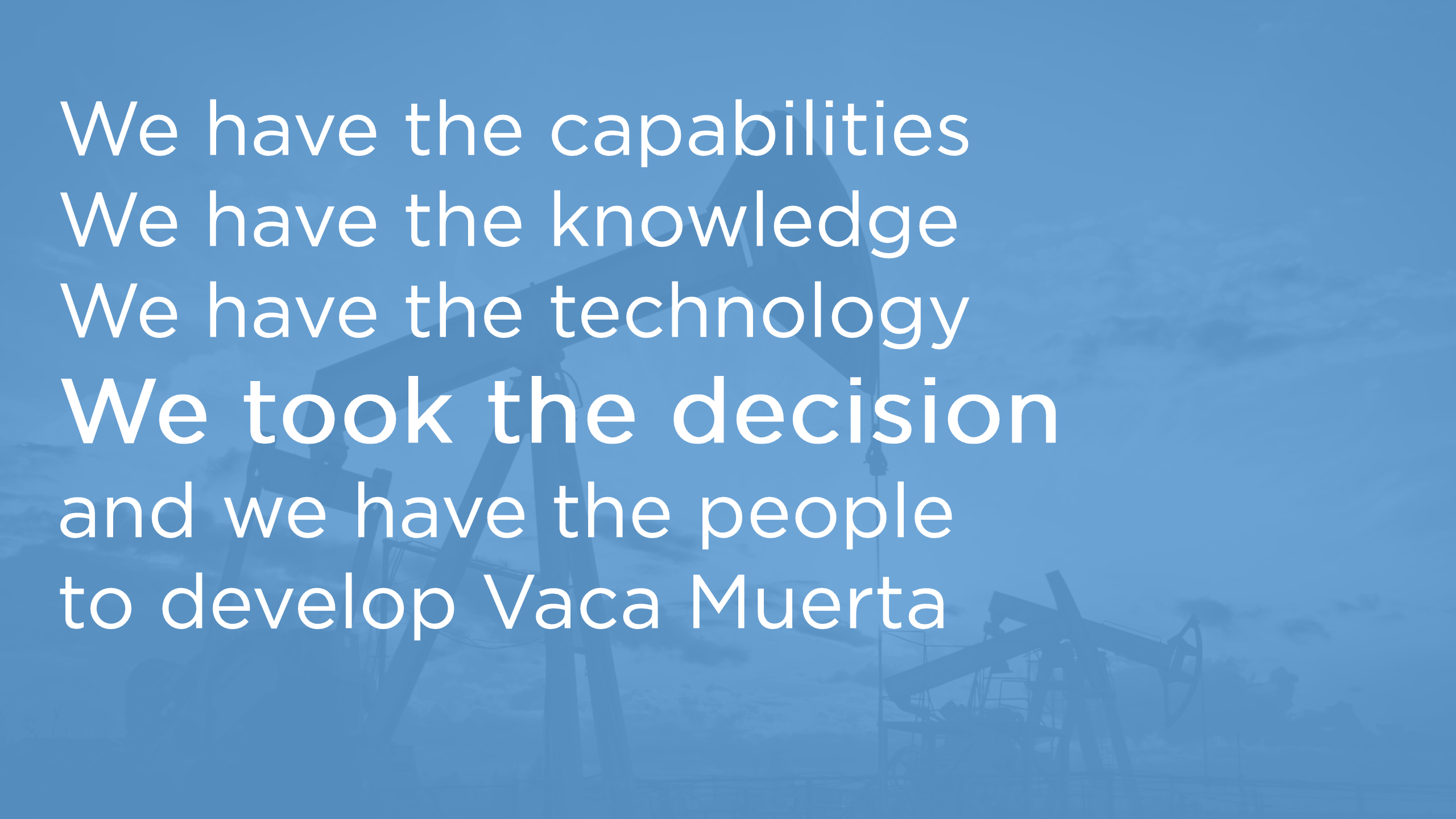


# O&G's net exports can surpass current agribusiness exports

## 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



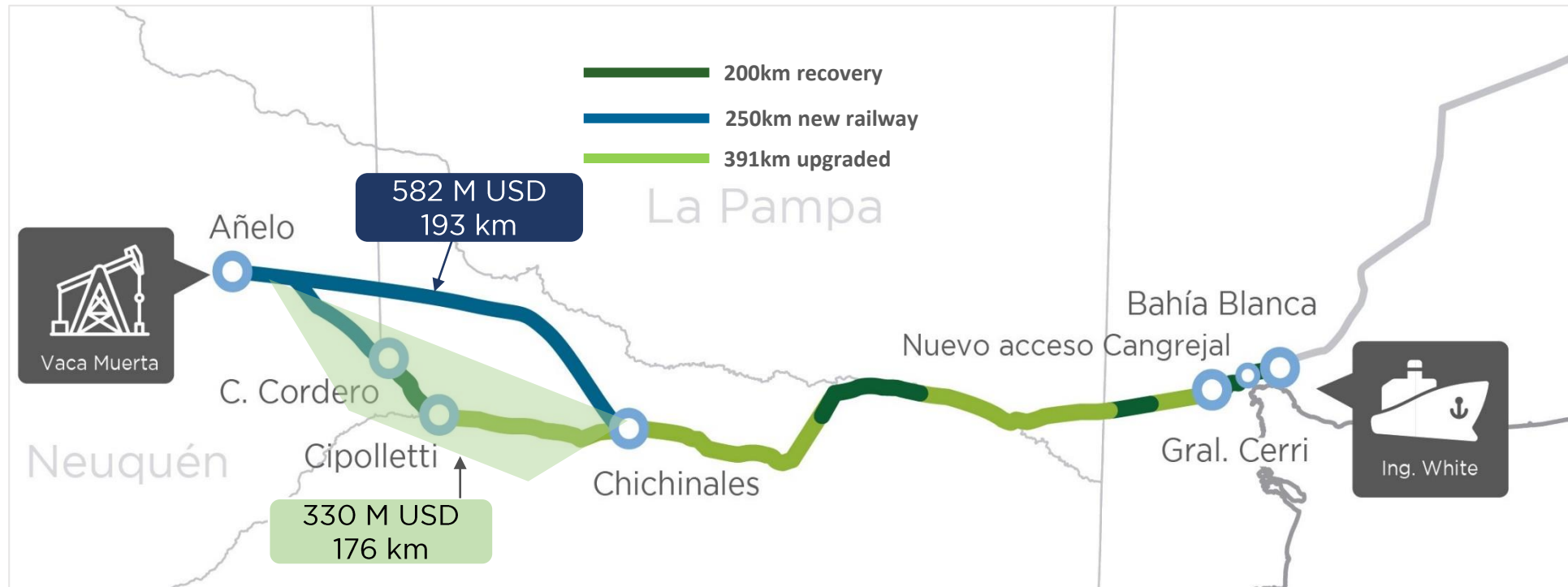
Estimated investments  
**1,285 M USD**

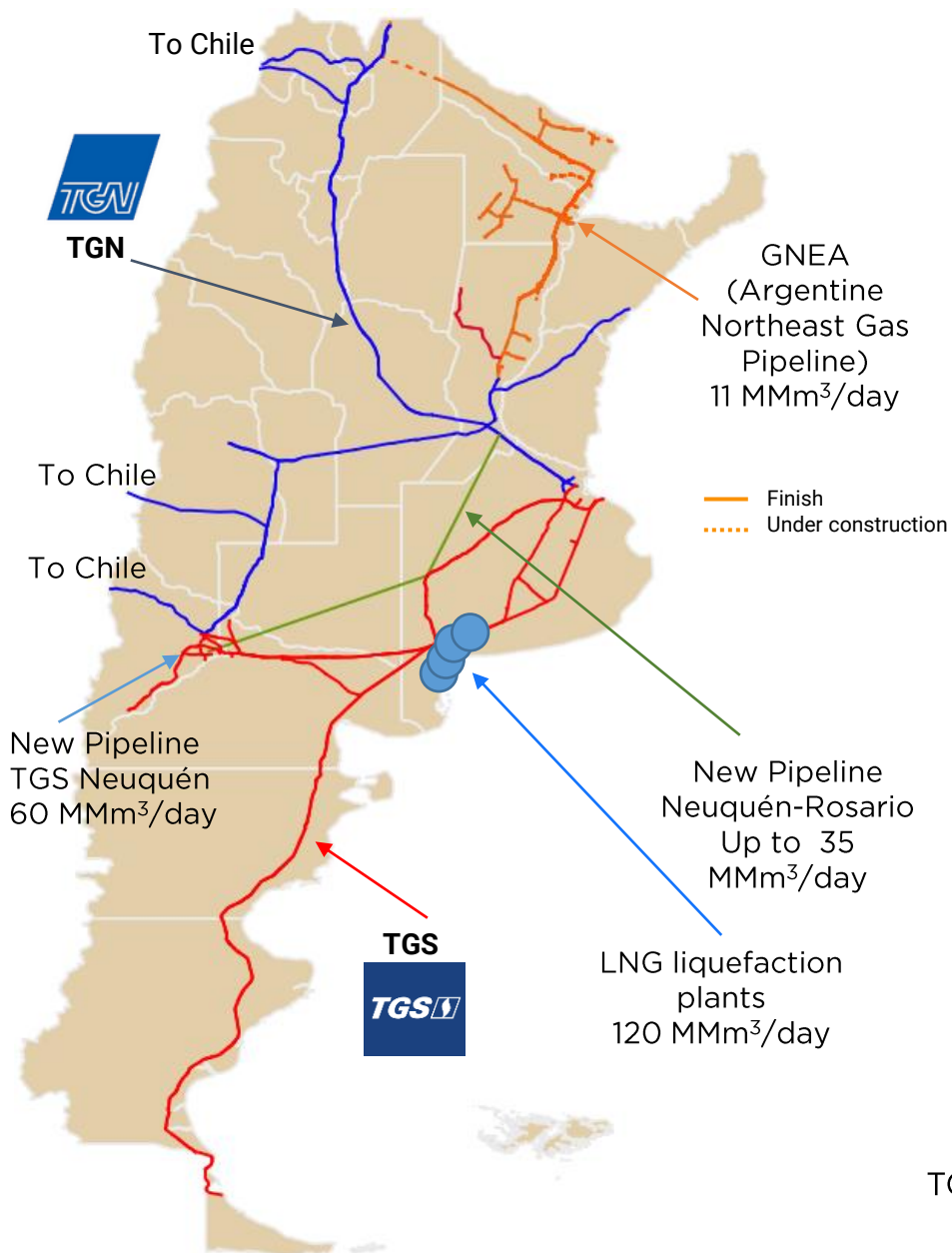
48 months of construction

850km recovery  
Capacity > 6Mt

## Standard of the Railway

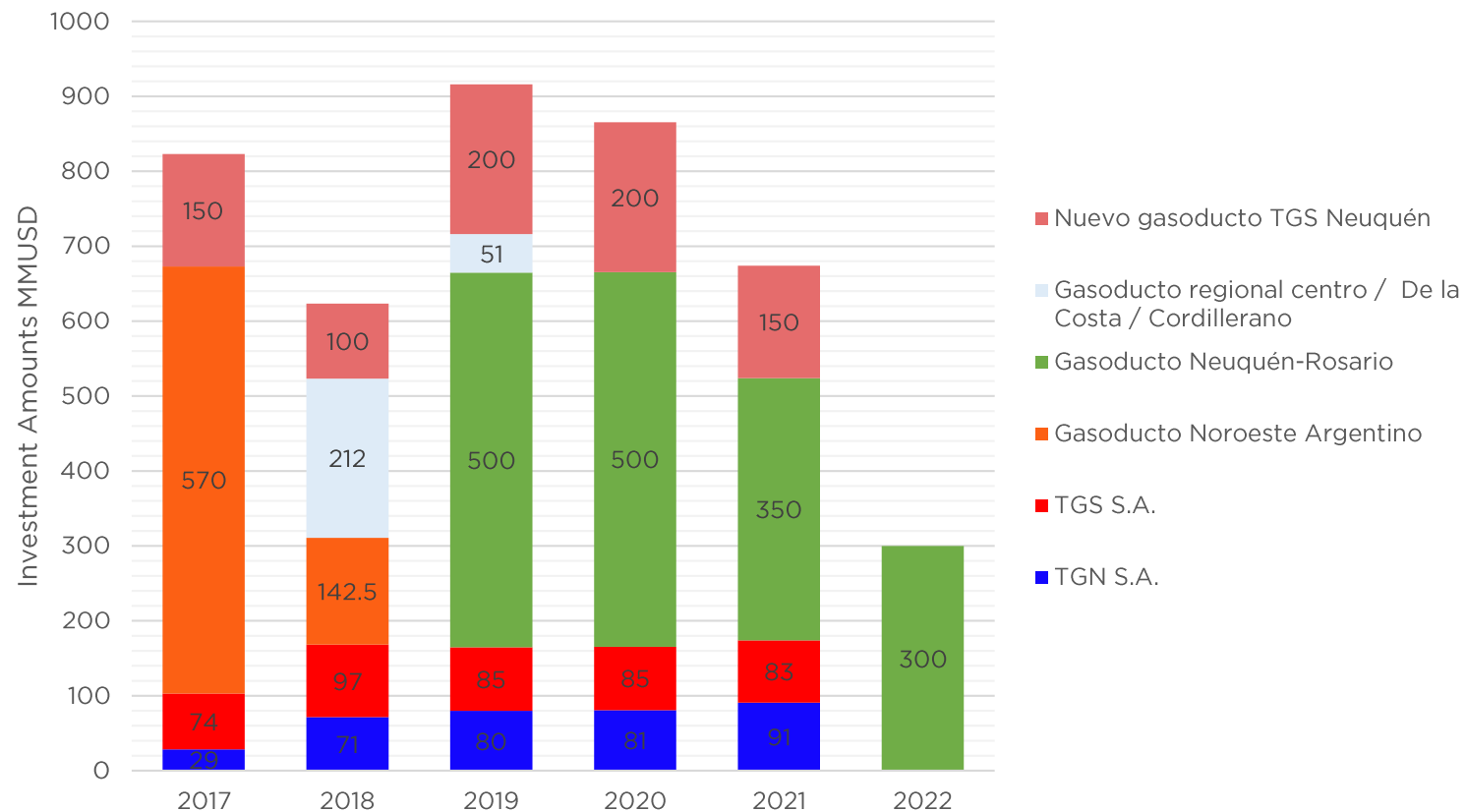
- ▶ 25 tons/ railway's axis upgraded
- ▶ Maximum speed of 70 km/h
- ▶ Crossings' Deviation for 100 wagons





## 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



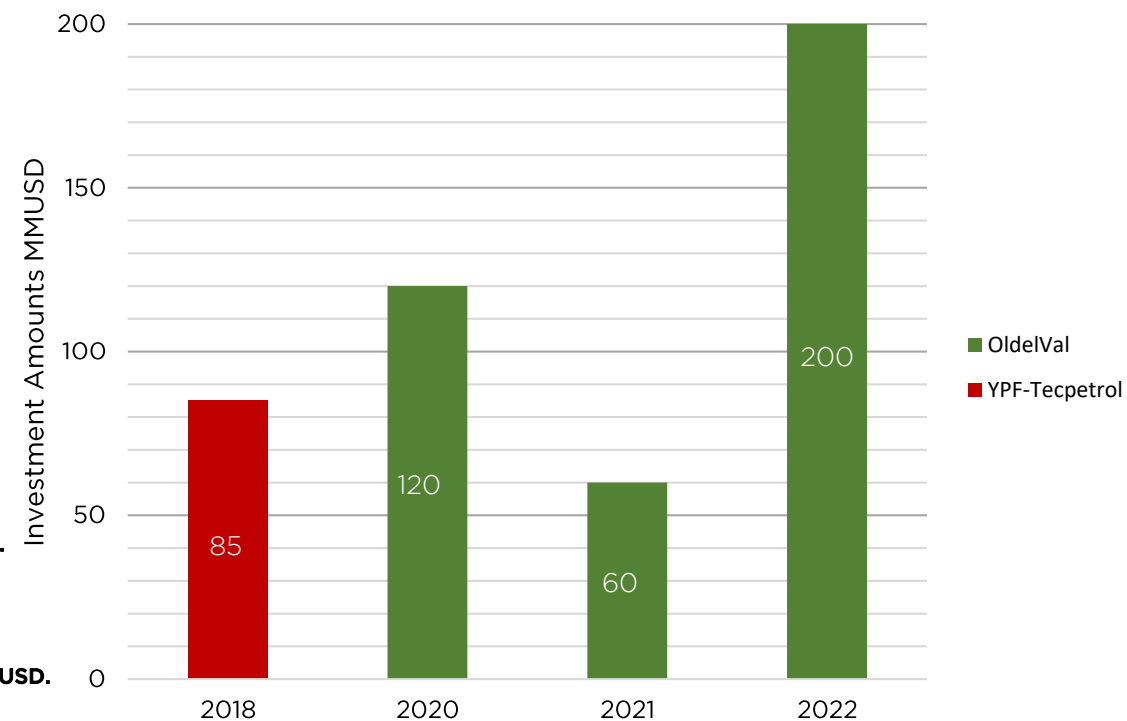
Note: Tariff Review values expressed in dollars using 16 ARS/USD exchange rate

TGN y TGS: Infraestructura desarrollada por Tariff Review corresponde a mantenimiento e mejoramiento de gasoductos y plantas de compresión.  
 TGS: incluye 125 km gasoducto.



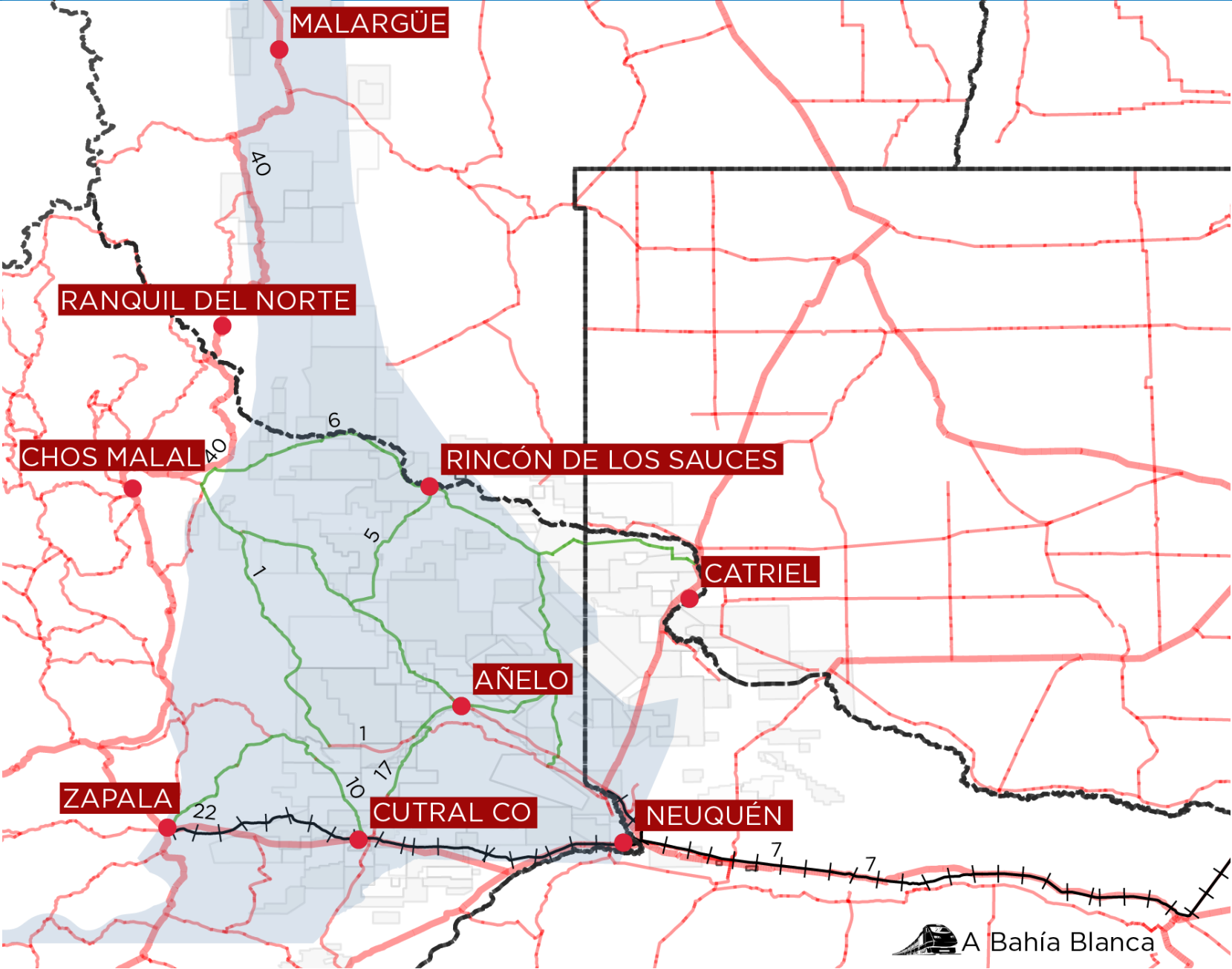
## Investments in Oil Pipelines

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.

# Cities and Interconnections - Resources from Res. 46/2017





# Vaca Muerta Roundtable

Meeting	Timetable	Subject
	08.30h	Entrance and Registration for Meeting #1 (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

Place: Espacio Duam – San Martín 5901 – Acceso Aeropuerto - Ciudad de Neuquén

Meetings frequency: Every 3 weeks (1 in Buenos Aires and 1 in Neuquén)

Please confirm your participation via mail to : [privadaplaneamiento@minem.gob.ar](mailto:privadaplaneamiento@minem.gob.ar) - 011-4349-7581/8624

Please attend exclusively to the corresponding meeting, one person from each organization per meeting



# Argentina Offshore Round 1

Austral / West Malvinas and Northern portion  
of the Argentina Basin



Secretaría de Gobierno  
de Energía

Secretaría de Planeamiento Energético

12 companies Nominated blocks.

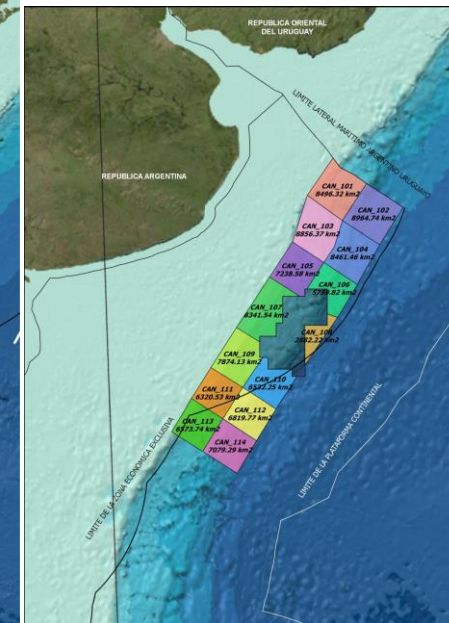
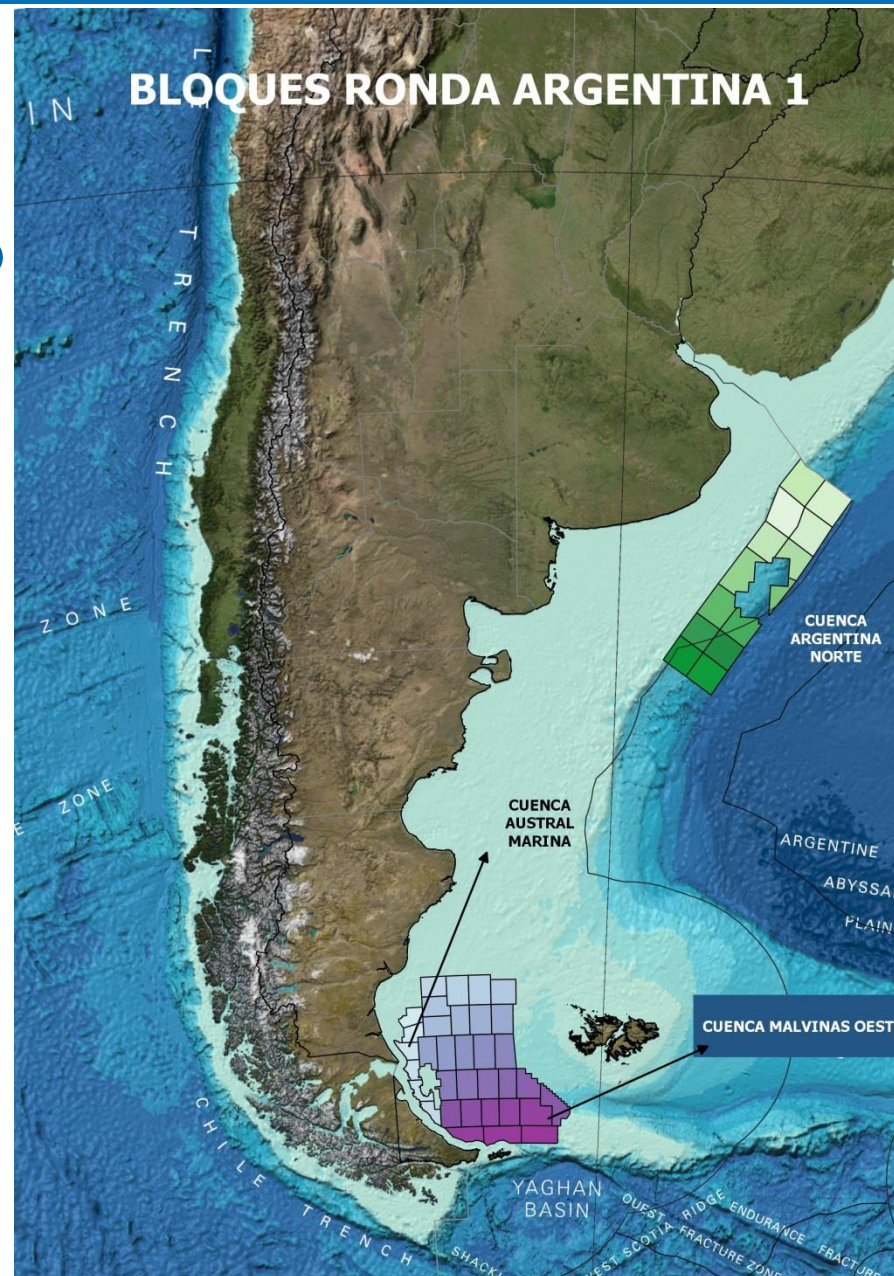
Blocks to be included in Round 1 are the following:

- Malvinas Basin: 18 Deepwater blocks from (WD 100 to 700 m) from 3,600 to 6,300 Km<sup>2</sup> (Discarded 10 blocks from Nomination process).
- Austral Basin: 6 Shallow water blocks (WD < 100 m) from 2,000 to 2,700 Km<sup>2</sup>
- Argentina Basin: 7 Deepwater blocks (WD 200 to 1,300 m) from 6,000 to 9,000 Km<sup>2</sup> & 7 UltraDeepwater blocks (WD 1,200 m to 4,000 m) from 3,000 to 9,000 km<sup>2</sup>.

7<sup>th</sup> June of 2018: Nomination Process ended.

31<sup>th</sup> October of 2018: Presidential decree 827/2018 allowed to call to International Public Contest.

28<sup>th</sup> February of 2019: Opening of offers.



## Bidding Terms

**Bids:** On committed Working Units for the 1st Exploration Period. Each block will have (i) Minimum Working Units (equivalent to a 4 x 4 or 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:

$$\text{Bid (usd)} = \text{WU} \times 5000 \text{ (usd/WU)} + \text{Bonus* (usd)}$$

*WU* : Working Units offered for 1<sup>st</sup> Exploration Period. Must be higher than or equal to Minimum Working Units

*\*Bonus* is accepted only if  $WU > \text{Basic WU}$ ; to be paid 50% upfront + 50% end of 3<sup>rd</sup> 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.

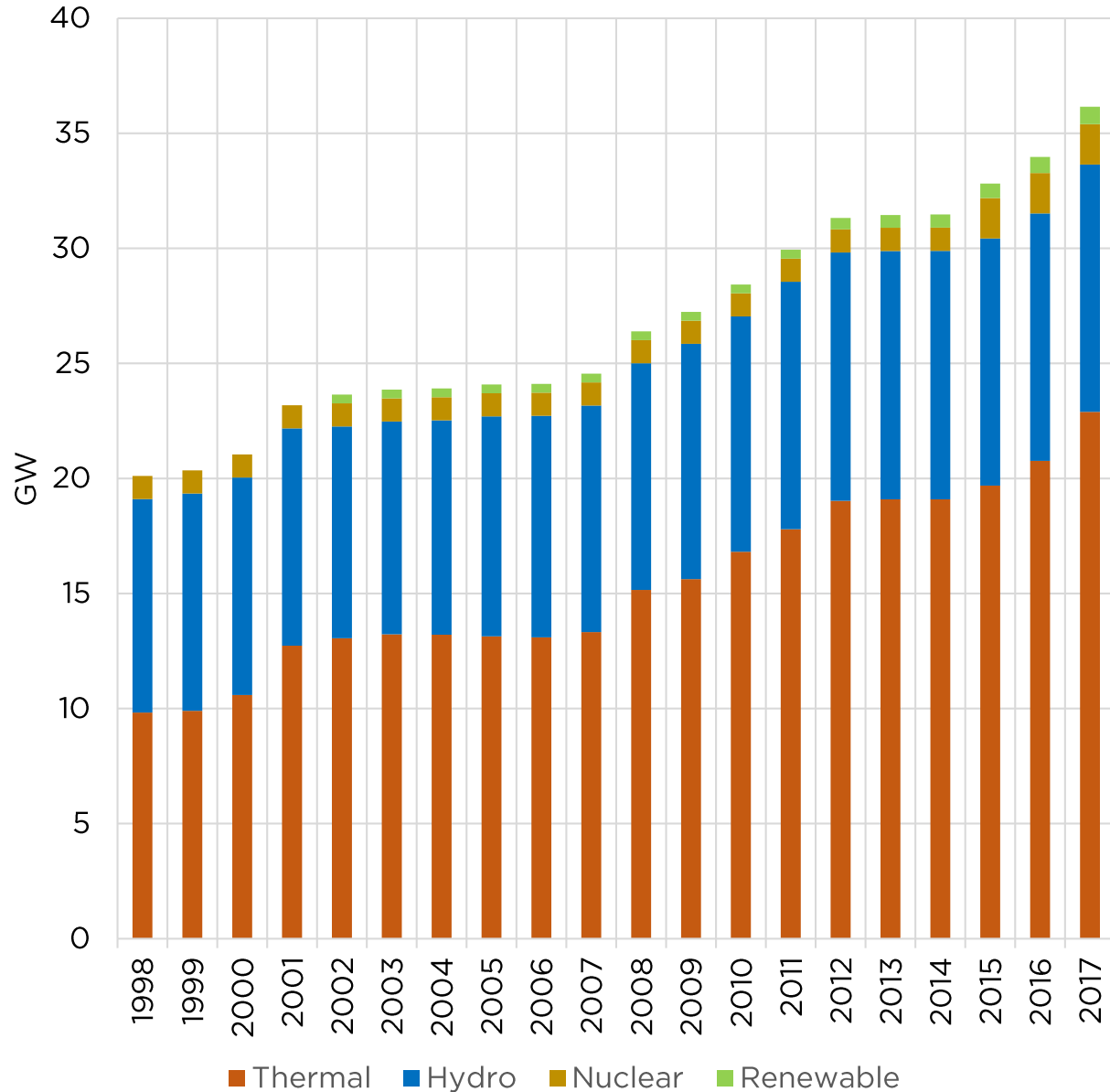
## Contract Terms

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

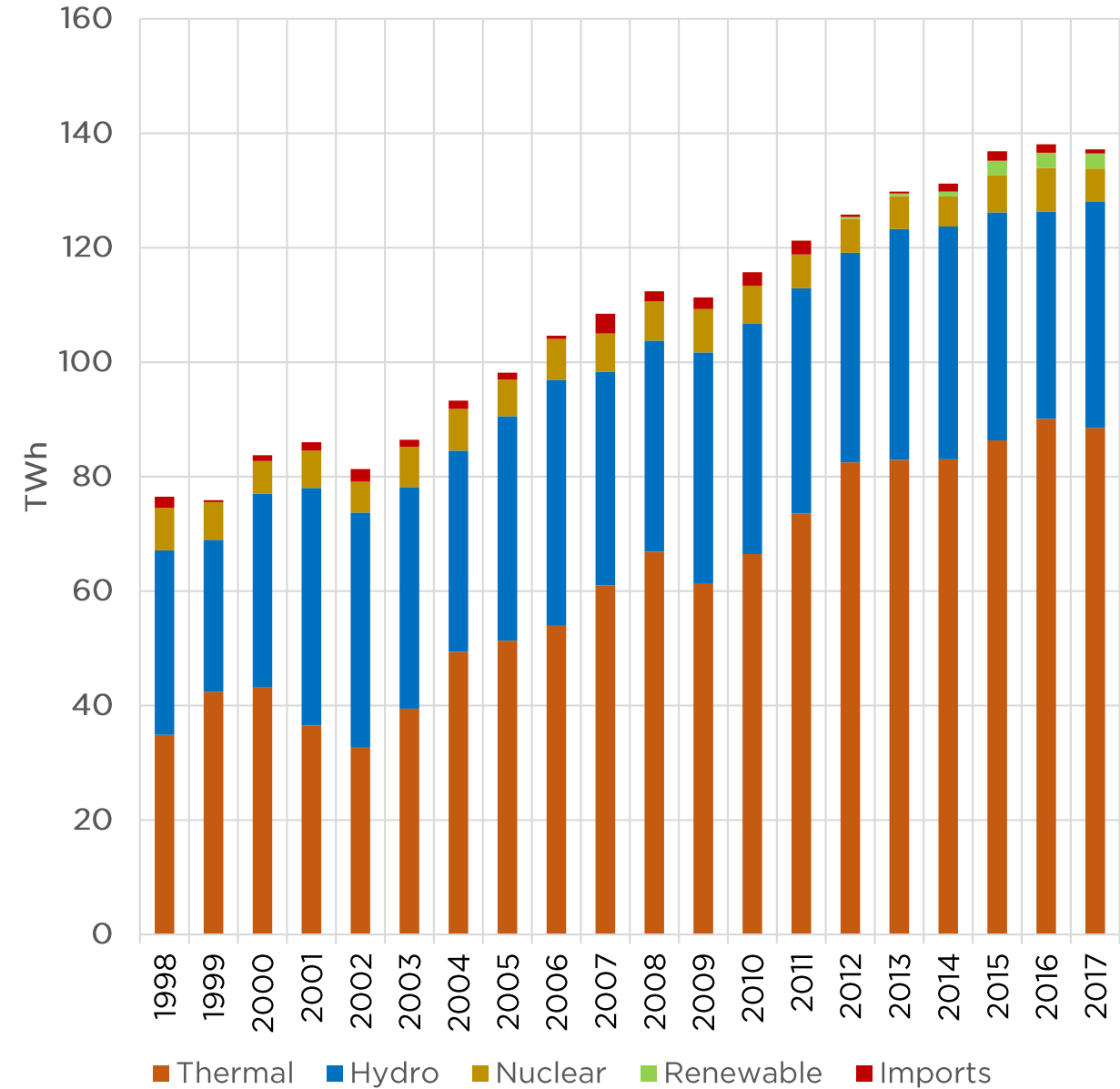
- Enough time for Production Concession: 30 years + 10 of extension (successive extensions possible)
- Ability to keep Non Commercial Discoveries: Possibility to keep discoveries for 5 + 5 years after Exploration Permit if discovery appraised and non commercial
- Reduced Royalties linked to success: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

$$\text{R factor} = (\Sigma \text{Sales} - \Sigma \text{Royalties}) / (\Sigma \text{E\&A} + \Sigma \text{Investments} + \Sigma \text{OPEX})$$

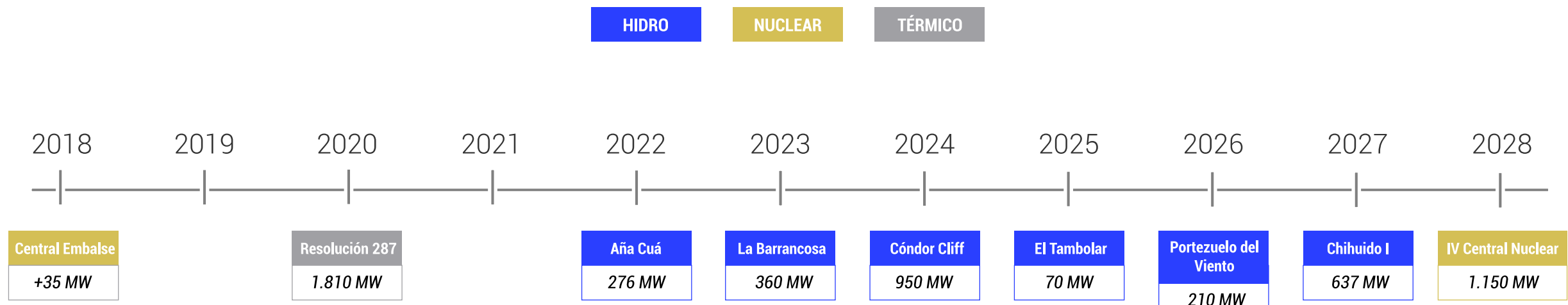
### Installed Power Capacity



### Generation by source



# Entrance of principal projects of electricity generation: Thermal, nuclear & hydro



PROYECTO	GRUPO OFERENTE	MW
EZEIZA TG04, TV05 Y TV06	GEN. MEDITERRÁNEA S.A.	138
C.T. MARANZANA TG08 Y TV09	GEN. MEDITERRÁNEA S.A.	113
LA PLATA	YPF ENERGÍA ELÉCTRICA S.A.	72
CIERRE CC VILA MARÍA	UENSA S.A.	99
CIERRE CC RIO ENERGY	Río Energy S.A.	104
YPF CT EL BRACHO	YGEN SA	198
CIERRE CC BARKER	UGEN S.A.	105
SAN PEDRO -"A"	Araucaria Generation S.A.	105
CICLO COMBINADO GENELBA PLUS	Pampa Energía S.A.	370
C.T. ARROYO SECO GEN MEDITERRÁNEA	Gen. Mediterránea S.A.	100
LUJAN DE CUYO CPUERTO	Central Puerto S.A.	89
TERMINAL 6 DE SAN LORENZO CPUERTO 330	Central Puerto S.A.	317



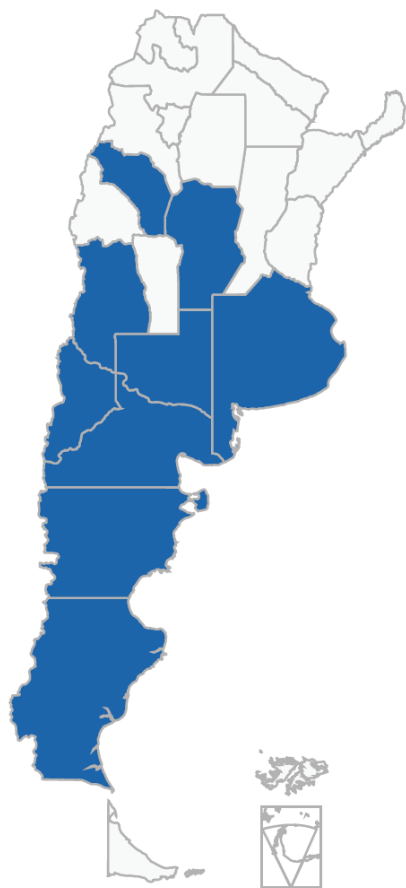
# Results of the RenovAr program

Diversity of technologies and federal distribution

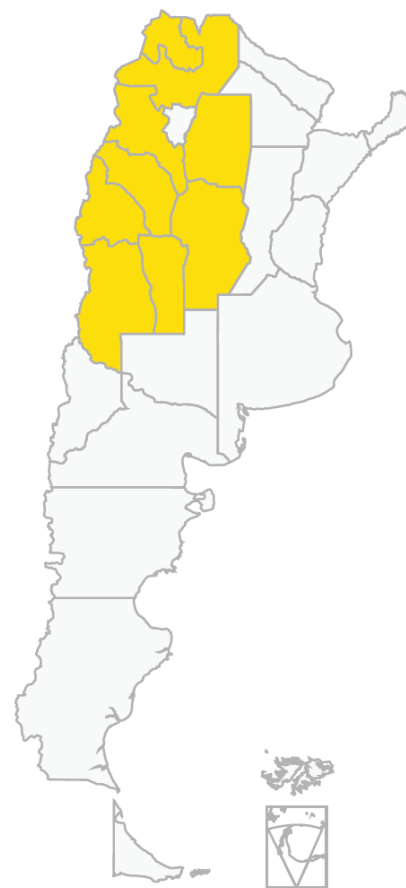
147  
Awarded projects

4,466.5 MW  
Power

15,835 GWh  
Energy



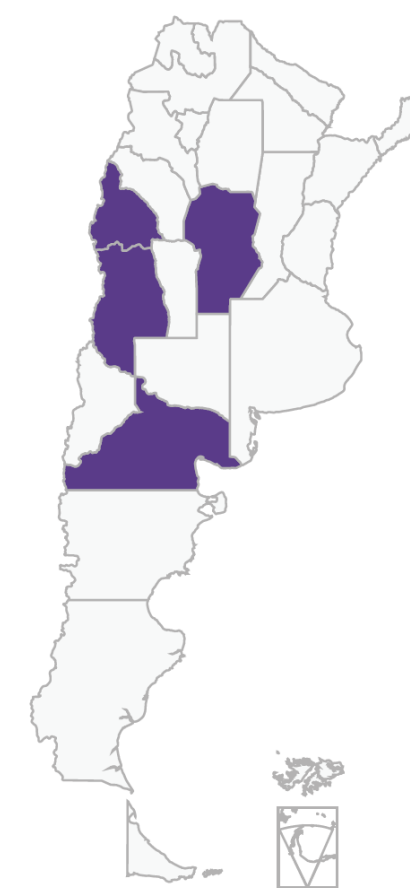
**WIND**  
34 projects  
2.466 MW 9.778 GWh/year



**SOLAR PV**  
41 projects  
1.732 MW  
4.290 GWh/year

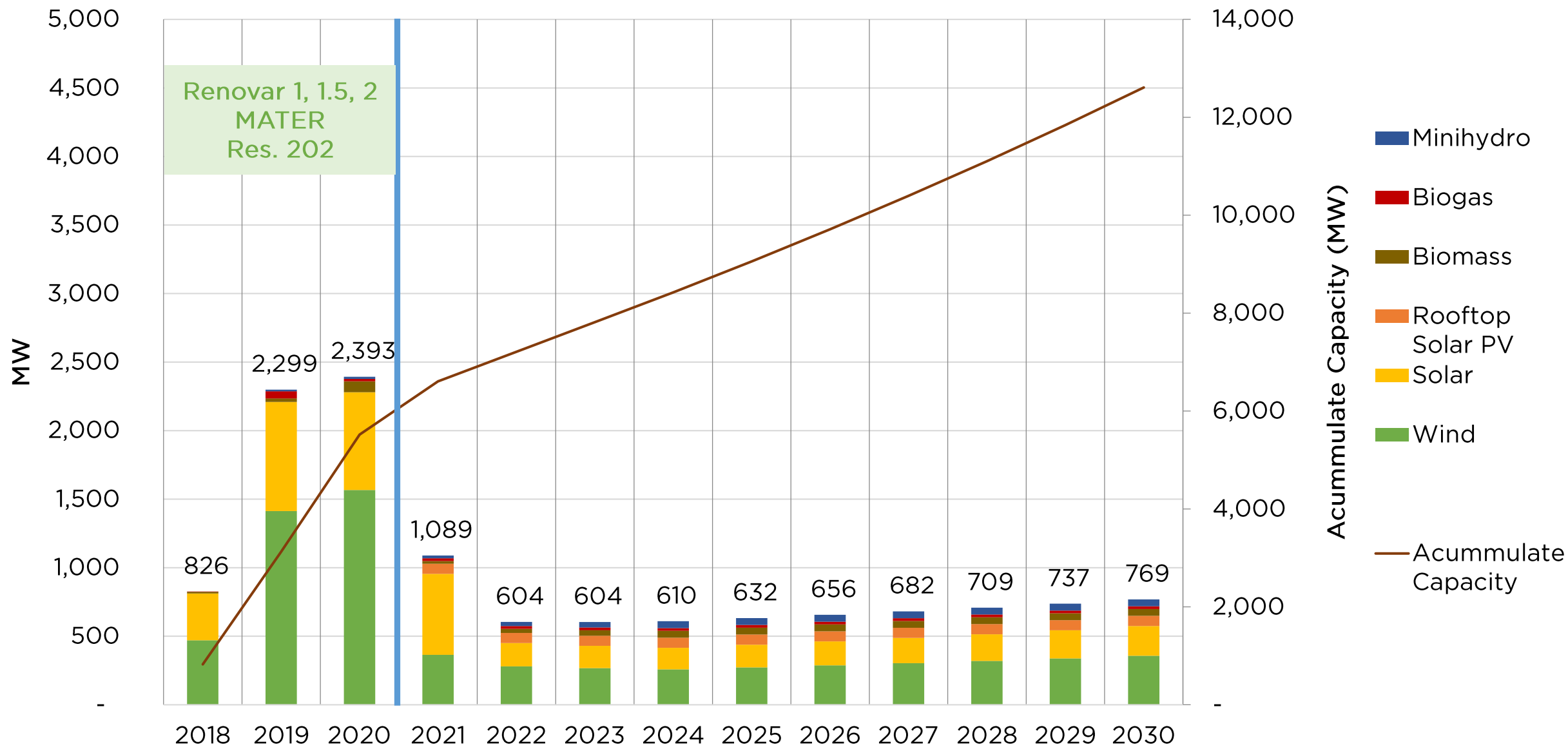


**BIOGAS AND BIOMASS**  
58 projects  
236 MW  
1.665 GWh/year



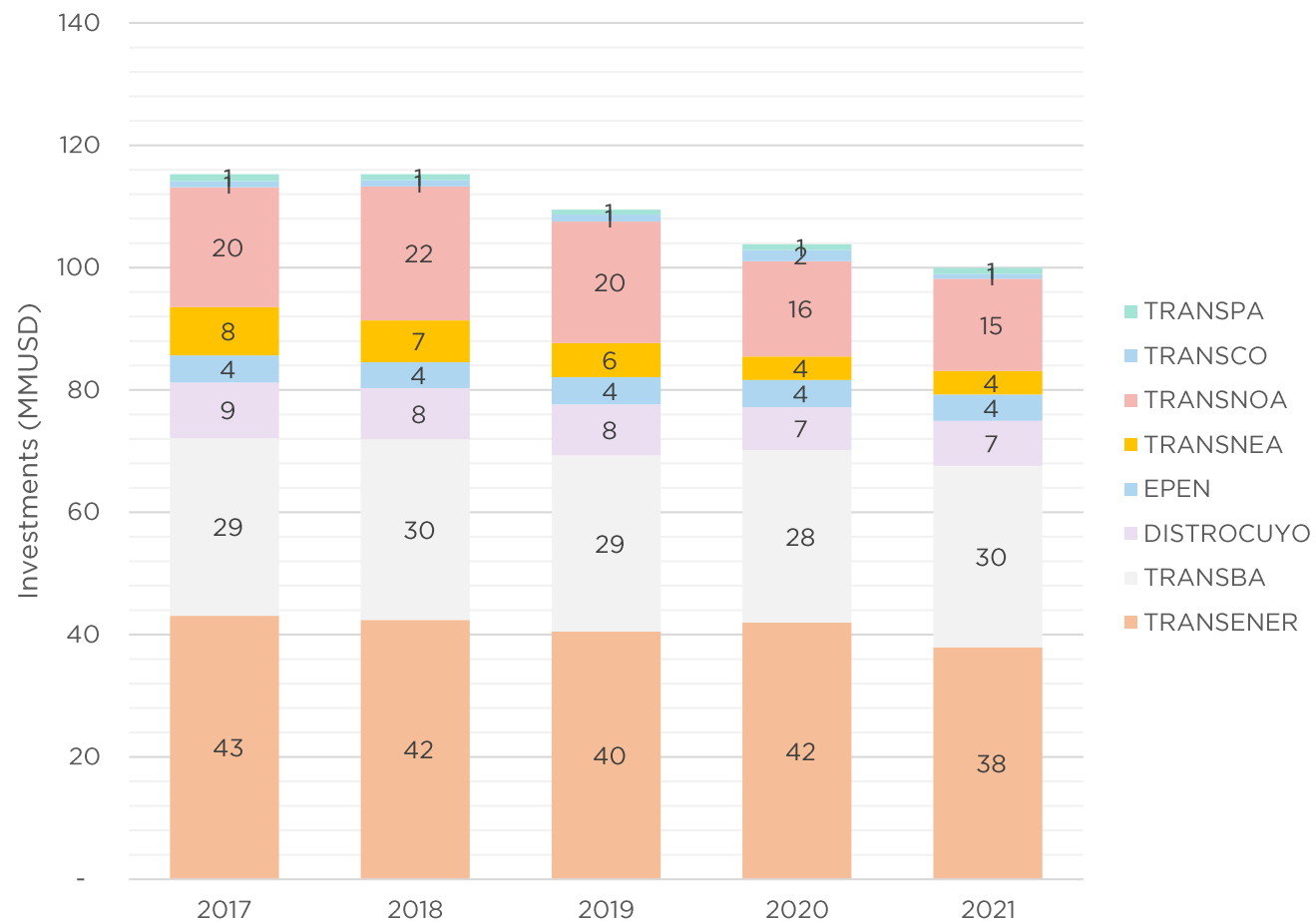
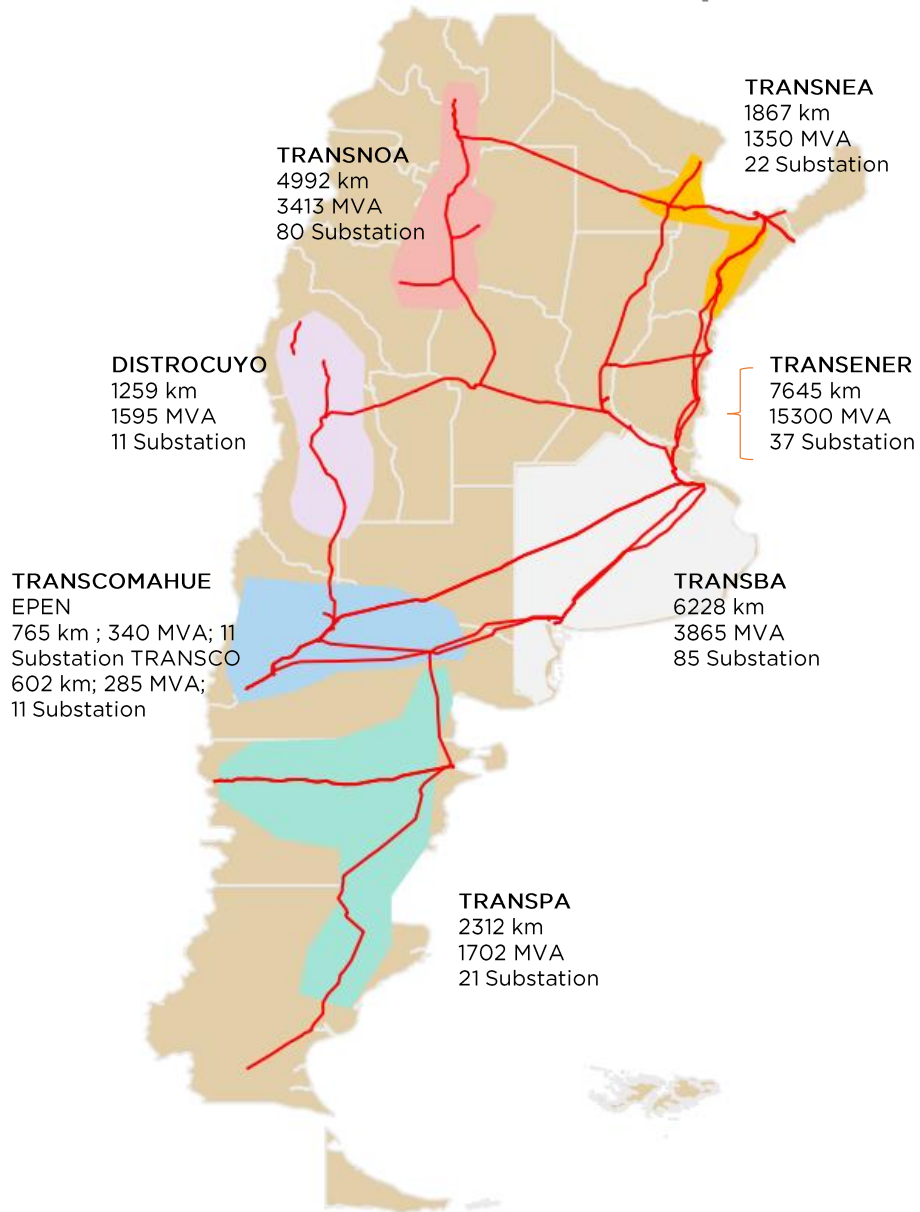
**MINI HYDRO**  
14 projects  
32 MW  
103 GWh/year

## New renewable capacity





## Investments in Power Transport



Amounts in ARS at May 2018 using 23 ARS/USD exchange rate



## Projects in progress █

- 500 kV Interconnection in Bahía Blanca - Mar del Plata and connection in 132 kV to Villa Gesell. North Section
- 500 kV Interconnection in Bahía Blanca - Mar del Plata and connection in 132 kV to Villa Gesell. South Section
- 500 kV Interconnection ET La Rioja Sur 500/132 kV and Supplementary Project II
- Electrical Interconnection ET Rincón Santa María - ET Resistencia - Line II

## PPP Investments - 2019 onwards █

- 500 kV Interconnection ET Río Diamante - ET Coronel Charlone and Supplementary Project in 132kV
- 500 kV Transmission Line ET New San Juan - ET Rodeo - Iglesias
- 500 kV Interconnection ET Atucha II - ET Nueva Belgrano - ET Oscar Smith
- 500 kV Interconnection ET Coronel Charlone - ET Plomer - ET Ezeiza
- 500 kV Interconnection ET Plomer - ET Vivoratá, ET Plomer - ET Atucha II, ET Plomer - ET Manuel Belgrano
- 500 kV Interconnection ET New San Juan - ET Rodeo - ET La Rioja
- 500 kV Interconnection ET Choele Choel - ET Puerto Madryn (2nd line)
- Transmission Substation 500/132 kV - 450 MVA Comodoro Rivadavia

Now being bidded



300  
MM USD



2,300  
MM USD

# Schedule and PPP Investments

## STAGE

## WORK

## PROJECTS

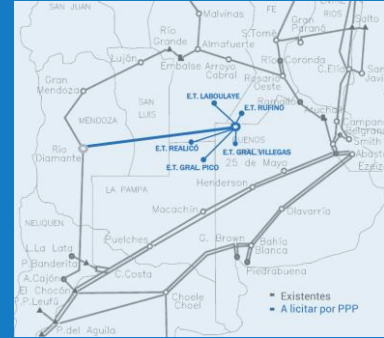
## MAP

## INVESTMENT

# 1

- 480 km – 500 kV
- 420 km – 132 kV
- 2 new substation

# 1

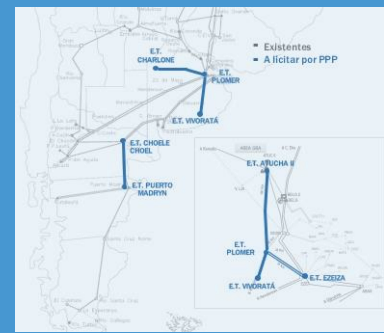


## USD 630 MM

# 2

- 1300 km – 500 kV
- 1 new substation

# 4

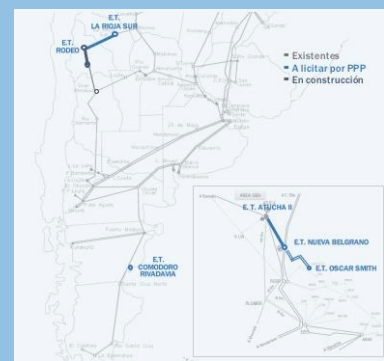


## USD 990 MM

# 3

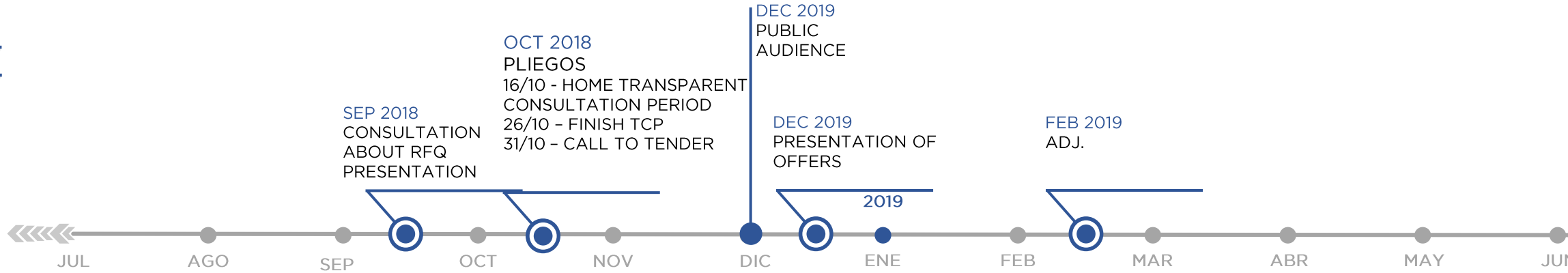
- 400 km – 500 kV
- 3 new substation

# 4

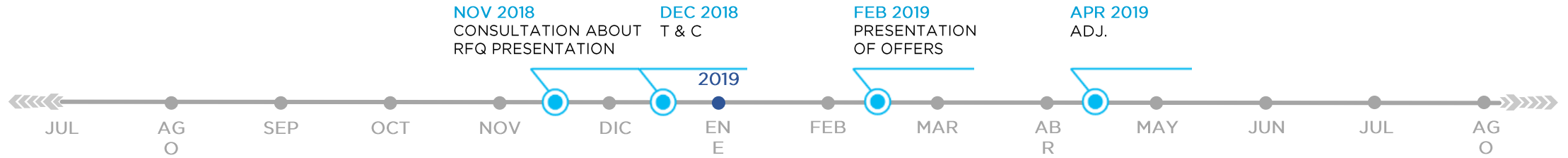


## USD 660 MM

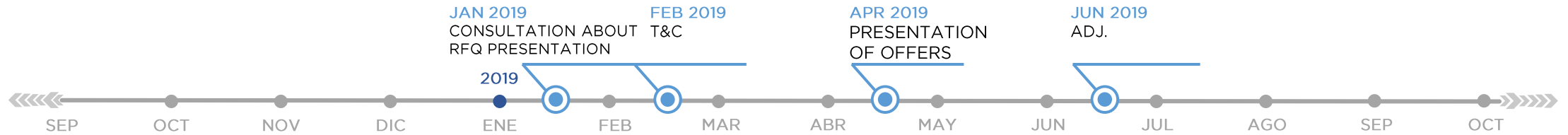
## STAGE 1



## STAGE 2



## STAGE 3



# Works to be bidden by PPP – Stage 1

## STAGE 1

LEAT 500 kV T. S. Río Diamante - new T. S. Coronel Charlone, Transforming substation and complementary works

**TOTAL LENGHT HVAC TL 500 kV 487 Km**

LEAT 500 kV E.T. Río Diamante - Nueva E.T. Coronel Charlone 487 Km

**TOTAL LENGTH 132 kV SINGLE AND DOUBLE CIRCUIT TL 422 Km**

LAT 132 kV single circuit Coronel Charlone - Laboulaye 71 Km

LAT 132 kV double circuit Coronel Charlone - Rufino 78 Km

LAT 132 kV single circuit Coronel Charlone - General Villegas 50 Km

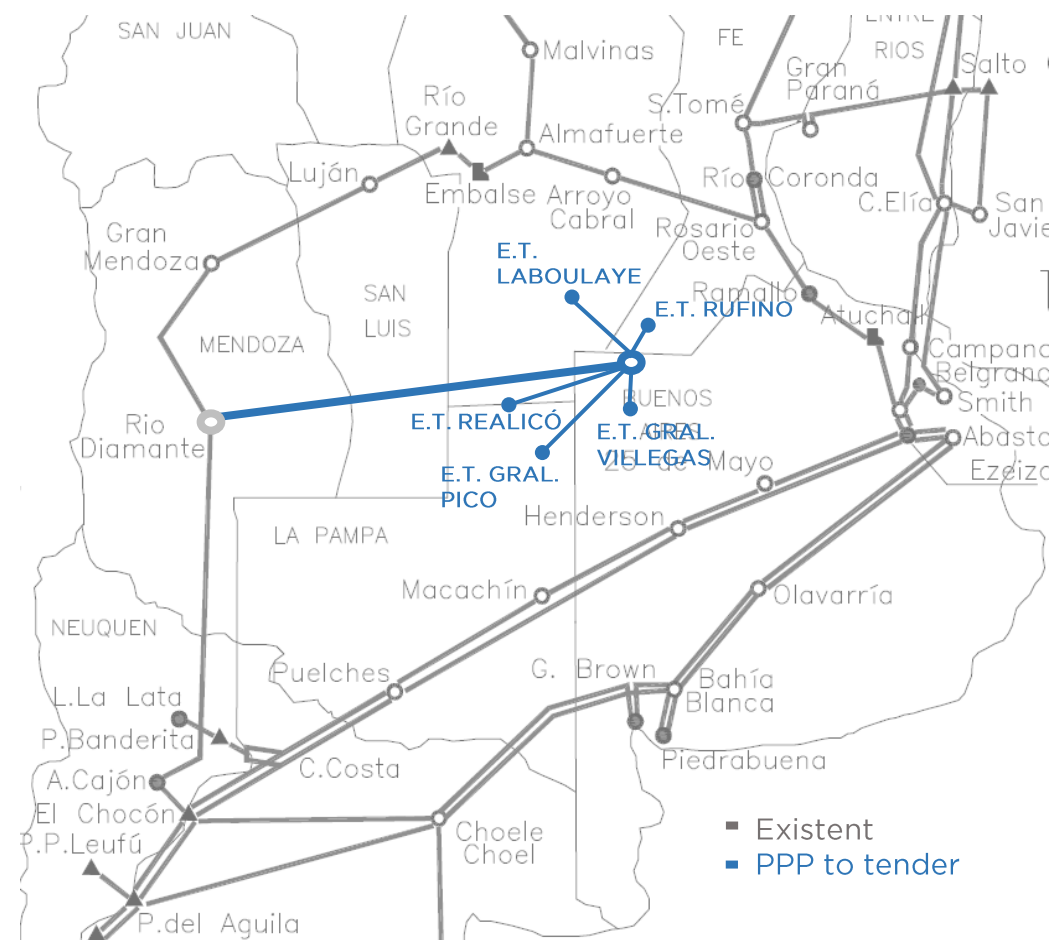
LAT 132 kV single circuit Coronel Charlone - General Pico Sur 127 Km

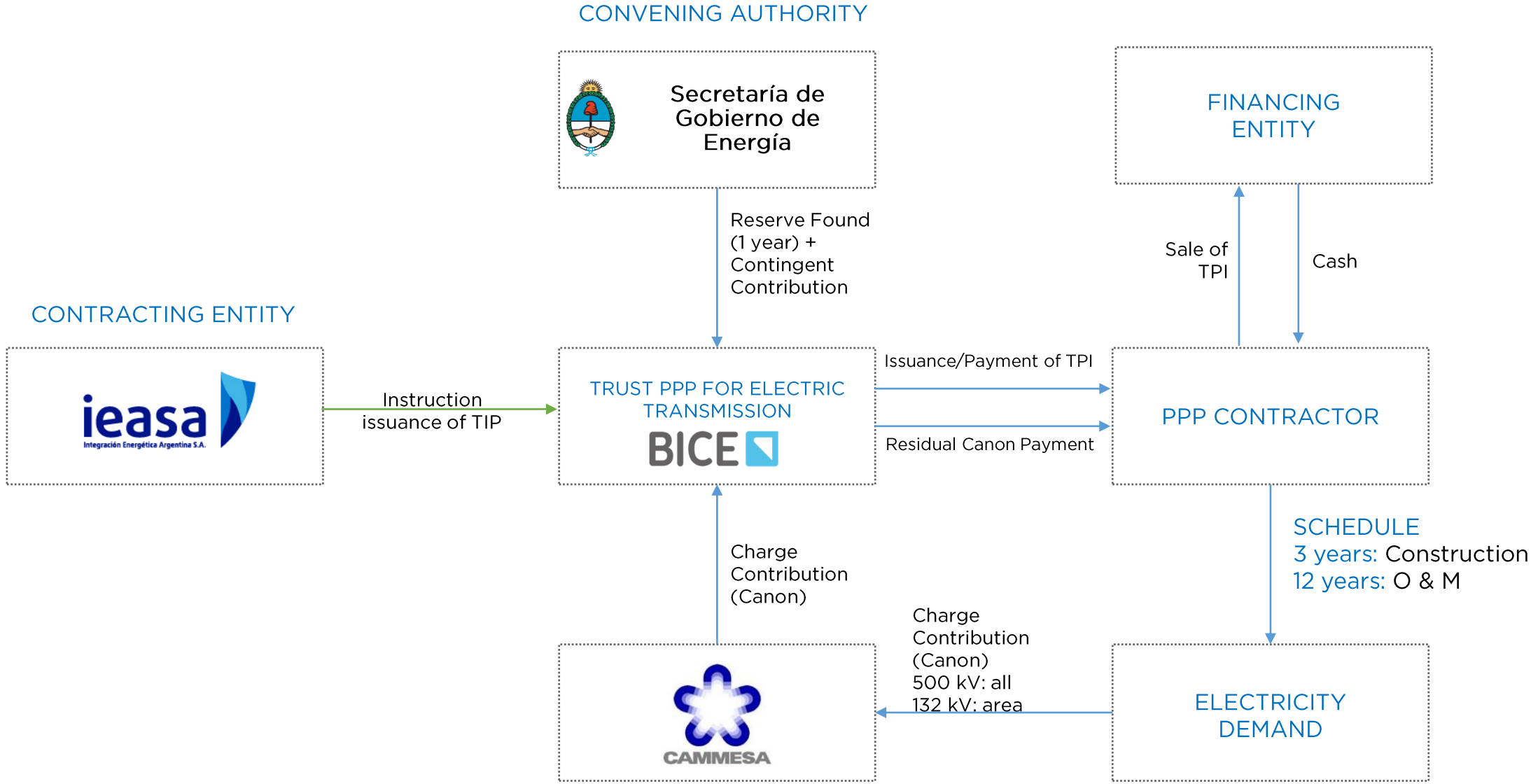
LAT 132 kV single circuit Coronel Charlone - Realicó 96 Km

### TRANSFORMER SUBSTATION

New T.S.. Coronel Charlone 500/132 kV

Extension of T.S. Río Diamante 500/220 kV









Thank

you.



# Appendix

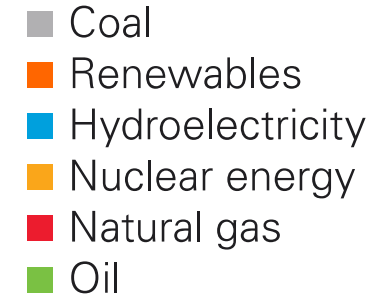
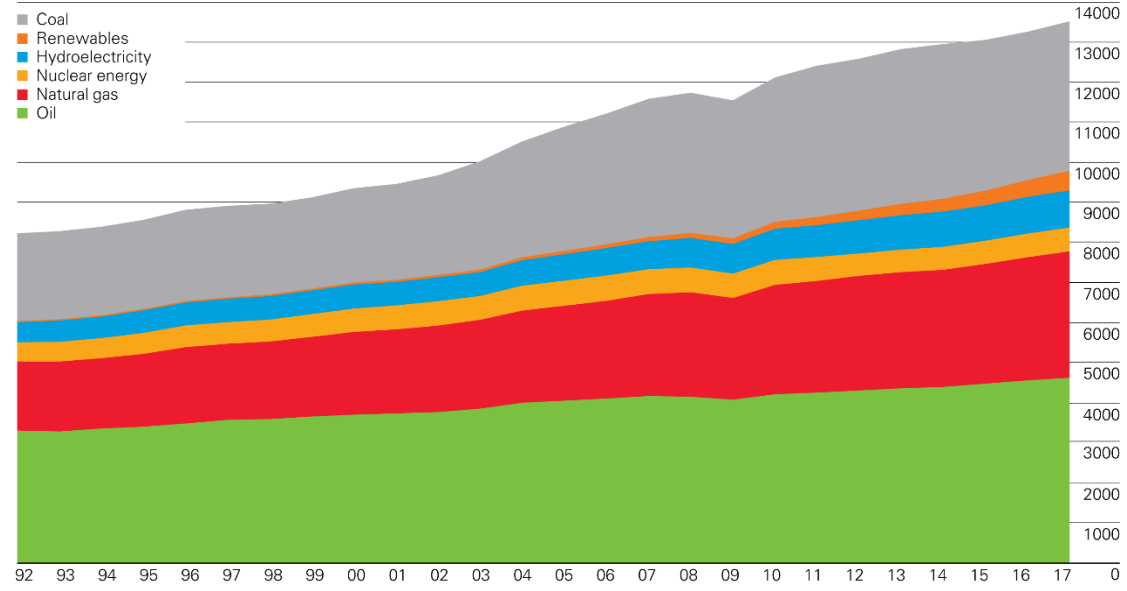
The image features a monochromatic blue color scheme. In the background, there are several oil pumpjacks (jack-o'-lanterns) silhouetted against a sky filled with soft, white clouds. The pumpjacks are positioned at various heights and angles, with the largest one in the foreground on the left and another smaller one in the distance on the right. The overall scene is industrial and atmospheric.

The image features a monochromatic blue color scheme. In the background, there are several oil pumpjacks (jack-o'-lanterns) silhouetted against a sky filled with soft, white clouds. The pumpjacks are positioned at various heights and angles, with the largest one in the foreground on the left and others receding into the distance. The overall mood is industrial and serene.

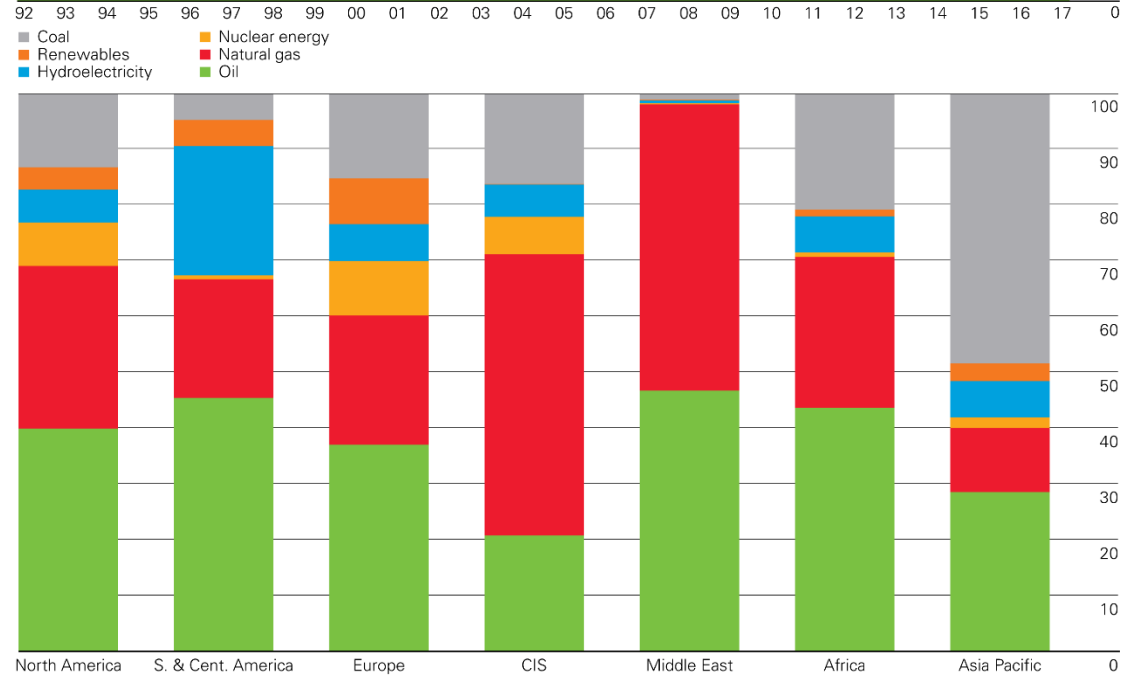
# Methodological Subannex

# World Energy Matrix - Primary Energy Offer (MMTOE)

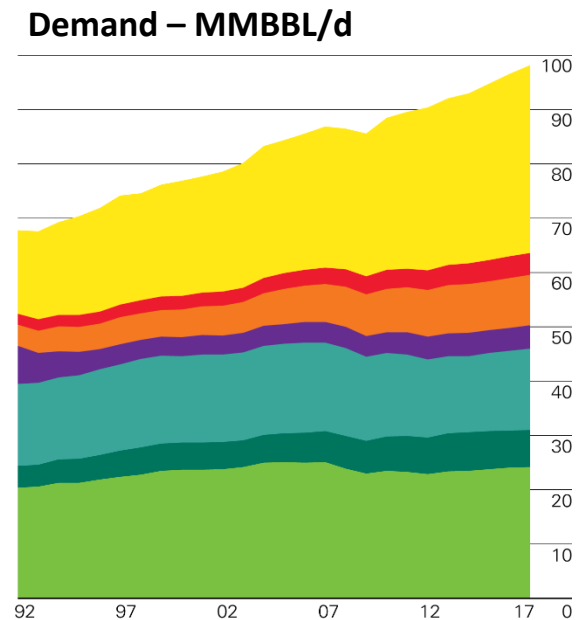
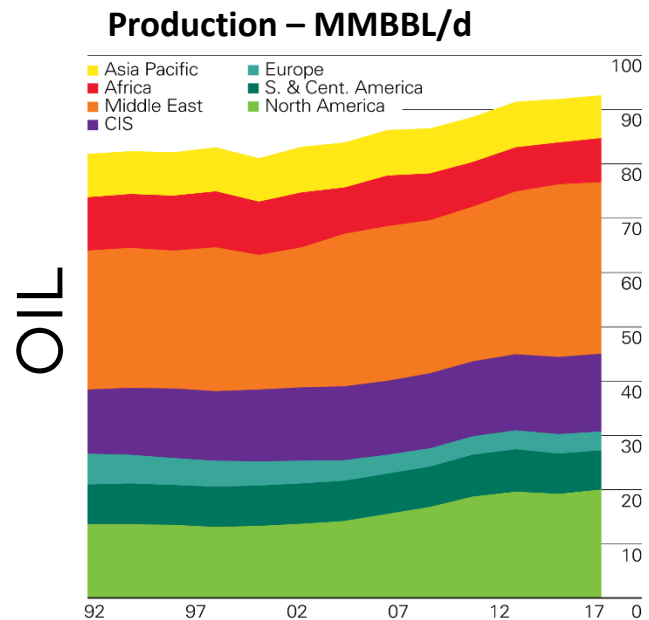
GLOBAL



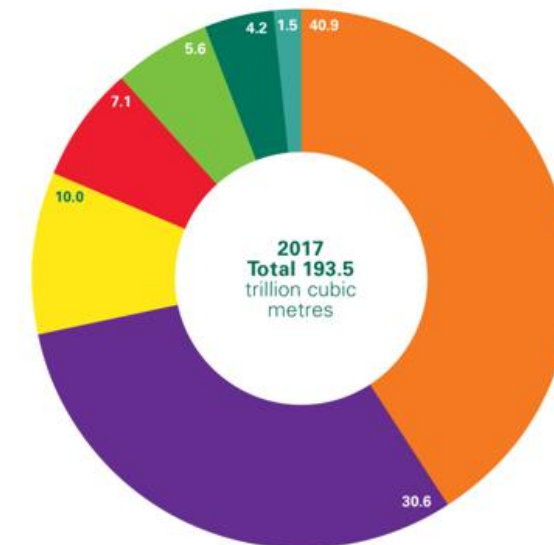
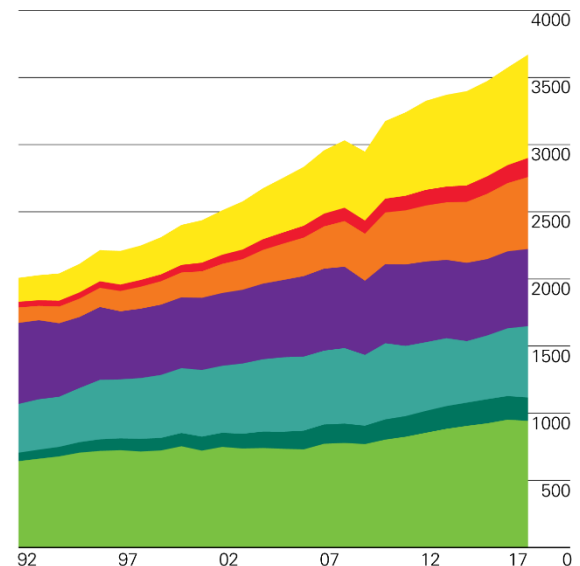
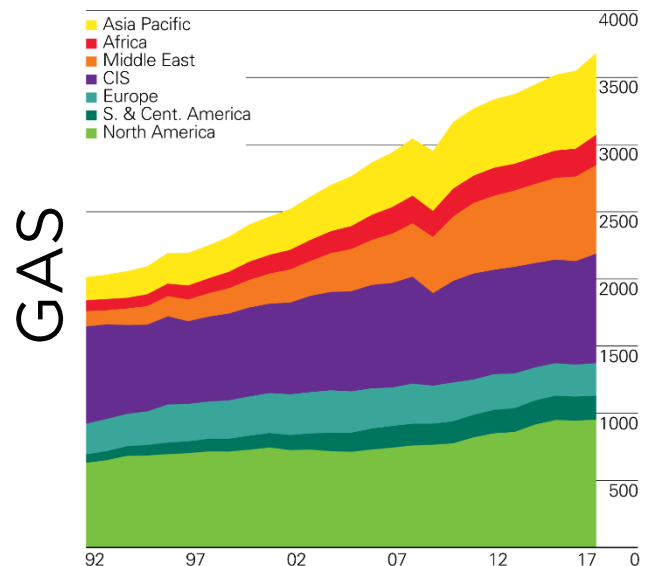
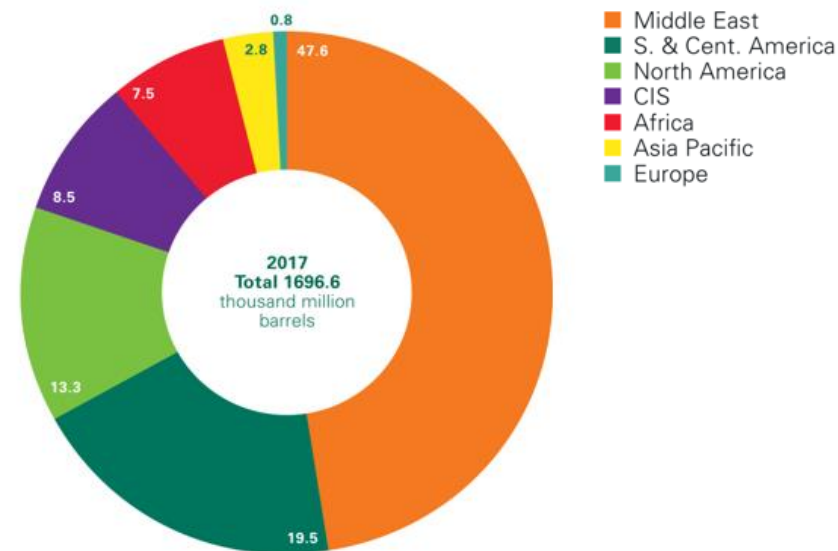
BY REGION



# Global energy context - Production, demand and reserves



### Reserves – %



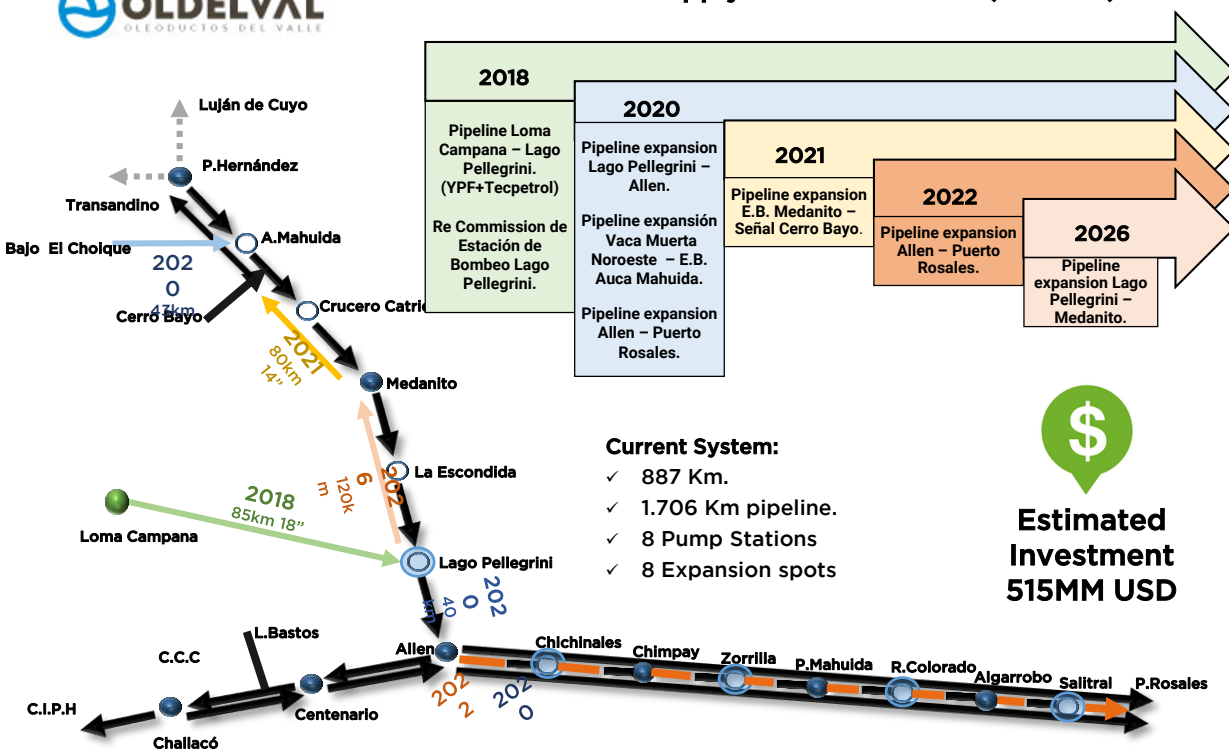
## Current situation

- ❖ 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.

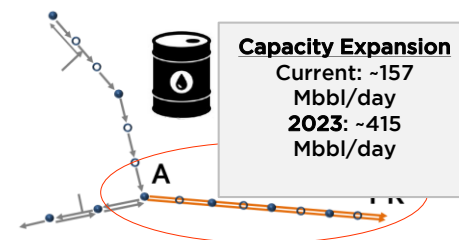
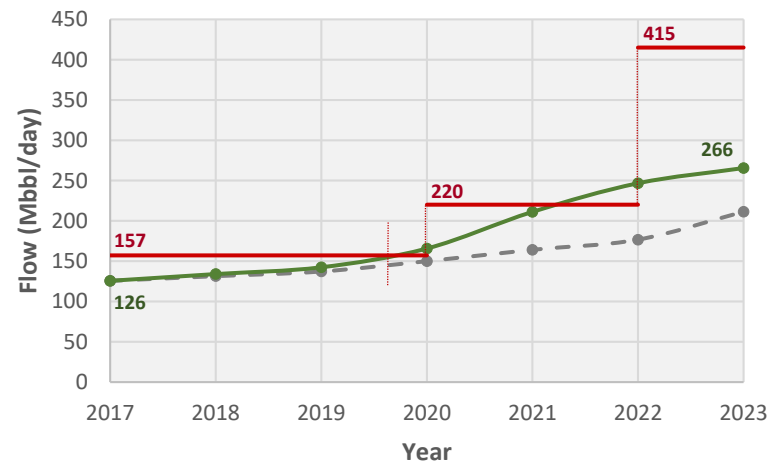
## Oil Transport System Expansion (OldelVal)



### Works needed to supply demand forecast (2019-26)



### Allen-Puerto Rosales Expansion Forecast



Forecast  
 - - - 2017  
 - - - 2018  
 - - - Capacity

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

## Next Steps

### OldelVal Proposition

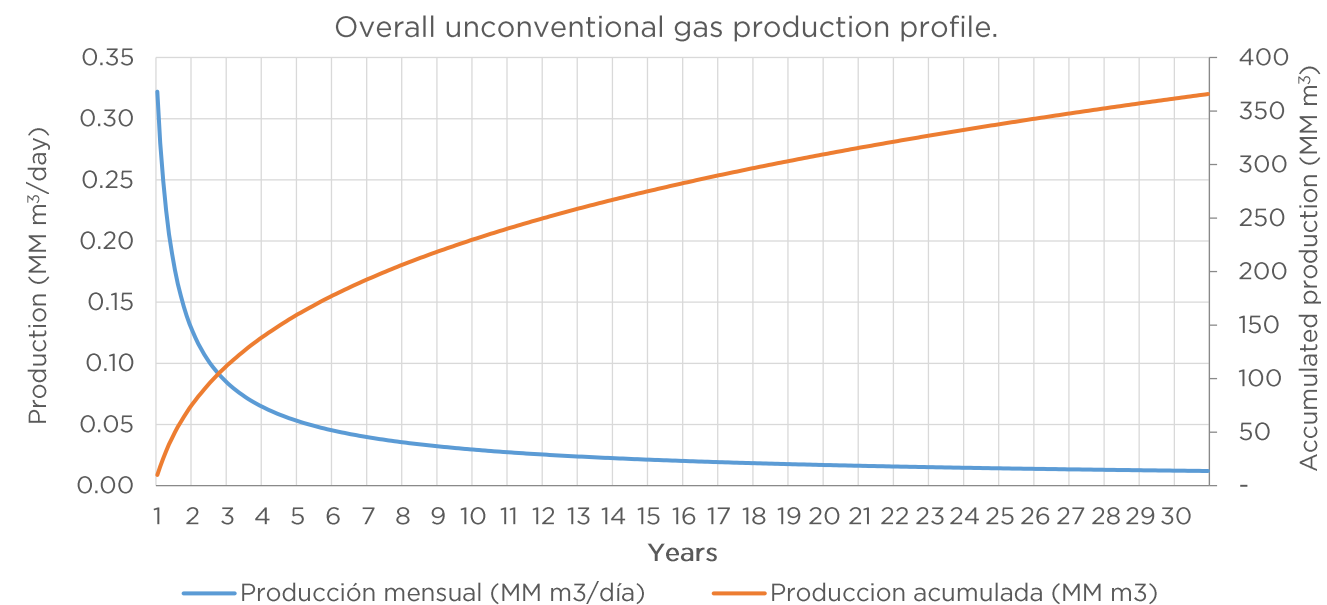
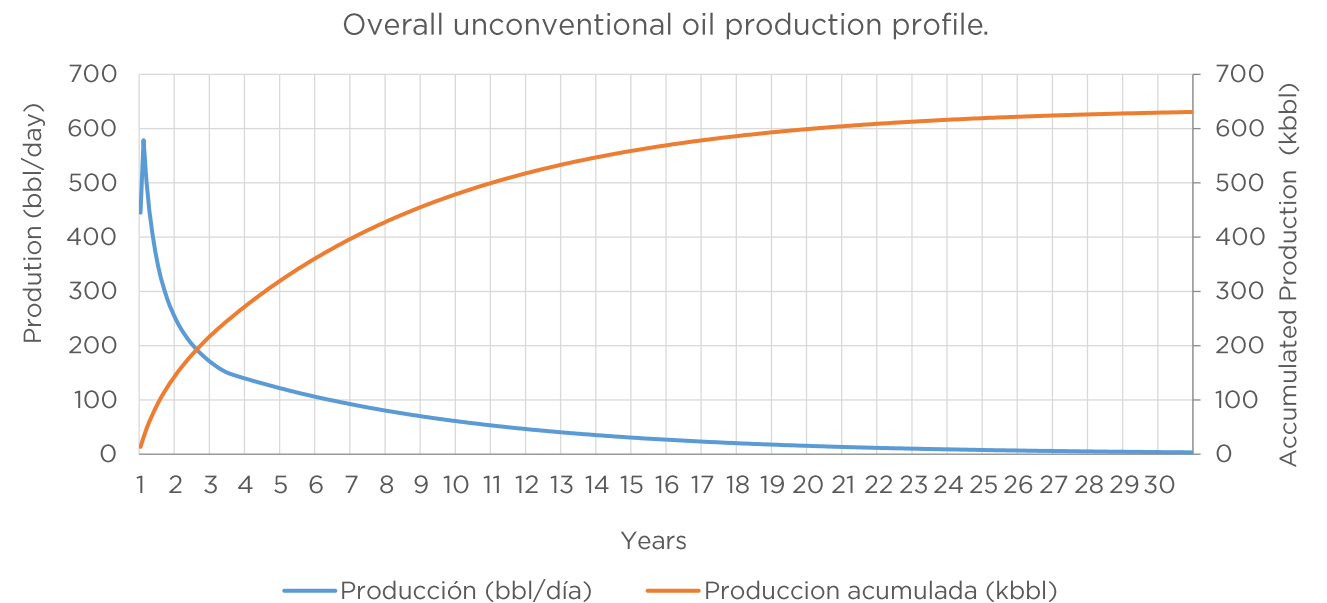
- ❖ New Contract Carrier regulation to enable firm offer transport contracts.
- ❖ Time extension of Oldelval concession to match investment amortization period.

### 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
<b>Conventional assumptions</b>		
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
<b>Unconventional assumptions</b>		
EUR (y30)	12,9 BCF	631 kbbl
EUR total (y30)	2,388 kboe	820 kboe
Condensed	1 m <sup>3</sup> oil per 28,000 m <sup>3</sup> gas	-
GOR	-	300 m <sup>3</sup> gas per m <sup>3</sup> 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%):

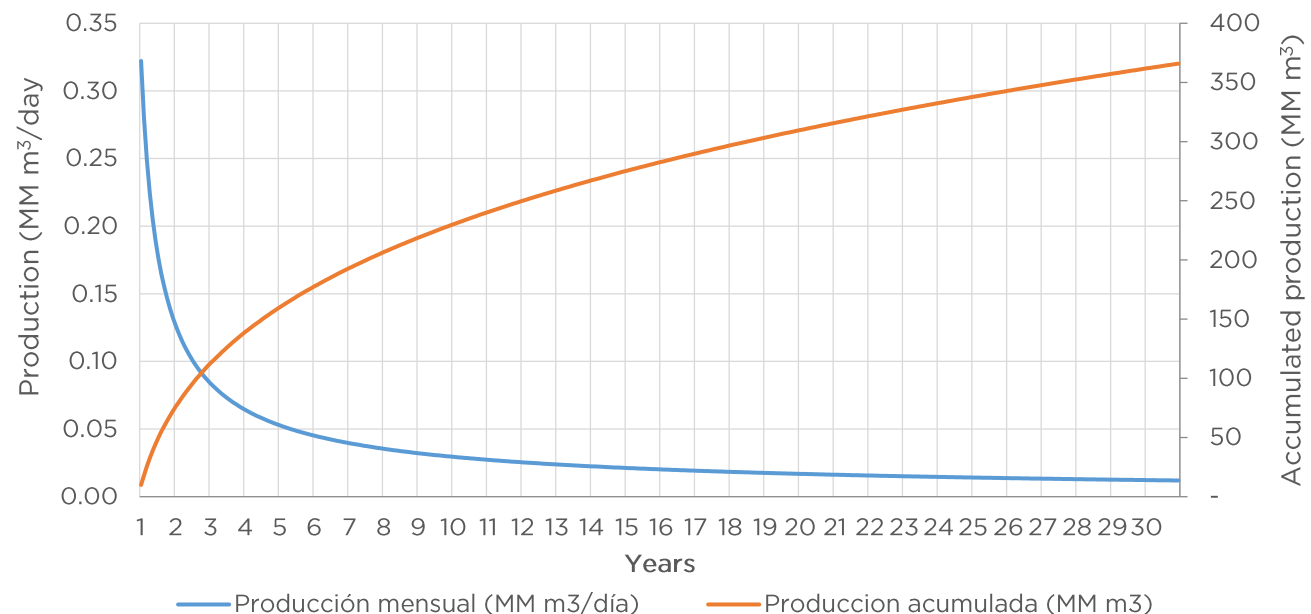
Total incorporated reserves: 172 Billion m<sup>3</sup> (6 TCF).

- 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<sup>3</sup> (1.5 BCF)
- Cost per well: 2.5 MM USD

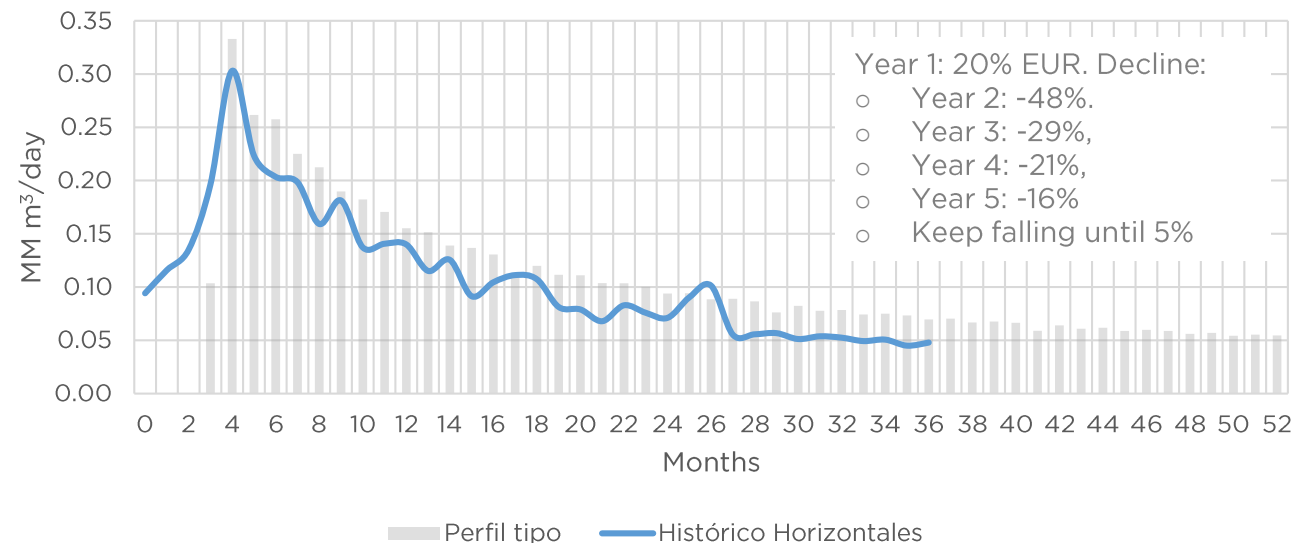
## Overall unconventional production profile

- EUR<sub>y30</sub> = 366 Million m<sup>3</sup> 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<sup>3</sup>/day gas
- Condensed: 1 m<sup>3</sup> de oil per 28,000 m<sup>3</sup> of gas
- Horizontal well with 33 fracture stages, 250 tons of sand per fracture
- 40 perforation's days

**Break-even: 4 USD/MMBTU**



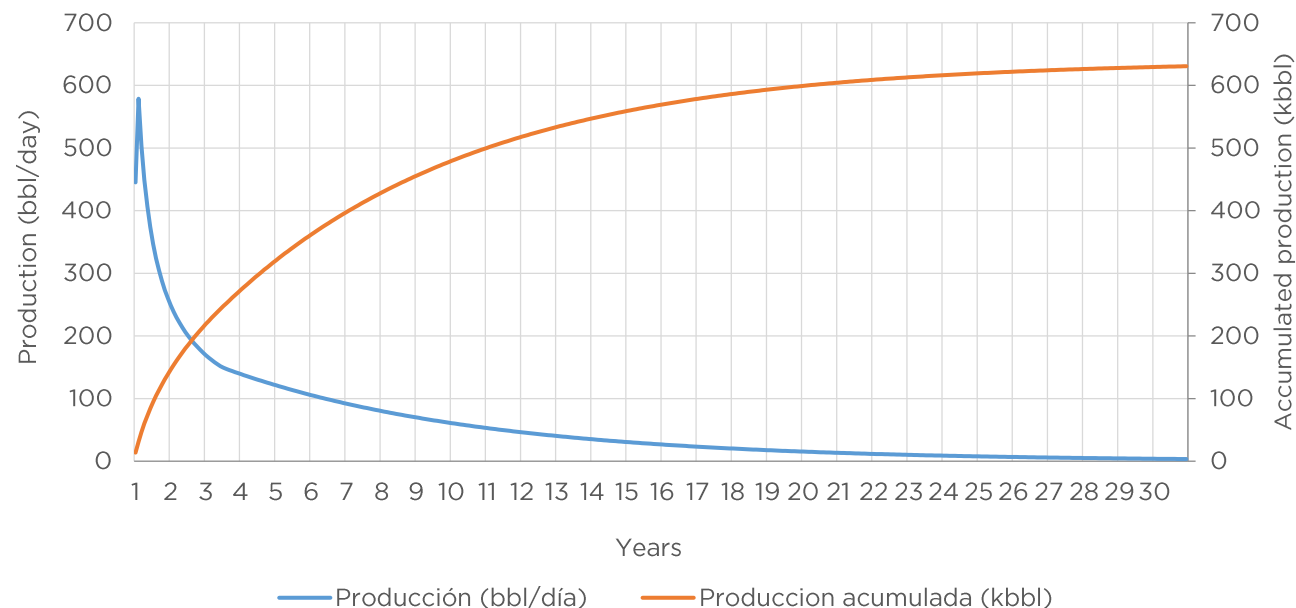
Profile of 30% of the best shale gas horizontal wells



# Main assumptions about Oil production

## Conventional Production:

- P1D (72%): declines @ 9%
- P1ND (100%) + P2 (50%) + P3 (10%):
- Total incorporated reserves : 157 Million m<sup>3</sup> (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<sup>3</sup> (180 kbbl)
- Cost per well: 2.5 MM USD.

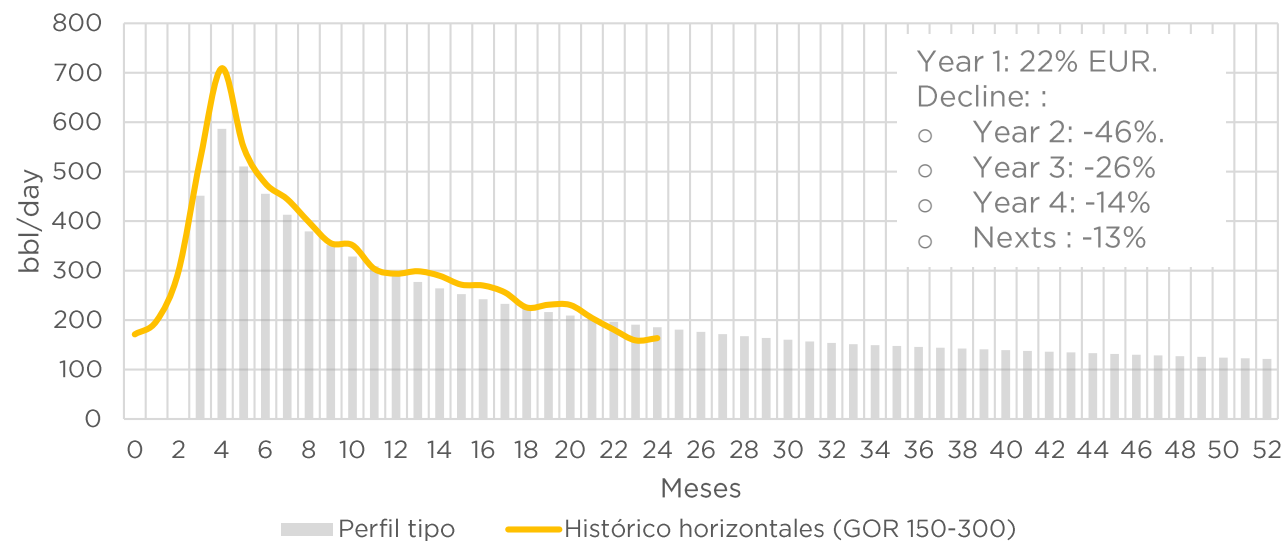


## Overall unconventional production profile

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

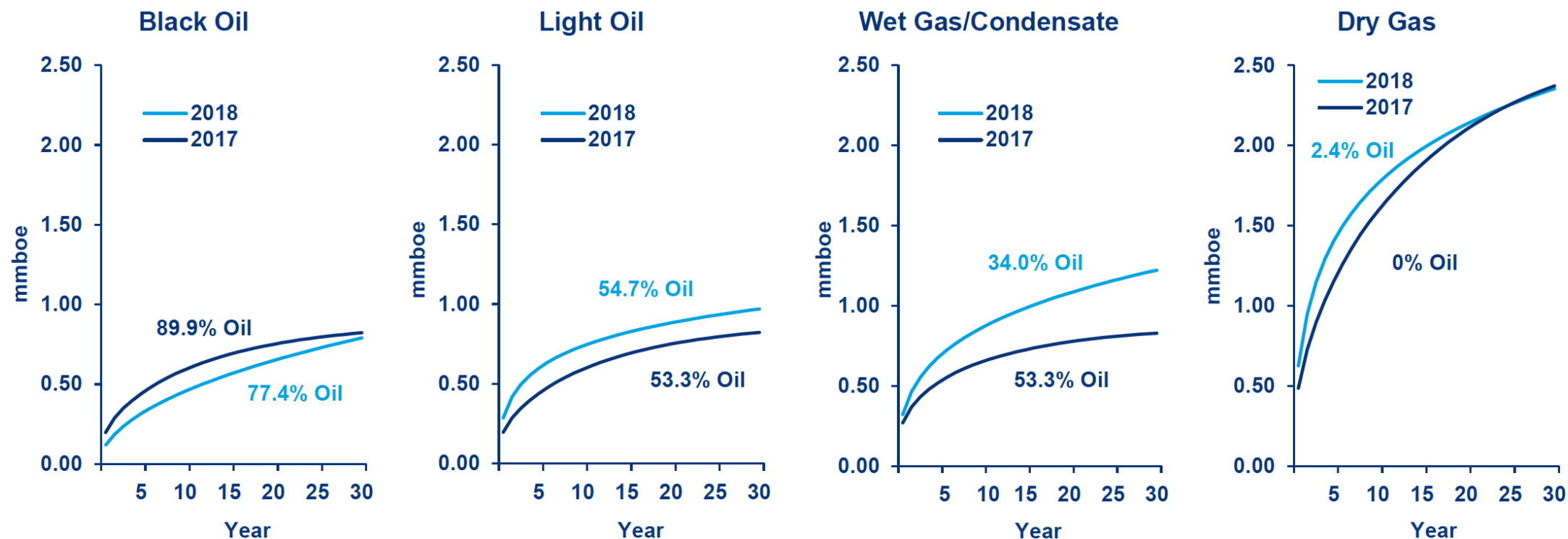
Break-even: 46.7 USD/BBL

Profile of 30% of the best shale oil horizontal wells

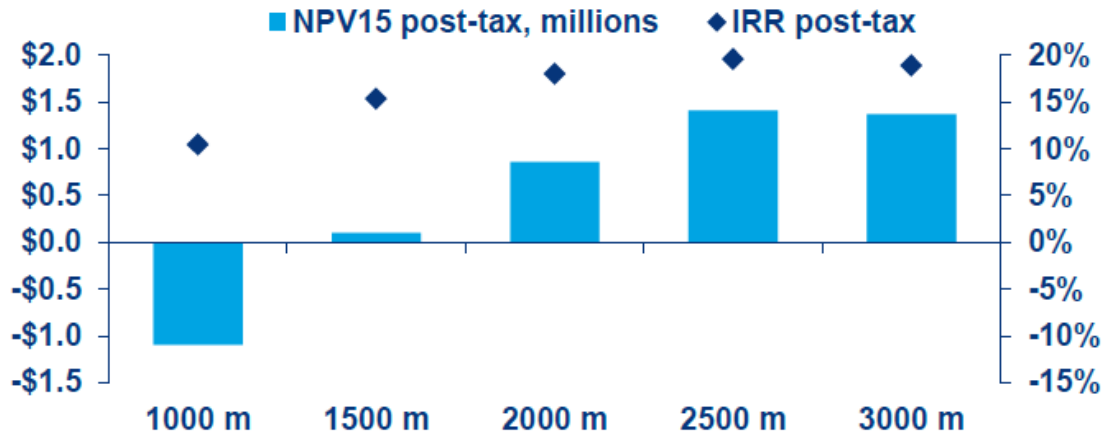


# Accumulated production by type of wells (Wood Mackenzie)

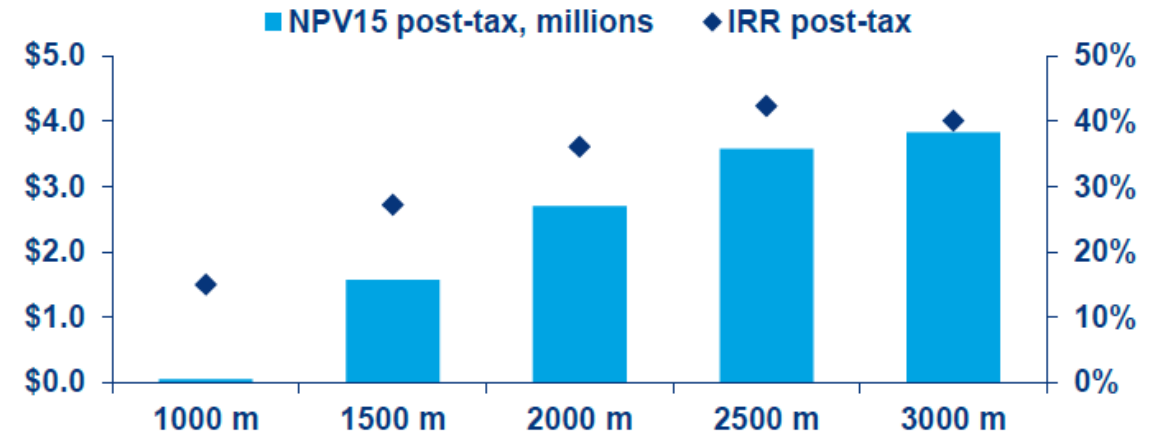
	IP30 (boe/d)			EUR (mmboe)			Cum 180 (kboe)			Cum 365 (kboe)		
	2017	2018	% change	2017	2018	% change	2017	2018	% change	2017	2018	% change
<b>Black Oil</b>	901	531	<b>-41%</b>	0.82	0.79	<b>-4%</b>	111	71	<b>-36%</b>	174	116	<b>-33%</b>
<b>Light Oil</b>	901	945	5%	0.82	0.97	18%	111	155	39%	174	280	61%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



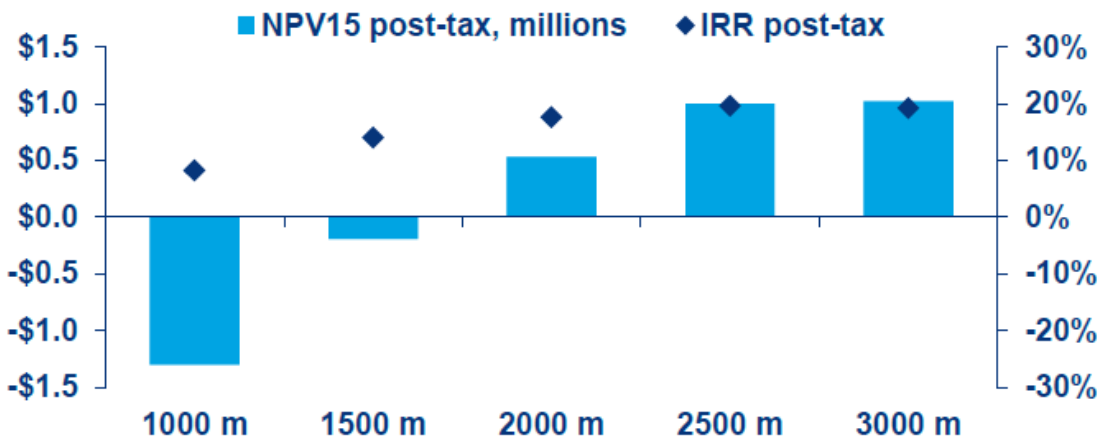
## Black Oil window type well



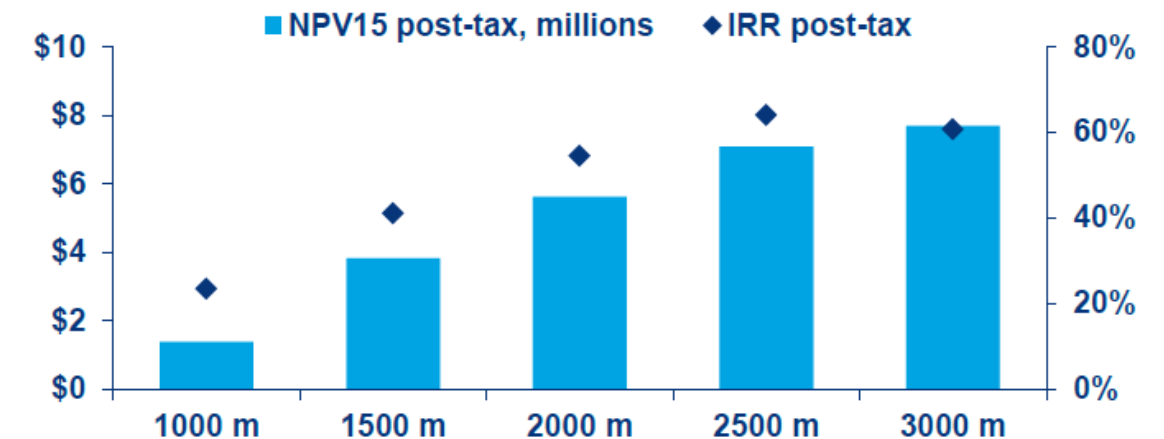
## Light Oil window type well



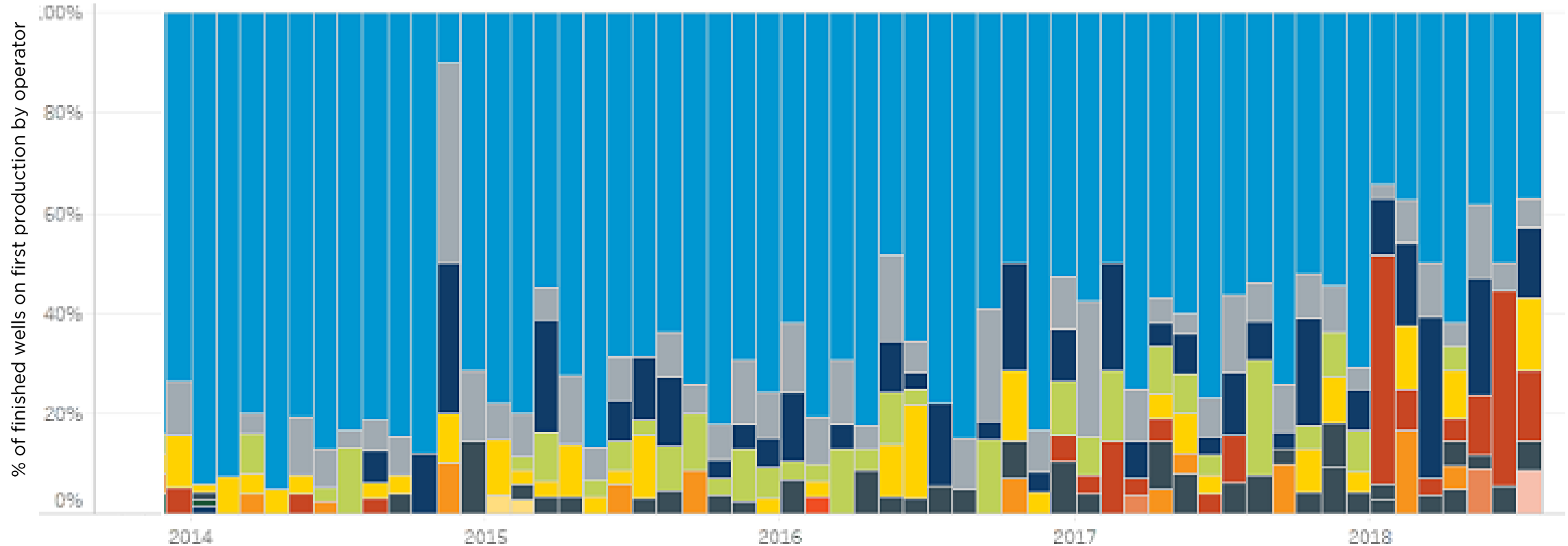
## Wet Gas/Condensate window type well



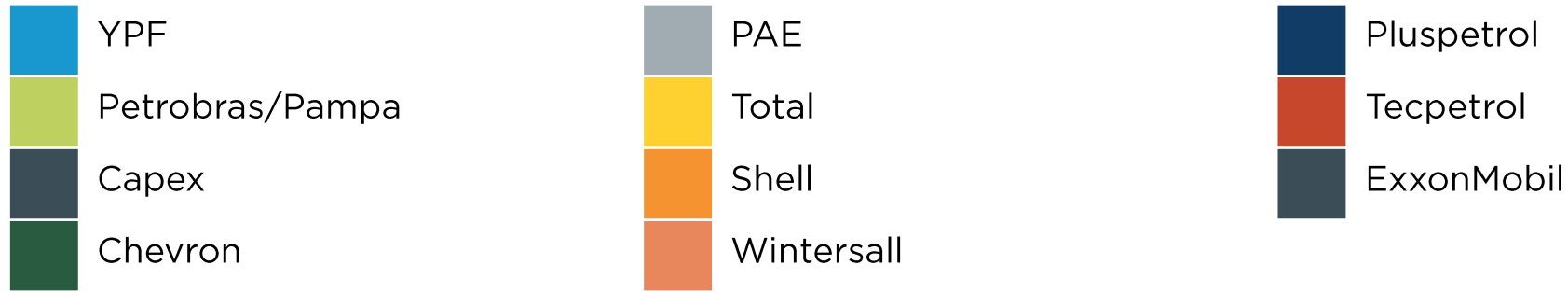
## Dry Gas window type well



# Activity is increasingly driven by new players (IHS - Markit)



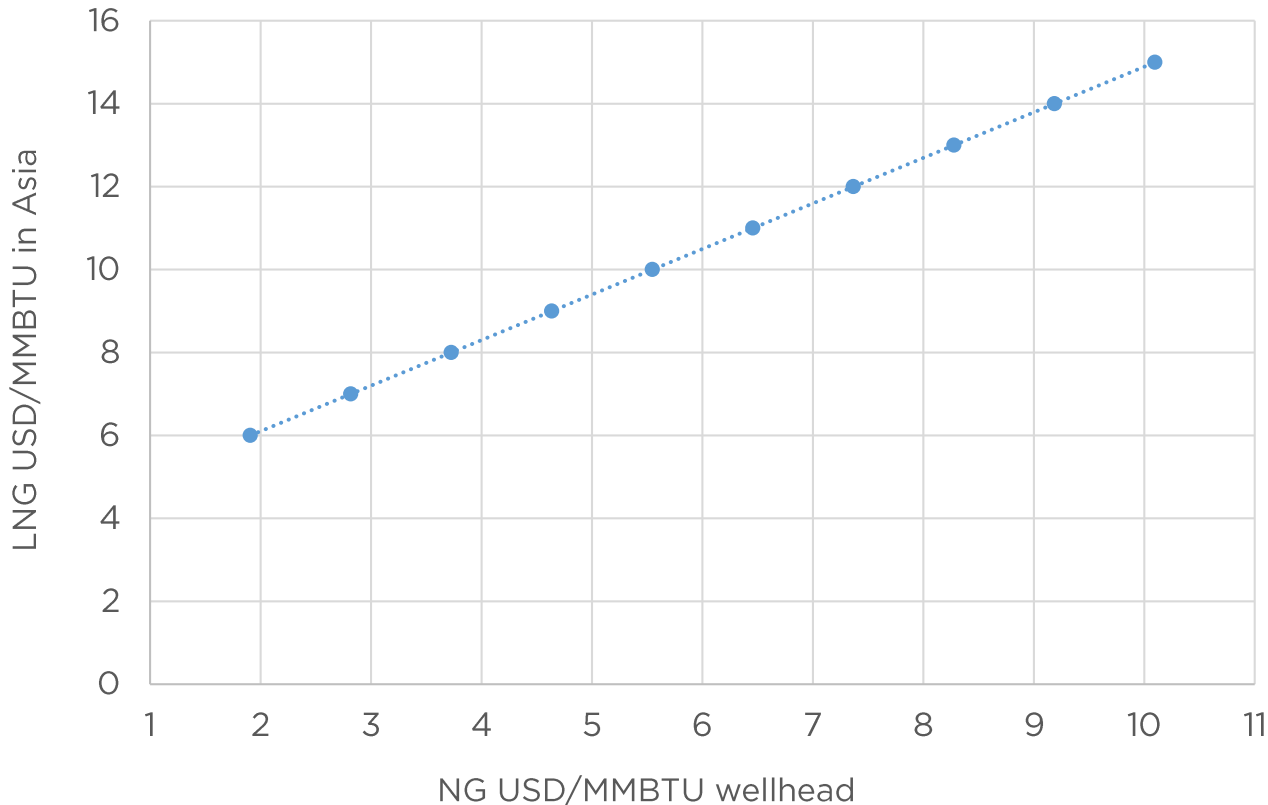
Month of Date - First BOE Prod



# Natural gas liquefaction plant analysis

- Gradual incorporation: 40 MMm<sup>3</sup>/day in 2023, 80 MMm<sup>3</sup>/day in 2024 and 120 MMm<sup>3</sup>/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 MMm<sup>3</sup>/day)
- Number of trains: 6
- Total capacity: 30 Mmmtpa (120 MMm<sup>3</sup>/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



## Trucks assumptions:

- 20% replacement in LNG trucks by 2030
- Annual gasoil consumption per truck: 10.2 m<sup>3</sup>
- Annual LNG consumption per truck: 8 tn
- Fleet growth in trucks fleet: 2% (a.a.)
- Initial fleet 2017 (ADEFA): 680 thousand.
- Effective cutting biodiesel 2030: 16%

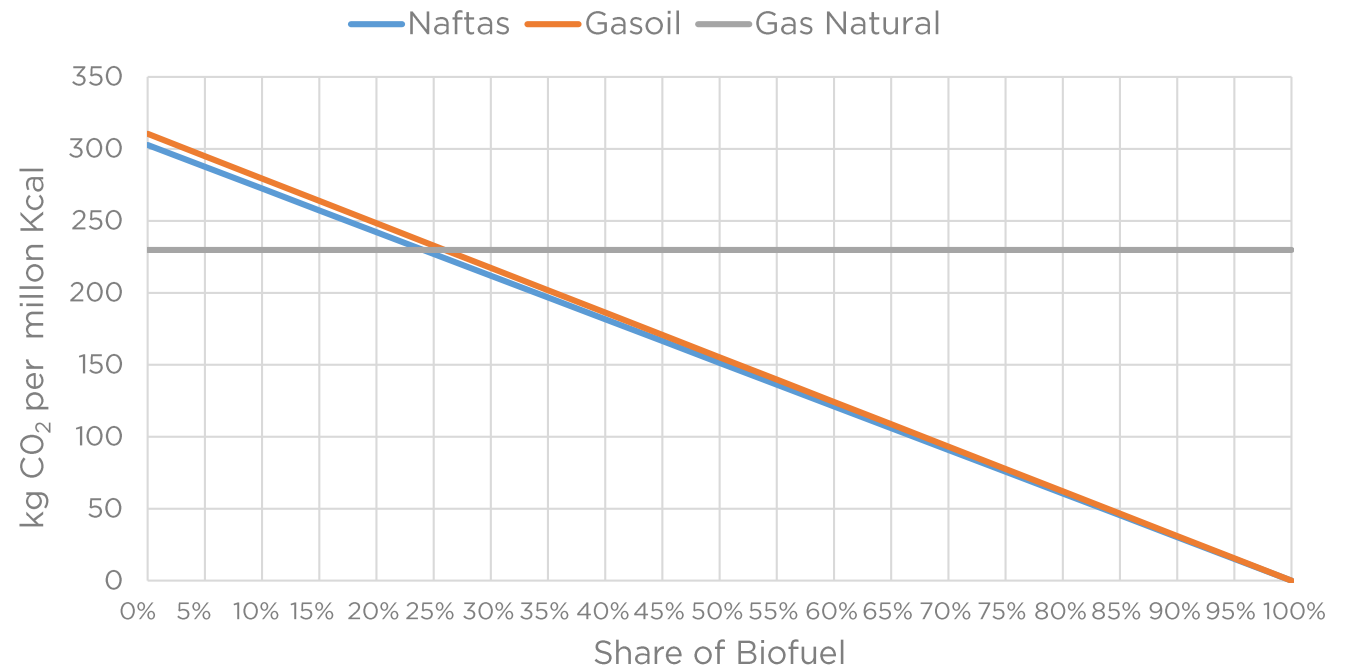
## AMBA buses assumptions:

- 80% of buses from AMBA to CNG in 2030
- Annual gasoil consumption per bus: 33 m<sup>3</sup>
- Annual CNG consumption per bus: 34 thousand m<sup>3</sup>
- Fleet growth in buses fleet: 2% (a.a.)
- Initial fleet 2017 (MINTRAN): 20 thousand.
- Effective biodiesel cutting: 20%

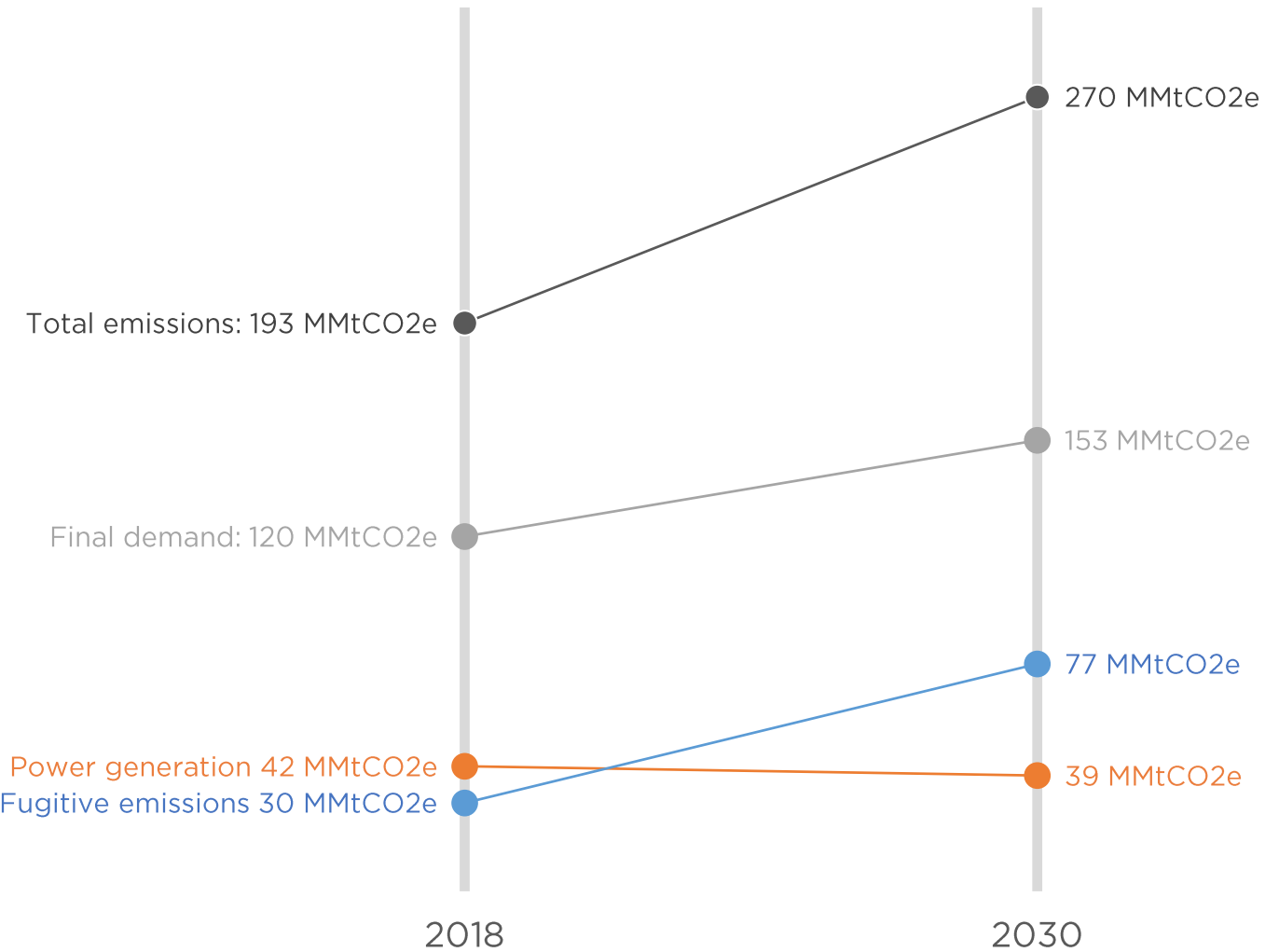
## Cars assumptions<sup>1</sup>:

- 20% replacement to CNG in the fleet in 2030.
- Annual gasoline consumption per car: 1.53 m<sup>3</sup>
- Annual GNC consumption per car: 1.38 thousand m<sup>3</sup>
- Fleet growth in vehicle fleet: 3.8% (a.a.)
- Initial fleet 2017 (ADEFA): 9.4 million
- Effective cut bioethanol: 22%

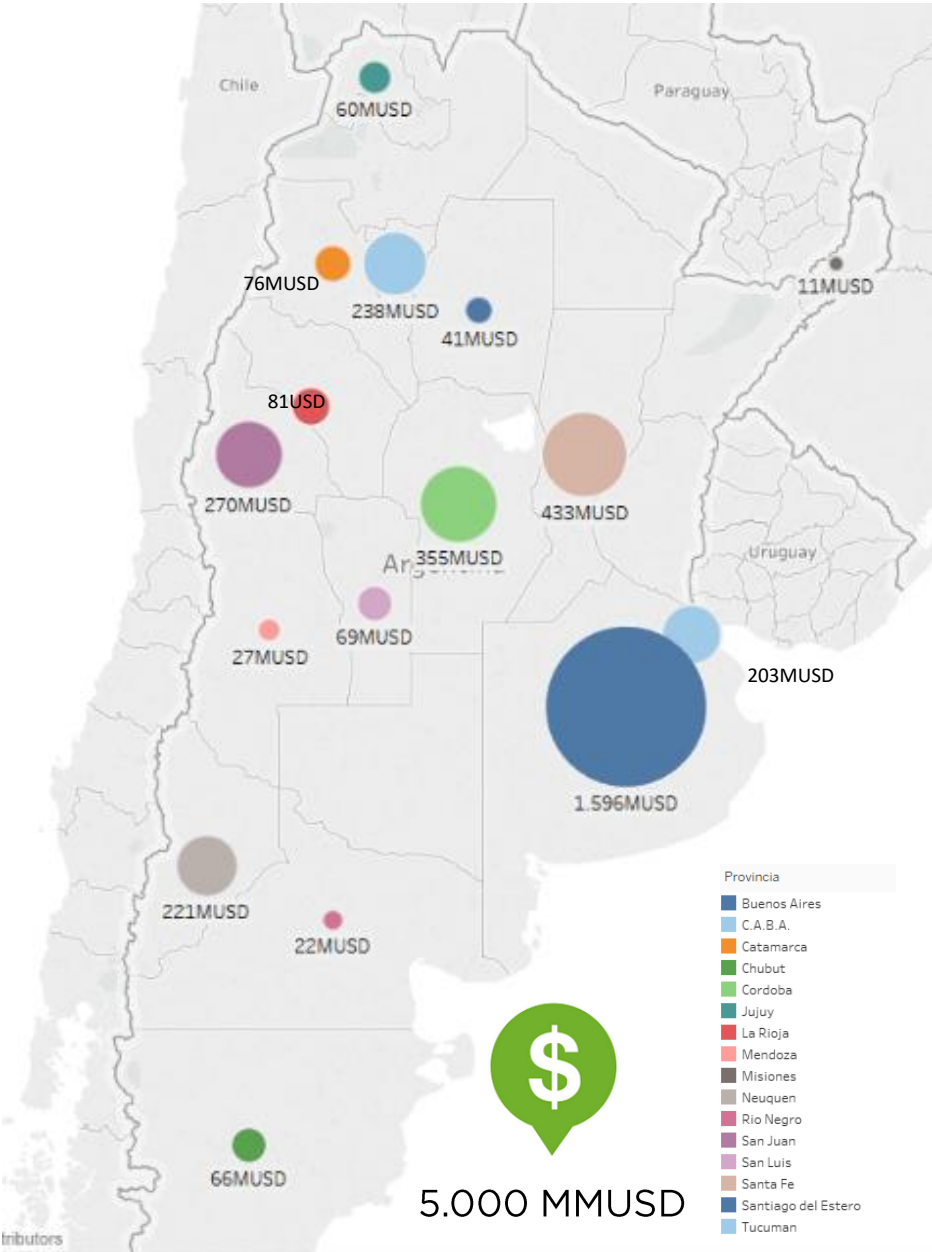
- In 2030 the demand for additional CNG amounts to 20 MMm<sup>3</sup> / day, given the reconversion of private vehicles, SUVs, trucks and buses to CNG / LNG.
- Due to the substitution of liquid fossil fuels, it is possible to save 0.85 million tCO<sub>2</sub>e of GHG in 2025 and 0.57 million in the year 2030.



Notes: 1) Includes private cars, taxis or similar and SUVs.

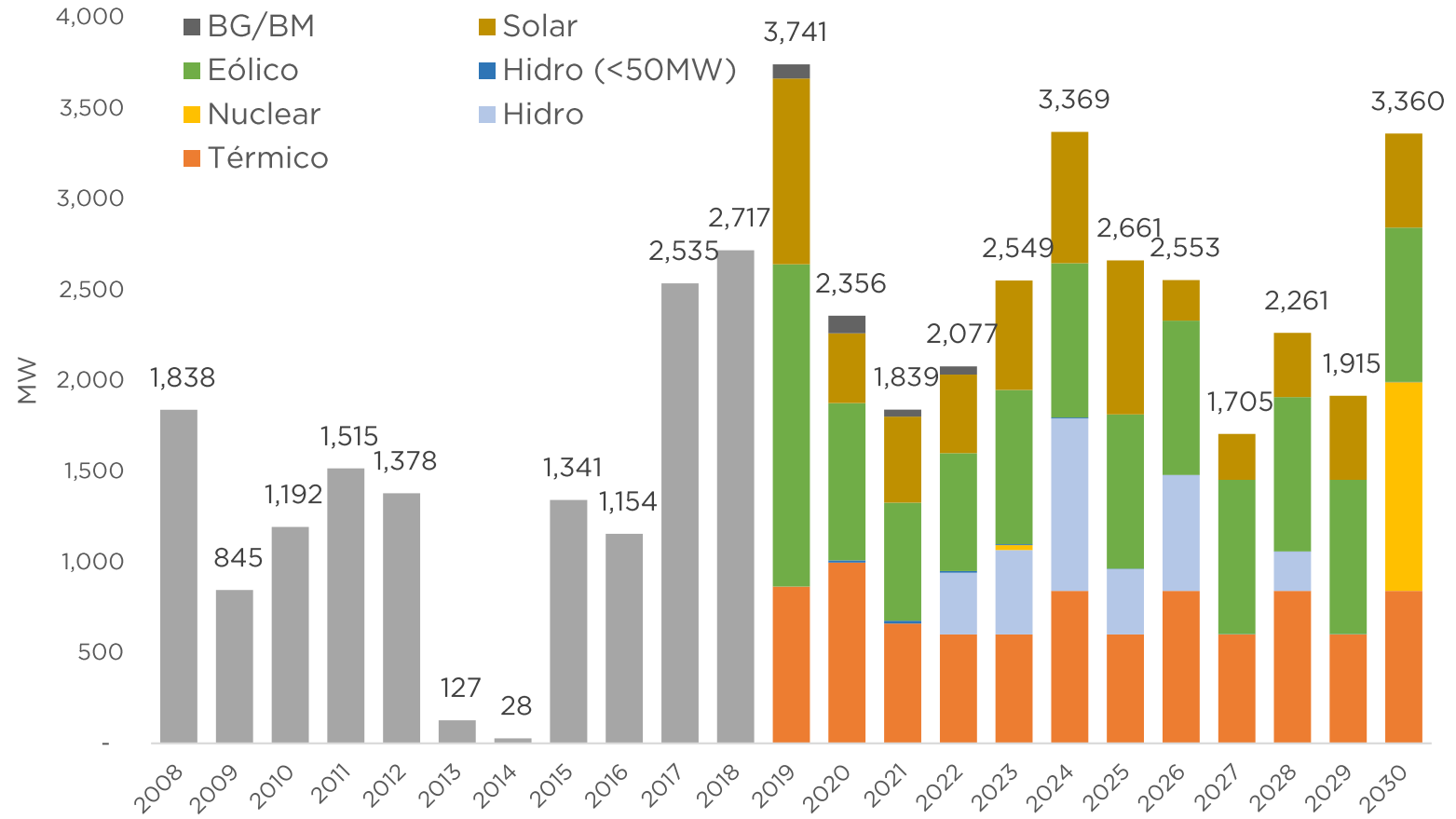


- Energy represents 52.5% of total emissions in 2014 (368 MMtCO<sub>2</sub>e - National emissions inventory).
- In the Paris Agreement, Argentina has an aggregate commitment to limit its emissions to 483 MMtCO<sub>2</sub>e unconditionally, and 369MMtCO<sub>2</sub>e in the conditional target to the application of certain policies
- Our estimations would lead the energy sector to 56% in the case of fulfilling the unconditional commitment and 73% of the conditional commitment.



Investment 2017 - 2018 (MMUSD)

## Nominal power incorporated per year [MW]



**5 BUSD**

Estimated value 2017 - 2018

**46 BUSD**

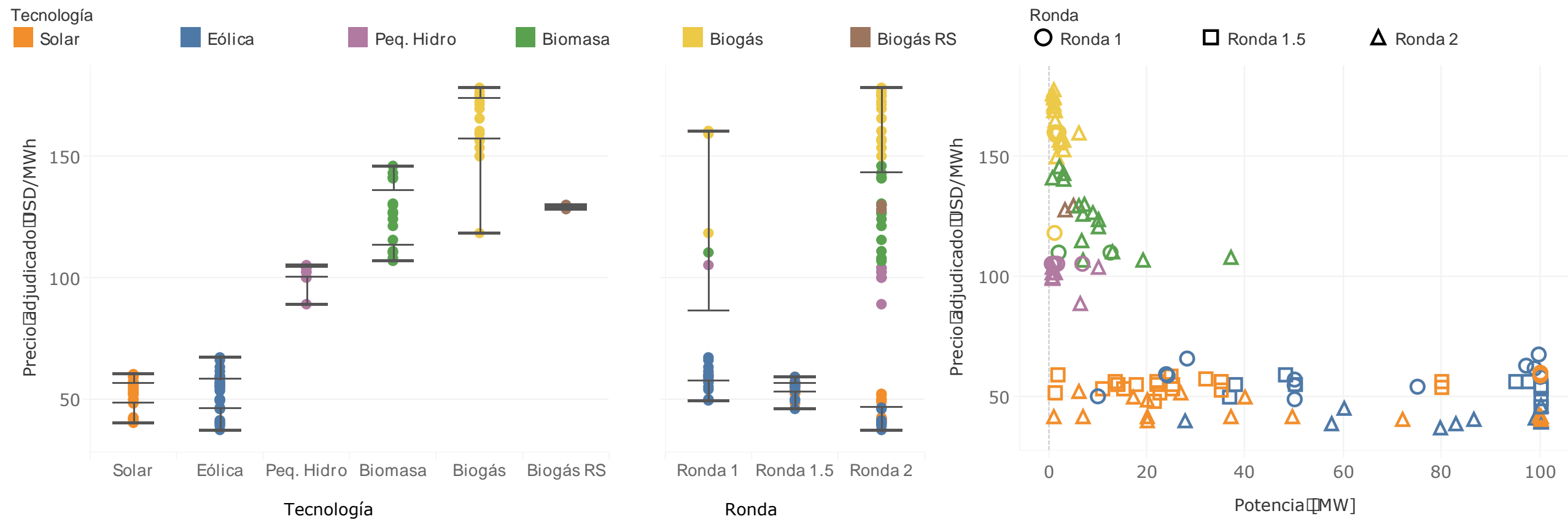
Estimated value 2019 - 2030

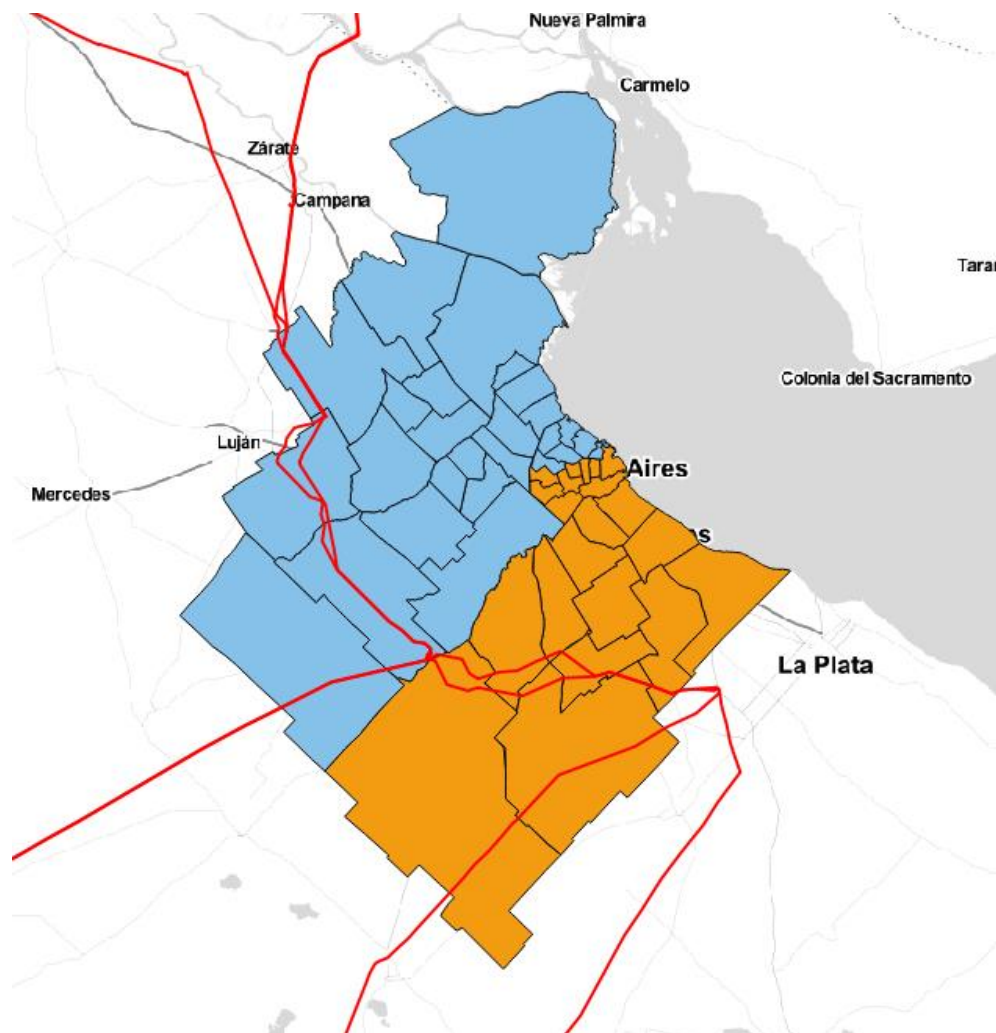
*Investment dates are based on project commissions*

# Results of the RenovAr program

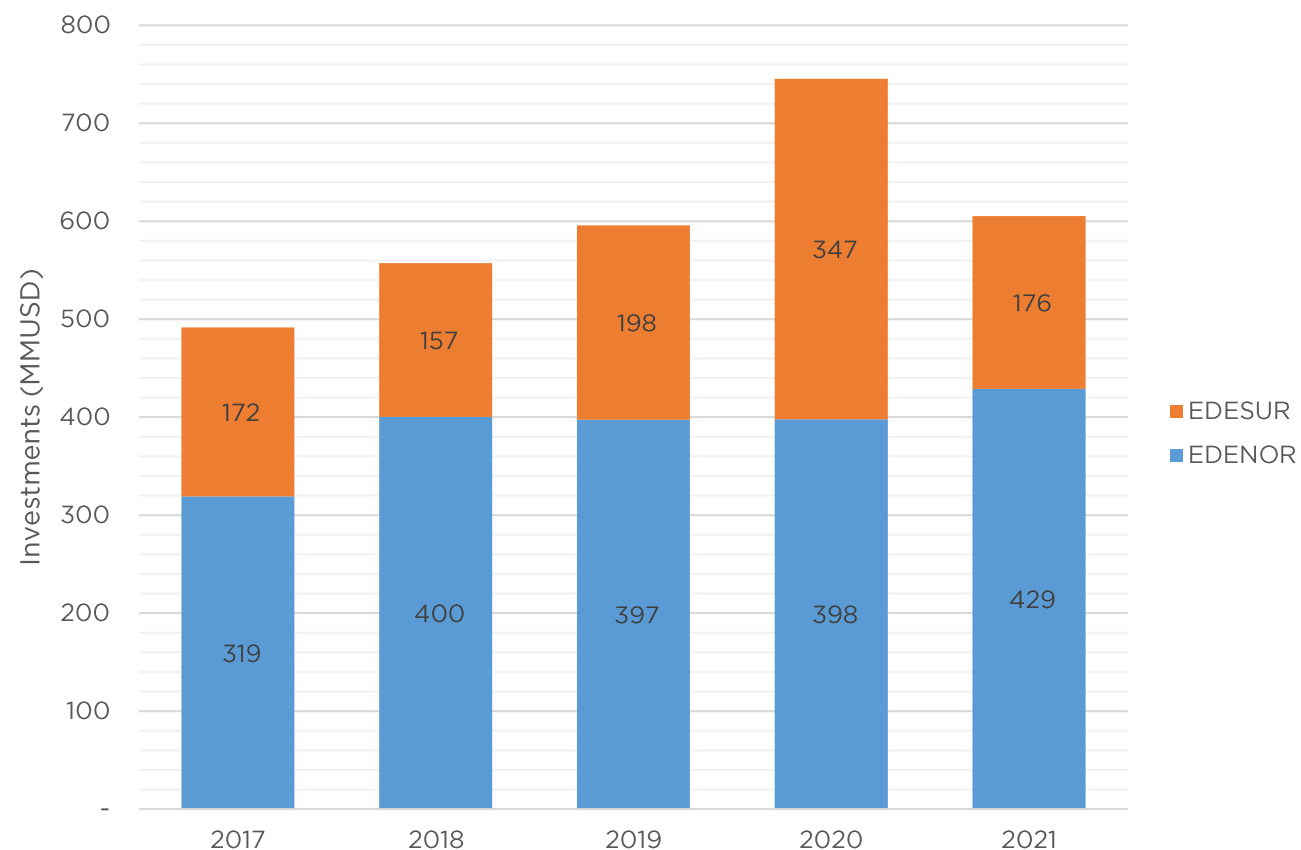
Decreasing prices in each competitive bidding.

## Weighted average price: 54.72 USD/MWh





## Investments in Electrical Distribution (Buenos Aires Metropolitan Area)

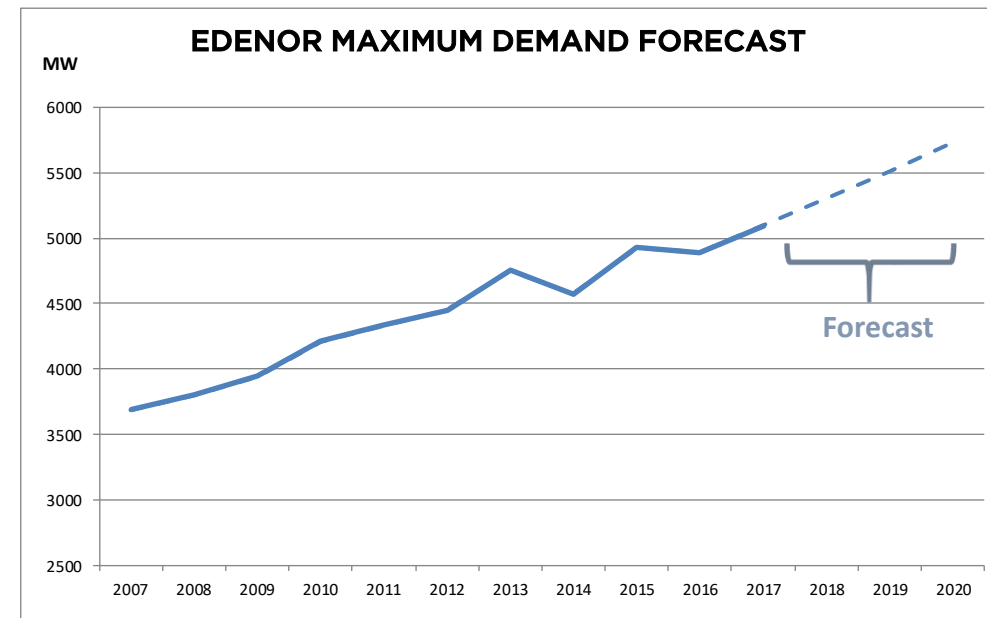
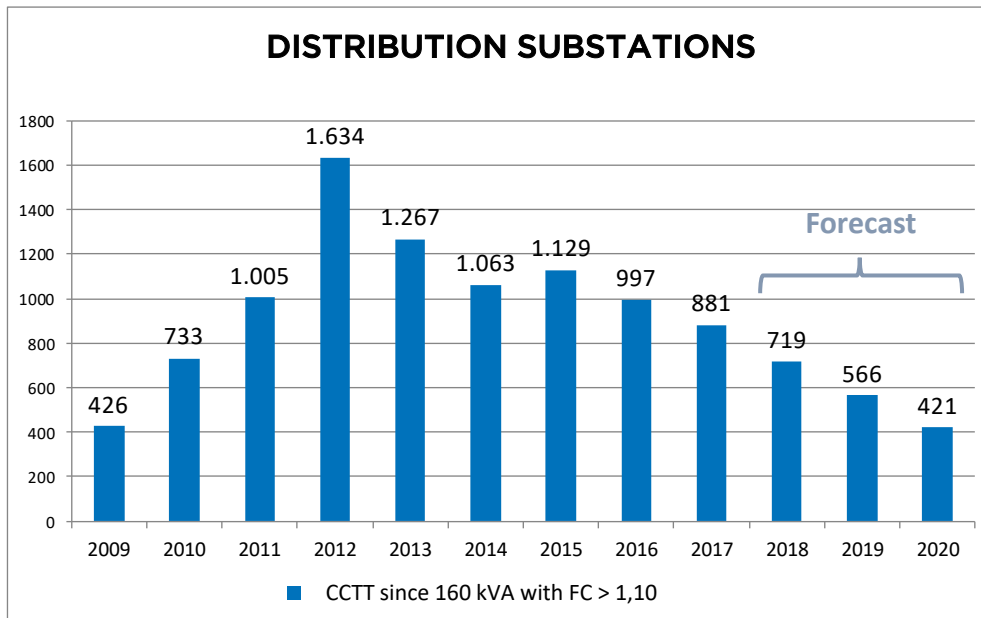
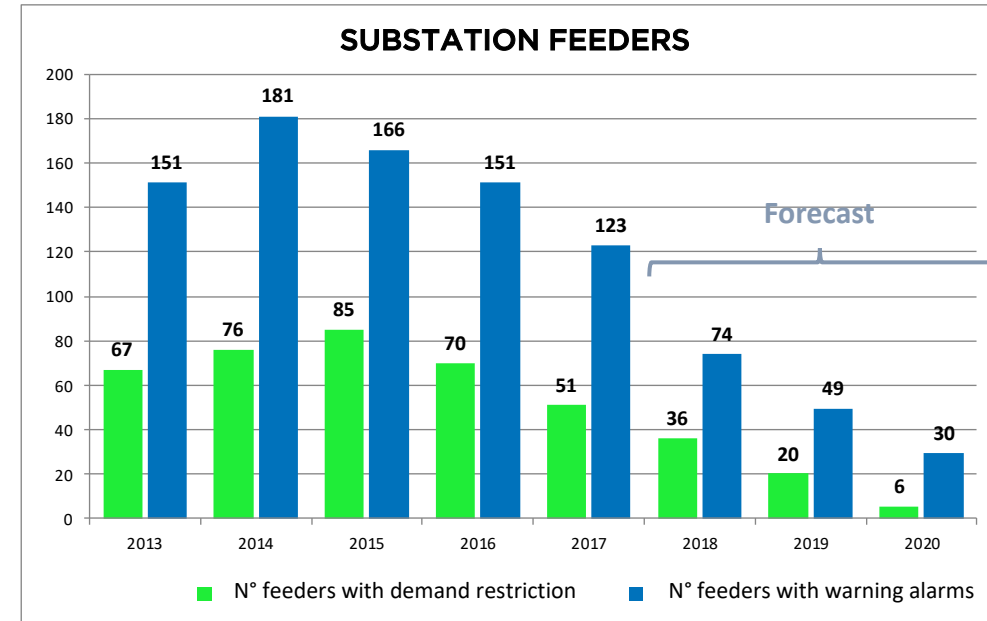
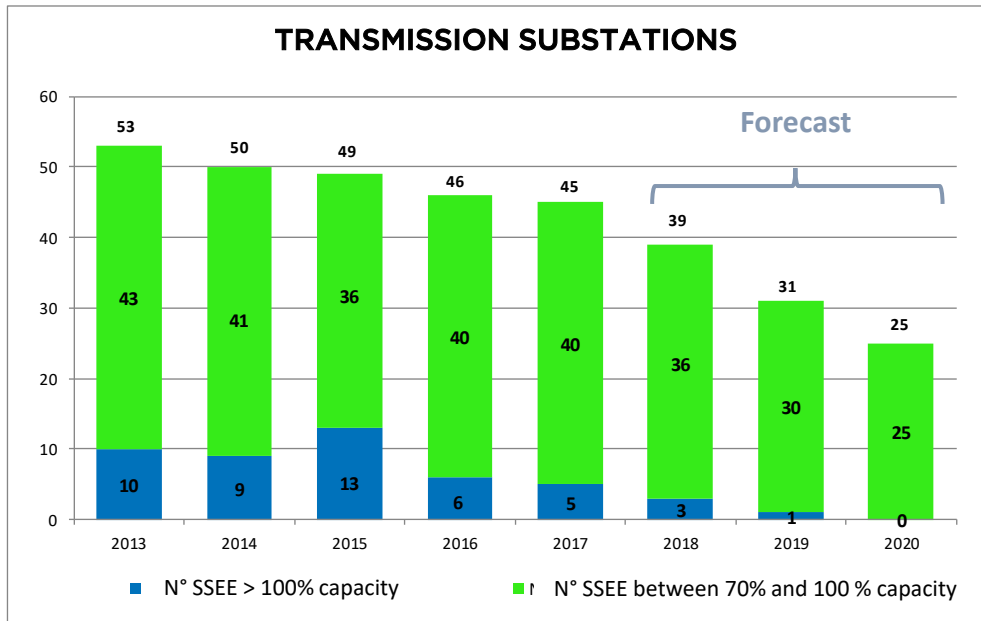


Amounts in ARS at May 2018 using 23 ARS/USD exchange rate

*Only EDENOR and EDESUR expansion and maintenance are considered*

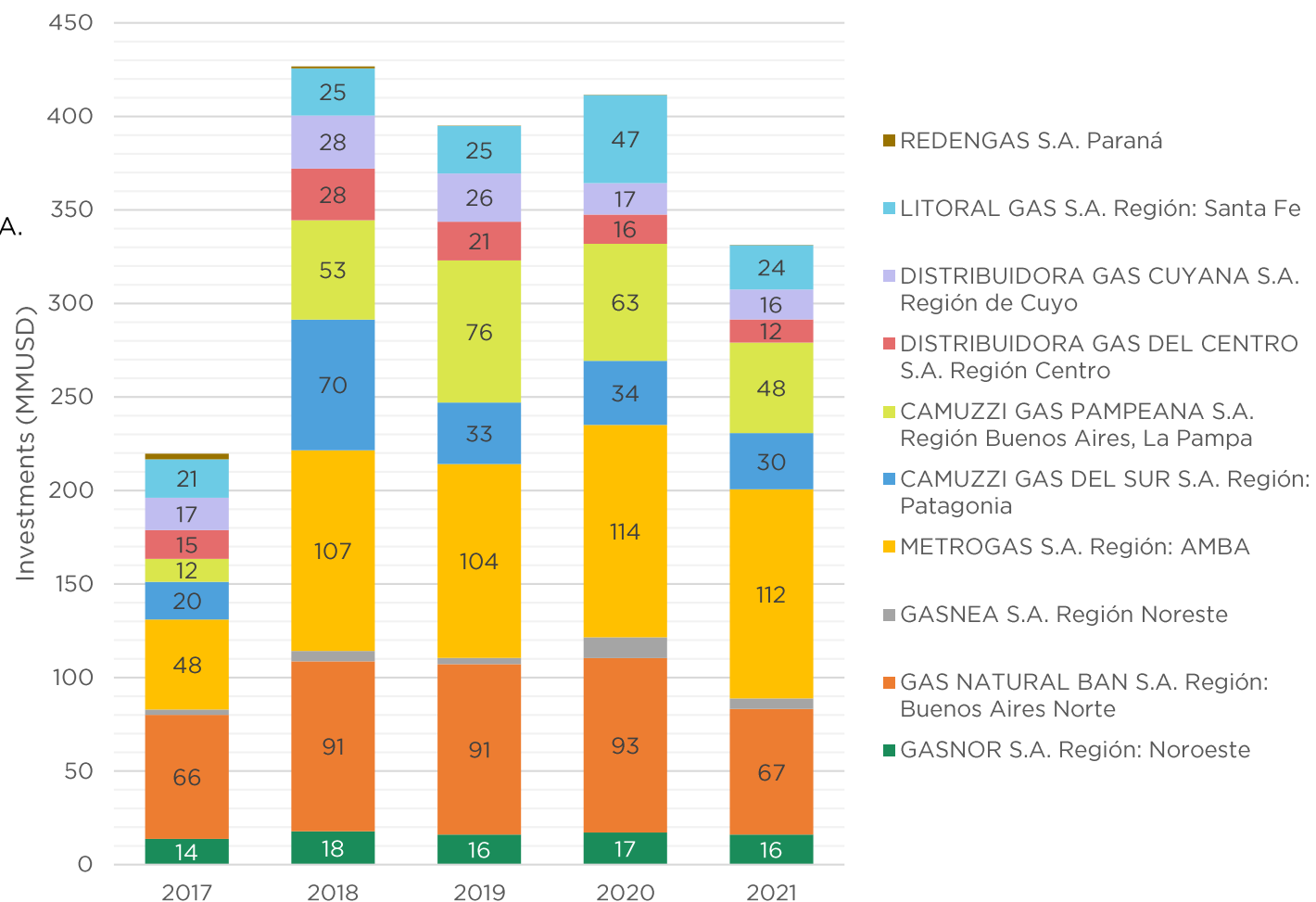
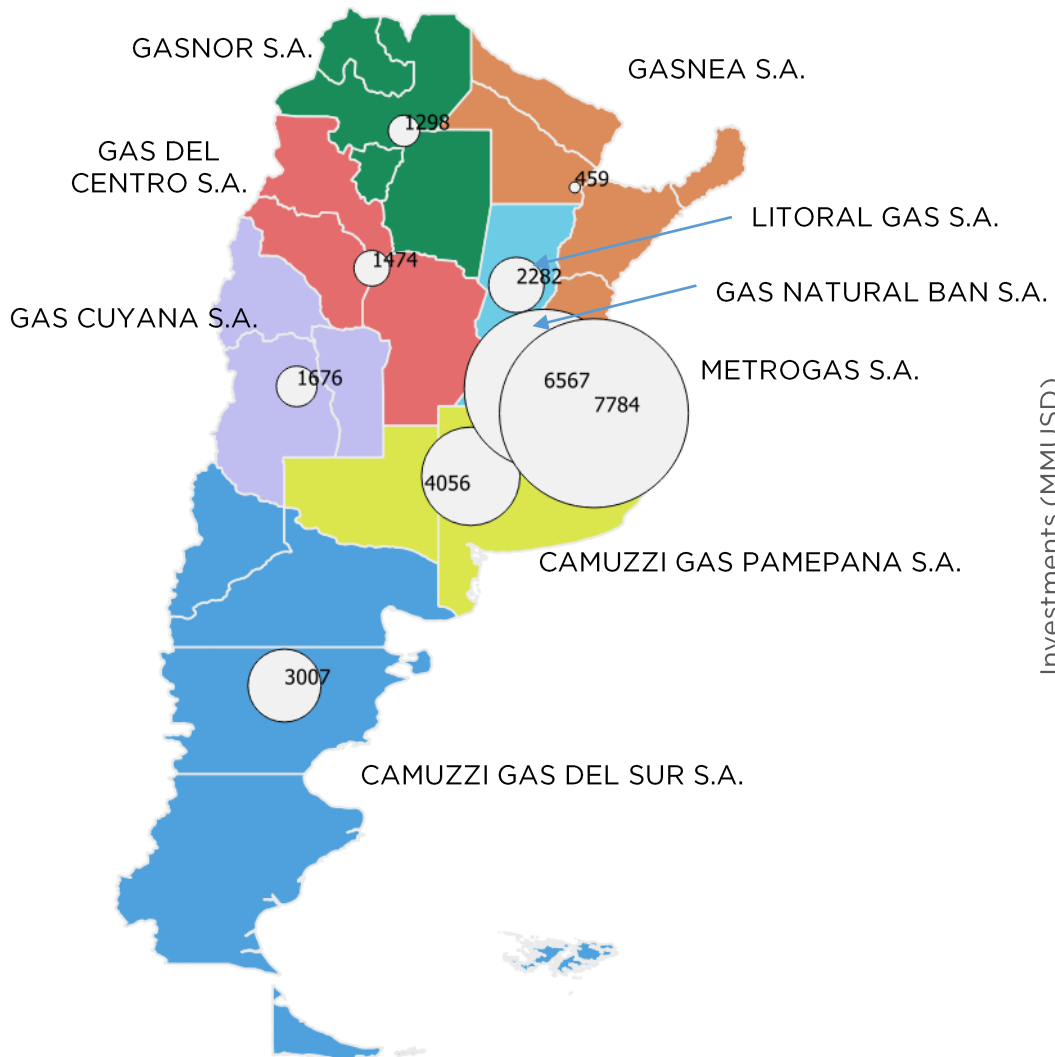
# EDENOR Investment Plan: Expected results

## Requirements in High, Medium and Low Voltage networks





## Investments (RTI) in Gas Distribution



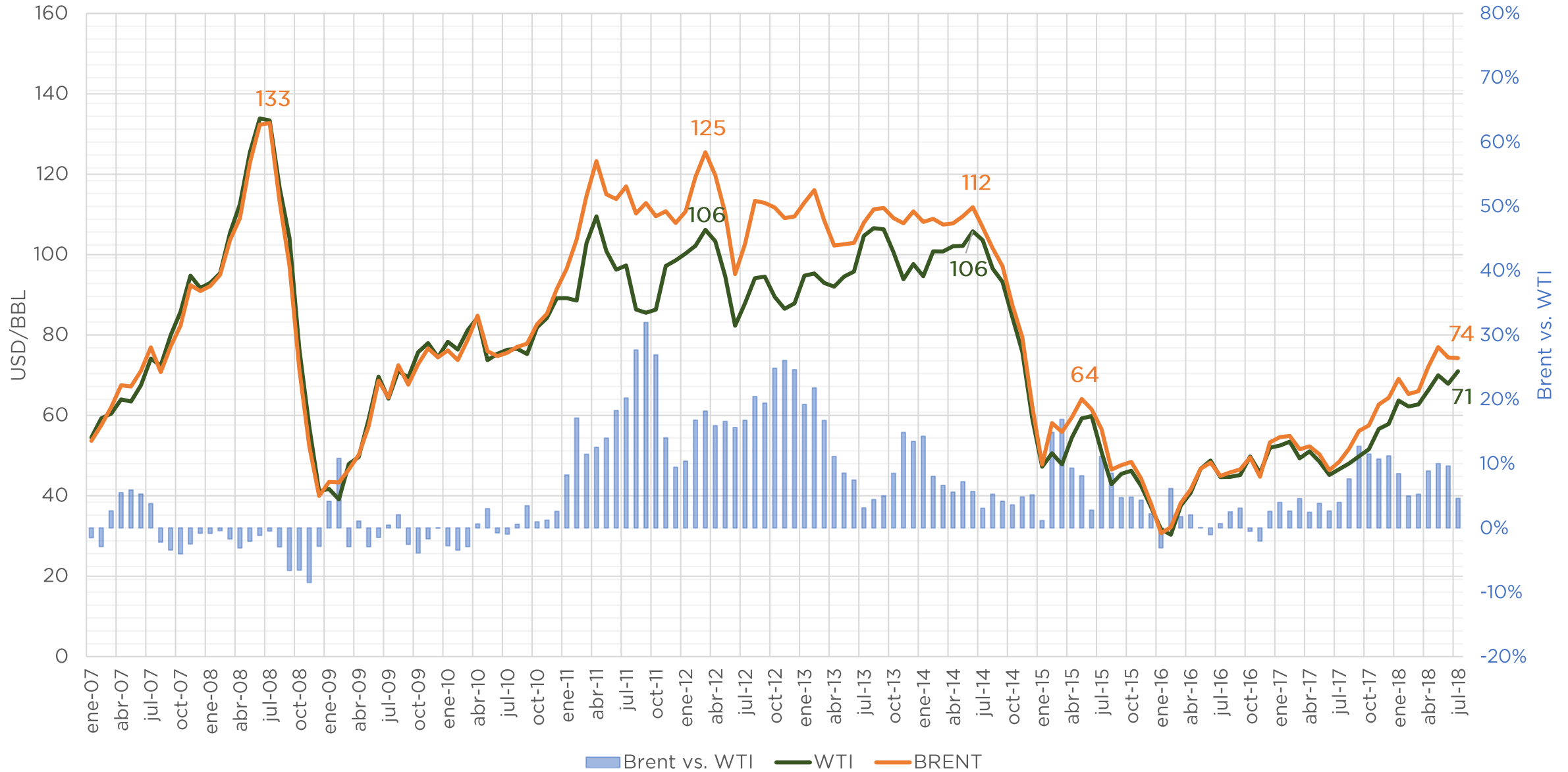
RTI values expressed in dollars using 16 ARS/USD exchange rate

*Investment includes in system expansion and maintenance*

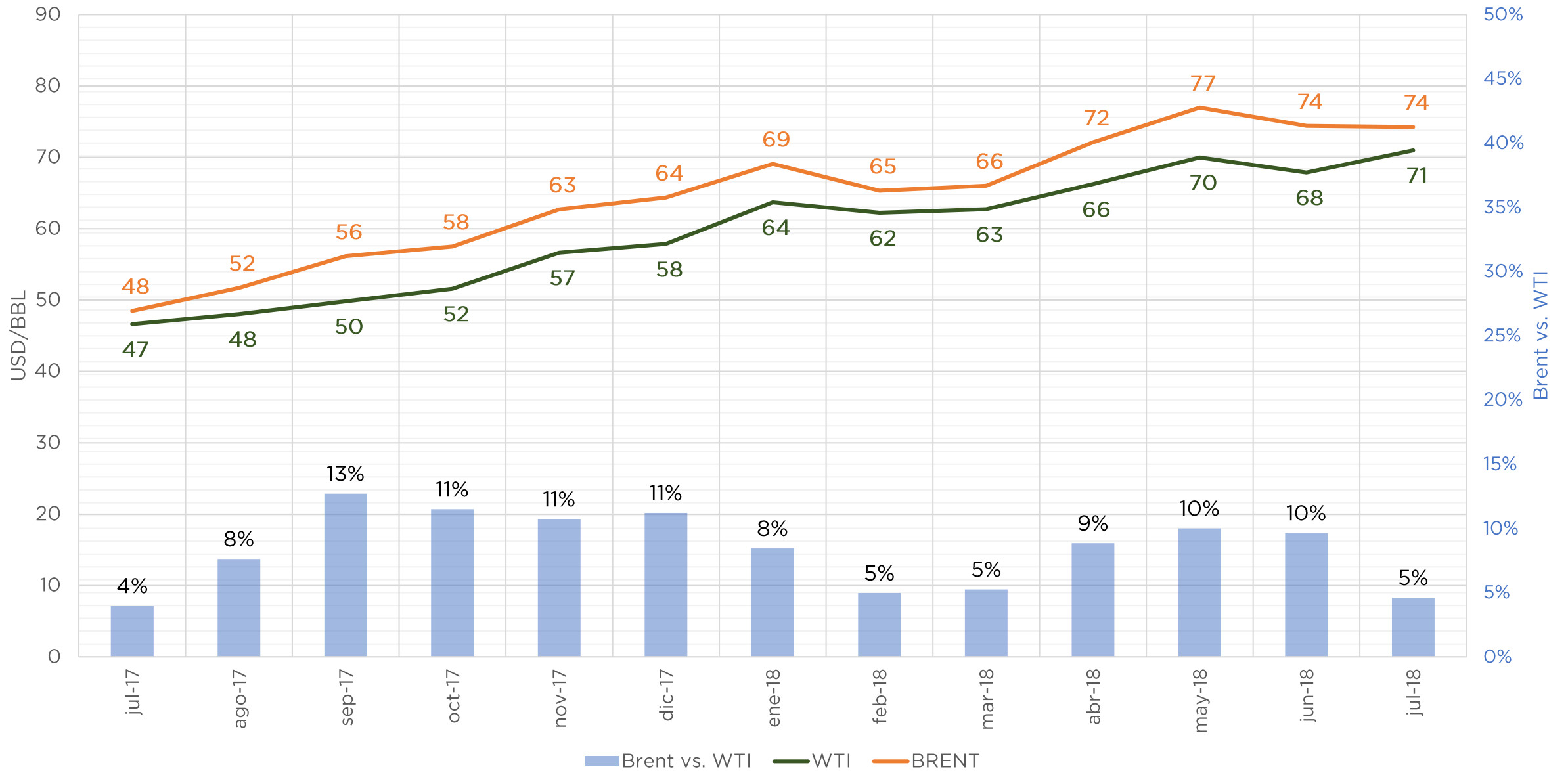
The image features a blue-tinted background with silhouettes of oil pumpjacks. One pumpjack is prominently shown in the foreground on the left, with its long walking beam angled upwards. Another pumpjack is visible in the background on the right. The sky is filled with soft, white clouds. The text 'Prices and Taxes Subannex' is overlaid in white on the left side of the image.

# Prices and Taxes Subannex

# Brent vs. WTI

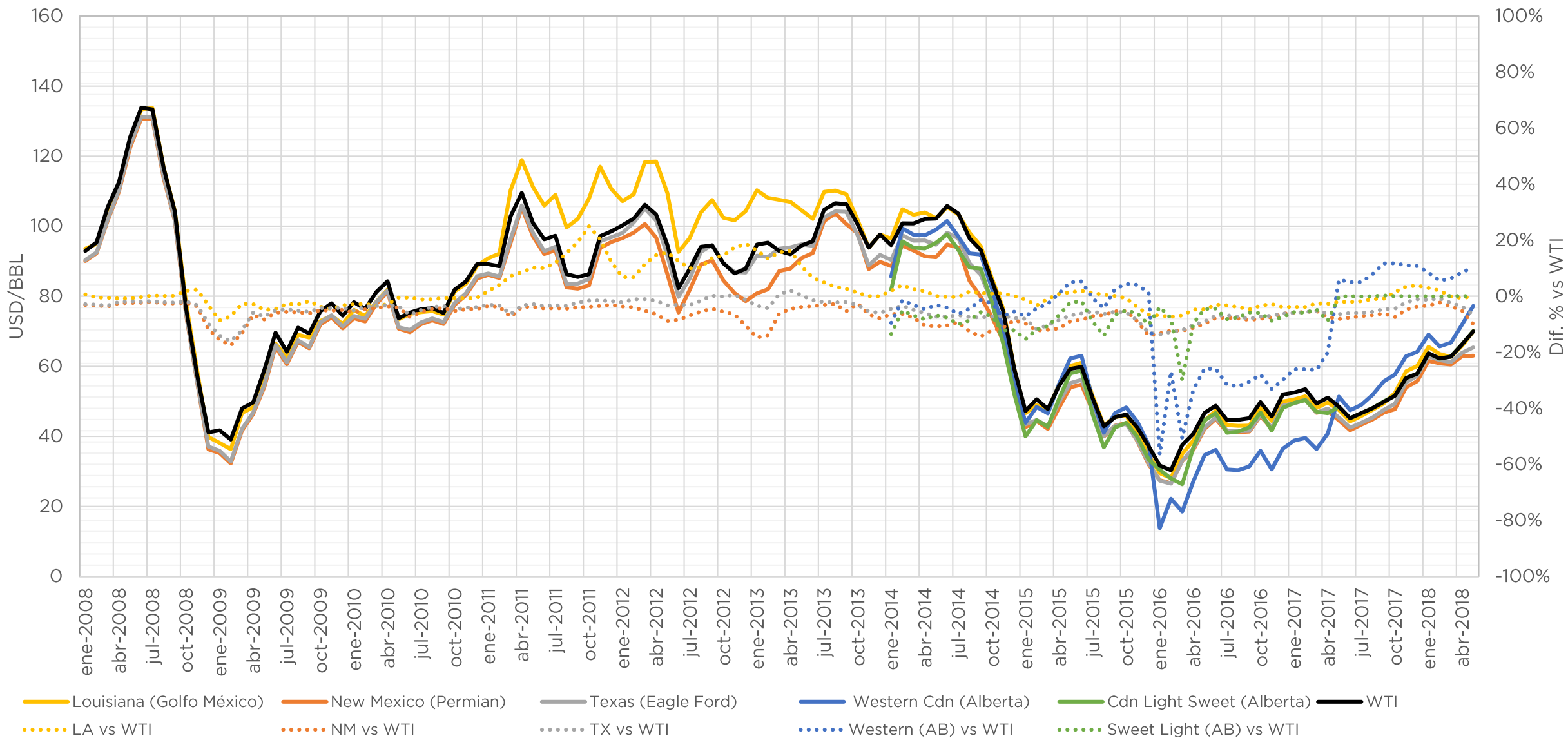


Source: Energy Information Administration (EIA)



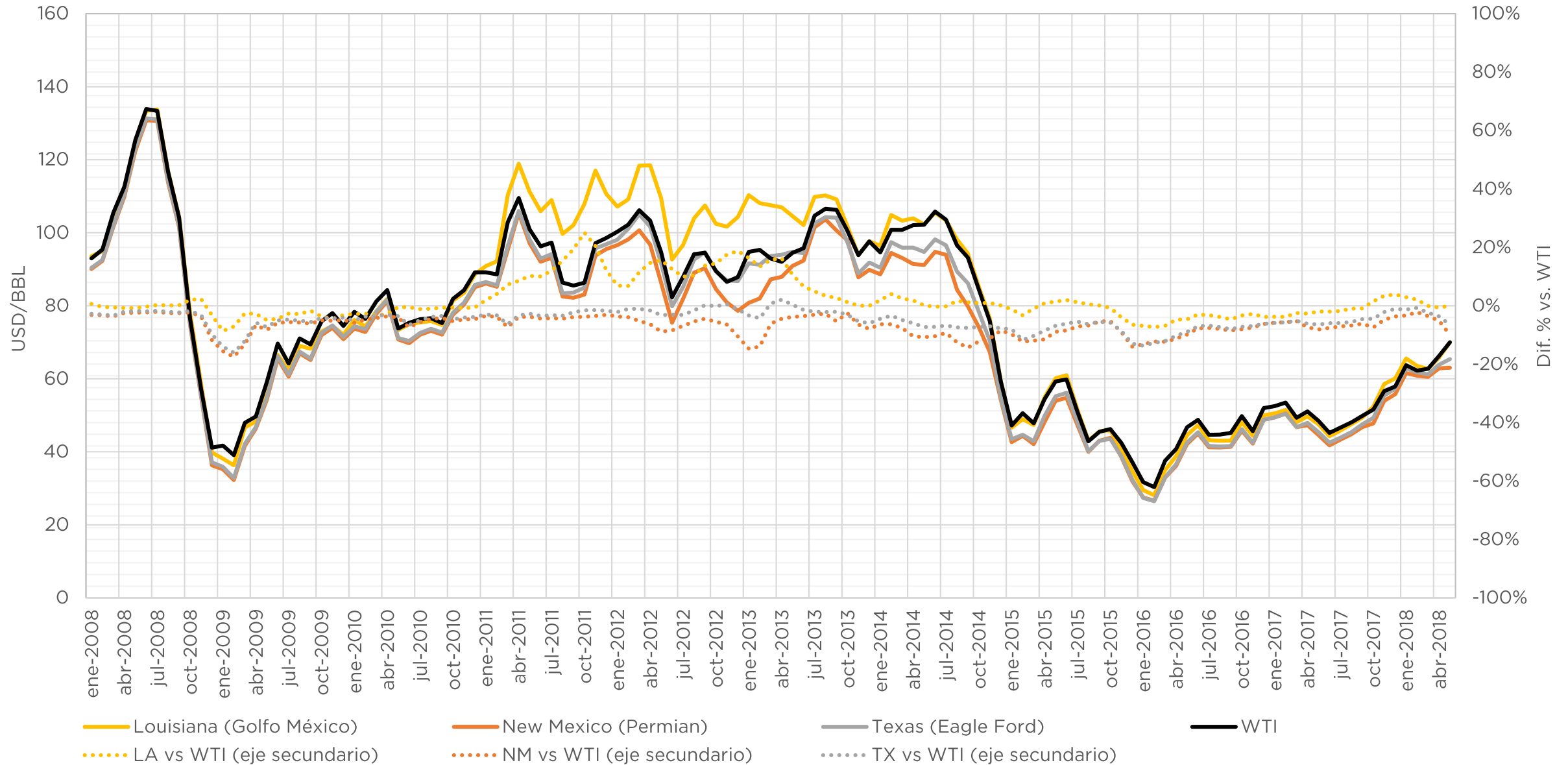
Source: Energy Information Administration (EIA)

# WTI vs. Oil prices in USA and Canada



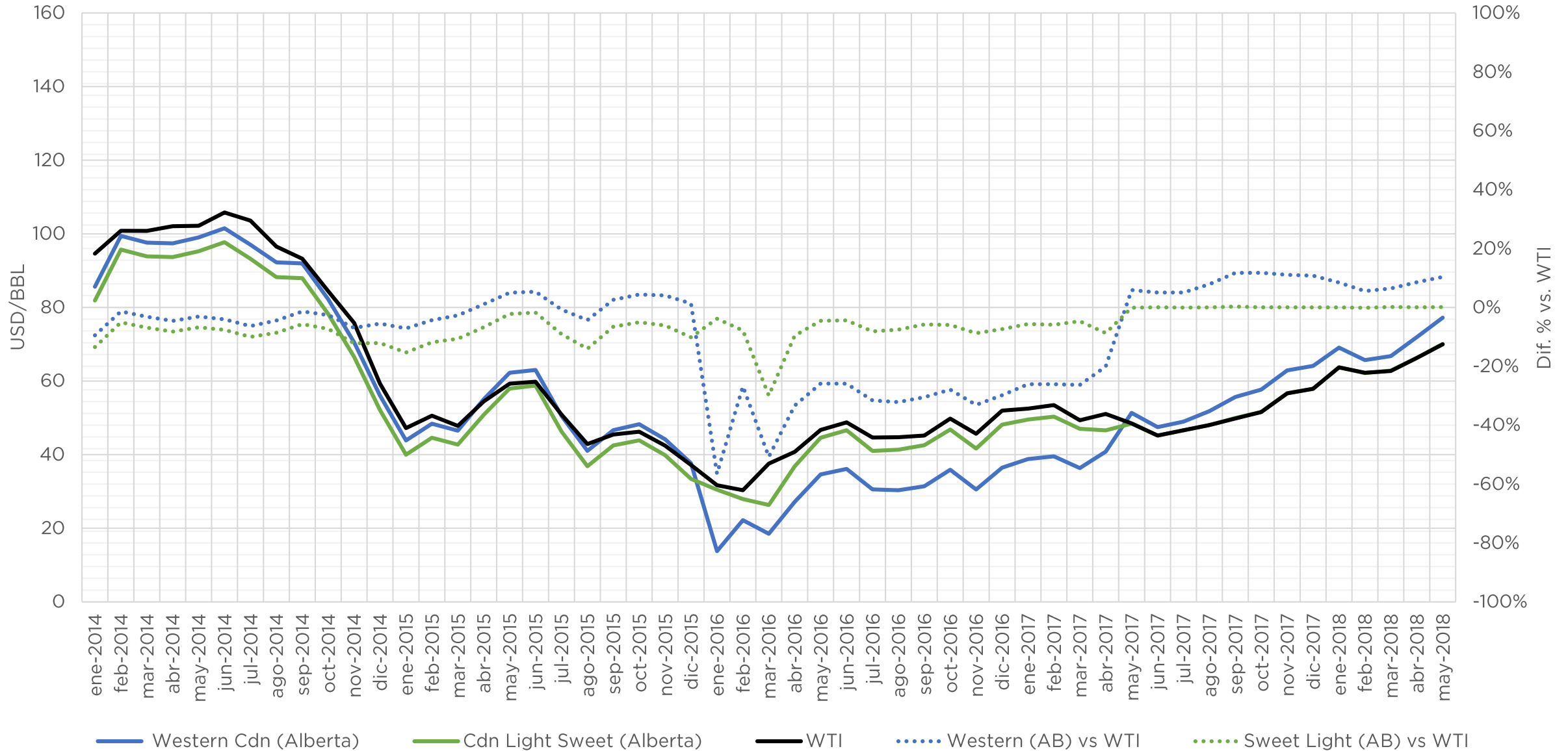
Sources: Energy Information Administration (EIA) y Natural Resources Canada

# WTI vs. Oil prices in USA

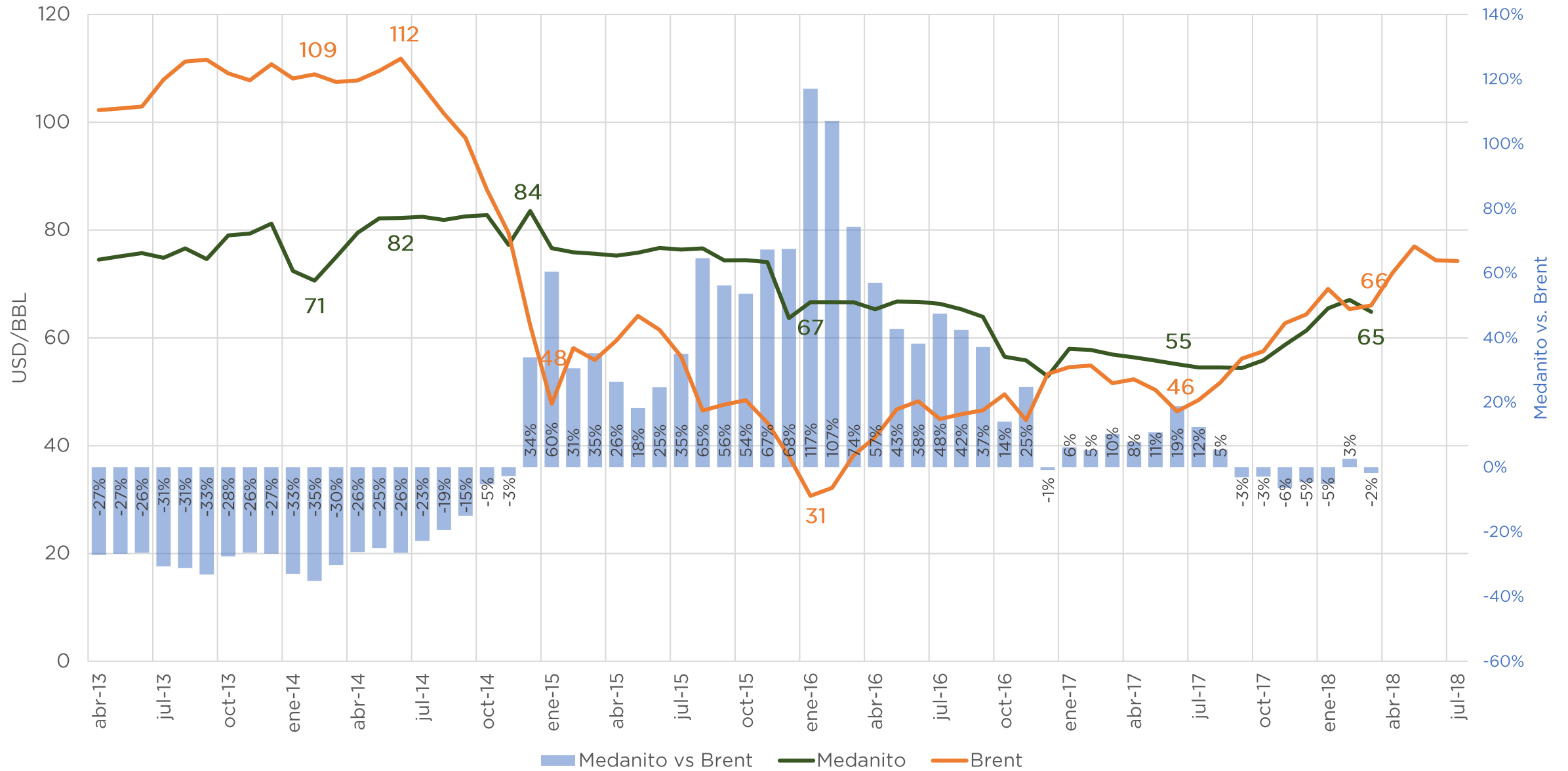


Sources: Energy Information Administration (EIA)





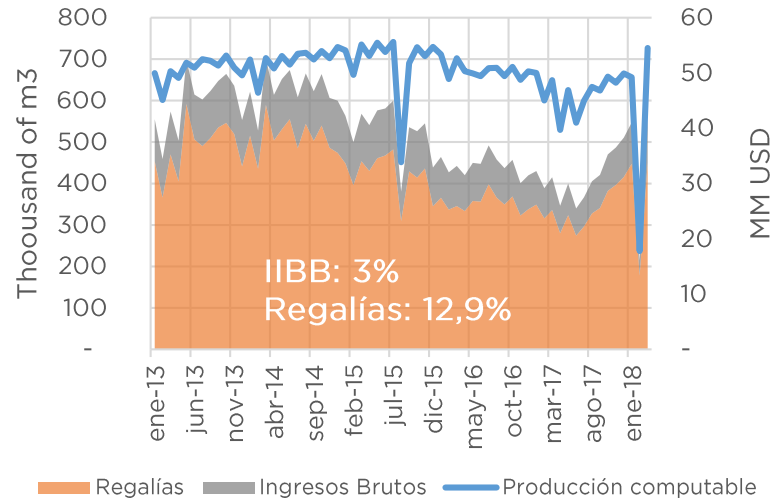
# Medanito vs. Brent



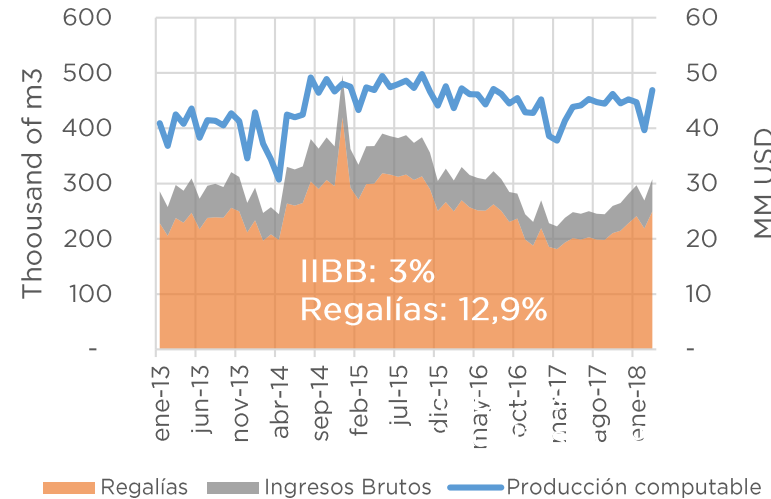
Sources: Energy Information Administration (EIA) y Ministerio de Energía de la Nación

# Oil royalties by province

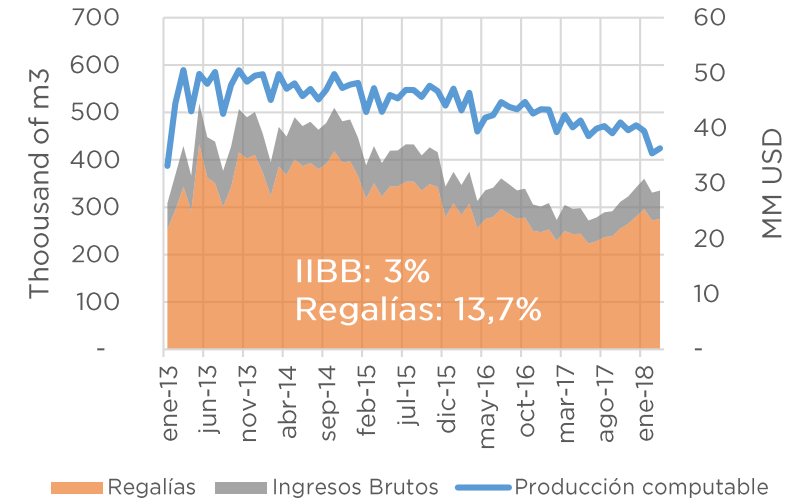
## Chubut



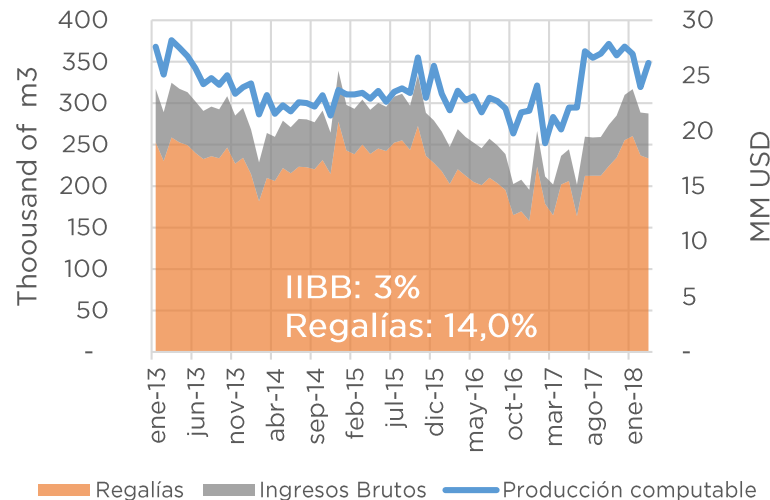
## Neuquén



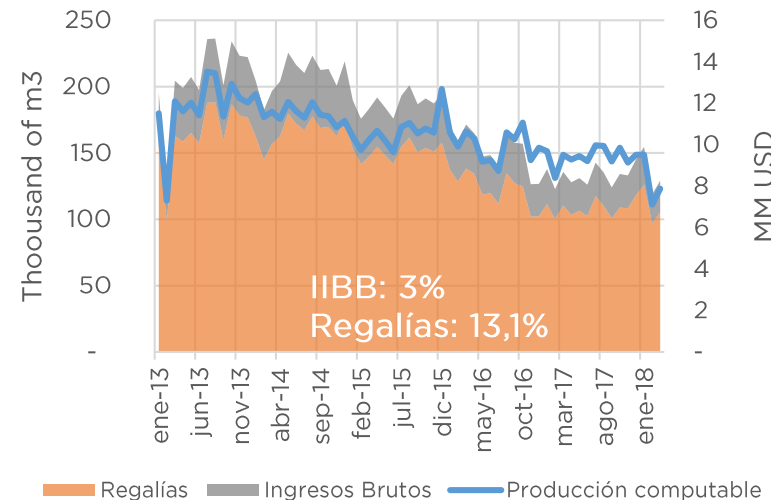
## Santa Cruz



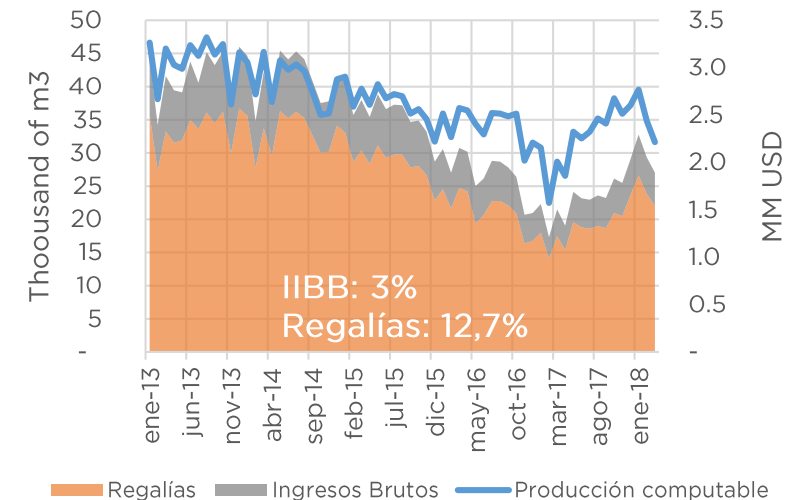
## Mendoza



## Río Negro



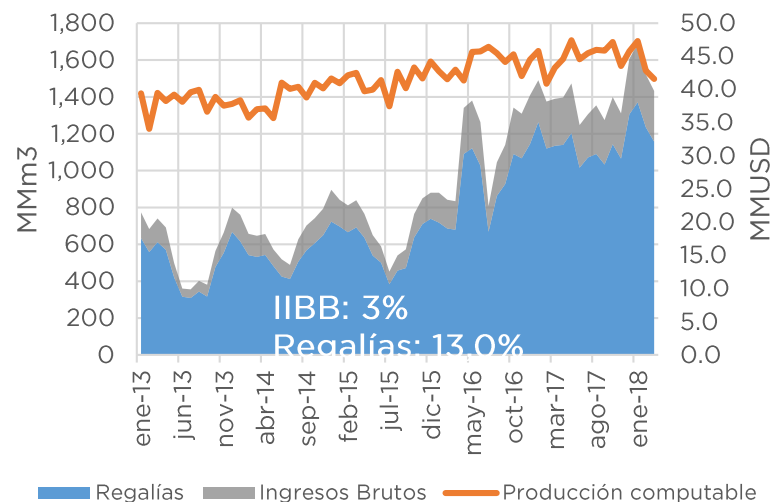
## Tierra del Fuego



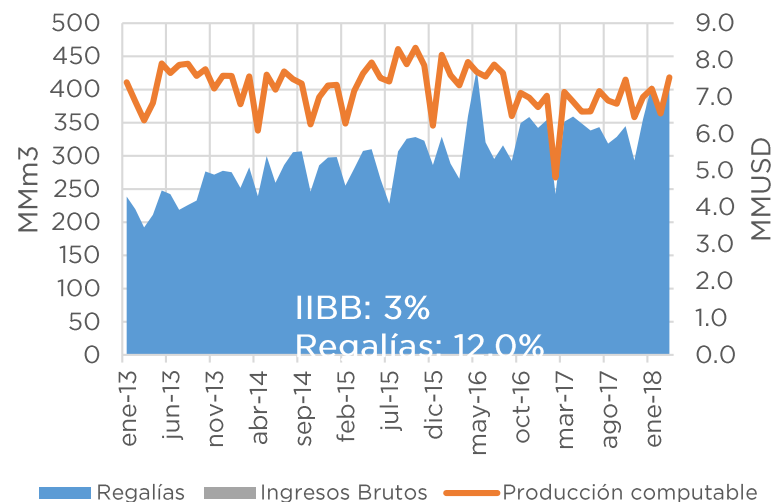
Source: Ministerio de Energía de la Nación.  
Note: Provincial sales taxes were estimated using legal tax rates. Royalties rates were estimated using weighted averages by province.

# Natural gas royalties by province

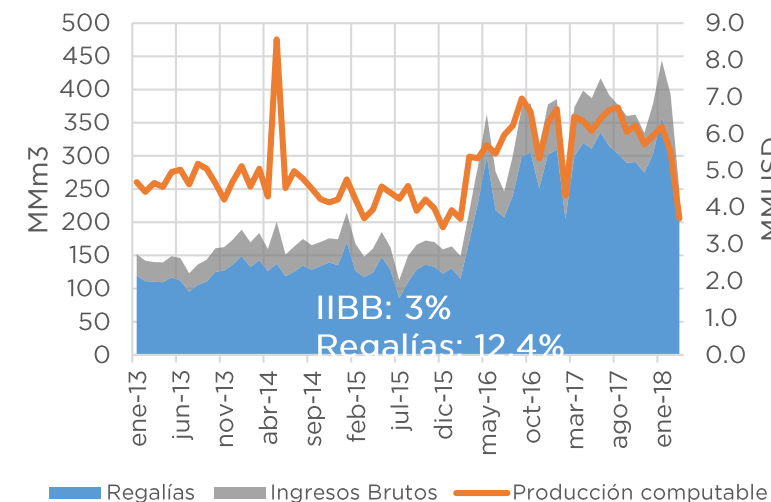
## Neuquén



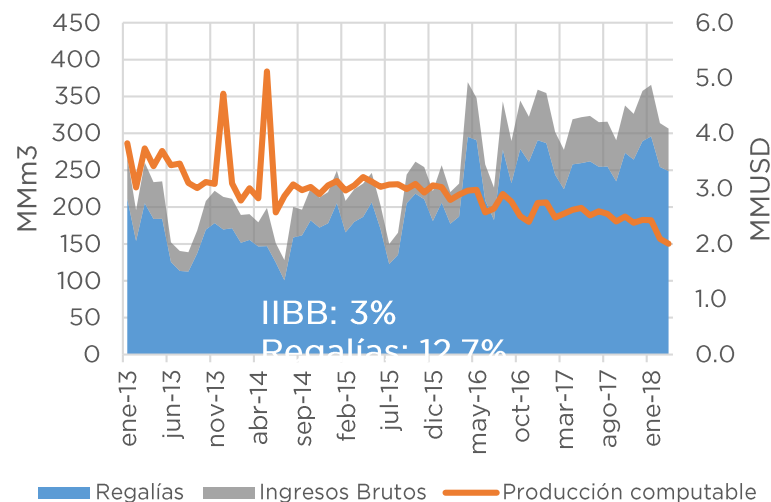
## Estado Nacional



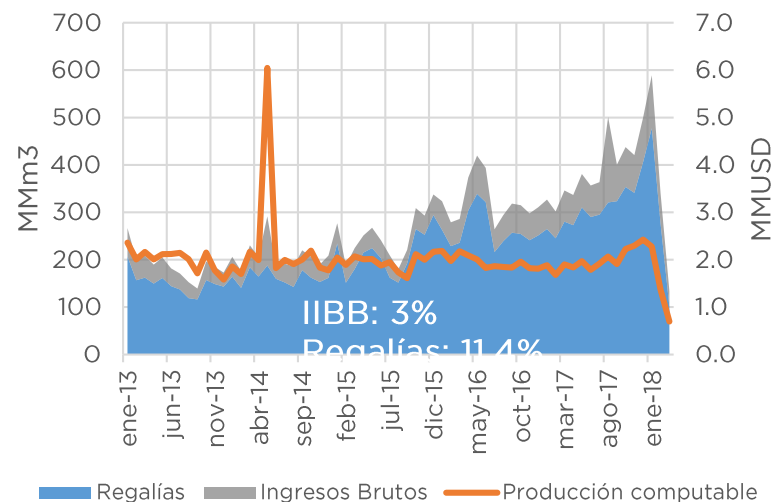
## Tierra del Fuego



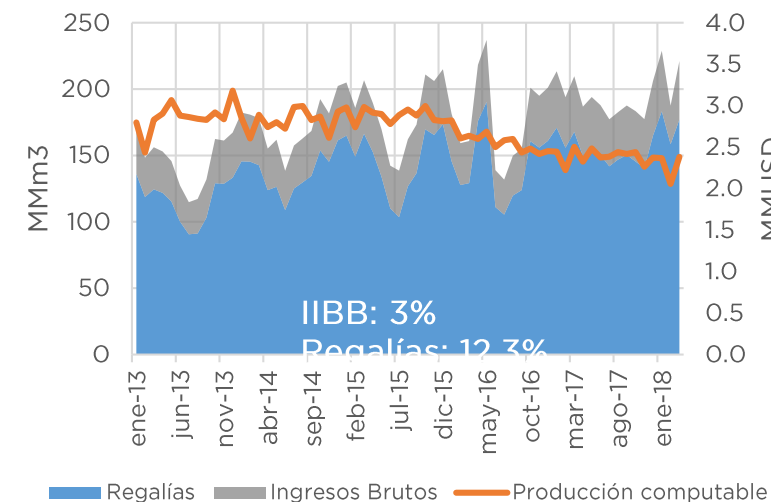
## Salta



## Santa Cruz



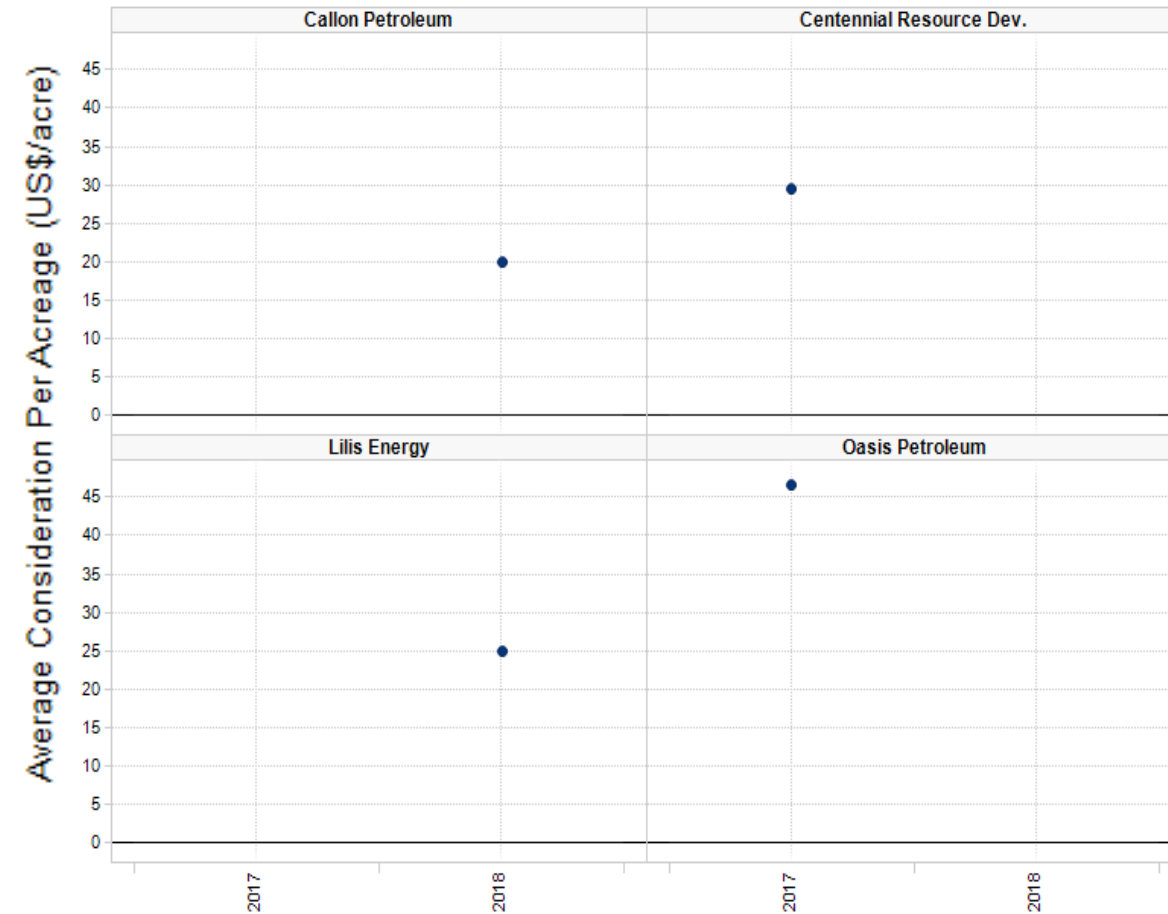
## Chubut



**Source:** Ministerio de Energía de la Nación.  
**Note:** Provincial sales taxes were estimated using legal tax rates. Royalties rates were estimated using weighted averages by province.

- 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



## Argentina fiscal terms and oil pricing assumptions

Royalty:	12%
Sales Tax:	2%
<u>Income Tax</u>	
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	Gross Acres	Net Acres
Basin	('000 acres)	('000 acres)
Delaware	590	240

Type Well Assumptions				
EUR	Initial Production	Initial Production	Initial Production	Royalty Rate
(mmboe)	Gas (mmcf/d)	Oil (b/d)	NGLs (b/d)	(%)
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%		