

FAUFENA · VACA MUERTA, 10 YEARS

Learning curve

In 2016, Vaca Muerta's wells took the curve and mass development began. Ten years later: how it learned to produce its own rock. Ten variables from 2015 to today, what was adapted to the geology, what has already leveled off, and how it compares with the Permian.

When people tell the story of Vaca Muerta, they list milestones: the first horizontal well, the longest lateral, the most stages in a day. This article looks at something else: **how the well changed year by year, what is still changing, and what has already been optimized as far as it can go.**

In 30 seconds

- Ten years ago, Vaca Muerta went into mass development with horizontal wells: in 2016 they became the majority of new wells. Since then, oil output has grown 21-fold.
- Between 2015 and 2019 Vaca Muerta changed almost everything: it moved from vertical to horizontal wells, nearly doubled lateral length and stopped importing proppant.
- Since 2023 the per-foot recipe has been fixed: one stage every ~200 ft, 520,000 lb of sand per stage (the same as in 2016), about 2,600 lb of sand and 45 bbl of water per foot of lateral.
- The only thing still growing is length: in 2025 the typical well had a 10,160 ft lateral and 51 stages. But first-year oil has been stuck at about 245,000 bbl per well since 2021, and per foot of lateral it has fallen 25%.
- Wells go on artificial lift sooner: half of the 2023–2025 wells were already on lift at 29 months. The 2020–2022 wells lasted until 36.
- Against the Permian: the same lateral length and the same decline. Vaca Muerta pumps more sand per foot, its wells flow naturally for two or three years, and it fracs at half the speed.

Almost all of those changes were about adapting the well to the rock (fit for basin): an overpressured formation, with fractures that grow little in height, and little water.

The curve that changed everything

In August 2016, Vaca Muerta produced about 32,000 barrels of oil per day. Brent was around \$46, and activity was propped up by a domestic price of about \$67.5 for Medanita, Argentina's benchmark crude. That year 112 wells were brought online, fewer than in 2015, and YPF drilled almost nine out of ten.

But 2016 was the turning point: **for the first time, most new wells were horizontal** (81%, up from 24% in 2015). In April that year, Vaca Muerta reached its first 100 horizontal wells on production. A few months later, in January 2017, the unions, companies and government signed a special labor agreement for unconventional work. That was the start of mass development.

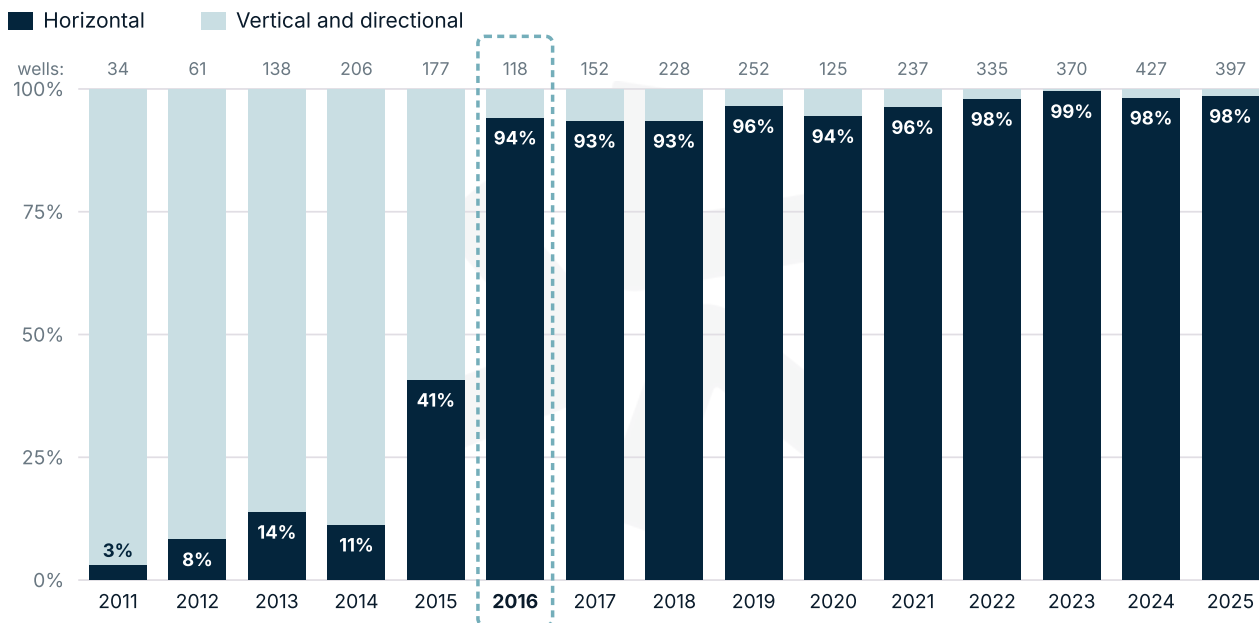
Before the switch, about 500 vertical and directional wells were drilled. The first horizontals were already being tested: 120 between 2011 and 2015.

Measured by spud year, the jump is even clearer: in 2015, 41% of the wells drilled were horizontal. In 2016, 94%. Vertical wells all but disappeared in a single year.

2016: the year the wells took the curve



Wells spudded each year in Vaca Muerta, by share



Above each bar, the number of wells spudded that year. 2015: 41% horizontal. 2016: 94%.

Vaca Muerta unconventional wells by spud year. Source: Argentina Energy Secretariat (Chapter IV well registry). faufena analysis.

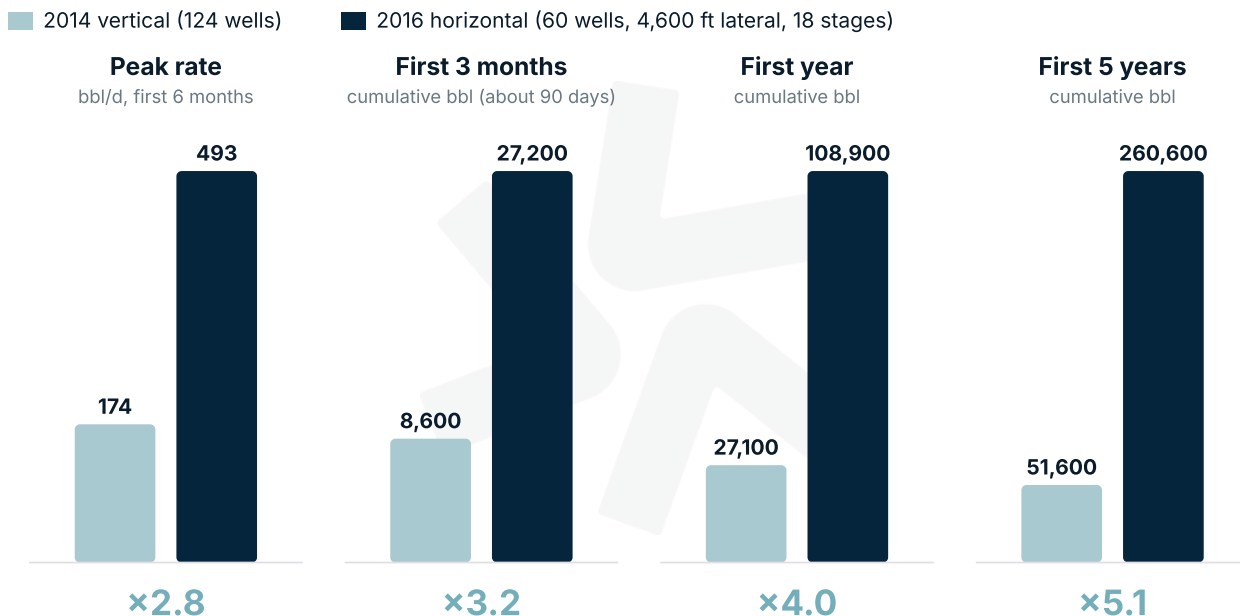
The title of this article has a double meaning. From 2016 on, Vaca Muerta's wells **took the curve**: they go straight down to the rock, turn, and run sideways through the formation, with a horizontal lateral more than 3,000 ft long. That changed everything.

The numbers showed it right away. The typical 2016 horizontal well (a 4,600 ft lateral and 18 stages) against the typical 2014 vertical:

- **After three months** it had already produced 27,000 barrels: 3.2 times as much as the vertical (8,600).
- **In the first year**, 109,000 barrels against 27,000: four times as much.
- **After five years**, 261,000 against 52,000: five times as much.

The wells took the curve and produced four times more

Typical Vaca Muerta oil well: 2014 vertical vs 2016 horizontal (median)



Per ton of proppant they delivered about the same (29 and 27 bbl in the first year): the difference was how much rock each well reached.
Vaca Muerta oil wells by year of first production. Source: Argentina Energy Secretariat (well production and frac reports). faufena analysis.

Per ton of sand they delivered about the same (29 and 27 barrels in the first year). The horizontal was not more efficient per ton: it reached much more rock from a single wellbore and a single pad. The first three months showed it was the right call.

Ten years later, Vaca Muerta produces 670,000 barrels per day, 21 times as much, with more than 2,800 horizontal wells and a dozen operators.

Ten years of horizontal Vaca Muerta



In 2016, horizontal wells became the majority of new wells. This is how everything has changed since.

Indicator	2016	Today	Change
Vaca Muerta oil production	32 kbbbl/d (Aug 2016)	670 kbbbl/d (Aug 2026)	×21
Horizontal wells on production (cumulative)	133 (Aug 2016)	2,822 (Aug 2026)	×21
New wells in the year	112 (2016)	470 (2025)	×4.2
Companies with new wells in the year	6	12	×2
Share of new wells drilled by YPF	89%	52%	−37 points
Lateral length per well	4,630 ft	10,160 ft	×2.2
Frac stages per well	18	51	×2.8
Proppant per well	4,700 tons	13,100 tons	×2.8
First-year oil per well	109 kbbbl	245 kbbbl	×2.2

Last four rows: horizontal oil wells, median of those that started producing in 2016 and in 2025. Tons are US short tons. Source: Argentina Energy Secretariat (well production and frac reports, data through August 2026). faufena analysis.

Sources for the 2016 context: [INSEE, Brent in August 2016](#) · [Hydrocarbon Engineering, domestic Medanita price](#) · [Ámbito, Vaca Muerta labor agreement](#)

Three eras

To see how the curve played out, we took Vaca Muerta's horizontal oil wells and tracked ten variables, year by year, since 2015. We used the data operators report to Argentina's Energy Secretariat: the detail of every frac job (the official equivalent of a FracFocus disclosure) and every well's monthly production. Each value is the median of the wells that started producing that year.

2011–2016: learning. Vaca Muerta's first wells were vertical, like conventional wells. In 2015, only one in four new wells was horizontal. In 2016 it was 81%, and in 2017, 96%. That year settled the debate.

2017–2022: stretch and tighten. Laterals grew from 4,850 to 8,460 ft. Stages got closer together: from one every 257 ft to one every 213 ft. Water intensity rose from 31 to 43 bbl per foot. In 2015, 68% of the sand was imported. By 2021, imports were practically zero.

Since 2023: the recipe. One stage every ~200 ft, about 2,600 lb of sand and 45 bbl of water per foot. The per-foot design has not moved since. What changes is how many feet the well has.

The ten variables

Ten Vaca Muerta variables, 2015 to today



Which are still changing and which have already been optimized as far as they can go.
Horizontal oil wells, median by year of first production.

Variable	2015	2019	2025	Optimized yet?
New wells that are horizontal	24%	97%	99%	Yes, since 2017
Lateral length (ft)	4,180	7,450	10,160	No, still growing
Frac stages per well	16	34	51	No, it follows the lateral
Stage spacing (ft)	257	215	198	Yes, since 2023
Proppant per stage (thousand lb)	502	522	520	Yes, since 2016
Proppant intensity (lb/ft)	1,970	2,470	2,630	Yes, since 2023
Water intensity (bbl/ft)	23	43	45	Yes, since 2019
Imported proppant	68%	21%	0%	Solved since 2021
First-year oil per well (thousand bbl)	95	211	245	Yes, since 2021
First-year oil per 1,000 ft of lateral (thousand bbl)	24.4	32.6	24.4	No, falling since 2021
Peak rate, first 6 months (bbl/d)	520	1,040	1,257	No, rising slowly
First-year decline	70%	60%	63%	Yes, 60 to 67%
Wells still flowing naturally at 24 months	—	72%*	62%*	No, lift comes sooner

The first row covers all new wells in the formation. * By group of years: 2017–2019 and 2023–2025. Source: Argentina Energy Secretariat (well production and frac reports, data through August 2026). faufena analysis.

Fit for basin: adapting the well to the rock

At first, Vaca Muerta copied the US recipe: vertical wells, imported ceramic proppant, long stages. Almost everything that changed afterwards has a geological reason. The industry calls this fit for basin: not doing what works in Texas, but what works for this rock.

Fit for basin: adapting the well to the rock

Almost everything that changed in Vaca Muerta has a geological reason.



What the rock has	What was adapted	What the data shows
Overpressure Gradient of 0.80 to 0.90 psi/ft (0.87 at Loma Campana), at 9,200–10,200 ft TVD.	More powerful frac fleets. Wells that flow on their own, without a pump, for years.	Max treating pressure: from 9,000 psi in 2013 to about 11,800 since 2019. Fleet horsepower: from 24,000 to 40,000 HP. Half the wells still flow naturally at 29–36 months.
Near-isotropic stresses and "beef" Horizontal calcite veins (~10% of the rock). Fractures grow little in height (about 165 ft propped).	Tighter stages and clusters to contact more rock along the lateral.	Stage spacing: from 257 ft to 198 ft. Proppant per stage did not change (520,000 lb): what rose was proppant per foot.
Stress direction Maximum horizontal stress runs east–west.	Laterals drilled north–south, so fractures cross the wellbore.	The literature cites 25–50% higher EUR with the right orientation.
200 to 1,600 ft thick With several landing zones: La Cocina, Orgánico, Carbonatos.	Geosteering in 15–30 ft windows. Laterals ~1,000 ft apart and staggered in height to avoid frac hits.	YPF identified up to five landing zones of 80–100 ft. Vista already lands in five.
High closure stress	From imported ceramic to natural sand: first from Entre Ríos, later also from Neuquén and Río Negro.	Imported proppant: from 68% in 2015 to 0% since 2021.
Little water in the rock ~20% water saturation in the best areas.	Fewer disposal wells and less produced-water handling than in the Permian.	In the first year, 0.25 to 0.4 bbl of water per bbl of oil. In the Permian, 2 to 8.
High dissolved gas and bottomhole pressure	Wells go straight from natural flow to rod pump or gas lift. ESPs, the first step in the Permian, are rarely used.	70% of lift changes go to rod pump, 26% to gas lift and under 3% to ESP.

Sources: AAPG (Memoir 121 and Wiki), Andean Geology, YPF (Conexplo 2018), OGJ, World Oil. Vaca Muerta data: Argentina Energy Secretariat (frac reports and well production, through August 2026). faufena analysis.

The learning curve is not over. Sand is one example: between 2019 and 2024, local sand from Neuquén and Río Negro came to cover about 40% of demand. In 2025, YPF went back to favoring sand from Entre Ríos. The argument is that, with Vaca Muerta's overpressure and stress regime, the stress on the grains rises as the well produces, and a weaker sand crushes. The same rock that lets wells flow on their own forces a better choice of proppant.

Fit for basin also explains what was not copied. So far, Vaca Muerta has no "cube" developments like the Permian, with many wells stacked across several zones at once. Fracturing is still almost all plug-and-perf. And simul-frac, used on more than half of Permian wells, only arrived here in 2021 (YPF, Rincón del Mangrullo).

Geology sources: AAPG Memoir 121, Loma Campana · AAPG Wiki, Vaca Muerta · Andean Geology, "beef" · YPF, landing zones (Conexplo 2018) · OGJ, Phoenix and Pan American pilots · Río Negro, frac sand 2026 · LM Neuquén, YPF's first ESP · LM Neuquén, first simul-frac · World Oil, Permian produced water

What no longer changes

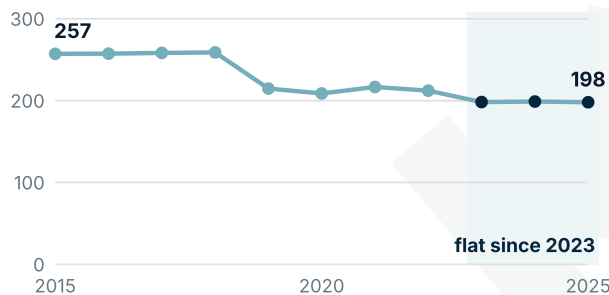
The per-foot recipe has stopped changing

Dark blue: years since each variable leveled off



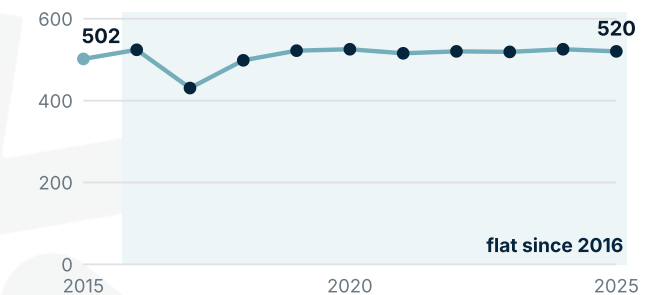
Stage spacing

feet of lateral per stage



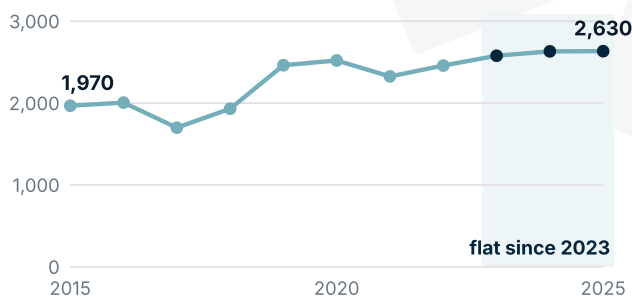
Proppant per stage

thousand lb



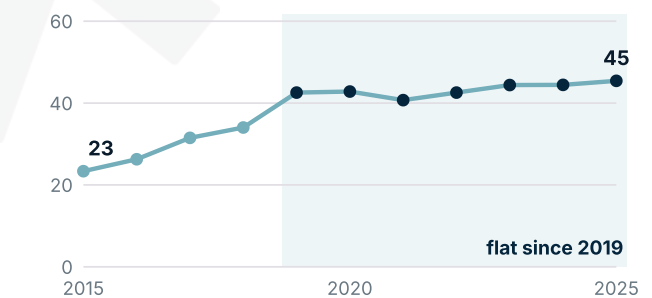
Proppant intensity

lb per foot of lateral



Water intensity

bbl per foot of lateral



Vaca Muerta horizontal oil wells, median by year of first production. Source: Argentina Energy Secretariat. faufena analysis.

The most striking number is proppant per stage: **520,000 lb, the same as in 2016**. In ten years, the size of each stage has not changed. What changed was the number of stages per foot. By moving them closer, from 257 to 198 ft, proppant intensity rose from about 1,970 to 2,630 lb per foot.

Since 2023, all four variables have held steady. **A 2025 well is a 2023 well with 1,300 more feet of lateral.**

For a service company, that gives a simple rule: **every 1,000 ft of lateral takes about 5 stages, 1,300 tons of sand and 45,000 bbl of water**. If you know how many feet of lateral will be fracked next year, you know how much sand, water and frac hours will be needed.

Still changing: length

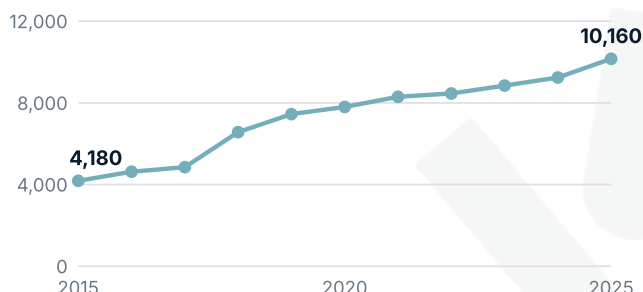
Still changing: well length, and what each foot delivers

With a fixed per-foot recipe, stages and proppant grow in step with the lateral



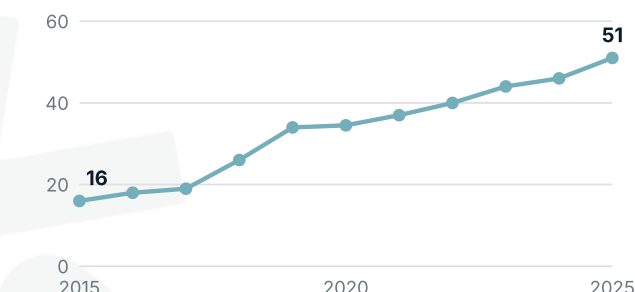
Lateral length

feet



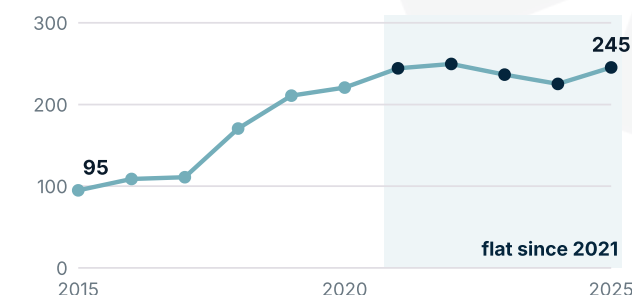
Frac stages

per well



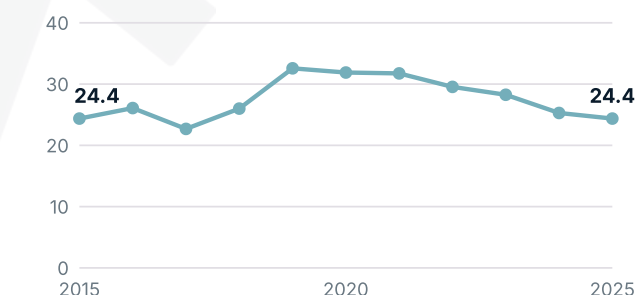
First-year oil

thousand bbl per well



First-year oil per 1,000 ft of lateral

thousand bbl

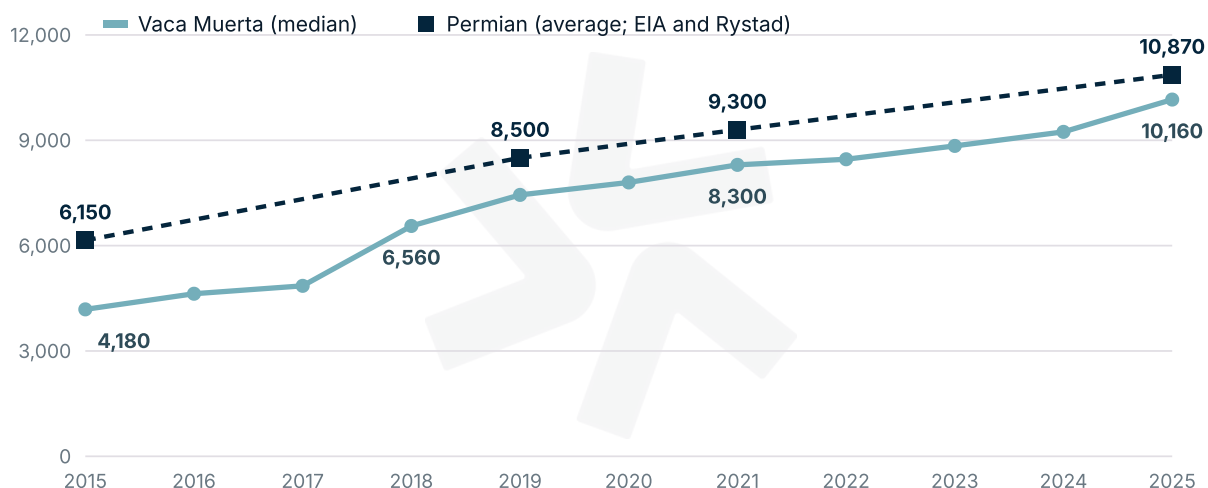


Vaca Muerta horizontal oil wells, median by year of first production. Source: Argentina Energy Secretariat. faufena analysis.

Laterals grew from 4,180 ft in 2015 to 10,160 ft in 2025, and stages followed: from 16 to 51. In 2025, 29% of wells had laterals over 11,500 ft, up from 6% in 2023, and the record reached 16,780 ft.

Lateral length: Vaca Muerta has caught up with the Permian

Feet of horizontal lateral per oil well



Vaca Muerta: Argentina Energy Secretariat, horizontal oil wells by start year. Permian: EIA (2015 and 2025), Rystad (2019 and 2021).

In 2026 the median is holding at about 10,000 ft. It is too early to tell whether this is a pause or a ceiling.

And here is the uncomfortable part. **First-year oil per well has not grown since 2021: it hovers around 245,000 barrels.** Wells are 1,870 ft longer and have 14 more stages, but they produce the same. That is why oil per 1,000 ft of lateral fell from 32,600 barrels in 2019 to 24,400 in 2025: back to the 2015 level.

It is the same effect we saw in [Frack or crash](#): each ton of sand yields less. Early rates are still rising (from 1,040 to 1,257 barrels per day between 2019 and 2025). The first-year decline, however, has not changed: between 60% and 67%. The well starts stronger, but over the year it delivers the same.

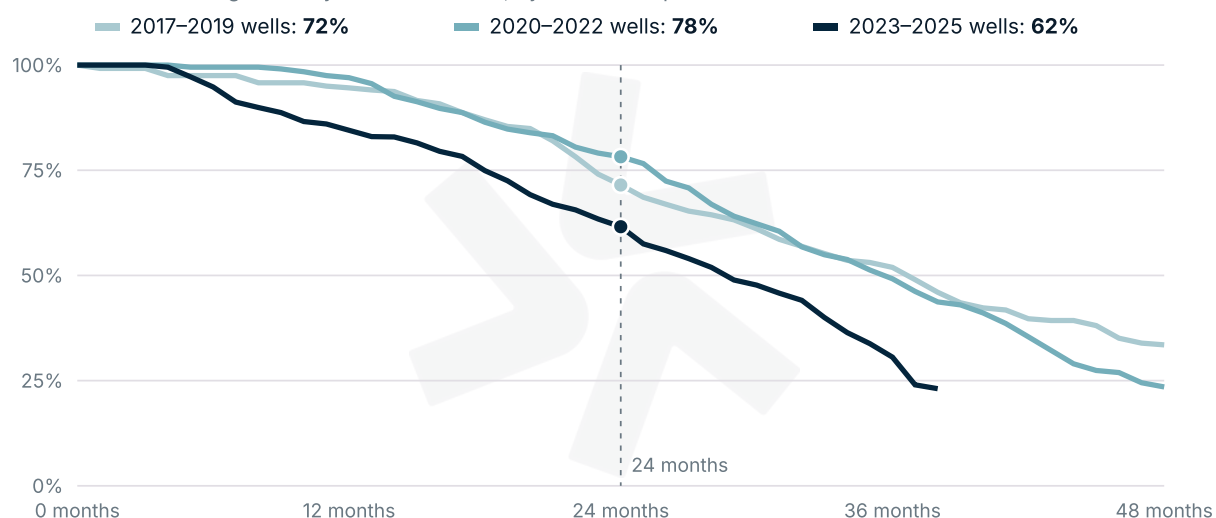
Flowing wells, for less and less time

One way Vaca Muerta differs from almost every other shale play in the world is pressure. The rock is overpressured and wells flow on their own, without a pump, for two or three years. That period is getting shorter.

Wells are going on artificial lift sooner



Share of wells still flowing naturally (no artificial lift), by months on production



Vaca Muerta horizontal oil wells. Kaplan-Meier estimate from the monthly lift type reported to the Energy Secretariat. faufena analysis.

Of the wells that came online between 2020 and 2022, half were still flowing at 36 months. For the 2023-2025 wells, it was 29. At two years, 62% are still flowing, against 78% for the previous group.

When they stop flowing, seven out of ten go straight to rod pump and one in four to gas lift. ESPs are barely used: under 3% of lift changes since 2023.

There are several possible explanations, and probably all of them play a part:

- More child wells, drilled next to parent wells that have already depleted the pressure.
- More water: water rose from 20% to 28% of the liquids produced in the first year.
- Operators that install the pump earlier so as not to lose rate.

Against the Permian

People in the industry keep saying Vaca Muerta is "the new Permian". This is how the two compare side by side on what can be compared:

Vaca Muerta vs the Permian

The indicators that can be compared with public data.



Indicator	Vaca Muerta	Permian
Lateral length, 2025	10,160 ft	10,870 ft (EIA)
Lateral length, 2015	4,180 ft	6,150 ft (EIA)
Stage spacing	~200 ft	~210 ft (Hart survey, 2016)
Proppant intensity	2,630 lb/ft, flat since 2023	~2,200 lb/ft, flat since 2017 (Novi Labs)
Water intensity	45 bbl/ft	48 to 63 bbl/ft (Delaware, 2018, Rystad)
First-year decline	60 to 67%	60 to 70%
Productivity per foot since 2019	~25%	Flat or falling (Delaware -5 to -13%)
Spud to first production	~6.5 months	~5 months (Delaware, ~2018)
First lift method	Natural flow for 2 to 3 years, then rod pump or gas lift	ESP or gas lift almost from day one; the ESP lasts up to 8 months
Frac speed	~9.5 stages per day per fleet (YPF, 2025); record 19–20	~18 stages per day per fleet (Diamondback, estimate); simul-frac on more than half of wells
Wells completed per year	~470 oil and gas (2025)	~6,800 (2025, API)

Vaca Muerta: Argentina Energy Secretariat, horizontal oil wells (data through August 2026). Permian: EIA, API, Rystad, Novi Labs, E&P/Hart, JPT, Diamondback. faufena analysis.

In design, Vaca Muerta has already caught up with the Permian. Lateral length is almost the same, so is stage spacing, and both basins have settled on their recipe: the Permian in 2017 and Vaca Muerta in 2023. Both have the same problem: wells are longer, but each foot delivers less.

The differences lie elsewhere.

Vaca Muerta did not copy, it adapted. It pumps more sand per foot (2,630 vs about 2,200 lb), produces far less water and takes advantage of the rock's pressure: a Permian well usually needs an ESP from its first months, which lasts up to eight months and then has to be replaced (switching to a rod pump costs about \$300,000 per well). A Vaca Muerta well skips that stage and goes straight from natural flow to rod pump.

The remaining gap is about speed and scale, not design. A Permian frac fleet completes roughly twice as many stages per day. More than 6,800 wells are completed there every year. Here, about 470.

What it means

The technical frontier of well design has been reached: stage spacing, proppant per stage and water per foot have not moved in years. Length can still grow, but each new foot delivers less than the one before.

So what will define Vaca Muerta's next years is not a better well but **drilling the same well faster and cheaper**: more stages per day, fewer days per well, moving sand with fewer trucks. That is where the gap with the Permian still lies. And it is a race that will be won by service companies as much as by operators.

How we measured it

Horizontal oil wells in the Vaca Muerta formation (Argentina Energy Secretariat: monthly production per unconventional well and frac job reports, data through August 2026). Each value is the median of the wells that started producing that year. First-year oil is only calculated for wells with 12 months of history, so 2025 includes wells that came online through August. Wells drilled per year: official well registry (Chapter IV), by spud date. Flowing wells are estimated from the lift type each operator reports month by month (Kaplan-Meier method). Metric data were converted to US units (1 m = 3.28 ft, 1 m³ = 6.29 bbl, tons are US short tons). There is no complete public annual series for the Permian, so some values are for specific years or are estimates, and we say so in each case.

Permian sources: EIA, laterals 2015–2025 · API, simul-frac and wells 2025 · Novi Labs, proppant intensity · E&P / Rystad, Delaware 2018 · E&P / Hart, stage spacing 2016 · JPT, spud to production · PB Oil & Gas, the ESP cycle · Diamondback, SEC filing · Bloomberg NEF, productivity 2022 · LM Neuquén, YPF frac speed

Keep reading

- Frack or crash: how many wells and how much sand are needed
- Fracs in Vaca Muerta, month by month and by field
- Hydraulic fracturing · Frac sand · Drilling
- Rod pumping · Gas lift · Electric submersible pumps (ESP)

Lautaro Maggi · Chemical Engineer (ITBA) · Specialist in Oil and Natural Gas Production (ITBA)

About faufena

faufena is an online catalog of companies in the Oil & Gas, energy, mining and renewables sectors of Argentina. There you can find suppliers and potential customers, as well as sector information and analysis, like this article. Visit faufena.com.

The website is in beta. We are still building it, so there may be errors, inconsistencies or missing information. All contact lines are open for comments and corrections: [write to us](#).