Field Trip 2011
Vaca Muerta “Shale oil”

Mr. Tomás García Blanco – YPF Upstream Executive Director
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The development of Shale Gas resources in the USA has totally changed the energy balance and largely eliminated the need to import LNG.

23% of US gas production currently comes from Shale Gas.

Fuente: Wood Mackenzie NAGS
“...While much of the increase in 2009 was associated with deepwater developments in the Federal Gulf of Mexico, the increase in 2010 was led by escalating horizontal drilling programs in U.S. shale plays, notably the North Dakota section of the Bakken formation.”

“Domestic Oil Production Reversed Decades-Long Decline in 2009 and 2010”

Source: U.S. Energy information administration

Source: HPDI, LLC
Could Argentina replicate U.S. experience?

Evolution of the oil and the natural gas in U.S. and Argentina

U.S. and Argentina’s crude oil production

U.S. crude oil production
Argentina’s crude oil production

U.S. and Argentina’s natural gas production

U.S. natural gas conventional production
U.S. natural gas unconventional production
Argentina’s natural gas production

Source: Wood Mackenzie / SEN Argentina
Shale gas: Worldwide Resources

MAIN SHALE GAS BASINS

<table>
<thead>
<tr>
<th>Continent</th>
<th>Risked technically recoverable (Tcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>1.931</td>
</tr>
<tr>
<td>South America</td>
<td>1.225</td>
</tr>
<tr>
<td>Europe</td>
<td>624</td>
</tr>
<tr>
<td>Africa</td>
<td>1.042</td>
</tr>
<tr>
<td>Asia</td>
<td>1.404</td>
</tr>
<tr>
<td>Australia</td>
<td>396</td>
</tr>
<tr>
<td>Total</td>
<td>6.622</td>
</tr>
</tbody>
</table>

12% of total world resources reported in Argentina

The EIA report (April 2011, “World Shale Gas Resources”) estimated Argentina as having the third largest resource base (The study excluded the Middle East, Russia, SubSaharan Africa)

Conventional and unconventional resources are estimated as being roughly equivalent (6,622 vs. 6,609Tcf) (study excluded the Middle East, Russia, SubSaharan Africa)

Source: EIA
# Shale oil Plays in the World

## Projects and recoverable resources

<table>
<thead>
<tr>
<th>Country</th>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>United States</strong></td>
<td>24 Bbbl of shale oil resources</td>
</tr>
<tr>
<td><strong>Argentina</strong></td>
<td>YPF pioneering the development of Shale Oil in Vaca Muerta.</td>
</tr>
<tr>
<td><strong>Brasil</strong></td>
<td>The potential of the onshore Parana basin remains to be evaluated.</td>
</tr>
<tr>
<td><strong>Egypt</strong></td>
<td>Resources estimated between 700 Mbbl and 2,2 Bbbl in East Bahariya.</td>
</tr>
<tr>
<td><strong>Australia</strong></td>
<td>17.8 Bbbl of resources estimated for the Falcon Australia Beetaloo Basin Project.</td>
</tr>
<tr>
<td><strong>Poland and Sweden</strong></td>
<td>Defining the Unconventional potential portfolio, production forecast for 2014.</td>
</tr>
<tr>
<td><strong>China</strong></td>
<td>Recent discovery of Shale Oil by PetroChina in the Liaohe depression, north east Bohai Gulf Basin joint ventures with US companies with proven track record.</td>
</tr>
<tr>
<td><strong>France</strong></td>
<td>The Paris Basin should have recoverable shale resources of 4 Bbbl, projects on hold due to environmental issue.</td>
</tr>
<tr>
<td><strong>Canada</strong></td>
<td>Main effort centered on Shale gas with potential for LNG export. Shale Oil less important for the moment.</td>
</tr>
</tbody>
</table>

*Fuente Análisis Interno YPF*
YPF Activity in Vaca Muerta: History of a discovery

- **2007**: Evaluation of Shale reservoir potential and regional studies
- **2008**: Drill first well
  - First shale gas well does not reach target, completed as discovery well in shallow reservoir
  - Definition of Shale Oil Pilot Project
- **2009**: 2nd. Licensing Round
  - 1º discovery of shale gas with drilling of LLLK-x1. July 2010
  - 1º discovery of shale oil with completion of LLL-479. November 2010
- **2010**: 3º Licensing Round
  - Partnered with Exxon / EOG / Total / Apache
  - Discovery of Shale Oil Loma La Lata and Loma Campana
  - Discovery of Shale Oil. Bajada de Añelo
  - Drill first horizontal well
- **2011**: Explore and appraise Rest of Basin
  - Pilot Development in North Loma La Lata

Source: YPF
Vaca Muerta Shale

- Extension of 30,000 km²
- Thickness greater than 250 m
- Evidence of light oil, wet and dry gas
- Overpressure gradient from 0.67 to 0.97 psi/ft
- Additional conventional opportunities

Source: YPF
Vaca Muerta Shale

Unconventional
Conventional
Upper Quintuco (oolitic, sandy limestones)
Vaca Muerta Fm (bituminous marl)
Pre-Q
Level Q
Quintuco Fm (flat)
Catriel Fm

8%
4%
8%
4%

Vaca Muerta
Eagle Ford
Bakken

Source: YPF
The YPF Position - Vaca Muerta Play

- Vaca Muerta is present in an area of 30,000 Km² (7.4 million acres)
- Of this area, YPF participates in 12,000 Km² (3.0 million acres - 40% of the total)
- 9,311 km² oil
- 670 km² wet gas
- 2,019 km² dry gas

Source: YPF
YPF Discovery of Shale Oil
Northern Loma La Lata
YPF Discovery of Shale Oil Northern Loma La Lata

Results by the end of September

VERTICAL WELLS IN PRODUCTION

- 17 vertical wells on production with 3 to 4 fracs per well
- The wells were drilled in the Loma de la Lata, Loma Campana and Bajada de Añelo Blocks
- Initial choked vertical well rates range between 200 and 600 bopd

Initial well rates; The wells are restricted by 4mm chokes

Source: YPF
Evolution in fracture productivity as of October 2011

PRELIMINARY RESULTS VACA MUERTA

Source: YPF
Vaca Muerta Analogues.
Eagle Ford and Bakken Shale productivity (*)

Comparison with Vaca Muerta

Source: YPF (*) Wood Mackenzie
Evolution in well head pressure producing under natural flow condition

Source: YPF
Vaca Muerta
The complete 200m section is productive

Results of PLTS


Source: YPF
Vaca Muerta: high quality oil and gas

**Oil and gas properties**

**Characteristic**

- Pres. = 550 - 650 kg/cm² at 2,800 m
- °API: 40 - 45
- Pb: 120-200 Kg/cm²
- GOR: 100-500 m³/m³
- Bo @ Pb: 1.5 – 1.7
- Viscosity @ Pb: 0.3 – 0.8 cP
- No H₂S, Minor CO₂

**Plant products – Gas**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>m³/mm³</th>
<th>bbl/mcft</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td>45.25</td>
<td>79.29</td>
</tr>
<tr>
<td>C3</td>
<td>366.07</td>
<td>65.19</td>
</tr>
<tr>
<td>C4</td>
<td>199.58</td>
<td>35.54</td>
</tr>
<tr>
<td>C5</td>
<td>64.92</td>
<td>11.56</td>
</tr>
<tr>
<td>C6</td>
<td>16.79</td>
<td>2.99</td>
</tr>
<tr>
<td>C7+</td>
<td>11.63</td>
<td>2.07</td>
</tr>
<tr>
<td>C5+</td>
<td>93.34</td>
<td>16.62</td>
</tr>
</tbody>
</table>

Source: YPF
Prior production - naturally flowing well
>700,000 stbo in 25 years

Unfractured well in Vaca Muerta

Source: IAPG
First Microseismic results

Source: YPF
First Microseismic results

Source: YPF
The comparison with Shale Plays in the USA shows Vaca Muerta to have very good properties.

<table>
<thead>
<tr>
<th></th>
<th>Vaca Muerta</th>
<th>Barnett</th>
<th>Haynesville</th>
<th>Marcellus</th>
<th>Eagle Ford (*)</th>
<th>Bakken 3-5 Mstb/km²</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOC (%)</td>
<td>6</td>
<td>5</td>
<td>2</td>
<td>12</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>Thickness (mts)</td>
<td>200</td>
<td>91</td>
<td>76</td>
<td>61</td>
<td>61</td>
<td>30</td>
</tr>
<tr>
<td>Depth (mts)</td>
<td>3,000</td>
<td>2,286</td>
<td>3,658</td>
<td>2,057</td>
<td>2,287</td>
<td>1,829</td>
</tr>
<tr>
<td>Area (Km²)</td>
<td>30,000</td>
<td>16,726</td>
<td>23,310</td>
<td>245,773</td>
<td>5,180</td>
<td>51,800</td>
</tr>
<tr>
<td>Reservoir pressure (psi)</td>
<td>9,000</td>
<td>3,525</td>
<td>10,800</td>
<td>3,375</td>
<td>4,502</td>
<td>4,200</td>
</tr>
<tr>
<td>Pressure gradient (psi/ft)</td>
<td>0.65 – 1.0</td>
<td>0.47</td>
<td>0.90</td>
<td>0.50</td>
<td>0.60</td>
<td>0.70</td>
</tr>
<tr>
<td>STOIP (Mbbi)</td>
<td>?</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>114,000</td>
<td>200,000</td>
</tr>
<tr>
<td>STOIP/Km2 (Mbbi/km²)</td>
<td>33 - 58</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>22.0</td>
<td>3.9</td>
</tr>
<tr>
<td>OGIP (Bcf)</td>
<td>-</td>
<td>422,337</td>
<td>717.016</td>
<td>1,499.215</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>OGIP/Km2 (Bcf/km²)</td>
<td>-</td>
<td>25.3</td>
<td>30.8</td>
<td>6.1</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Vaca Muerta: High Quality Crude in over pressured conditions, and with high thickness

Source: SPE, EIA, WM, UG Harts & YPF

(*) oil window
Calendar Moth  Initial Production rates for individual wells (drilled post-Jan 1, 2009 and 6:1 gas/oil ratio)

Peak Calendar – Month Rate (boe/d)

Source: GeoScout, HPDI, RSEG (*) Vaca Muerta with Vertical wells, 2/4 fractures
**Resources – 930km² (428km² + 502km²)**

<table>
<thead>
<tr>
<th>Gross</th>
<th>Net</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Surface (km²)</strong></td>
<td><strong>Oil (Mbbls)</strong></td>
</tr>
<tr>
<td>Loma La Lata Norte + Loma Campana</td>
<td>428</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Surface (km²)</strong></th>
<th><strong>Oil (Mbbls)</strong></th>
<th><strong>Gas (BCF)</strong></th>
<th><strong>BOE (Mboe)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>428</td>
<td>741</td>
<td>1040</td>
<td>927</td>
</tr>
</tbody>
</table>

Source: YPF
YPF Shale & Tight Exploration Plan in Argentina
Vaca Muerta is just the first step...

Shale and Tight Portfolio

Neuquina
• Fm Vaca Muerta
• Fm Los Molles
• Fm Agrio
• Fm Lajas (tight)
• Quintuco (tight)
• Mulichinco (tight)

Cuyana
• Fm Cacheuta
• Fm Potrerillos

Golfo San Jorge
• Fm Pozo D-129
• Neocomiano

Austral
• Fm Inoceramus

Chaco Paranense
• Devonico
• Permico
Conclusion

The discovery of shale oil & gas in the USA has started a new cycle in the oil & gas industry and is changing the scenario for exploration activity in many countries throughout the world.

In Argentina, the discovery of Vaca Muerta shale and the data from the 27 vertical wells drilled till now, indicate that this shale has excellent Properties compared to USA plays on production.

The results obtained to date confirm independent reports, which present Argentina as having great potential for shale Oil and gas and should allow Argentina to successfully repeat US Shale Gas and Oil experience.
Conclusion

In Argentina, YPF is pioneer in unconventional oil exploration and development with the discovery of the Vaca Muerta Shale Oil Play.

Results to date show the potential of 927 Mboe for high quality crude oil resource development in an area of 428 km² (105,000 acres) in Loma Campana and the North of Loma La Lata Blocks and extra 502 km² extension to the north with resources under estimation.

Based upon exploration activity undertaken by YPF, its partners and other companies in the Neuquen basin, the true potential of the Vaca Muerta Shale Oil & Gas Plays should be revealed within the next 18 months.

In the next 4 years YPF will explore the rest of tight and shale opportunities in Argentina and we will discover if we should replicate the “USA shale and tight model”.
Neuquen - Argentina
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