

Shale Gas Exploration McArthur Basin Onshore Australia

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Demonstrate why cultural heritage & natural environment must take precedence over petroleum

Challenge technology providers to deliver necessary & timely breakthrough



Imperial's stand to preserve culture & environment *and* exploit resource



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McArthur Basin Shale Gas Play

- Imperial Oil & Gas
- Competitive landscape in Australia
- Shale Gas Play
- Aboriginal Land & Environment
- ♦ V + V + S
- Footprint
- Call to Action for petroleum technologists



Imperial Oil & Gas







U.S. Energy Information Administration

APRIL 2011

www.eia.gov

World Shale Gas Resources: An Initial Assessment of 14 Regions **Outside the United States**

Independent Statistics & Analysis U.S. Department of Energy Washington, DC 20585

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Australia

- Shale Gas is still in infancy Little exploration & no-commercial production
- 396 Tcf TRR Shale Gas
- Greater than estimated CSG reserves that will... underpin 3 recent LNG projects deliver capacity of 25 million tonnes a year

Continent	Risked Gas In-Place (Tcf)	Risked Technically Recoverable (Tcf)	
North America	3,856	1,069	
South America	4,569	1,225	
Europe	2,587	624	
Africa	3,962	1,042	
Asia	5,661	1,404	
Australia	1,381	396	#6
Total	22,016	5,760	



Pace







Pace









Big moving on the **small**

Jun 2010	Mitsubishi	A\$ 152.4 million	50%	Buru Energy	Canning Basin
Dec 2010	CNOOC	A\$50 million	50%	Exoma Energy	Galilee Basin
Apr 2011	Hess	U\$60 million (+10 mm shares)	62.5%	Falcon Oil & Gas	Beetaloo Basin
Jul 2011	СоР	A\$ 109.5 million (+back costs)	75%	New Standard Energy	Canning Basin
	BG	A\$ 130 million (+back costs)	60%	Drillsearch Energy	Cooper Basin

Beach flowed 2 mm scfd shale gas booking contingent 2Tcf in Cooper Basin

Oz deals <u>currently</u> modest compared with USA & Canada

Jul 2011BHP U\$12.1 billion Petrohawke Energy
(Texas & Louisiana Eagle Ford, Haynesville & Permian shale plays)

From Norton Rose Australia, 18th August 2011. "Unconventional series - The shale gas revolution comes to Australia"



McArthur Basin





Shale Play



The most spectacular indication of live hydrocarbons encountered to date in the McArthur Group was in the Kennecott-Amoco mineral exploration corehole GR 9, drilled in the Glyde area. A summary log of this drillhole is shown as Figure 5, and the location is shown in Figure 2. Upon unintentional swabbing at the end of drilling (in December 1979), the corehole experienced a gas blow-out which yielded a 5-6m (15-20 ft) long flame. Condensate flow accompanying the gas, was indicated by the bright orange-yellow colour of the flame, and by an accompanying sooty tail. The hole flowed gas for an indeterminate period during the immediately following "Wet" season. By the end of the "Wet" the hole was filled with water and the gas flow had degenerated to a series of gas bubbles percolating through hydrostatic head. A sample of the gas taken at this stage yielded the following analysis:-

	Methane		74.25%	
	Ethane		10.25%	
	Propane		3.25%	
	Iso-Butane		0.175%	
	N-Butane		0.60%	
	N-Pentane		0.105%	
	Hexane		0.165%	
	Heptane		0.08%	
	Nitrogen		10.75%	
	Carbon Dioxide		0.20%.	
ıe	hole was plugged	with	cement in April	1980.





GR-9 Well





"... mineral exploration hole drilled at the Glyde River prospect by Amoco in 1979 flowed gas and condensates at 140psi for 6 months"

Armour Energy ASX announcement 11th October 2010





Play Summary

Uncertainties

Shale Quality

- Distribution of gas-shale
- ➡ Regional quality trends

Shale Effectiveness

- Position of OGW/GGW
- 🔶 Timing
- ➡ Sweet spots

Marcellus Analogue for volume



Access to Aboriginal Land.....





Aboriginal Land

Imperial Acreage

 47,952 km² Aboriginal Land
 80%

 11,220 km² Native Title
 20%



Aboriginal Land Rights (Northern Territory)

Act 1976

191 of 19













Environment





Now

Perception

Future ?









..... is not necessarily fact

On the one hand....

"...the push to drill for natural gas is turning vast swaths of beautiful American country into dangerous sludge dumps..."

"... dirty business ... "

.... yet on the other

"...2 out of the 3 wells that Gas-Land featured were contaminated biogenic gas unrelated to oil and gas activity"

"...natural gas falsely accused (of) 35 mile fish kill. U.S. Environmental Protection Agency tied the fish kills to coal mine run-off"



Incremental Change





Game Change





Imperial's Vision

Safely develop the shale gas resources while preserving cultural heritage, customs & natural environment

... which means



Guiding Principle

... being true to our words

Resources

... then

Technology breakthrough

Values



So, the reality is

- access to resource is constrained by environment & culture
- protect these or forget the resources

Strategy

Drive the **timely development** & implementation of drilling & production **technology** to

- remove risk to environment & culture
- maximise recovery
- optimise shale gas economics



Minimising Footprint





Natural Rehabilitation











6 months - regrowth 10 years - complete regrowth



Shale Gas Drilling Limit

Current

- Deepest (MD) 7,620m e-c
- Deepest (TVD) 4,481m g-b
- Lateral Length 3,048m b-c
- Highest Initial Production
 - 10,000 BOPD
 - 60 MMCF/Day
- Up to 22 fracs per well



Values provided by Packers Plus April 2011



Trends

- Cleaner
- Deeper
- Hotter
- Longer
- More Laterals
- More fracs per well
- Cheaper





Push the limit







1999

World record for 11km long reach horizontal well



A Call for Technology

Strategy

Drive the **timely development** & implementation of **drilling & production technology** to

- remove environment risk
- maximise recovery
- optimise shale gas economics



Technology Challenge

- Cheap
- Safe
- 10km+ fracced horizontal wells
- with multi-lateral, multi-level & multi frac
- that have no lasting impact on environment







- no compromise!

"....I'll tell you what I want, what I really, really want..."



Technology breakthrough in 2-5 years

- Safe, cheap & clean
- 10km+ fracced horizontal wells as standard
- multi-lateral/level/frac





The first predominantly Aboriginal-led petroleum exploitation company with focus on the East Arnhem Region



..... a 'NOC' like **PetroMin** in PNG

Petromin PNG Holdings Limited is an independent company created by the State of Papua New Guinea to hold the State's assets and to maximise indigenious ownership and revenue gains in the mineral and petroleum sectors.

It is empowered as the vehicle to better leverage the State's equity holdings and encourage more production and downstream processing of oil, gas and minerals in PNG through proactive investment strategies either wholly or in partnership with resource developers.



More Stuff

IMPERIAL ..

McArthur Basin Shale Gas Play

Northern Territory Onshore Australia



Opportunity

In 2010 Imperial Oil & Gas secured **100% interest in 59,000 km²** of prospective shale gas exploration acreage in the Proterozoic McArthur Basin (*Exploration Permit Applications EP (A) 180 – 188*). The McArthur is a petrole um frontier basin at **low exploration maturity** and no prior shale gas activity. It is an inverted Proterozoic basin with **thick carbon-rich black shale** petrole um source rocks also mined for Pb-Zn. There are **direct indications of oil & gas** in the basin and existing gas pipelines. Analogue shale gas basins suggest Imperials acreage contains of the order of **24 Tcf of potential recoverable resources**. For the permits to be granted and exploration work to start agreements must be negotiated with Traditional Land Owners. This process has commenced.



Exploration Plays The target gas resource is in 1,640 million year old Palaeo-Proterozoic organic-rich black shales of the Barney Creek Formation and equivalents, proven gas-prone in the South McArthur Basin. In particular the 1979 mineral core hole GRNT-79-9 ignited and sustained a 6m high yellow smoky gas flare for approximately 6 months producing an estimated 0.5 Bcf at 6mmscfd. Gas analysis revealed C1-C7. In addition oil bleeds are common in cores and hence shale oil offers secondary potential.

The Meso-Proterozoic Velkerri Formation also contains carbon-rich black shales & siltstones and is present in the southern EP(A) 5187 & 188. This formation is the focus of shale gas exploration by others in the adjacent Beetaloo Basin to the south. Key Uncertainties & Risk Consistent with a frontier basin the regional extent, quality, and thermal maturity of the Barney Creek & Velkerri Formation shales have yet to be adequately constrained due chiefly to past focus on mineral exploitation from the former. Potential gas-prone sweet spots are yet to be delineated and hence Imperials strategy of acquiring a very large initial acreage position.

Land access and permit grant in six of the seven permit applications requires approval of the Traditional Owners given they are in Aboriginal Freehold Land. This is a risk given the licenses may not be granted for some time or at all. If negotiations are successful then some permits could be granted and work commence as early as 1H 2012. If not then the majority of the permits enter a 5 year veto period after which negotiations may re-commence.

Exploration Work Programmes Once each permit is granted, the work programmes in all 7 permit areas are essentially the same. Years 1 & 2 of the 5 Year initial Exploration Term will be concerned with demonstrating the quality of any potential gas shales by geological fieldwork, sampling, and by acquiring drill core samples. This work will form the basis for a Petroleum System Analysis to constrain whether, and in what locations, these shales may be capable of gas (or oil) production. The option to exit can be exercised at the end of any permit year.

Year 3 will focus on 2D seismic acquisition to define the basin shape and depth as well as subsurface targets for vertical test drilling in Year 4. If proven to contain shale-gas then Year 5 will include the drilling and evaluation of a deviated or horizontal well involving fracting and gas production testing.

 Barney Creek Formation

 Lithofacies
 Carbonaceous black silty dolomitic shale

 Depth
 Outcrop to 4,000m

 Gross
 500 – 1,000m

 Net
 13% (in GR-9) to 2,

 TOC
 0.4 – 10.4%

 S1+S2
 5 – 70 kg/ton

 Maturity
 Immature to GGW





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