DEEP AND ULTRADEEP WATER PRODUCTION IN BRAZIL

a high value knowledge base

Solange Guedes
Petrobras Head of Exploration & Production
Safety is our most important value

PREVENTIVE VISION

Reduction of **36%**
In the Total Recordable Injury Frequency Rate (TRIFR*)

FROM **2.2** in 2015 TO **1.4** in 2018

* TRIFR = number of reportable injuries per million man-hours

BEHAVIOR & ATTITUDES

PROCESS SAFETY & ASSET INTEGRITY

Safety First
In our journey, we went through four production expansion cycles. Each cycle represented a new technological frontier.
These cycles were carried out through a learning curve. And the knowledge base was crucial to create opportunities and overcome challenges.

- Partnership with universities, operators and service companies
- Supply chain development

- Lessons Learned
- Increasing expertise

- Portfolio risk management
- Operational safety & asset integrity
  - Production growth
  - Recovery improvement

- Cost optimization
- Scalability
- Standardization

Value generation
Our story began in 1953 and 15 years later we went offshore after important oil discoveries.
In the 80’s, we started a deep water technology development program, turning Campos Basin into a real lab.
In collaboration with the academia and suppliers, we built breakthrough solutions...

- **1996**: Roncador field discovery
- **1999**: Roncador production with Drill Pipe Riser and DP unit
- **2000**: Horizontal trees for 2,500m Roncador and Marlim Sul
- **2001**: First horizontal well with column and lines of large diameter Marlim Sul
- **2002**: Golfinho field discovery
- **2003**: ESP above subsea tree Drill Pipe Riser Production - Jubarte
- **2005**: First Torpedo Piles Installation Albacora Leste
- **2006**: Pendular Manifold Installation Roncador
- **2007**: Downhole High Power ESP and ROV Intervened subsea tree cap - Jubarte
- **2008**: Free Standing Hybrid Riser Roncador
...and thus we reached the awarded technologies applied in the Pre-Salt:

- Carbonate Rocks Characterization Pre-Salt
- Pre-salt discovery

2006:
- Intelligent Completion in Ultra-deepwater Satellite Wells with High Potential for Carbonate Scaling
- First CO₂ Separation from Associated Natural Gas in Ultra-deepwater with CO₂ Re-injection

2011:
- Water Alternating Gas Injection Method in Ultra-deepwaters

2012:
- Deepest Offshore Well 2,173 m - Injecting Gas with CO₂
- Buoy Supporting Risers Sapinhoá
- First Steel Catenary Risers with lined pipes

2014:
- First Application of Flexible Risers with Integrated Tensile Armor Wire Monitoring System

2015:
- Deepest Steel Lazy Wave Riser
- Deepest Offshore Well 2,173 m - Injecting Gas with CO₂
- Buoy Supporting Risers Sapinhoá
- First Steel Catenary Risers with lined pipes
Petrobras accumulated a large experience throughout the years...

Gross accumulated oil production (MMbbl)

Years since first oil

- 9 years¹
- 15 years
- 26 years

Gross Accumulated Oil Production

<table>
<thead>
<tr>
<th></th>
<th>PRE-SALT</th>
<th>CAMPOS BASIN²</th>
<th>OTHER BASINS</th>
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</thead>
<tbody>
<tr>
<td>1.0 Bi bbl</td>
<td>11.0 Bi bbl</td>
<td>4.5 Bi bbl</td>
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- >130 Production units
- >1000 Subsea trees
- > 7.5 mil km Flexible lines
- > 600 Offshore horizontal wells

¹) To be reached by the end of 2016  ²) Campos basin excluding pre-salt
...with relevant performance in different scenarios

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<tr>
<td><strong>LULA</strong></td>
<td>Giant oil field with very competitive production cost</td>
<td>Giant mature oil field with recovery factor of around 50%</td>
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<tr>
<td>Producing since 2006</td>
<td>Producing since 1991</td>
<td>Producing since 1986</td>
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The Campos Basin legacy: how does a learning curve work?

Acceleration process and proper management system delivered outstanding results in pre-salt areas

**Internal studies for each critical item**

- Drilling Systems
- Reservoir Testing
- Subsea Trees
- Metallurgy for tubing
- Logistics
- Rig Performance

**... seeking actions to intensify experience effects...**

**Original experience curve**

**Intensification of experience effects**

- Increase slope
- Translate curve

**... to achieve costs reduction and operational efficiency**

Well construction time days/well

3x faster

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<tr>
<td>Value</td>
<td>311</td>
<td>228</td>
<td>190</td>
<td>185</td>
<td>151</td>
<td>129</td>
<td>89</td>
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Leading us to the Pre-salt, our most profitable play

... and the cycle of expansion of production being resumed

Higher Profitability (Ebitda/boe)

- Onshore and shallow
- Deep and Ultradeep water
- Pre-salt

1.9x

Cost optimization initiatives

- Pre-salt Recovery Factor
- Operational Efficiency
- Production Projects Reengineering
- Libra@35
- Well cost reduction
- Subsea / Logistics Optimization
- Zero base budgeting
- Standardization
- Contracts Renegotiation
We have access to large potential to be developed in the next decades

CAMPOS BASIN • CONCESSION

- 7 Producing Fields
- 2 Exploratory Blocks operated by other Companies

SANTOS BASIN • CONCESSION

- 7 Producing Fields
- 3 Exploratory Blocks

SANTOS BASIN • TRANSFER OF RIGHTS

- 10 Producing Fields

SANTOS BASIN • PRODUCTION SHARING

- 1 Exploratory Block

* BG E&P Brasil Ltda – a subsidiary of Royal Dutch Shell plc
Petrobras has developed a knowledge base that allows the company to access resources and produce them in competitive cost.
The repetition of learning cycles allow Petrobras develop a robust **knowledge base** and deliver value to shareholders, as well as opportunities to **industrial development** to the country in a **competitive basis**.
Obrigada! (Thanks!)