

instinct
energy



Introduction to Coal Bed Methane

**“A potentially transformational source
of energy for Zambia”**

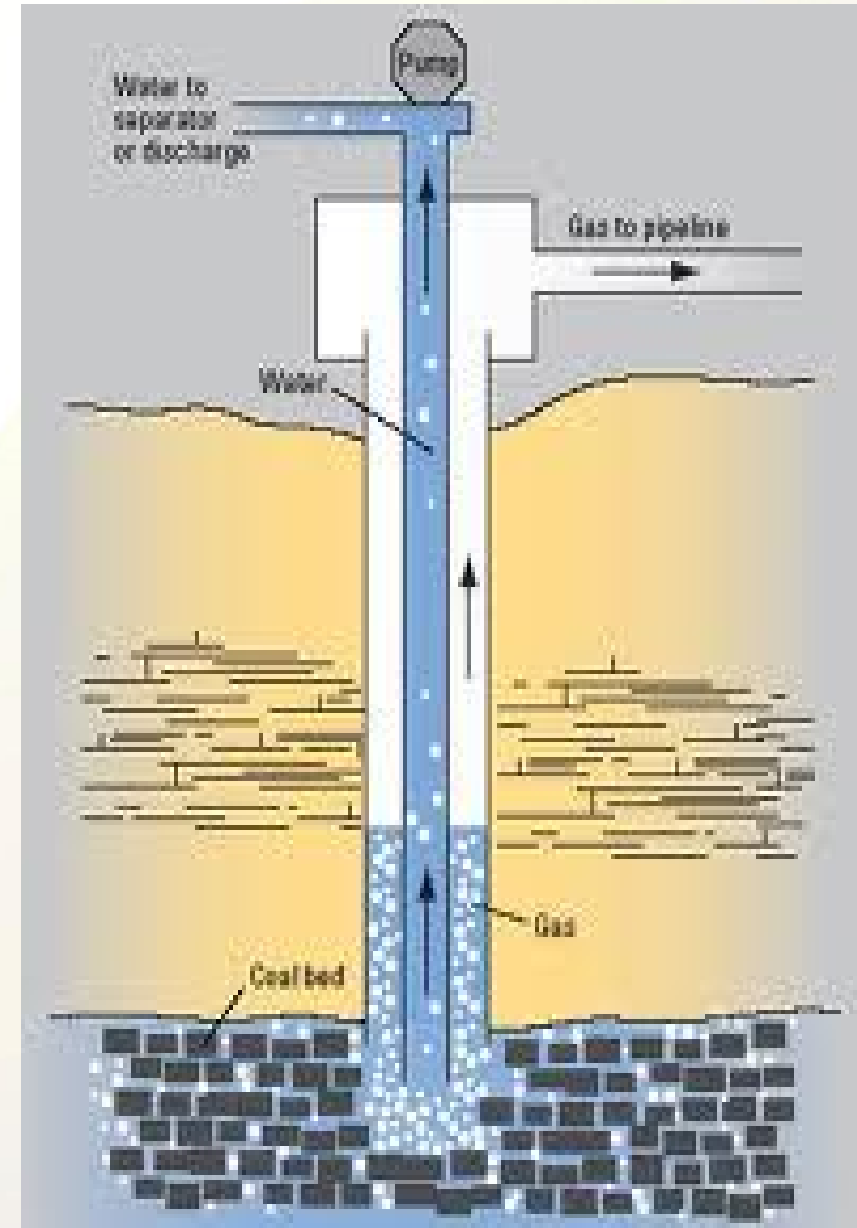
By: Ian Tchacos

February 2015



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What is CBM and how is it produced?

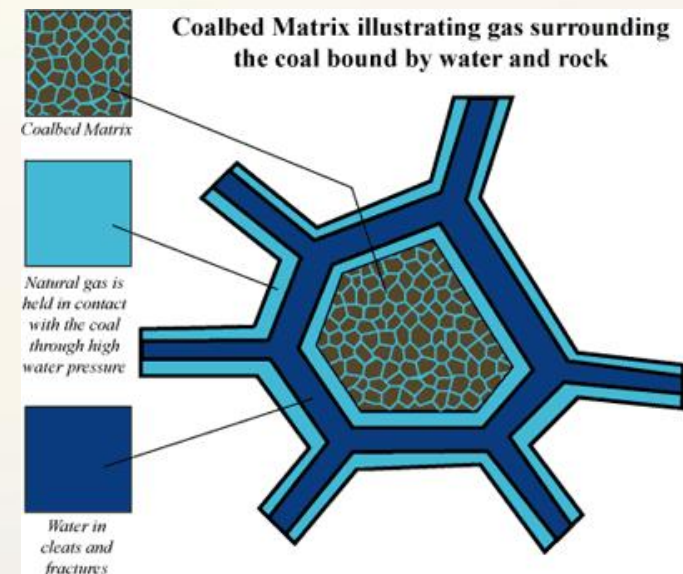
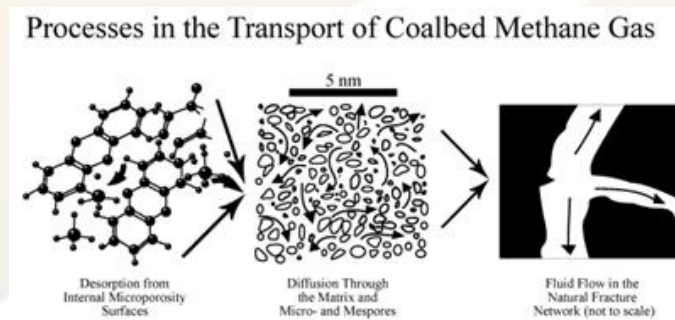
A naturally occurring gas present in some coal deposits that is similar in composition to natural gas

What is Coal Bed Methane (CBM)?

- CBM (coal bed methane) is a gas that occurs in association with coal. During the coalification process, a large amount of gas is produced.

It has properties that are similar to natural gas making it an ideal fuel source

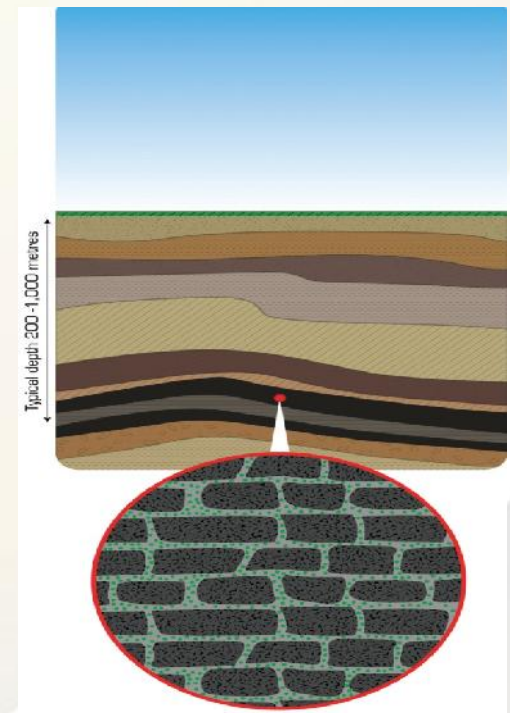
- Methane in coal is absorbed on the large coal surface area of coal seams and stored under pressure as free gas in the cleats and open pores



What is CBM continued?



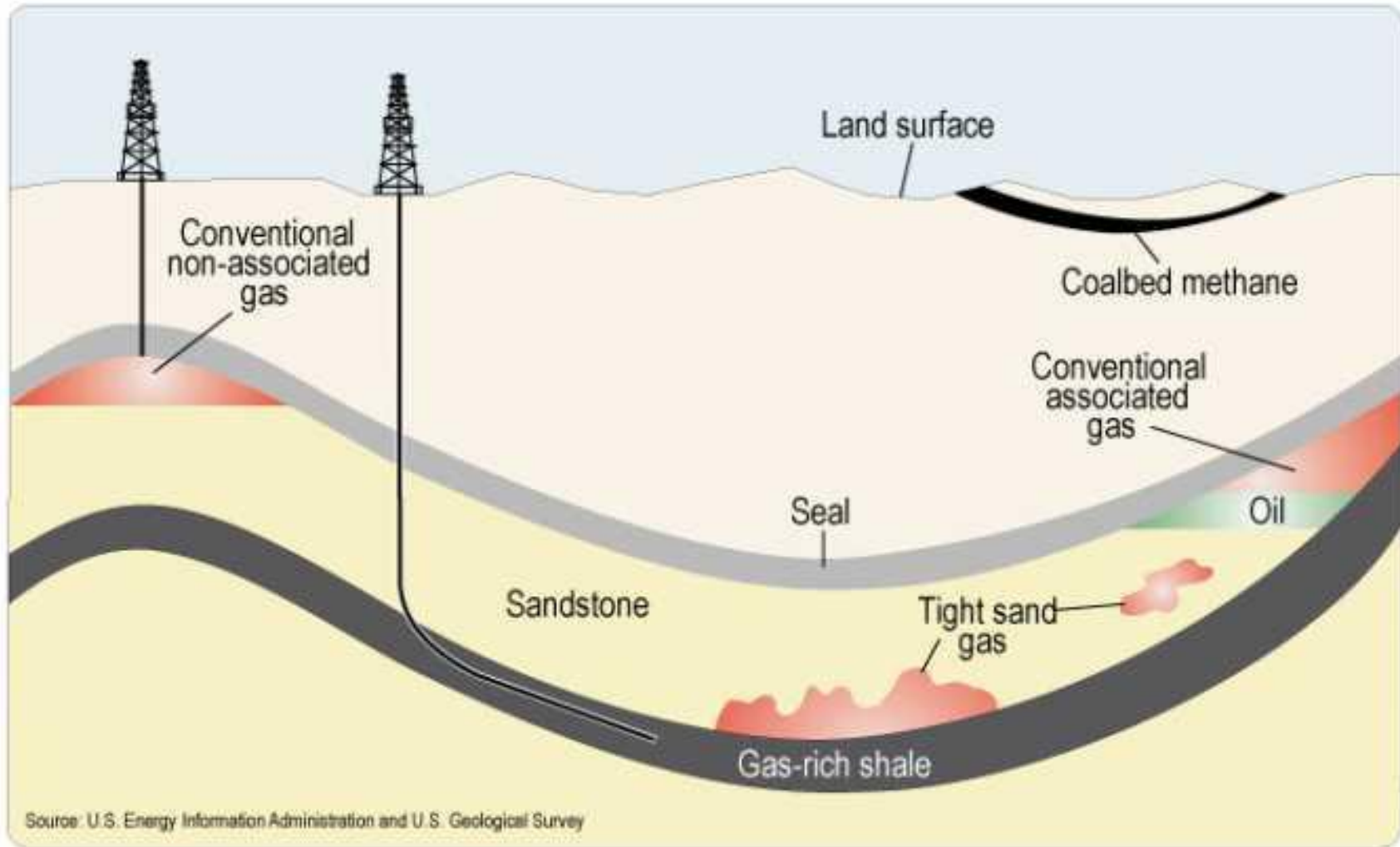
- CBM collects in underground coal seams by bonding to the surface of the coal particles present in these seams.
- The coal seams where the CBM is present are generally filled with water.
- The pressure of the water in these underground coal seams keeps the gas as a thin film on the surface of the coal.
- The combination of the water pressure and the ground pressure traps the gas in the 'cleats' of the coal seams.
- The quantity of gas that can be extracted from a coal bed depends on
 - the thickness of the coal seam;
 - the proportion of gas trapped in the coal seam 'cleats';
 - permeability of the coal seam; and
 - the depth of the coal seam.
- Currently it is usually economical to extract CBM from coal seams that are between 200 and 1,000 metres below the surface.



➤ Source: http://www.aplng.com.au/pdf/factsheets/What_is_CSG.pdf

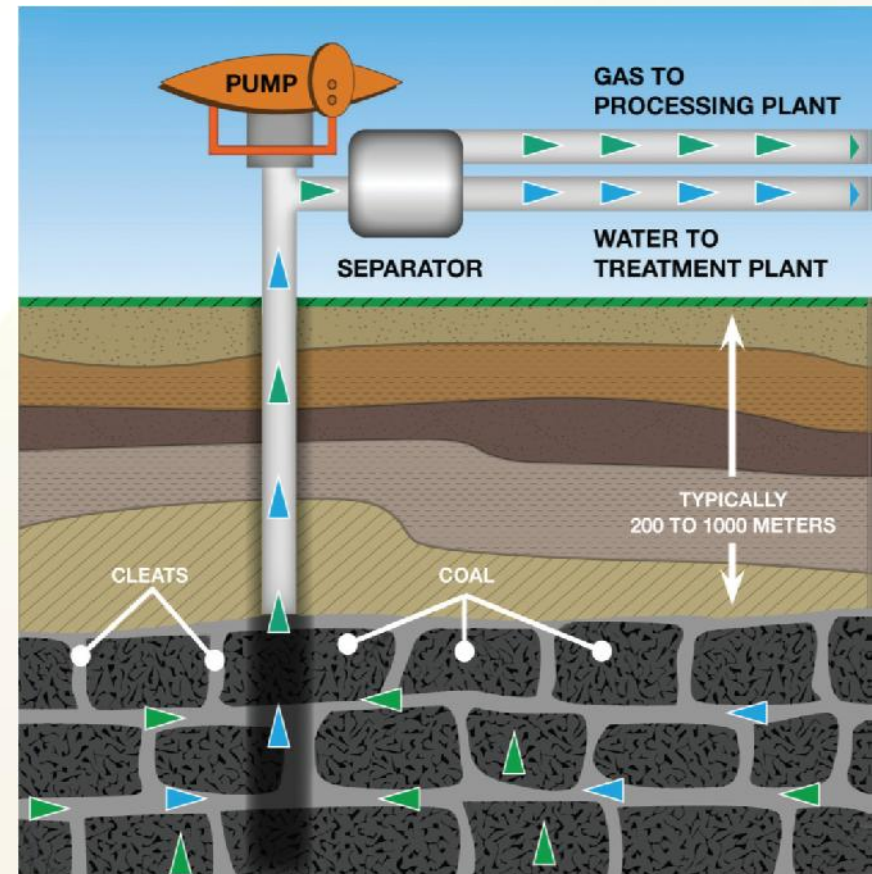
What is CBM? (continued)

CBM, Conventional Gas and Shale Gas



How is CBM Produced?

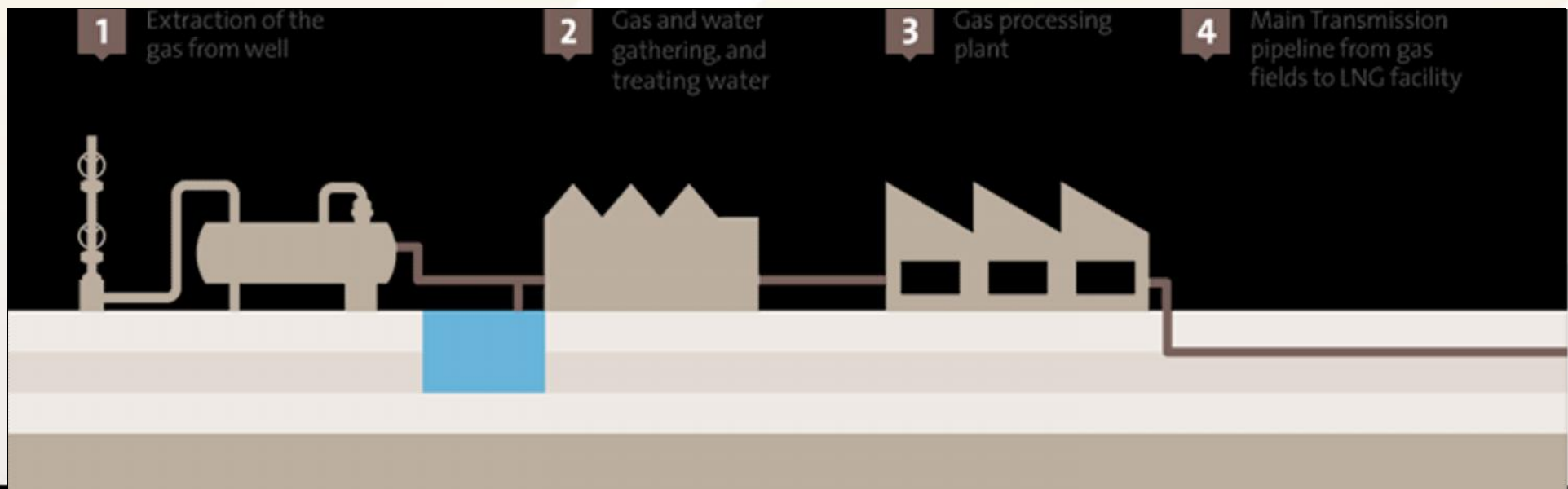
- CBM is produced by extracting groundwater from the coal seams,
 - this releases the underground pressure allowing the gas to escape from the coal particles
 - permits the gas to travel freely through the coal seam to the point of least pressure >>> the well.
- If the coal seam is not permeable enough to allow the gas to flow freely through the coal seam, the seam can be hydraulically fractured.
- The gas and associated water then comes to the surface via the well. On the surface the gas and the water are separated.



How is CBM Processed and Used?

Once at Surface:

- After separation of water from gas, water is pumped to a water treatment facility and gas is pumped to a gas treatment facility.
- At the gas processing facility remaining water is removed, the gas is compressed and pumped through high pressure pipelines to domestic and commercial users.
- If the gas is used for power generation, it is pumped to a power plant for fuel either in reciprocating gas engines (<< 50 Mwatts) or gas turbines (50 – 500 Mwatts)
- Alternately gas can be pumped to a LNG facility for export or use as a transport fuel



CBM as an electricity power generation fuel source

CBM can be used as a small scale or large scale fuel source.

It is highly desirable in terms of cost, financeability, fuel efficiency and environmental sustainability.

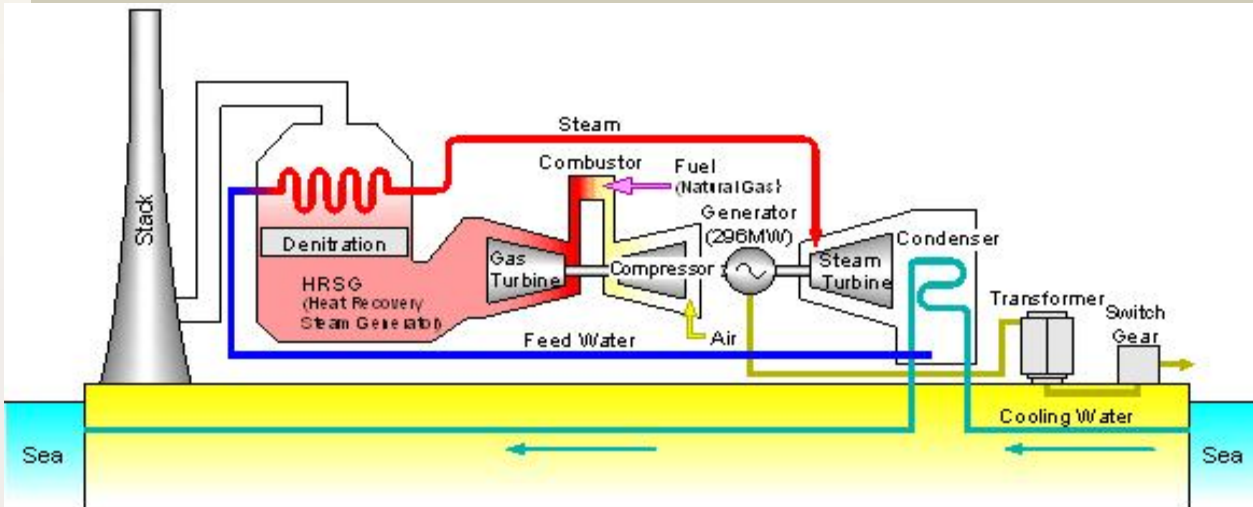
CBM for Power Generation



**Base Load Gas Fired Turbine Facility 640 MW
Uranquinty, Australia**



**2 MW CBM to power reciprocating
facility. Bengal India**



Gas Power Generation Costs vs other options



Capital Cost Comparisons of Generation Technologies

Technology	Capacity Case (MW)	Unit Capex Equiv (US \$ / KW)	% age difference to "Gas CCC"
Gas Conventional Combined Cycle	620	\$917	100%
Coal Single Unit Advanced Pulverised	650	\$3,246	354%
Uranium Dual Unit	2234	\$5,530	603%
Biomass Combined Cycle	20	\$8,180	892%
Wind Onshore	100	\$2,213	241%
Solar Thermal	100	\$5,067	553%
Geothermal Dual Flash	50	\$6,243	681%
Hydro Electric	500	\$5,530	603%

Source: US Energy Information Unit - 2013 Study of Capital Costs for Utility Scale Operating Plants

Commercial Considerations of Gas versus Coal Fired:

- Shorter planning and build times
- Lower cost of capital
- Greater access to capital
- Greater access to owner operators
- Scalable with ability to add capacity inline with demand
- Lower site cost component
- Lower equipment lead times

The World Wide CBM Industry

**A major fuel source that is well
understood and accepted World Wide**

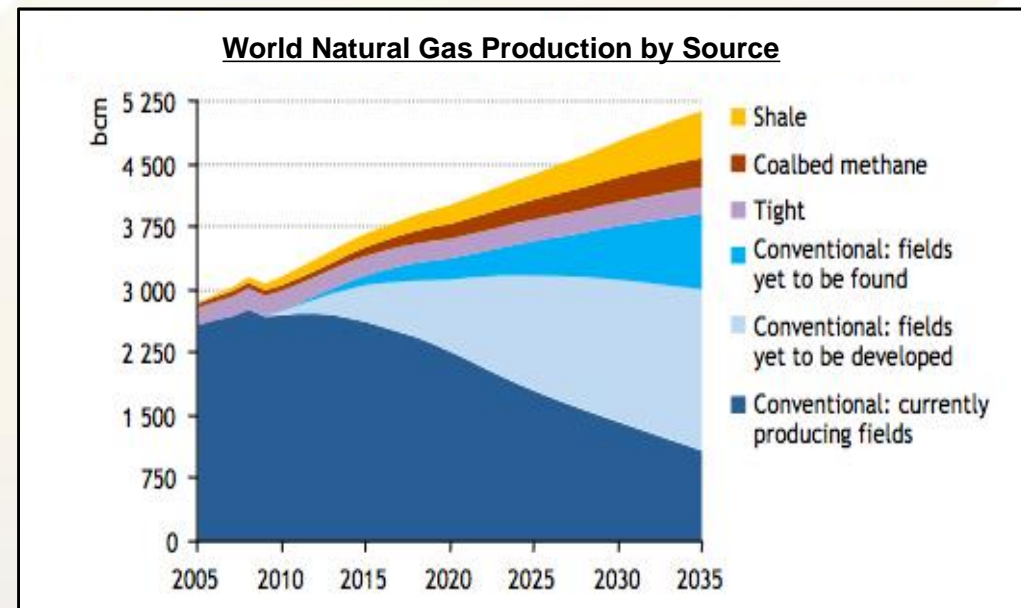
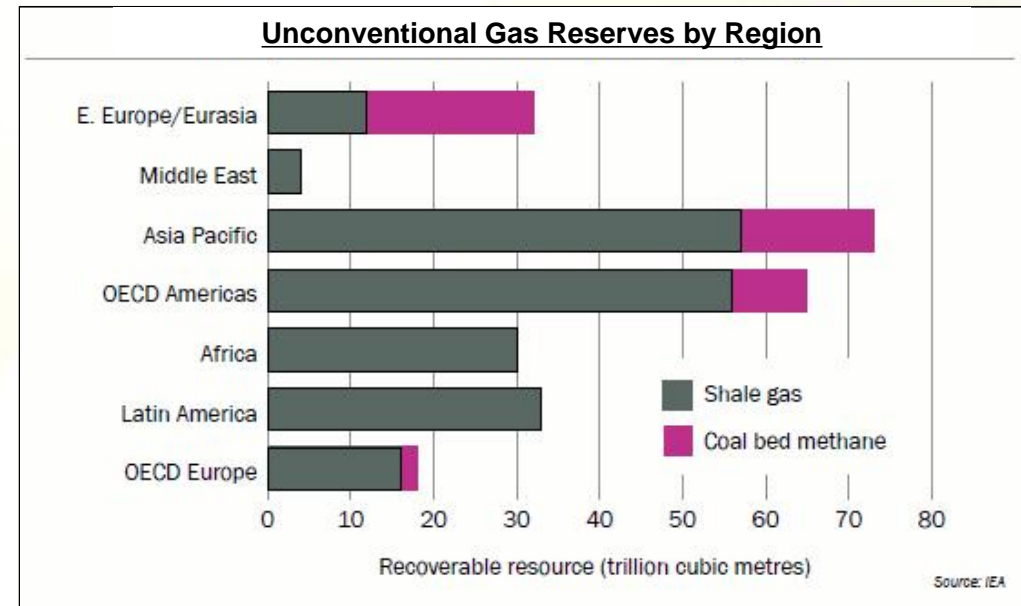
World Wide CBM Use



Currently Active Areas

- In Australia a CBM to LNG is a major export industry in Australia
- In the US CBM is mature industry in decline due to emergence of Shale gas
- Growth industry in China, India & Indonesia – large coal potential and need for energy
- Large potential in Eastern Europe and Russia

CBM is a Proven and Accepted World Wide Fuel Source



CBM Experience in Australia

**Now a major industry that can
provide guidance for Zambia in
the success case!**

What Coal Bed Methane has done for Australia?



- CBM production commenced in Queensland's Surat Basin in 1995.
- Since 1995, there has been an exponential growth in CBM production in Australia (particularly in Queensland).
- Some statistics:
 - Annual number of wells drilled increased from **10** in 1995 to **600** in 2011
 - annual CBM production has increased from **4Bcf** in 1998 to **234 Bcf** in 2011
 - CBM now accounts for in excess of 25% of eastern Australia's gas supply
 - there are currently 3 export LNG facilities under construction with a value in excess of **\$60 billion**. Expected to produce 28.8 MTPA (million tones per annum) of LNG (value approx US\$ 18 billion per annum)
 - the CBM industry is predicted to create 18,000 jobs

“Major New Industry, Substantial Export Income, Increased Economic Activity, Large Job Creation”

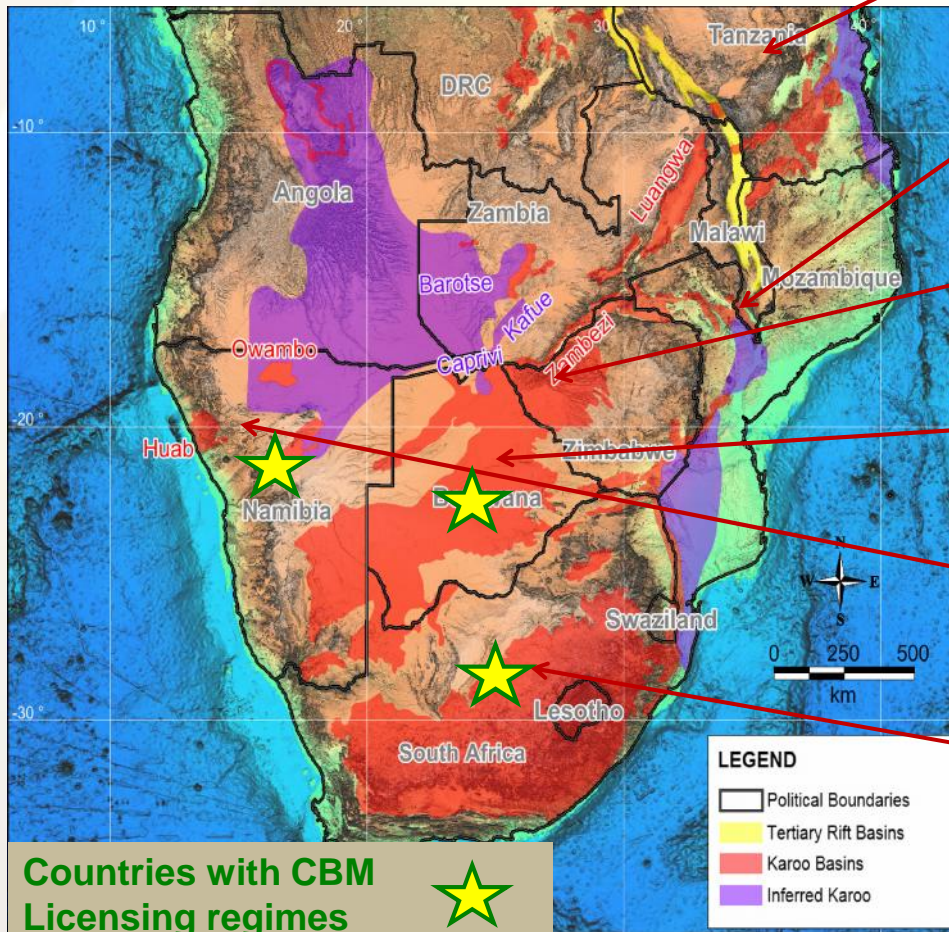
CBM potential in Sub Saharan Africa

**Extract from Oil and Gas Summit
Cape Town**

Ian Tchacos – 9 September 2014

CBM Activity in Africa

Extensive Karoo Sediments in Southern Africa from Kenya to RSA



Current CBM Activities

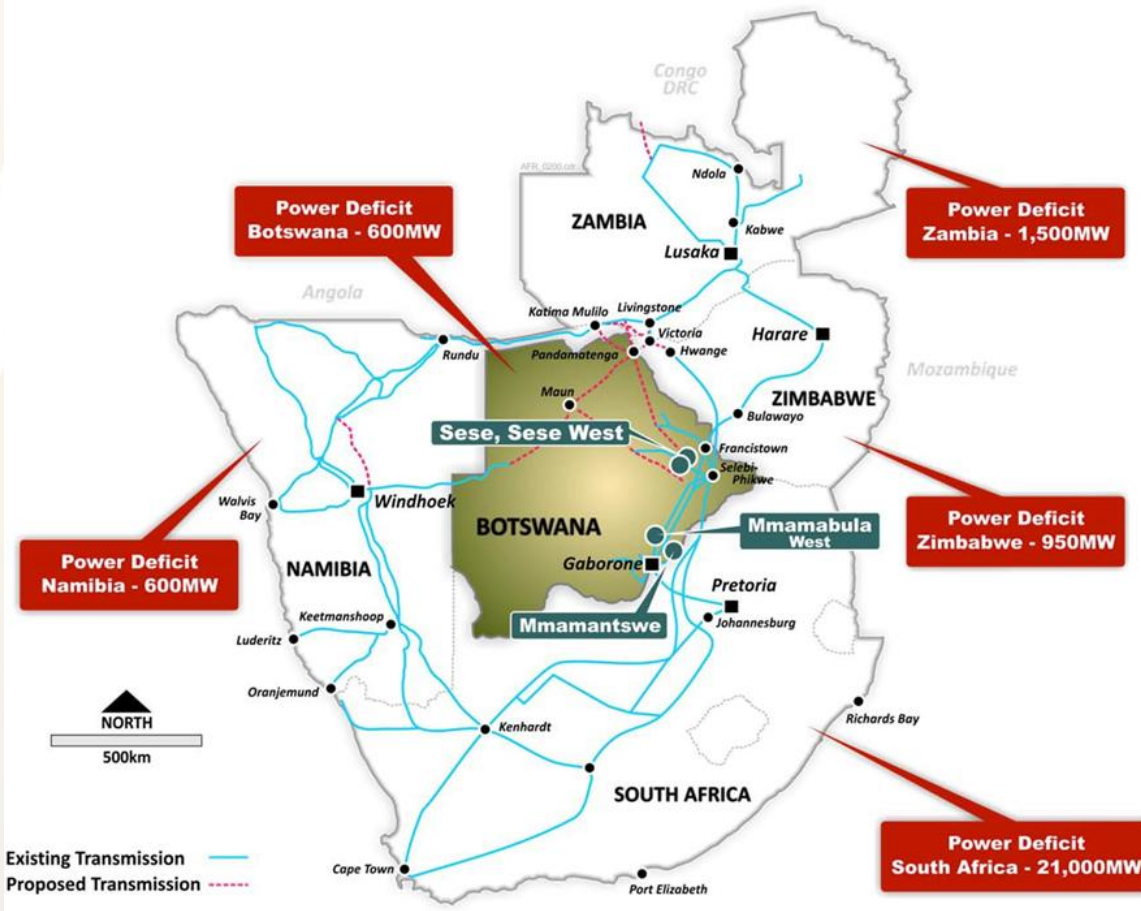
- **Tanzania** – potential identified but no activity
- **Mozambique** – large potential identified in Tete region awaiting CBM licensing
- **Zimbabwe** – large coal intersections and good gas content but no progress
- **Botswana** – exploration and pilot testing activities
- **Namibia** – limited exploration activity in poorly defined basins
- **South Africa** – exploration in a number of basins and one project in appraisal phase

“Only exploration and appraisal activities to date - no production”

CBM Relevance for Zambia

**A potential game changer in
terms energy self sufficiency and
economic development!**

Regional Demand and Infrastructure



Source; Africa Energy

Key Points

- Good country inter connectivity but further infrastructure upgrades required to provide access to more of the population
- Large current demand and strong projected growth
- Namibia needs 600 MW and imports 2 GW from RSA
- Zambia also has commenced export to DRC and Tanzania
- Some Zambian copper belt mines are using diesel for power generation

“It is chicken and egg – need the power for the upgrades in transmission infrastructure.”

Uses for Gas in Zambia

At source of production:

- Power Generation
- Conversion to LNG
 - For use as transport fuel
 - For export by LNG tanker



Via Pipeline to regional centres:

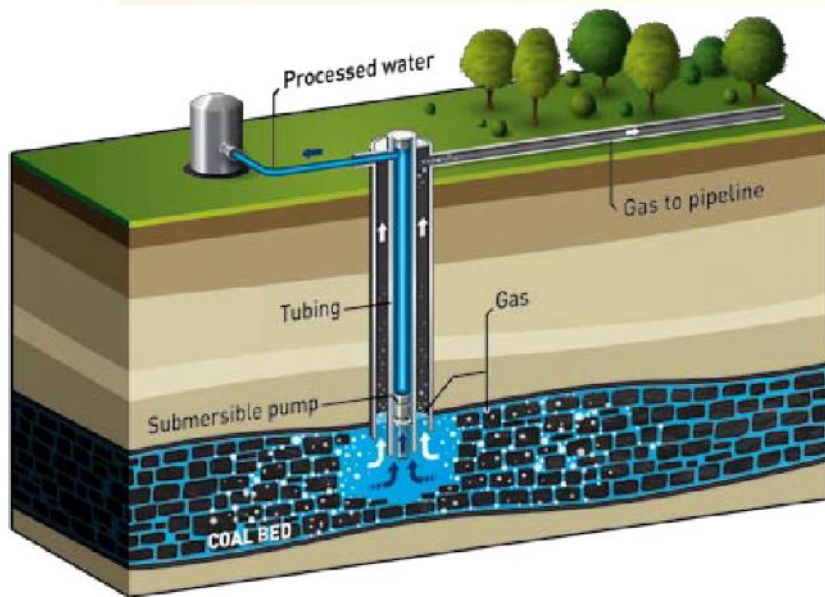
- Industrial use for mineral processing, mining operations and fertiliser plants
- Domestic use for cooking, heating and air-conditioning displacing electricity
- Use for regional Power Generation or Industrial centres

“Building a gas economy”

CBM a potential Game Changer



Social and economic benefits

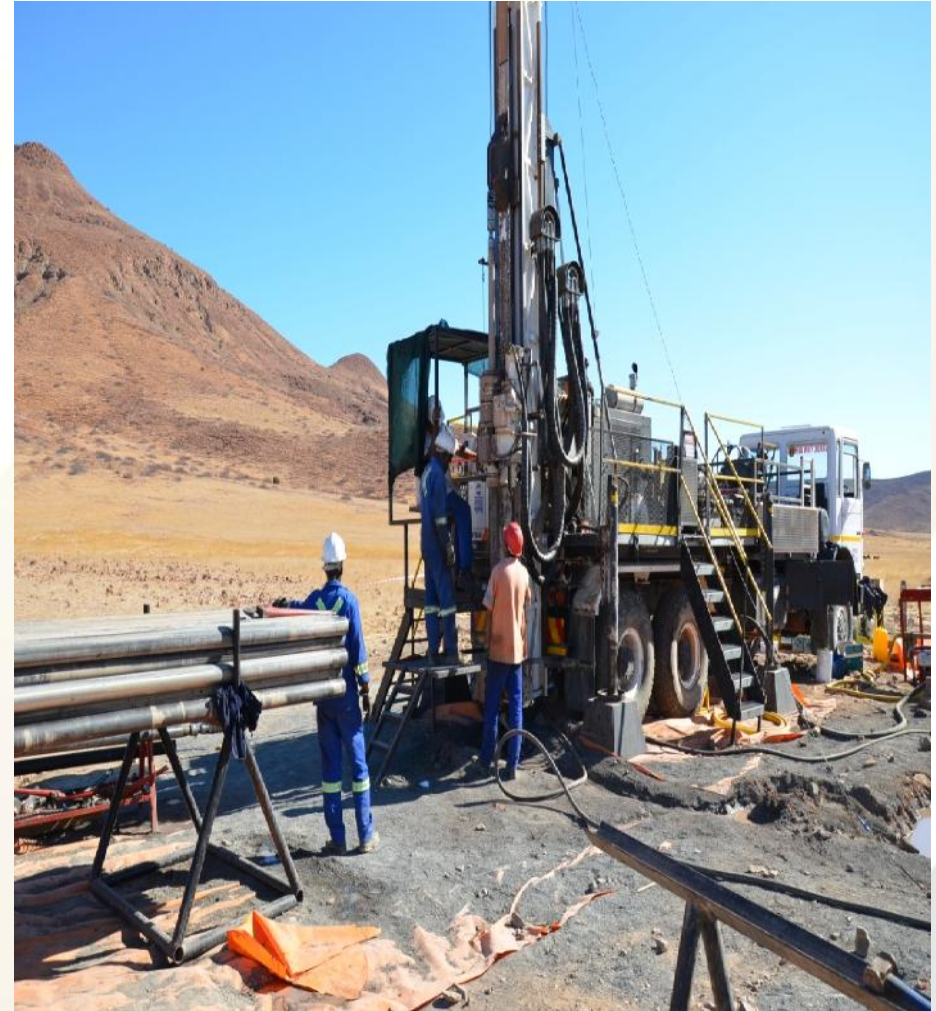


Synergies with coal mining

- Gas available as stable fuel source for:
 - Domestic electricity or cogeneration
 - Water treatment and medical facilities
 - Industry, mining or transport (CNG)
 - Simple, low pressure and relative low cost technology
 - Develop energy infrastructure
 - Create new employment
 - Displace expensive imports of oil or diesel
-
- Improved mine safety
 - Environmental benefit by minimising green house gas emissions
 - Shared facilities and data

What is required to determine a viable resource?

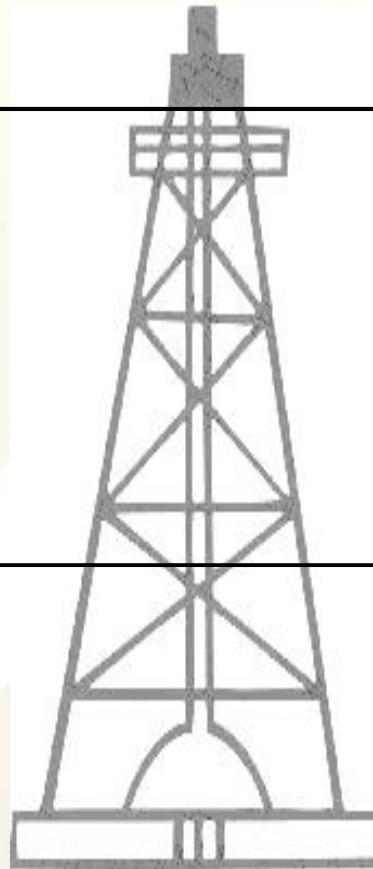
1. **Existence of significant continuous coal seams determined by exploration drilling, logging and if available seismic**
2. *Sufficient gas content tested by drilling, coal core recovery, in situ desorption and laboratory analysis??*
3. *Well in flow testing to determine coal seam permeability??*
4. *Pilot test flow program to determine gas recovery factor and de watering profile??*



**Instinct drilling in the Huab
dessert , Namibia**

Reservoir Parameters Need to Accurately Predict Coalbed Methane Production

	<u>Parameter</u>	<u>Data Source</u>
Exploration stage	Seam Depth	Log, Existing Data
	Seam Thickness	Log, Existing Data
	Temperature	Log
	Coal rank	Core - Coal analysis
	Coal Petrology	Core - Coal analysis
	Cleat spacing	Core - Coal analysis
	Gas content	Canister test (core)
	Diffusion co-efficient	Canister test (core)
	Desorption isotherm	Core sample
	Pressure	Well test, fluid level
	Compressibility	Well test, core test
	Initial saturations	Well test, production analysis
	Permeability	Well test, production analysis
	Desorption pressure	Well test, production analysis

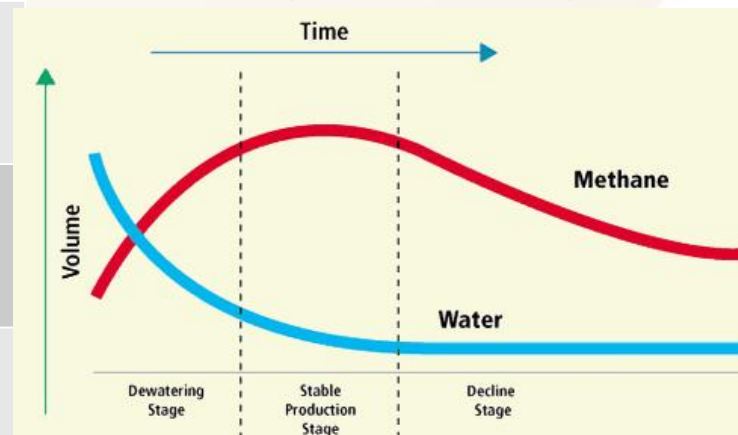


CBM Phases of Resource Development

Stage	Work Summary	Program	Schedule
CBM Area Licensing	Finalisation of JV , applications to ministry and award		6 months
Program Planning	Geological data gathering, work program planning, materials procurement and geotechnical work		6 months
Appraisal drilling and evaluation of results	Drill core wells, desorb cores on site and lab work. Analyse results and determine potential for commerciality		12 months
Pilot program design approval and execution	Pilot project feasibility, design, environmental approvals, licensing and procurement		6 months
Pilot program execution	Drill wells install surface facilities and monitor well production		24 months
Resource determination	Review results, undertake internal evaluation and obtain third party assessment		6 months



Pilot Program Dewatering



“A 5 year process but can be accelerated to less than 4 years”

Introduction to Instinct

**People, Projects, Capabilities
and Strategy**

Who is Instinct?



An unlisted energy company;

- Focused on Onshore Sub Saharan unconventional and conventional energy assets
- Complimentary Coal Bed Methane (CBM) Conventional Oil & Gas and Coal assets in Namibia
- Working with local companies to develop CBM opportunities in Zambia and Mozambique
- Seeking new opportunities in other pro investment, politically stable countries in sub Saharan Africa
- Experienced Board and management team supported by motivated contractors in Perth, Australia with UK management and operational support



Key Investment Objectives



- Develop a portfolio of unconventional and conventional energy resources in pro development Sub Saharan jurisdictions
- Develop available resources to provide competitively priced and reliable energy sources for host countries – **tailored solutions**
- Introduce international skills and finance to prospective projects
- Develop strong in country relationships by maximising local content and employment opportunities
- Become a partner of choice by delivering where possible economic, social and environmental benefits.
- Develop a strong track record to attract international capital to African energy projects.

Board Experience



Person	Nationality	Key Credentials
Mr Ian Tchacos Executive Chairman	Australian	Petroleum Engineering professional with over 30 years of international experience in exploration, production, finance and corporate development. Formerly Managing Director of Nexus Energy Limited which he grew from a micro-company with an AUD 2m market capitalization into an ASX 200 Company with an AUD 1.2 billion market capitalization.
Mr Kevan Fearnley Director	British	Over 30 years of experience in the oil and gas industry and corporate development. Co-founder and Chairman of Composite Energy Limited, a UK-based CBM company acquired by Dart Energy Limited for USD 68m. Co-founder and Managing Director of Expro plc (GBP 1.6 billion market capitalization).
Mr Philip Moore Director	British	Petroleum Engineer with over 35 years of engineering, operations and corporate development experience. Managed BP plc's largest UK onshore field. Founder and Managing Director of Helix Petroleum LLC (USD 60m market capitalization).
Mr Noel Newell Director	Australian	Geotechnical professional with over 30 years of experience in the oil and gas industry. Previously served in senior positions with BHP Billiton plc and Petrofina SA. Founder and Managing Director of ASX listed 3D Oil Limited which focuses on acreage in offshore Southeast Australia.
Mr Robert Downey Director	Australian	Corporate lawyer with over 15 years of experience. General Counsel of AIM listed Canadian E&P company. Advisor, founder and director of numerous ASX, TSX and AIM listed resources companies.

Management Team Capability



Person	Key Competencies							
	Corporate Finance	Legal	Project Execution	Drilling	Production	Geo-technical	Energy Sales	HSE
Mr Ian Tchacos Executive Chairman	✓		✓	✓	✓		✓	✓
Mr Rob Downey Executive Director	✓	✓						
Mr Bernard Crawford Finance Manager	✓							
Mr Noel Newell Director	✓					✓		✓
Mr Kevin Mallin Operations Advisor			✓	✓	✓	✓		✓
Mr John Henderson Technical Advisor and CBM specialist			✓	✓	✓		✓	✓
Dr John Jackson Geo Technical Advisor	✓		✓	✓	✓	✓	✓	✓

Key Contractor Relationships



Lomond and Assoc.	Independent Geological Advisors	UK
Geokrak	Well site geology, core sampling and analysis	Poland
Resource Potentials	Geophysical acquisition, modelling and advisors	Australia
Prinsloo Drilling	Drilling Contractor and logistical support	Namibia
Matrix Consulting	Environmental Advisors	Namibia
University of Namibia	Local Geotechnical Support and Data Sourcing	Namibia

**“Extending management capability
and experience as well as adding skills on the ground”**

Core Competencies



1. Oil and Gas exploration and appraisal
 2. Coal Bed Methane exploration and appraisal
 3. Resource project feasibility and development
 4. Resource project management and optimisation
 5. Energy commercialisation strategy, marketing, supply and demand modelling
- *Management has been involved in major onshore and offshore developments including – Oil, domestic gas, CBM, LNG and Geothermal*
 - *All operations in Namibia have been conducted in an environmentally sustainable and safe manner, with particular attention being paid to maximising local content utilising where possible local contractors and consultants.*



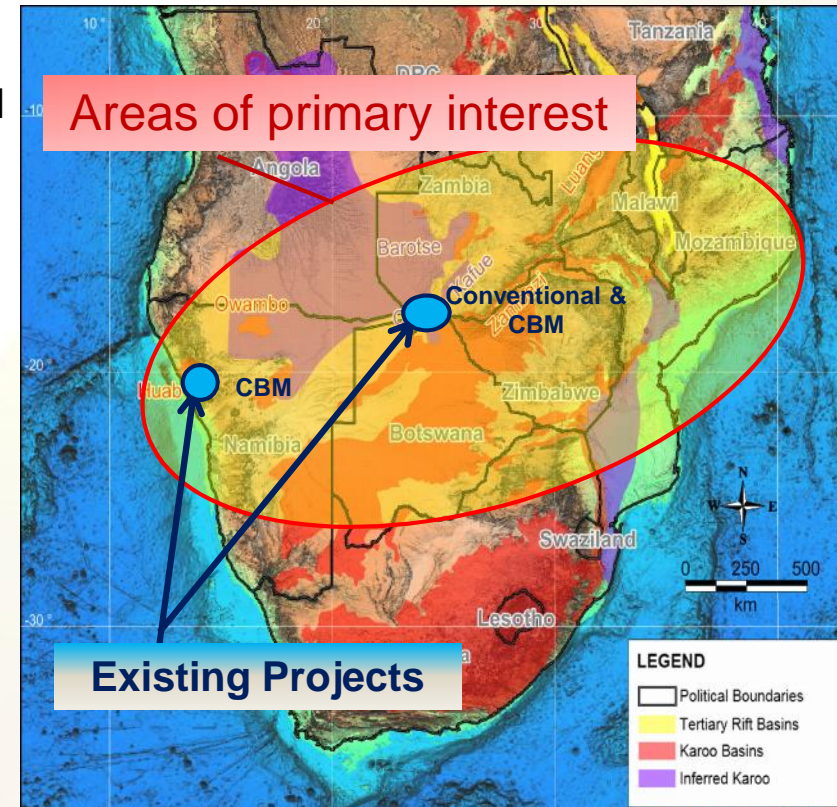
Gas Exploration in the Huab Basin (April 2012)



Geophysical Acquisition in the Zambezi Region

Geographic focus

- ✓ **Favourable geology for oil and gas (rift basins) and CBM (Karoo coal fields)**
 - Under explored rift basins with conventional hydrocarbon potential
 - Known coal deposits with potential for CBM resources
- ✓ **Politically stable and pro-development countries**
- ✓ **Countries with large unmet energy demand and large growth potential**
 - Approximately 5 GWatts of power currently required in Southern African Power Pool
 - Favourable electricity pricing (< US\$0.13/kwatt hour)
- ✓ **Existence of interconnected electricity infrastructure, suitable access regime and local support for new sources of energy**



Map showing Sub Saharan Tertiary Rift Basins, Karoo Basins and Inferred Karoo Basins

“Looking for Right Place, Right Time and Right Geology”

What has been achieved to date?

- ✓ Established a significant CBM and conventional oil and gas portfolio in Namibia
- ✓ Successful operated CBM drilling operations on the ground in Namibia (2 wells)
- ✓ Recent CBM well encountered approximately 15 meters of net coal in unexplored areas of Huab basin (one 12 metre seam)
- ✓ Identified new oil and gas prone basin in the Caprivi basin (Zambezi region) from recent geophysical work
- ✓ Strong ministry support and development of key in-country relationships
- ✓ Development of a capable operations and geological team
- ✓ Follow up opportunities in Namibia and other jurisdictions eg Zambia and Mozambique



Conclusion - Summary of Key Points



- **CBM is a clean and environmentally sustainable fuel source**
- **Gas is the cheapest, most efficient and fastest power generation development option**
- **CBM is potential source of new employment and skills development in Zambia during exploration, appraisal, development and operational phases**
- **CBM may provide an excellent domestic power and electricity export opportunity for Zambia**
- **Instinct is an experienced, highly motivated Sub Saharan focussed CBM explorer seeking to undertake exploration to determine potential of CBM with “Mawe Exploration and Technical Services”**

“CBM ticks all the boxes as a new potential Energy Resource for Zambia. Instinct looks forward to helping establish its potential”

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Thank you on behalf of “Mawe Exploration and Technical Services” and “Instinct Energy”

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