SOUTH AFRICA:

Overview of Offshore and Onshore Exploration Activities

Selwyn Adams

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Exploration and Production History

Petroleum Agency South Africa

The regulatory framework: Role of PASA

Offshore exploration activities

Onshore exploration activities

Way forward and conclusions
Exploration drilling was most active from 1981 to 1991 during which some 181 exploration wells were drilled. The Bredasdorp Basin has been the focus of most seismic and drilling activity since 1980.
VISION
A viable, sustainable and responsible upstream industry in South Africa.

MISSION
To promote, facilitate and regulate exploration and sustainable development of oil and gas in South Africa.

STRATEGY
Increase E&P in SA
Regulate E&P in SA
Acquire, archive and enhance E&P data in SA
Ensure a viable and sustainable Agency
**PETROLEUM AGENCY SOUTH AFRICA**

**Regulations**
- Compliance
- Standards
- Regulations

**Information Services**
- Interpret, evaluate, add value
- Data Repository
- Promote
- Evaluate
- Regulate
- Find/View critical data in seconds
- Manage entire data lifecycle
- Capture all of your data from instruments and scenarios
- Catalog according to plan protocols/projects
- Use to send advanced data to Ngemedia Client and other software
- MS Office, CRM, ERP

**Resource Management**
- Onshore & Offshore
- Advise and Inform
- Ministry
- Promote, Evaluate

**Vibrant Upstream Petroleum Industry in South Africa**
EXPLORATION ACTIVITIES
2009 - 2015 DATA ACQUISITION

3D SURVEYS

>21 800 km²

2D SURVEYS

>50 600 km
CURRENT OPERATORS
WHAT ATTRACTED THESE COMPANIES

- Success in east coast African countries
- Sustained relatively high oil price over period
- Petroleum Agency SA promotion efforts
- Change to enabling MPRDA and investment clarity from Royalties Act
- Improvements in technology – deep water, shale gas
- Uncertainty - Recent amendments to MPRDA
- Hydraulic fracturing – environmental concerns
- Low oil price
Offshore Exploration Activities
Rights and major operators

- **Shallow-water** — Cairn India, PetroSA, Thombo, Simbo, High Street, Sasol
- **Sunbird** - Production right around Ibhubesi
- **Mid-Basin** — Sungu Sungu
- **Deep-water** — BHP Billiton and Shell
- **Southern basin** — Anadarko and PetroSA

**Best Estimate (Speculative Resource):**
- OIP 10.2 Billion BBL
- GIP 27.7 TCF
IHBUBESI GAS PROJECT

License Summary:

- Production right (Sunbird & PetroSA)
- ±5 000 km² in extent, 60 km offshore
- Water depth 200m - 250m
- ±400 km north of Cape Town
- Largest undeveloped field (540 Bcf proven 2P reserves)
- 11 wells drilled, 7 gas discoveries
- Covers ±1770 km² 3D and multiple 2D seismic data

Ankerlig:

- Currently operating on diesel (expensive and inefficient)
- Ankerlig to be converted from diesel to gas operated via the IGP
- MOU and GSA term sheet signed between Sunbird and Eskom – investigate the feasibility to supply gas from Ibhubesi
The plan:
- Sales and delivery point at Ankerlig
- **First gas** deliveries 2019
- 2P reserves $\rightarrow \pm 15$ year Production Period
- Additional line into Saldanha for power generation and industrial supply

The concept:
- Production drilling - Initial 7 wells plus further 7 wells in phase 2
- Subsea Infrastructure
- Offshore Processing Facility
- Export Pipeline – 400 km offshore and 15 km onshore
- Small onshore gas receiving and metering station

Offshore production facility:
- Two options considered for the Production Facility

Floating Production Storage Offload Vessel (FPSO)
Semi-submersible Production Platform
Greater Outeniqia Basin
Bredasdorp, Pletmos, Gamtoos, Algoa and Southern Outeniqua sub-basins
Total, CNR, Silverwave and Brilliant Oil in the deep water

Best Estimate (Speculative Resource):
OIP 9.55 Billion BBL
GIP 25.7 TCF
Total’s Brulpadda-1AX well in Block 11B/12B was spudded on 21 July 2014

The well was drilled to 1835m (~500m below mud line)

Suspended on 27 September
Block 9 – PetroSA F-O gas field

Project Ikhwezi

110km offshore, 40 km SE of F-A

4 wells drilled, 3 tied back and producing to feed GTL plant

SOUTH COAST

F-O Gas Field

Best Estimate: P50 OIP, GIP:
Contingent: 20 MM BBL, 0.46 TCF
Reserves: 5 MM BBL, 0.38 TCF
**EAST COAST**

**Rights and major operators**

**Shallower water** – ExxonMobil and Impact - 2 ERs
Sasol and ENI – ER in **deep water**
Silver Wave and ExxonMobil in the **ultra deep water**

**Best Estimate (Speculative Resource):**
- OIP 2 Billion BBL
- GIP 8 TCF
UNCONVENTIONAL RESOURCES: ONSHORE

Recent activities and developments
KAROO PETROLEUM POTENTIAL

North Oil CBM plays

South Gas prone Shale gas potential
Biogenic gas exploitation, discovered during gold exploration, is about to become a reality. Possibility of using gas for underground locomotives in gold mines – Sibanye Gold

First onshore natural gas Production Right awarded in September 2012

Molopo has gas assets in Virginia in the Free State and Evander, south east of JHB.

P50 of 23 Bcf reserves
COALBED METHANE

Coal bearing basins
Lephalale
Springbok Flats
Soutpansberg
Ermelo
COALBED METHANE

Lephalale CBM Project

Waterberg Coalfield - Grootvlei

More than 80 core holes drilled

Single 5-spot production test

Production testing initiated in 2004 and is still flowing gas.

Total Recoverable Reserves

~1 Tcf
JV between *Umbono* and *Sunbird Energy*

**Gas projects:**

Mopane, Springbok Flats, Ermelo and Somkhele Coalfields
The Mopane Project

- 420km NE of Johannesburg covering an area of ± 1577km²
- Expanded 8 core hole drilling program underway
- Drilling and logging of 2 core holes completed and now undergoing permeability testing
- 3 core holes piloted to 100+ metres
- 2 rigs operating on site to complete program
- **Best Estimate GIP of 1.9 Tcf**
COALBED METHANE

The Ermelo Project

• 200 km SE of Johannesburg within the Witbank coal mining region—covers an area of ±1443km².

• Extensive historic drilling by coal miners provides a detailed understanding of the coal geology.

• Five target coals seams with a range of net coal thickness from 6m to 15m. Individual coal seams are up to 3m thick.

• The Ermelo project provides a combined Best Estimate GIP of 0.8 Tcf, with a High Estimate GIP of 3.45 Tcf

Project Operation photos
Ermelo

**COALBED METHANE**

- JV between Badimo Gas and Kinetiko Energy - **AfroEnergy**

- The JV covers two exploration rights in Amersfoort Coalfield

- Considered highly prospective for CBM and also gassy sandstones overlying the coal horizons

- Initial drilling complete

- Contingent resources at P50 level of 2.4Tcf GIIP
Play fairway in southern part of basin
EIA: reporting 390 Tcf (2013)
Petroleum Agency SA’s conservative
Best estimate 183 Tcf (TRGIIP)
Karoo Basin

Shale Gas Resource Assessment
Objective

• De-risk potential Prospective Area
  • “Sweet Spots”
• Quantify the potential hydrocarbon resource
• With the aim to:
  • Inform policy decision and regulations
  • Guide Energy Planning and Energy Security
  • Attracting foreign investment and technology
Shales

- Basal Ecca Group (Permian), southern Main Karoo Basin

- Whitehill Fm is prospective:
  - TOC = 4.5 % average
  - $R_o = 1\text{-}4 \%$ range
  - Qtz = 50 % average
  - Thickness = 42m average
  - Large areal extent (200,000 km$^2$)

- Prince Albert & Collingham less so:
  - Leaner TOC
  - Prince Albert a possible local extension of Whitehill play
Risk and uncertainty

- Porosity, permeability and gas content are major unknowns

- Available Data
  - Old weathered cores and no modern log data
  - +40 yr old seismic and well Log data

- Cape Fold Belt (Permian-Triassic):
  - Thermal tectonism - overcooking & destruction of porosity?

- Karoo dolerites (early Jurassic):
  - Catastrophic degassing (contact metamorphism)?
  - Destruction of porosity?
  - Compartmentalisation of reservoirs?
Play Elements For Shale Gas

- Mineralogy
- Gas Content
- Porosity
- Permeability
- Organic Richness
- Maturation
- Depth
- Temperature & Pressure
- Thickness
- Depth

- Determine ratio of absorbed gas vs free gas

- < 40% Clay content
- > 100 scf/ton
- 1% - 8% Porosity
- Nanodarcy ranges
- > 2 wt% TOC

- 30m – 90m
- 1000m – 500m Depth
- 1.2 – 3.5 \( R_0 \)
Risked Play Elements Whitehill Formation

Shale Gas Production

- Depth: 1500m – 7000m Depth
- Thickness: 42m Average
- Porosity: > 4.5 wt% TOC
- Permeability: Nanodarcy ranges
- Maturation: 1.2 – 3.5 R₀
- Organic Richness: > 4.5 wt% TOC
- Temperature & Pressure: > 132 scf/ton
- Mineralogy: > 40 % Clay content
- Gas Content: 1.18% – 1.81% Porosity

Determine ratio of absorbed gas vs free gas
Methodology

• Play Fairway Analysis
  – CRS Mapping

• Generate a risk map for each Play Element

• Convolve each risk map to produce composite CRS map

• Delineate areas
  – High Risk
  – Best Risk
  – Low Risk
COMMON RISK SEGMENT MAPPING

Shale Gas Play Elements
- Depth Map: >1500m Deep
- Thickness Map: > 30m Thick
- Mineralogy Map: > 50% Qtz
- Maturity: < 3.5% R₀
- Dolerite Intrusions: 0 Intrusions

Prospective Play Area
- High Risk: 78,272 km²
- Best Risk: 33,400 km²
- Low Risk: 4,900 km²
Volumteric Resource Estimate

Absorbed Gas

\[ GIIP_A = A \times h \times \rho \times G \]

Free Gas

\[ GIIP_F = A \times h \times \varnothing \times B_g \]

Technically Recoverable Gas

\[ TRGIIP = (GIIP_A + GIIP_F) \times RF \]
Speculative Resource Estimate

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• Existing applications are now being processed
• Work programmes for first 3 years do not include hydraulic fracturing
• Moratorium on new applications remains

• Regulations publicised

• Parliamentary process.
South Africa has attracted a wide diversity of international and local exploration companies over the past few years.

Majority of acreage under license or under application: opportunities for partnerships.

A number of new surveys have been conducted offshore in previously underexplored areas.

Plenty of exploration activity onshore for unconventional resources.
Thank you

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