How Much Oil and Gas from Deepwater?
The Brazilian Experience

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1. From Onshore to Deep Water Exploration and Production

2. Technological Challenges for Developing Deep Water Fields

3. Assuring Increasing Petroleum Production and Reserves in Brazil

4. Conclusions
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Evolution of Proven Reserves

- **13.0 billion boe**
  - (15% Gas)
  - Reserves Life = 21.7 yr.

- **Before Petrobras**
- **Onshore Phase**
- **Shallow Water Phase**
- **Deep Water Phase**

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*(15% Gas)*
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Presentation Outline

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2004 Production

- Onshore: 6%
- Shallow Water (0-300m): 21%
- Shallow Water (0-300m) Onshore: 18%

Total: 1.758 million boepd

2004 Proven Reserves (SPE)

- Deep Water (300-1500m): 23%
- Ultra-Deep Water (>1500m): 10%
- Ultra-Deep Water: 11%

Total: 13.02 billion boe

E&P Profile

Current Exploratory Area

~150.000 km²
The development of deep and ultra-deep water fields has continuously provided new challenges...

... these fields must be developed with fewer wells, high-productivity (>10,000 – 15,000 bopd) wells, horizontal or highly-deviated wells, drilled into poorly-consolidated reservoirs.
Development of Deep-Water, Heavy Oil Fields

Large volumes in deep- and ultra-deep water Campos Basin (STOIIP > 16 billion bbl, < 19 ºAPI, > 10 cp @ reservoir conditions)

New production technologies:
- long, horizontal or multilateral wells
- reliable, high rate artificial lift devices
- efficient heat management systems
- compact oil-water separation systems

Oil production in the recently-discovered Jubarte field:
1,076 m long horizontal well → 22,000 bopd
17 ºAPI, 14 cp @ reservoir conditions
Challenges:

- Water injection (volume, quality and distribution)
- Disposal of large volumes of produced water
- Scale and souring prevention and remediation
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Evolution of Proven Reserves

2001 → 2004: + 3.35 billion boe (35%)
Evolution of Oil Production and Target

Brazilian self-sufficiency in 2006 (1.9 million bopd)

Million bpd

Year


0 500 1.000 1.500 2.000 2.500 3.000

Brazilian self-sufficiency in 2006 (1.9 million bopd)
Petrobras Exploratory Concessions

~150.000 km²

(73% Deep & Ultra-Deep Waters)

Concession Areas

(August/2004)
Important New Petroleum Provinces

- Fields discovered until 1984 (shallow water)
- Fields discovered after 1984 (deep water)
- Fields discovered in 2002-2004 (deep water)
- New discoveries under evaluation (mostly deep water)

Discoveries over the past 3 years (2002-2004): 6.6 billion boe
Incorporated as proven reserves: 3.3 billion boe
Under exploratory evaluation: 3.3 billion boe
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Since 1968, when offshore exploration started, Petrobras continuously moved to aggressive exploration and production in deep and ultra-deep waters.

Deep and ultra-deep water reservoirs are responsible for 61% production (1.1 million bopd), 79% proven reserves (10.3 billion boe), 73% exploratory portfolio (110,000 km²). Their importance will keep growing ...
The development of deep and ultra-deep water fields has continuously provided new challenges for reservoir characterization and management:

- fields must be developed with few, horizontal, and high-productivity wells, drilled into poorly consolidated reservoirs,
- large volumes of heavy and viscous oil (< 19 °API, > 10 cp @ reservoir conditions),
- handling of large volumes of injected- and produced water.

Continuous investment in R&D to make possible production of new discoveries in water depths up to 3,000 m.
To assure the historical trend of increasing petroleum production and reserves in Brazil:

- strengthen expertise in deep and ultra-deep waters,
- produce oil and gas from onshore and shallow-water fields with focus on profitable opportunities,
- implement practices and new technologies in areas with high exploitation degree in order to optimize recovery factor,
- developing exploratory efforts in new frontiers.

Recent, large discoveries outside the very prolific Campos Basin (Santos, Espírito Santo, Sergipe-Alagoas ...) make very difficult to forecast when petroleum production and reserves will peak in Brazil.
Thank You!
Muito Obrigado!