Oil and Gas Reserves in South Africa

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IEP Colloquium, Midrand
Summary of talk

- Role of Petroleum Agency SA
- Geological factors required for hydrocarbon accumulations to form
- Definitions of reserves and resources
- Pitfalls in disclosure of resources
- Inventory of onshore and offshore resources
- Glimpse into the future
Petroleum Agency SA

1. **Promotion** and **Regulation** of oil and gas exploration and production in South Africa

2. **Archiving** all data

Under Department of Mineral Resources headed by Hon. Minister Susan Shabangu
Source and reservoir rock, migration, seal, trap
Steps essential for hydrocarbon formation in sedimentary basins

- Reservoir
- Source rock
- Migration
- Seal
- Trap

**STRUCTURAL TRAP**
- Organic rich shale source rock
- Oil migration pathway
- Shale (seal)
- Gas / oil
- Water
- Oil/water contact
- Reservoir sandstone (porous)
- Top structure

**CONTOUR MAP OF TOP STRUCTURE** (metres below sea level)
- 2300
- 2200
- 2100
- 2000
- High

Trapped gas/oil down to the level of the oil/water contact
Dealing with uncertainty

• Parameters to calculate reserves are based on the drilling results of the nearest well

• Uncertain parameters cannot be fully characterised other than by a distribution of possibilities

• Uncertain parameters can be approximated by three numbers
  – Deterministic Low, Best, High
  – Reserves 1P, 2P, 3P
  – Probabilistic P90, Mean/P50, P10

• Reporting reserves as a single number is not full disclosure!
# Reserves and resources classification system

<table>
<thead>
<tr>
<th>DISCOVERED COMMERCIAL</th>
<th>RESERVES</th>
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<tbody>
<tr>
<td>1P</td>
<td>2P</td>
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<tr>
<td><strong>DISCOVERED SUB-COMMERICAL</strong></td>
<td><strong>CONTINGENT RESOURCES</strong></td>
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<tr>
<td>Low</td>
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<th>UNDISCOVERED</th>
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**PROJECT STATUS**
- On Production
- Under Development
- Planned for Development
- Development Pending
- Development on Hold
- Development not Viable
- Prospect
- Lead
- Play

**Range of Uncertainty**

**Prospect**
- Lead
- Play

**Higher Risk**
- Prospect
- Lead
- Play

**Lower Risk**
- On Production
- Under Development
- Planned for Development
- Development Pending
- Development on Hold
- Development not Viable
Current licenses and applications
Orange Basin – West Coast

Rights and major operators

- Shallow-water – PetroSA
- Production right around Ibhubesi
- Deep-water – BHP Billiton
- Mid-Basin – Sungu Sungu
- Deep water – Shell
- Southern basin – PetroSA and Anadarko
Current licenses and applications

**Orange Basin off the West Coast:**
Best Estimate **Prospective Resources** oil in place = 3.6 Billion Barrels
Best Estimate **Prospective Resources** gas in place = 22.5 Tcf
(based on geological modeling and long-distance projections and NO drilling)
South Coast

Comprising the Bredasdorp, Pletmos, Gamtoos, Algoa and Southern Outeniqua sub-basins

Best estimate for Prospective Resources in place
= 5.14 Billion Barrels of oil and 19.4 Tcf of gas
South Coast

Block 9 - PetroSA

Contingent resources P50 gas and oil in place
= 1 Tcf and 25 million barrels
Reserves of gas and oil
= 300 Bscf and 12 million barrels
East Coast

Durban and Zululand basins

Prospective P50 estimates of oil in place
= 600 million barrels

Prospective P50 estimates of gas in place
= 4 Tcf
SA onshore

Karoo Basin

- Main Karoo Basin and associated sub-basins
- Coalbed methane, biogenic gas and shale gas
- 58 concessions & 65 applications
Coalbed methane

- Lephalale formerly known as Waterberg: ~1 Tcf
- Springbok Flats: ~ 5 Tcf
- GIP prospective resources
- Tuli & Soutpansberg sub-basins
- Northern coalfields
Biogenic gas

- Exploration in Evander
- Recent application for a production right in Virginia area
- Gas reserves P50 values of 23 Bscf
- Biogenic gas from underlying Archean basement
Shale gas

- Play fairway in southern part of basin
- $\sim 10^1$-$10^2$ Tcf (EIA: 485 Tcf)
- Moratorium on issuing of concessions until February 2012

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**Sungu Sungu**

**Chesapeake/Statoil**

**Shell**

**Falcon**

**Bundu**
UNFC-2009 categories and examples of classes

- Socio-economic viability
  - Subcategories: Sales Production, Non-sales Production

- Project feasibility
  - Subcategories: E₁, E₂, E₃, F₁, F₂, F₃, F₄

- Geological knowledge
  - Subcategories: G₁, G₂, G₃, G₄

- Commercial projects
- Potentially commercial projects
- Non-commercial projects
- Exploration projects
- Additional quantities in place
- Other combinations
- Extracted quantities
- Codification (E₁;F₂;G₃)
SA’s Offshore Prospective Resources gas in place (P50) = 45.9 Tcf
SA’s Offshore Prospective Resources oil in place (P50) = 9.34 Billion
SA’s Offshore Contingent Resources gas in place = 3 Tcf
SA’s Offshore Contingent Resources oil in place = 30 bbl
SA’s Reserves oil in place = 12 bbl
SA’s CBM Prospective Resources gas in place (P50) more than 5 Tcf
SA’s shale gas Prospective Resources in place (P50) more than 50 Tcf
Biogenic gas Reserve (P50)= 23 Bscf