HIGH ENERGY
LOW CARBON
PETROBRAS ULTRA DEEP INNOVATION

BÚZIOS FIELD
A Journey of Innovation in Deep Water
**Búzios Field**

A Journey of Innovation in Deep Water

- **Búzios field**, in the Santos Basin pre-salt cluster, is the most perfect translation of our journey of innovation in ultra-deep water. There, we work at the limit of knowledge and in such extreme conditions that only the most sophisticated technologies are capable of operating.

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**Oil of Excellent Quality, Huge Reserves, and Low Lifting Costs**

- Reservoir area: 136,000 acres
  - Equivalent to 11 American Gulf of Mexico standard offshore blocks

- **Challenging Fluid Properties**
  - High GOR: 230m³/m³ (1,300 SCF/STB)
  - CO₂ content around 23% in gas phase
  - H₂S content ranging from 5 to 180 ppmv

- Reservoir thickness: 200–400 m
  - Comparable to the height of the Sugar Loaf Hill

- Quality: 26° – 30° API
The world’s largest deepwater field in terms of volume, Búzios has unleashed a series of cutting-edge innovations especially designed to make its production a reality with high value. By applying these technologies, this field already accounts for more than 20% of our total production in just two years since the first oil.

THE SUPER GIANT BÚZIOS:
- 4 FPSOs INSTALLED IN 11 MONTHS
- PRODUCTION AT 844,000 BOEPD IN JUST 2 YEARS

P-74, P-75, P-76 and P-77
- 150 kbpd - 6 MMm3/d capacity each

NUMBERS
- 55 drilled wells
- 46 completed wells
- 33 production wells
- 432 miles of risers, flowlines and umbilicals
- July/2021: Búzios Field production: 844,000 boepd or 674,000 bopd
The Búzios field development required pioneering solutions in the industry, which allowed us to operate in a scenario that combines extreme conditions, such as ultra-deep water and reservoirs below the salt layer that are subject to high levels of pressure and low temperatures.

INTERNATIONAL RECOGNITION: THE OTC AWARD ACKNOWLEDGES UNPRECEDENTED TECHNOLOGIES APPLIED IN BÚZIOS FIELD

- New riser system configuration development approach
- First optimized 20 line spread mooring FPSO in ultra-deep water
- Largest 3D Ocean Bottom Nodes (OBN) seismic acquisition in deep water
In addition to breaking technical paradigms, these solutions brought unprecedented gains in efficiency and productivity. The Búzios field development represents a legacy of knowledge and innovation that is unique to the global offshore industry.

- **GLR virtual meter for proactive shut-in pressure management**
- **First water and gas simultaneous injection through ultra-deep water manifold**
- **First intensive use of intelligent completion for total fluid loss scenario**
- **First intelligent well completion in two-zones open-hole configuration**

**OTC AWARDS GRANTED TO PETROBRAS**

- **1992**
  - Innovations developed for the Marlim Field

- **2001**
  - Set of technological solutions for Roncador Field

- **2015**
  - Technologies for developing the Santos Basin Pre-Salt

- **2020**
  - Technological advances in Búzios 4th OTC AWARD
PETROBRAS PRIORITY IS TO OPERATE AT LOW COSTS AND WITH SUPERIOR PERFORMANCE IN CARBON, SAFELY AND DELIVERING ACCESSIBLE ENERGY ACCORDING TO OUR SUSTAINABILITY COMMITMENTS

We are one of the companies with the best efficiency in greenhouse gas emissions (GHG) in oil exploration and production.

GHG emissions

<table>
<thead>
<tr>
<th>Year</th>
<th>MMtCO₂e</th>
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<tbody>
<tr>
<td>2015</td>
<td>78</td>
</tr>
<tr>
<td>2016</td>
<td>66</td>
</tr>
<tr>
<td>2017</td>
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<td>2019</td>
<td>59</td>
</tr>
<tr>
<td>2020</td>
<td>56</td>
</tr>
<tr>
<td>GOAL 2030</td>
<td>59</td>
</tr>
</tbody>
</table>

E&P carbon intensity

<table>
<thead>
<tr>
<th>Year</th>
<th>kgCO₂e/boe produced*</th>
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<tbody>
<tr>
<td>2009</td>
<td>30</td>
</tr>
<tr>
<td>2019</td>
<td>17.3</td>
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<tr>
<td>2020</td>
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<tr>
<td>GOAL 2025</td>
<td>15</td>
</tr>
<tr>
<td>GOAL 2030</td>
<td>15</td>
</tr>
</tbody>
</table>

* Total wellhead operated production

CCUS (CARBON CAPTURE, UTILIZATION AND STORAGE)

Award-winning CO₂ reinjection technologies (CCUS EOR) in ultra-deep water at the OTC 2015 – Offshore Technology Conference (water depth 2,220 m).

This solution reinjects the CO₂ directly into the reservoir, preventing ventilation to the atmosphere.

CO₂ reinjection:

In 2020 we operated the third largest reinjection program in the world at our pre-salt fields.

> 20 millions tons of CO₂ reinjected since 2008

7 million tons of CO₂ reinjected in 2020

18% of the CCUS projects in the world

~40% in Búzios
**INCREASING EFFICIENCY AND REDUCING GREENHOUSE GAS EMISSIONS**

- **Flare Gas Recovery System:**
  Natural gas sent to the flare is recovered, restricting flaring only to abnormal or emergency situations

- **Low Emissions Valves:**
  Use of valves that reduce fugitive methane emissions

- **Methane Recovery Systems:**
  Recovery of methane released from closed drainage system and glycol regeneration unit

- **Preparation for External Power Supply:**
  New designs include facilities that enable future connection with low carbon electric power

- **HISEP®**: A high pressure, dense phase separation technology patented by PETROBRAS that enhances production by enabling the separation and reinjection of a major fraction of this CO₂-rich associated gas on the seabed, hence reducing the need of gas processing in the topside. As a result, oil production plateau is extended and production is accelerated. Represents an opportunity to maximize production with controlled handled gas inventory in the surface facility, reducing CAPEX, OPEX, and lead time, as well as emissions, improving safety

- **All electric-fully electrified platform**: The all electric concept consists of maximizing electricity as a source of energy on the platform, which is generated at one point. This configuration is more efficient and allows to use less fuel and minimize atmospheric emissions such as GHG and NOx. The adoption of the concept in large production units with electricity demand above 100MW is pending of regulatory adaptation for offshore operations

*Under development*