

NATURAL GAS SUPPLY

iGas Presentation SANEA

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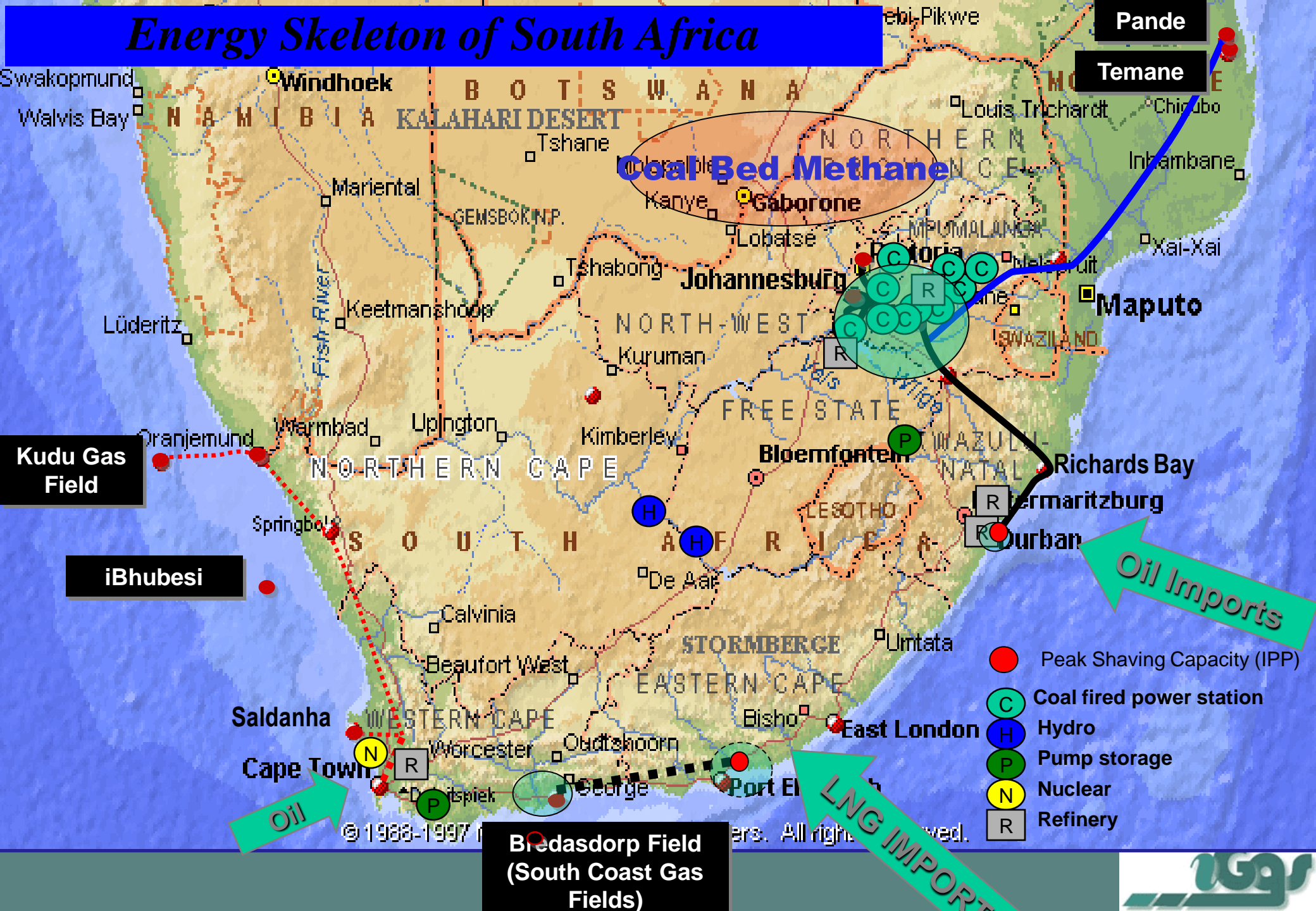


GAS RESERVOIRS

- Where are they?
- What do they look like?
- What can we expect from them?.



Energy Skeleton of South Africa



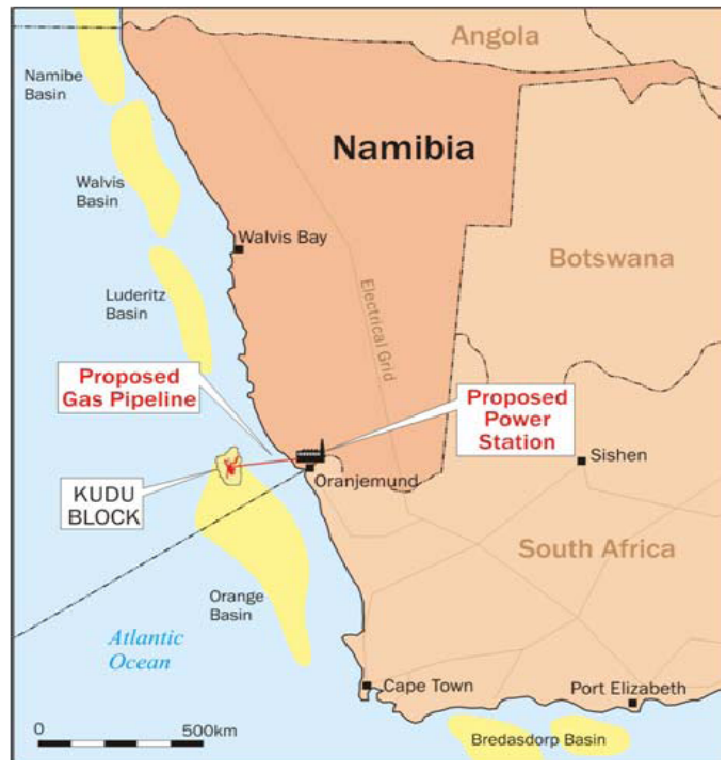
- Peak Shaving Capacity (IPP)
- C Coal fired power station
- H Hydro
- P Pump storage
- N Nuclear
- R Refinery



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Kudu Reserve

Kudu: an important year for commercial progress



Kudu Opportunity

- Tullow operated asset
- 90% working interest
- Reserves potential up to 9tcf

Phase 1

- Gas to power (800MW)
- FEED study completed
- GSA and PPA negotiations under way
- First gas ~2010

Phase 2

- Two well appraisal programme
- Rig secured 1Q 2007
- Ongoing concept studies (Gas to Power, Modular LNG, gas export)



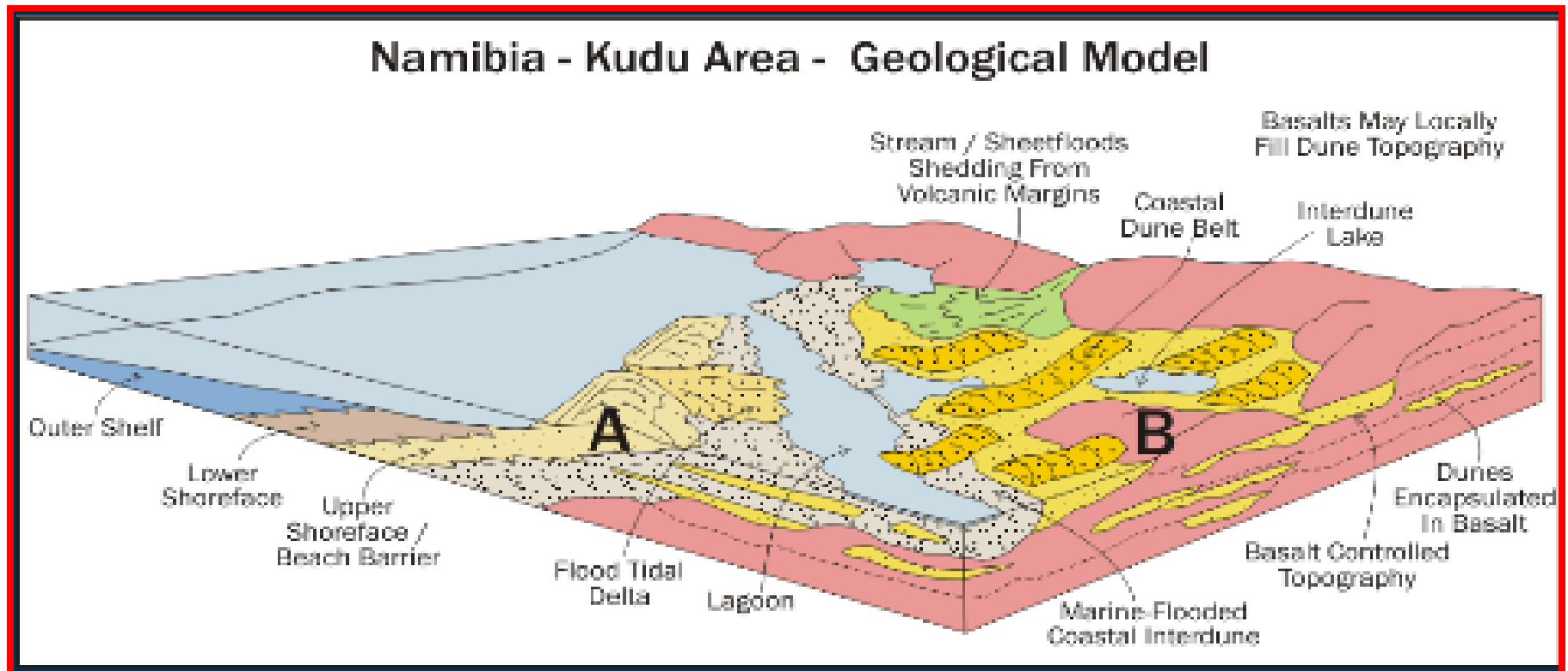
Kudu Gas Reserve

- Sedimentary inter-layers varying from 12 to 38 metres in thickness interleaved between basalt flows.

Source: The oil and gas habitats of the South Atlantic By
Clure, Cameron and Bate, Geological Society of London



Kudu Geological model

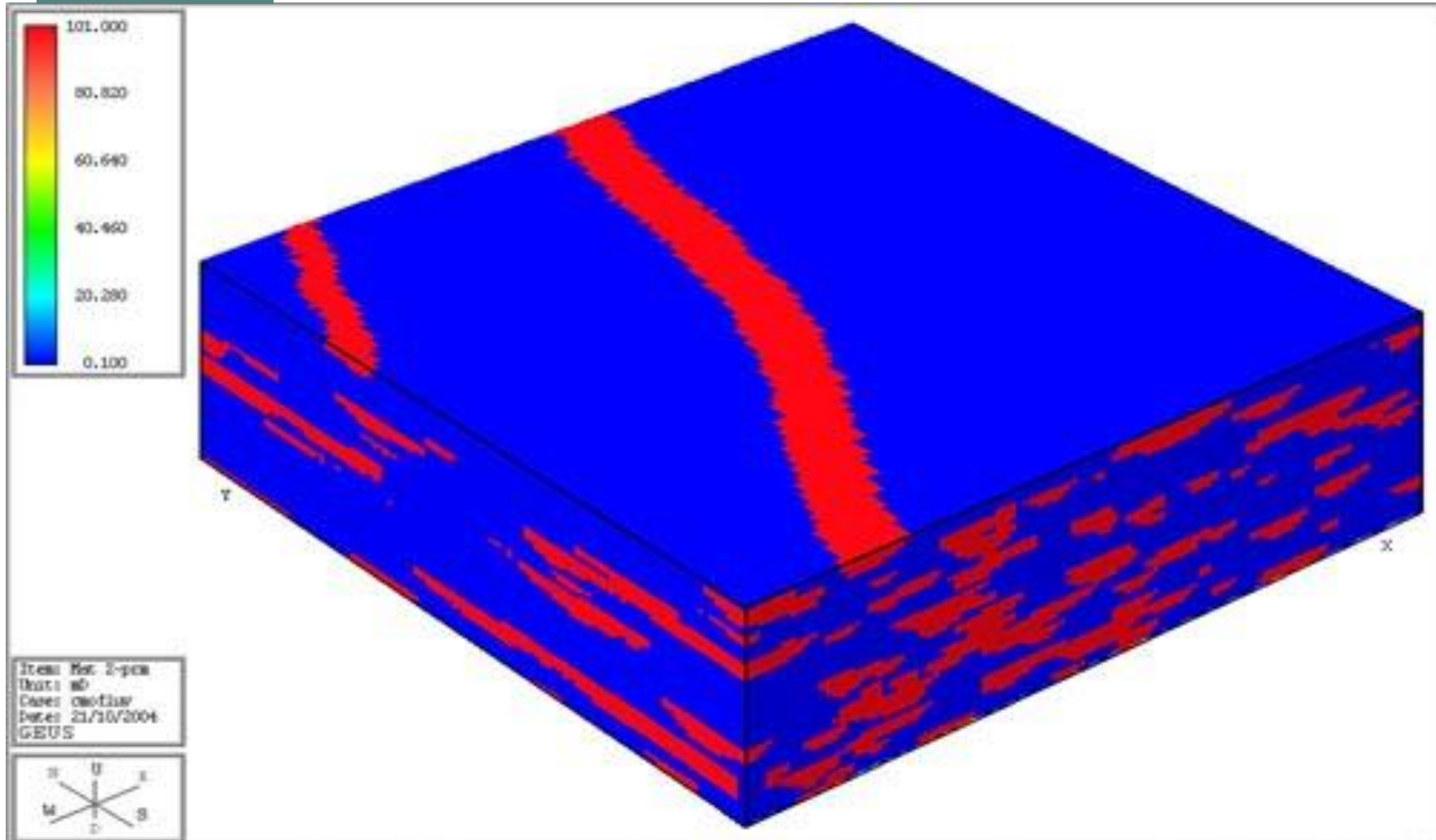


Source: Tullow Oil; 2006 Capital Markets Day Analysts Presentation

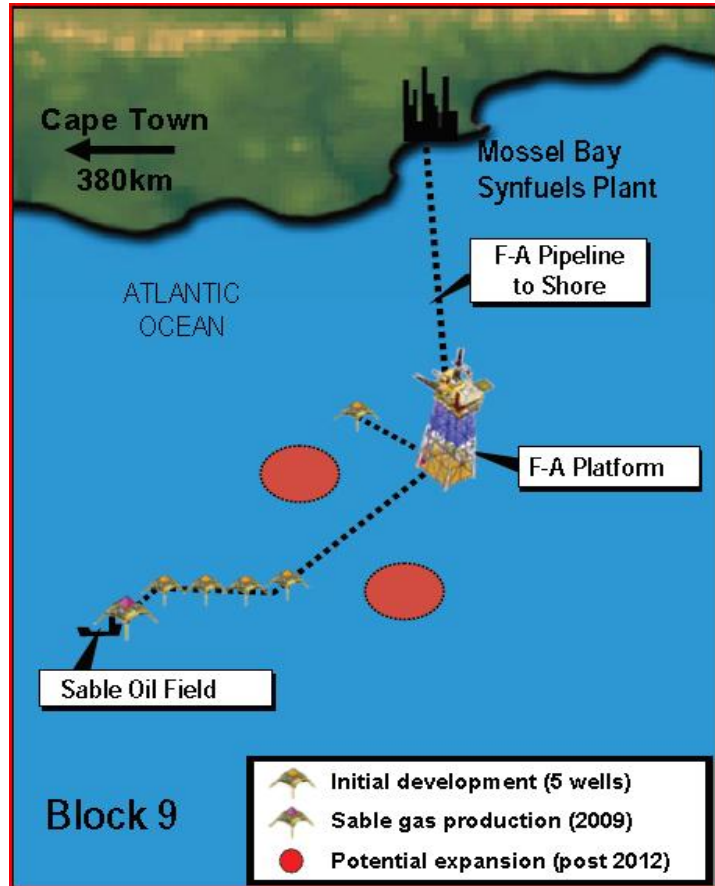
Clarens , Free State : An example of a sedimentary layer under a basalt flow



Geostatistical model of fluvial channel system



South Coast Gas

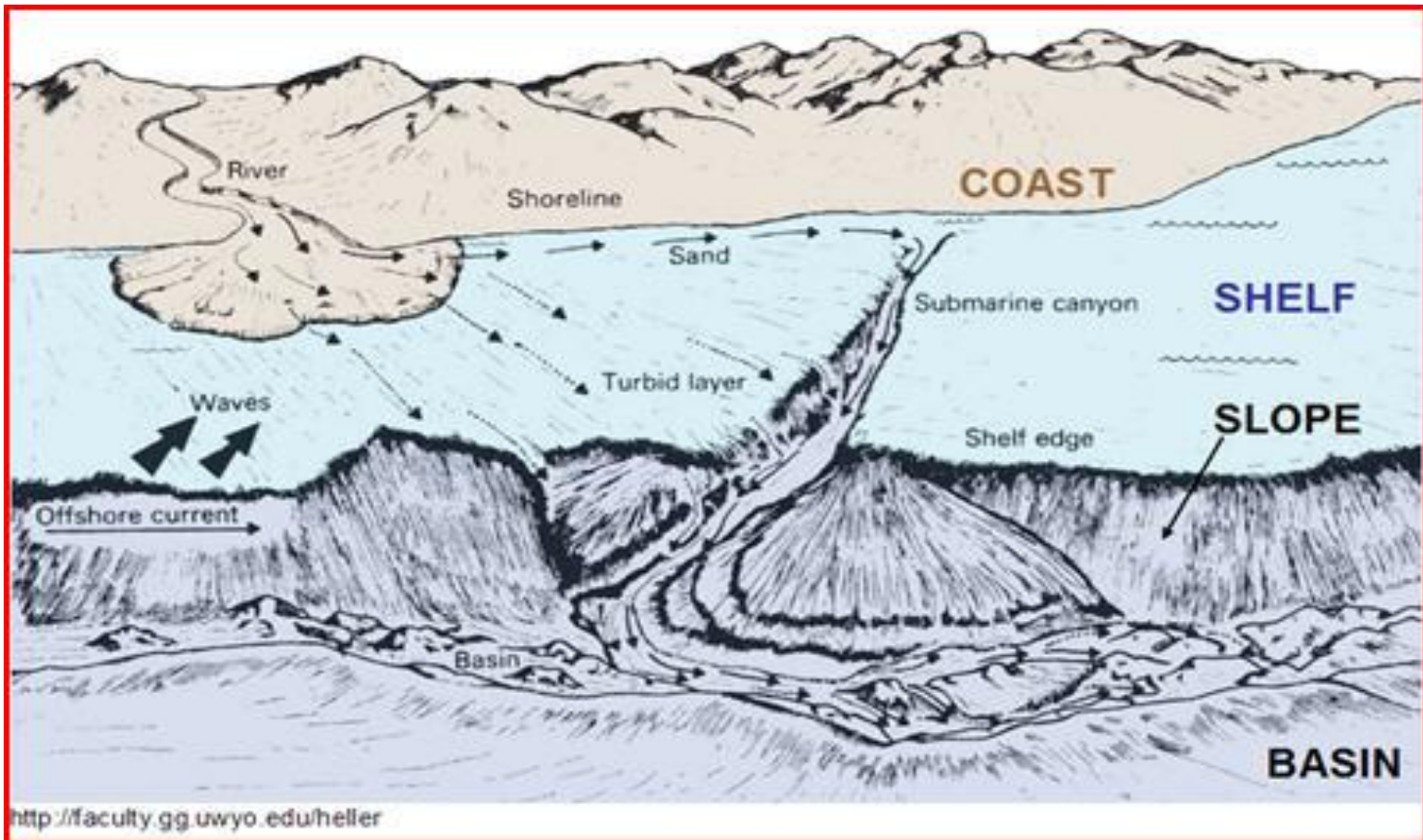


Thought to be deep marine turbidite mass flow deposits

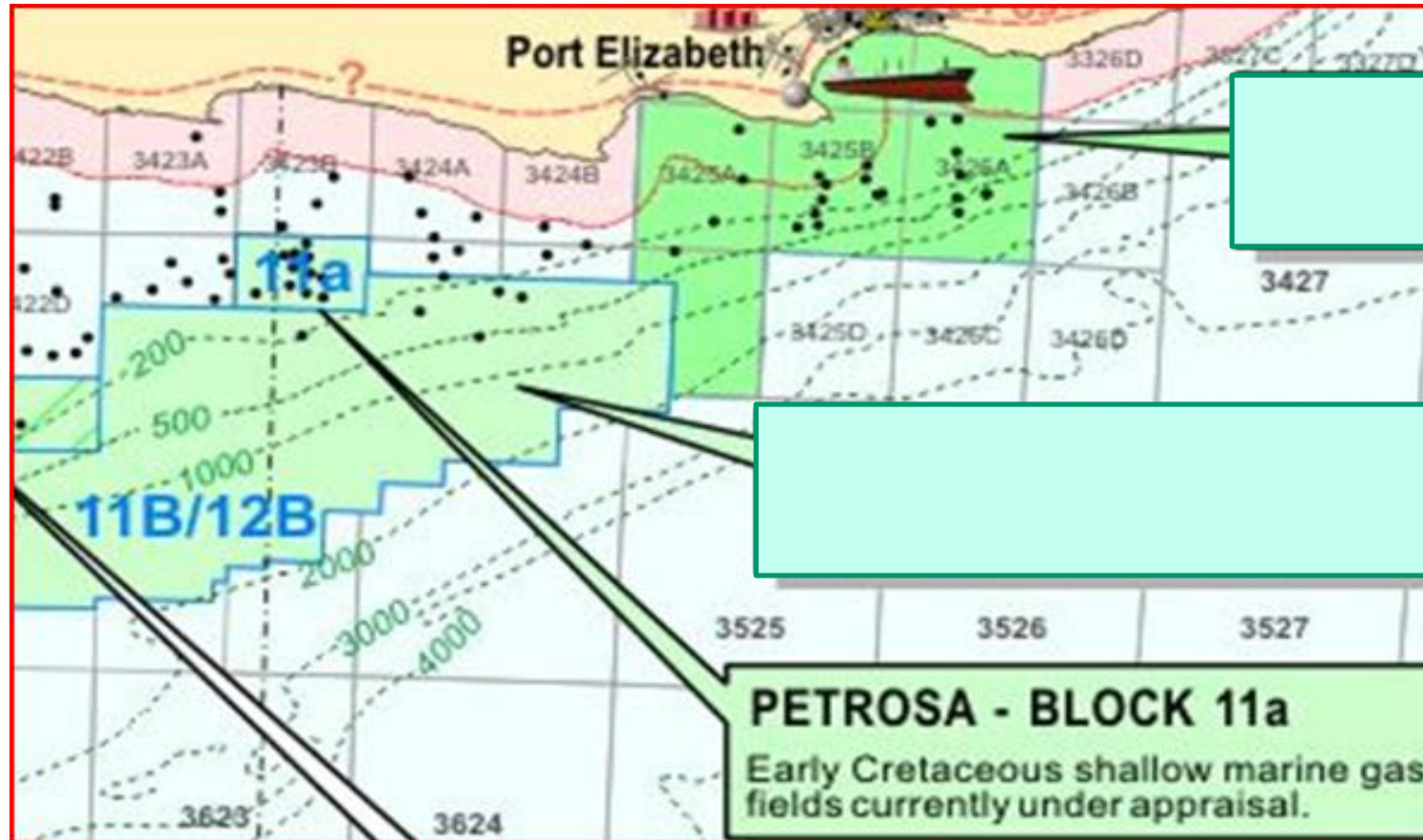
Source: Pioneer Natural Resources; 2007



Example of deep marine turbidite deposit



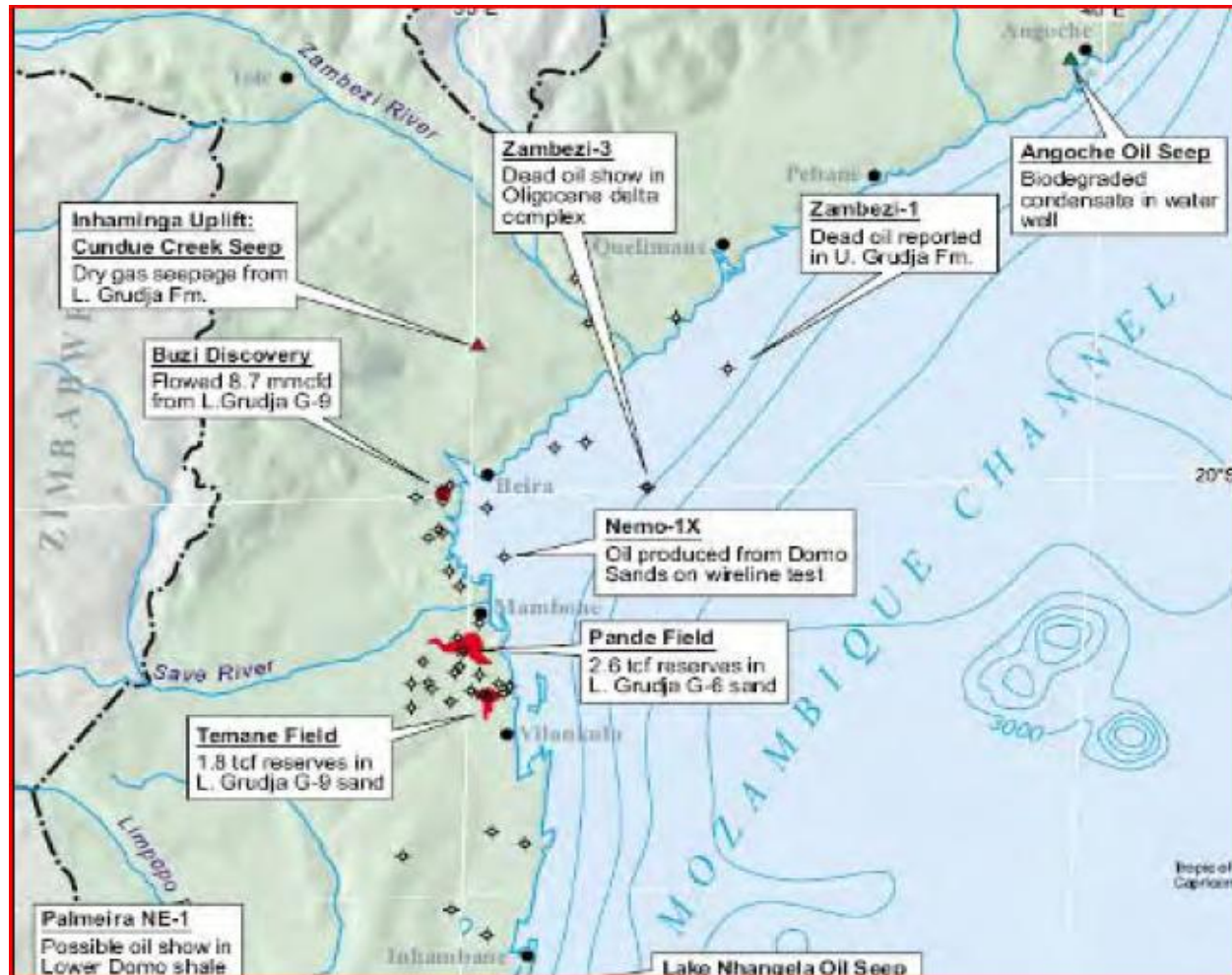
Gas discoveries offshore Port Elizabeth



Source: Petroleum Agency of South Africa



Pande and Temane Gas Fields, Mocambique



Pande: Reserves
2.6 Tcf

Temane:
Reserves 1.8 Tcf

Source: Instituto Nacional de Petroleo; 2008



Pande and Temane Reservoirs

- Both reservoirs are shallow marine sand deposits which are very porous
- The Pande reservoir is relatively shallow at about 1100 m compared to the Mossel Bat FA field which is 2700 m deep.
- The Temane reservoir is deeper and thinner than the Pande reservoir.



PETROLEUM EXPLORATION AND PRODUCTION ACTIVITIES IN SOUTH AFRICA

Mineral and Petroleum Resources Development Act, No 28 of 2002.

- Role of Petroleum Agency SA**
Under section 71 of the above Act, Petroleum Agency SA has been appointed the designated Agency, with the following responsibilities:
- Promotion and regulation of exploration and production on and offshore
 - Receive applications, evaluate and recommend the award of permits and rights
 - Review, evaluate and recommend approval of EMPs
 - Monitor compliance of licence conditions
 - Maintain and add value to the national petroleum exploration and production database
 - Acquire reconnaissance data
 - Collect all prescribed fees

- Permits and rights**
The above Act defines the following permits and rights:
- Reconnaissance Permit - 12 months, non-exclusive
 - Technical Cooperation Permit - 12 months, exclusive desk-top study, exclusive right to apply for Exploration Right
 - Exploration Right - exclusive, transferable, 3 years, renewable for a maximum of 3 periods of 2 years each.
 - Production Right - exclusive, transferable, 30 years, renewable.

KUDU GAS FIELD
(Tullow Oil 70%, ITOCHU 20% (subject to approval), Namcor 10%)
Discovered in 1974 by a Chevron / Regent / Soekor consortium. The reservoir comprises Barremian (Early Cretaceous) aeolian sandstones with average porosities up to 22% at 4400 m.

**FOREST INTERNATIONAL (OPERATOR) (53.2%)
PETROSA (24%)
ANSCHUTZ (22.8%)**
Block 2A: Under application for a Production Right.
Block 2C: Evaluating deep water oil potential.

IBHUBESI GAS FIELD
Being appraised for development by Forest with 3D seismic and appraisal wells. This Albian (Early Cretaceous) fluvial play (part of the Orange Delta) extends northwards into Block 1 and upside gas resources are estimated as multi Tcf for the combined area of Blocks 1 and 2A.

**BHP BILLITON (OPERATOR) (90%)
GLOBAL OFFSHORE OIL (10%)**
Evaluating deep water oil potential.

**BHP BILLITON (OPERATOR) (60%)
PETROSA (30%)
SASOL PETROLEUM INTERNATIONAL (10%)**
Evaluating shallow water gas potential.

BOTSWANA COALBED METHANE (CBM) EXPLORATION
Large Potential Resource

PANDE & TEMANE GAS FIELDS
Combined reserves in excess of 5.5 Tcf. Now operated by Sasol/ENH partnership.

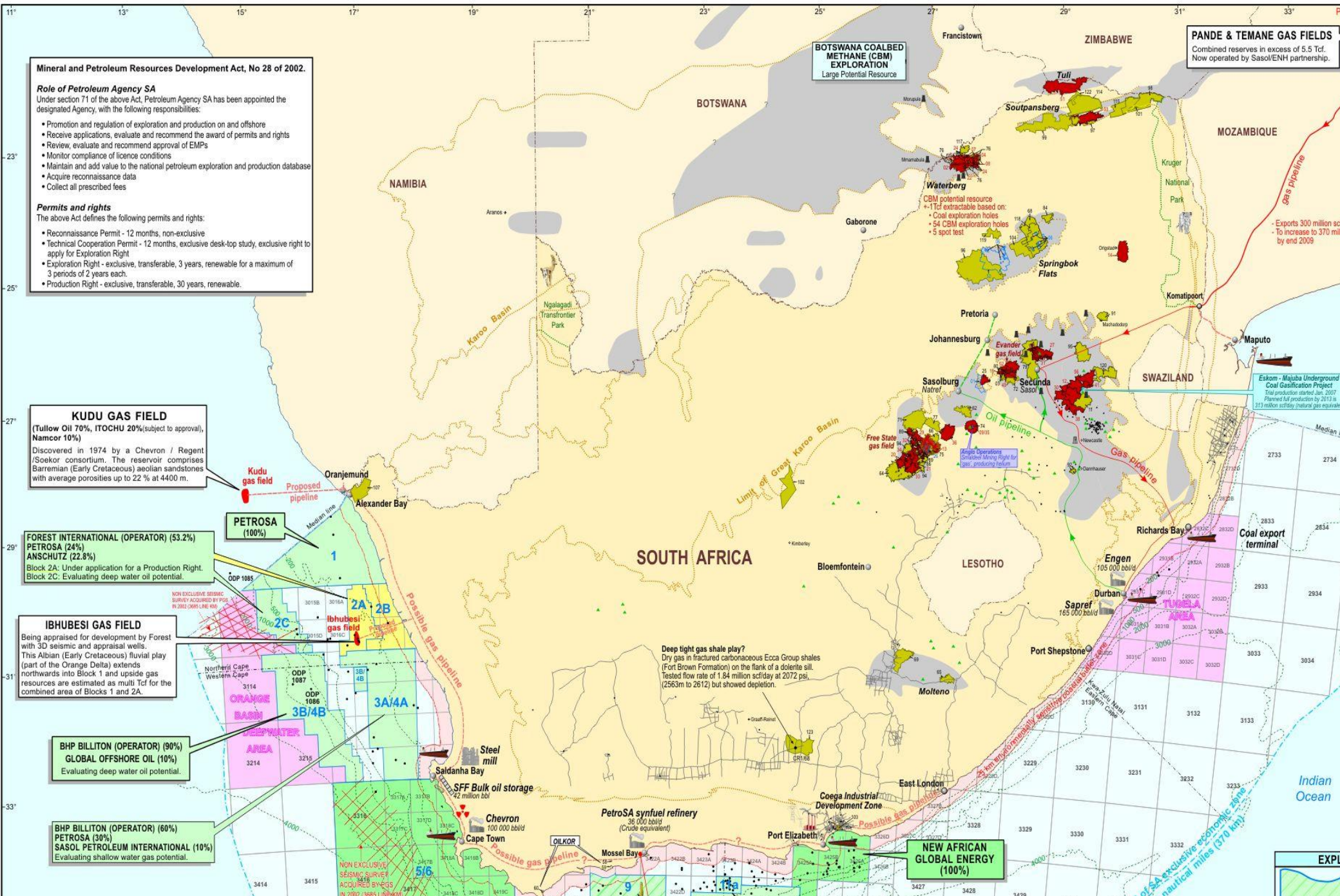
SOUTH AFRICA

Deep tight gas shale play?
Dry gas in fractured carbonaceous Ecca Group shales (Fort Brown Formation) on the flank of a dolerite sill. Tested flow rate of 1.84 million scf/day at 2072 psi, (2563m to 2612) but showed depletion.

- Exports 300 million scf/day
- To increase to 370 million scf/day by end 2009

Eskom - Majuba Underground Coal Gasification Project
Trial production started Jan. 2007
Planned full production by 2012 @ 313 million scf/day (natural gas equivalent)

EXP



GAS MARKETS

- Gauteng and surrounds :
 - Secunda (synthetic fuels)
 - Sasolburg (synthetic chemicals)
 - Sasol Gas markets (replacing Sasol's methane rich gas and markets with environmental or coal handling issues)
 - eGoli gas markets (house-holds and light industry)
- Kwazulu-Natal :
 - Newcastle industries (Secunda methane rich gas)
 - Durban south Refinery use (environmentally driven)
- Mossel Bay : Gas to Liquids Refinery

Possible Future Gas Market

Largest single future additional potential application : Gas as a fuel for open/closed cycle gas turbines



GAS TO ELECTRICITY

Advantages :

- Lower capital cost than coal fired power plant
- Significantly lower carbon dioxide and sulphur emissions
- Much more flexible than coal fired power plant (from peaking to mid-merit and base-load)
- Shorter development time than coal fired or nuclear power stations
- International capital has a lower cost for environmentally fuelled power stations.

Disadvantages:

- Fuel costs higher than coal
- Fuel costs linked to a commodity cycle (oil)
- Fuel costs linked to foreign currency (\$)
- Long term contracts needed.



POSSIBLE SOLUTIONS TO GAS TO POWER COST DISADVANTAGE

FOR GAS FIRED TURBINES ;

- Run the turbines in mid-merit mode rather than in base-load mode
- Turbines need to be distant from coal fired power stations so that the transmission losses and the load stabilisation works in favour of the gas turbines. (Port Elizabeth, Cape Town, Mossel Bay)
- Plan for closed cycle turbines where the efficiency is about 58% (compared to the 33% of coal fired power stations)
- Seek to use indigenous gas first with the aim to minimize currency risk
- Hedge currency risk (only possible over a short term)
- Recognise that for higher international fuel prices there will be higher coal prices.



GAS INFRASTRUCTURE



Gas Pipelines	LNG
•Gas Reservoir	•Gas Reservoir
•Connecting pipes	•Connecting pipes
•Gas clean-up	•Gas Clean-up (extra units)
•Compression	
	•LNG Ship Loading
	•Ship Transport
	•LNG Ship off-loading
	•LNG Re-gasification
•Transmission Pipeline	•Transmission Pipeline
•Compression	•Compression
•Pressure Protection Station	•Pressure Protection Station
•Distribution	•Distribution



OPTIONS FOR SOUTH AFRICA

- Expand the pipeline through-put from Mozambique, until the gas reserves become a constraint.
- Continue exploiting the Mossel Bay operations until these reserves become a constraint.
- Carefully weigh up the option of encouraging more local exploration by fast tracking infrastructure development. May need to review tariff structuring to encourage such developments, but discouraging reckless expenditure.
- Evaluate the options of LNG import to the economy from three aspects;
 - Environmental
 - Cost to country, and
 - Strategic positioning if the availability of LNG becomes limited in the future.



WHAT NOW?



SNAP SHOT OF TODAY

- Significant movement in the Eskom multi-year price determination regulation where Eskom will be able to claim pass through of fuel costs, appropriately planned and costed.
- Large South African industries are moving to supply their own power. The accumulated effect of such in-house power usage, which is usually of a base-load nature, will further (in the future) strain an Eskom system which is biased towards base load generation.
- Small but positive contribution with regulatory feed-in tariffs for renewable fuels.
- Still an uncertain future from 2017 onwards for electricity generation.
- Some gas resources are available; but face difficult investment decisions based on the Banker's case for pipeline infrastructural development.



What next :

- Not much will change geologically.
- The use and value of energy will change drastically in the near future. This will be driven by the unstable commodity swings, the uncertainty of future large oil deposits, the resultant behaviour of countries which are energy rich, and most importantly the international reaction to climate change.
- South Africa will continue to rely on coal as the primary energy resource, but ever increasingly will move to diversify this resource.

FUTURE SCENARIOS FOR GAS

- **Business as usual** : Gas makes up the 3% of the primary energy usage of South Africa. (As it does now.) This has a medium probability of being achieved.
- **Islands of light** : Where industry adds sufficient power generation for their needs. This is happening at present, however the question is to what extent? Future power interruptions will encourage this scenario. In this scenario the available gas resources will be more carefully considered, as well as other fuel sources for power. Indigenous gas and further gas from Mozambique will increase the usage up to 5%. This scenario is the most likely.



FUTURE SCENARIOS FOR GAS (continued)

- **Environmental Imperatives** : In this scenario export products from countries are rated according to the use of cleaner sources of energy. For such a scenario to develop there must be agreement at the new “Kyoto” forum (Denmark) at the end of 2009. In such a scenario there will be a rush to use natural gas, world wide, to plug a short term need. Concurrently there will be more intensive work on renewable fuels. This scenario has a low possibility of occurring but its effect on trade and the development of alternative energy resources would be severe.

