The Petroleum Potential of the Brazilian Sedimentary Basins
Brazil’s Upstream

• 10th largest O&G producer (high potential for growth)

• Production (May, 2017)
  - Oil – 2.7 million bpd
  - Gas – 105 million m³/d

• Proved Reserves (Dec, 2016)
  - Oil – 12.7 billion bbl
  - Gas – 378 billion m³

• 95 companies
Proven reserves

Billion of boe

2005: 13.7
2006: 14.4
2007: 15.0
2008: 15.2
2009: 15.2
2010: 17.0
2011: 18.0
2012: 18.3
2013: 18.5
2014: 19.7
2015: 15.8
2016: 15.1
Oil production

- Total oil
- Post salt
- Pre salt
- Onshore

Million of Barrels per Day

2008/01 to 2017/01
• 29 sedimentary basins, some very large and barely explored. Two “virgin” basins, without a single well
• ~259,000 Km² contracted area (less than 5%)
• Unconventional plays
• 311 exploratory blocks
• 443 fields
• ~30,000 wells
Brazil’s Prospectivity

- Wide variety of plays under exploration and production

- Two Main Plays producing in Brazil:
  - Turbidite Sandstones
  - Pre-salt Carbonates

- Potential for much more to be explored, conventional and unconventional plays
Overview - pre-salt

Unparalleled Potential
Overview - pre-salt

One of the most relevant exploratory opportunities in the world

10 Most Productive Wells - March of 2017

<table>
<thead>
<tr>
<th>Well</th>
<th>Production (Thousands of Barrels per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7SP7DPS</td>
<td>31.6</td>
</tr>
<tr>
<td>7UB34NESS</td>
<td>31.2</td>
</tr>
<tr>
<td>7L80DRIS</td>
<td>30.5</td>
</tr>
<tr>
<td>8L81DRIS</td>
<td>30.3</td>
</tr>
<tr>
<td>7L84DRIS</td>
<td>29.6</td>
</tr>
<tr>
<td>9L20DRIS</td>
<td>29.4</td>
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<tr>
<td>7SP67PS</td>
<td>29.3</td>
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<tr>
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<tr>
<td>8L37DRIS</td>
<td>28.7</td>
</tr>
<tr>
<td>7LPA1DPS</td>
<td>28.6</td>
</tr>
</tbody>
</table>

Pre-salt Production

- Millions of barrels of oil equivalent per day
- 2014: 0.6
  - 2015: 0.95
  - 2016: 1.27
  - 2017: 1.54

High Quality Reservoirs
Large Structures

27º API

46% High geological chance of success

Dozens Bbbl Of Potential Resources (contracted and to be contracted areas)
Outline

1. Brazil’s Prospectivity / Bid rounds
2. Oil and gas in Brazil
3. Final Remarks
Bidding rounds schedule
(2020 and 2021 calendar to be announced in December)

2017
27.09.17
14ª Bidding Round

2017
27.10.17
2ª Production Sharing Bidding Rounds (Unitizable Areas)

2017
27.10.17
3ª Production Sharing Bidding Rounds

2018
(May)
15ª Bidding Round

2018
(May)
4ª Production Sharing Bidding Rounds

2018
(tbd)
5ª Marginal Fields Bidding Rounds

2019
3º q
16ª Bidding Round

2019
3º q
4ª Production Sharing Bidding Rounds

2019
(tbd)
6ª Marginal Fields Bidding Rounds
14th Bidding Round

287 Blocks
Total Area: 122,616 km²

Offshore Areas
- Sergipe-Alagoas
- Espirito Santo
- Campos
- Santos
- Pelotas

Onshore New Frontier Basins
- Parnaíba
- Parana

Onshore Mature Basins
(Potiguar, Sergipe-Alagoas, Espirito Santo and Reconcavo)
14th Bidding Round Offshore

- Sergipe-Alagoas Basin
  - Turbidite Sandstones
- Espirito Santo Basin
  - Paleogene Turbidites
- Campos Basin
  - Pre-salt Carbonates and Turbidites Sandstones
- Santos Basin
  - Turbidite Sandstones
- Pelotas Basin
  - Turbidite Sandstones
Sergipe-Alagoas Basin

Arbitrary Section – 0264_BM_SEAL_4_10_11 Survey
Courtesy of PGS

- Paleocene
- Turonian
- Maastrichtian
- Lead
- Volcanic岩
Turbidite Sandstones

Espírito Santo Basin
Leads similar to Marlim Sul Field

Flat Spot
Pre-salt Carbonates
Turbidite Sandstones

Santos Basin
Leads similar to Baúna Field

Courtesy of PGS
Pelotas Basin

Survey 0257_PEP2_2015 - Seismic Line 0257-7860 – Courtesy SPECTRUM
R14 Onshore Gas Prone Basins

Paraná Basin

- 11 Exploration Blocks
- Total Area ~31,000 km²
- Area per block ~3,000 km²

Parnaiba Basin

- 12 Exploration Blocks
- Total Area ~34,000 km²
- Area per block ~3,000 km²
Parnaíba Basin

Accumulation Model – Gaviões Cluster

Source: Cunha et al., 2012
R14 Onshore Mature Basins

Onshore Potiguar
62 blocks
~1,700 km²

Onshore Sergipe-Alagoas
46 blocks
~1,300 km²

Reconcavo
27 blocks
~640 km²

Onshore Espírito Santo
19 blocks
~460 km²

Block on offer R14
14th Bidding Round Unrisked In Place Volumes

Unrisked in place oil volume > 50 Billion Barrels
2<sup>nd</sup> PSC bidding round - offered areas

**Carcará**
- Exploration Phase
- Estimated in Place Volumes:
  - 2.2 Bbbl

**Gato do Mato**
- Exploration Phase

**Sapinhoá**
- In Production:
  - 250,000 bbld

**Tartaruga Verde**
- Under Development
- First oil: 2017
3rd PSC bidding round – areas on offer

4 Pre-salt Areas:
- Pau Brasil
- Peroba
- Alto de Cabo Frio Oeste
- Alto de Cabo Frio Central
Peroba e Pau Brasil are prominent four way closure structures.

Peroba is just south of Lula Field.

Peroba
Estimated unrisked in place volume
5.3 billion barrels of oil

Pau Brasil
Estimated unrisked in place volume
4.1 billion barrels of oil
3\textsuperscript{rd} Production Sharing Bidding Round

### Depth (m)
- 2,000
- 4,000
- 6,000
- 8,000
- 10,000

### Arbitrary Line

- **Sea Bottom**
- **Top of Salt**
- **Base of Salt**
- **Basement**
- **Faults**

### Survey
- Survey 0264_CGGV_SANTOS_FASE_I_6B – Courtesy of CGG

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**Inline 34550**

**Peroba**

**Pau Brasil**

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**Constellation Survey Fast Track – Courtesy of CGG**
15th and 16th bidding rounds
4th PSC bidding round
New Seismic Data – Preliminary Results

Saturno

Survey 0264_CGGV_SANTOS_FASE_VII Courtesy of CGG
Outline

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O&G sector in Brazil since the 50's

**Upstream**

- **1953**: Petrobras monopoly
- **1975**: Risk contracts: minimal impact
- **1997**: End of monopoly (Oil Act)
  - ANP bid rounds (concession contracts)
- **2010**: New pre-salt law (Petrobras sole operatorship – PSA)
- **2016**: New E&P policy Petrobras repositioning (focus in large offshore fields)

**Downstream and natural gas**

- **1953**: Petrobras monopoly
- **1997**: End of monopoly (Oil Act)
  - Petrobras maintains dominant position
- **2016**: Petrobras repositioning (in favor of a competitive and open market)
Brazil’s Upstream

Bidding rounds:
- 1999
- 2000
- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015

Pre-salt discovery:
- 2006

5 years without bidding rounds:
- 2007
- 2008
- 2009
- 2010
- 2011

Graph:
- Brent

Offer of blocks in the Pre-salt region:
- Only 14% of offered blocks were contracted

Working program executed:
- 37% Onshore
- 5% Offshore

13% Executed of the working program
Upstream Scenario

The bidding rounds calendar represents the resumption of the exploratory activities in Brazil, which shows a strong decrease.

Policy and regulatory measures were necessary to restore sector’s dynamics.
Upstream Scenario

Reduction in the number of drilling rigs working in Brazil

Number of drilling rigs in Brazil

Drilling rigs in Latin America (May 2017)

- Venezuela 54
- Argentina 53
- México 23
- Colômbia 20
- Brasil 16
- Equador 9
- Trinidad e Tobago 7
- Bolivia 3
- Peru 3
- Chile 2

Number of development wells

- 2015: 575
- 2016: 241
- 2017: 36
Improvements in the energy policy

- Private companies can now operate blocks in the pre-salt polygon

- New E&P Policies:
  - Open Acreage
  - Local Content:

<table>
<thead>
<tr>
<th>Offshore</th>
<th>Onshore</th>
</tr>
</thead>
<tbody>
<tr>
<td>25% • Production Units</td>
<td>50% • Exploration</td>
</tr>
<tr>
<td>25% • Well Construction</td>
<td>50% • Production</td>
</tr>
<tr>
<td>18% • Exploration Activities</td>
<td>40% • Collection and Disposal System</td>
</tr>
</tbody>
</table>

- Ongoing Government Programs:
  - REATE (Onshore Revitalization)
  - Gás para Crescer (Gas to Grow)
Improvements in the regulatory framework

• Short term regulatory measures to unlock investments:
  - Local content waiver regulation
  - Contracts extension
  - Incentives for incremental production in mature fields (royalties reduction)
  - Simpler regulation
  - Reserve base lending

• Medium/long term regulatory measures to stimulate investments:
  - Bidding rounds calendar
  - Open acreage offer
  - Reduced entry costs
  - Simpler contracts
  - Incentives for investments funds to participate
  - Royalties adjustment in mature and frontier basins
O&G scenario in 2017

The country is going through the greatest transformation in its energy sector since the foundation of Petrobras in 1953, leading to a more competitive market.

- Creation of a competitive, open, diverse and internationally referred refining and fuels market
- Unique E&P opportunity:
  - immediate reserves certification
  - fast production development
  - reserves and production growth
- Development of a diverse and competitive supply chain and services market
- First ever effective opening in the natural gas business
Outline

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<thead>
<tr>
<th></th>
<th>Value</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>New Investments</td>
<td>+$80B</td>
<td>New offshore wells</td>
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<tr>
<td>Royalties</td>
<td>+$100B</td>
<td>New Productions Units</td>
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<tr>
<td>Income Tax</td>
<td>+$120B</td>
<td>Gas Pipeline</td>
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<tr>
<td>Profit Oil</td>
<td>+$60B</td>
<td>Offshores Rigs simultaneously</td>
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<tr>
<td>Recoverable</td>
<td>+10Bbbl</td>
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<tr>
<td>Km</td>
<td>+1.100Km</td>
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<tr>
<td>Mbpd</td>
<td>+2</td>
<td>Oil in 2027</td>
</tr>
<tr>
<td>Thousands of Jobs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Upstream Scenario 2017 - 2027

- Projects under development:
  - R$ 240 bi investments
  - 20 FPSO’s
  - 900 wells
- Exploratory wells:
  - 150 wells (40 offshore)
  - R$ 10 bi investments

- 11ª - 12ª bid rounds exploratory period extension
- contracts extension
- regulatory improvements
- transfer of rights
- environmental licensing
- local content

- New exploratory blocks:
  - bid rounds
  - open acreage
  - R$ 260 bi investments
  - 17 FPSO’s
  - 300 offshore wells
Final Remarks

• Brazil is a highly prospective territory with several under explored basins

• Improvements in the energy policy were adopted to attract investments and incentivize exploration activities in Brazil

• New bidding rounds are planned for 2017-2019 offering acreages containing billions of barrels of oil in place and creating opportunities for all types of exploration and production companies

• Some of the blocks in offer are among the most attractive exploration opportunities available worldwide

• Companies interested in investing in E&P, in the supply chain, in the service industry, in the natural gas, in downstream and in the biofuels sectors in Brazil have the largest window of opportunity ever