Brazil’s Pre-Salt Development and CO₂ Management

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Outline

Brazilian Oil and Gas Industry at a Glance

Pre-Salt Development

CO₂ Management

Final Remarks
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Pre-Salt Development

CO$_2$ Management

Final Remarks
Evolution of Brazilian Oil Production

Evolution of Brazilian Oil Production

Brazilian Production  
(February, 2018)  

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<th></th>
<th>Oil</th>
<th>Gas</th>
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<tbody>
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<td>2.62 Million bpd</td>
<td>110 Million m³/d</td>
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February, 2018

- Pre-Salt: 53%
- Conventional Offshore: 40%
- Onshore: 7%

Production is declining in all regions, except for the pre-salt play.

Production Distribution Per Operator (February 2018)

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**Pre-Salt**

- Huge reservoirs (carbonates) of oil and natural gas (recoverable reserves of 8.3 to 12 billion BOE);
- Between 5,000 and 7,000 m below sea level;
- ~300 km off the coast;
- Water depth ~2,000 m;
- Salt layer with more than 2,000 m thick, in some areas;
- Light oil (30° API), high GOR (>200), and variable CO₂ content (between 1 and 20%)

Pre-Salt Province

Total area = 149,000 km²; area already under concession = 30.6%; 26.6% with Petrobras interest

From Pos-Salt to Pre-Salt

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Handling of CO2 in the Pre-Salt Hydrocarbon Fluids

Motivation:

• High (8 to 20%) CO₂ content in the gas phase in some wells;
• Although it doesn't have target obligations to reduce its emissions, Brazil is committed with climate change control;
• Accordingly, Petrobras and partners in the pre-salt blocks do not consider to vent the CO₂ associated to the produced gas.

Questions raised:

• What is the best way to capture the CO₂ in an offshore ultra-deep water environment (2,100 m WD), 300 km from shore?
• What is the best option for sequestrating the captured CO₂?

Natural Gas Processing

CO₂ content in the fluids address challenges:

- Size & Footprint
- Weight
- Efficiency

Membranes:

- Better for medium or high CO₂ content
- Smaller footprint
- Simple to operate and easy to maintain
- Process a wide range of CO₂ in the inlet stream.

Floating Production Storage and Offloading Unit (FPSO) in operation

- Cidade de Angra dos Reis and Cidade de São Paulo (UOP – spiral wound)
- Cidade de Ilhabela, Cidade de Paraty, Cidade de Maricá, Cidade de Saquarema, and P-66 (Cameron - hollow fiber)
WAG-CO2 EOR

CO2 Injection for EOR

Evolução dos recordes de produção diária de óleo no pré-sal

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• 7 production system (FPSOs) at Santos Basin;

• Natural gas pre-treatment and the CO$_2$ separation using membranes are running with success;

• Around 7 million tonnes of CO2 injected (December 2017);

• Technology is the key factor to address the changing energy environment.
Thank you!

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