ASX ANNOUNCEMENT **ASX CODE: CTP**

23 November 2010

TO: The Manager, Company Announcements ASX Limited

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HELIUM CONTENT AT OORAMINNA-2 MAY POINT WAY TO COMMERCIALISATION

Central Petroleum Limited (ASX:**CTP**) ("**Central**"), as Operator has pleasure in announcing that recently completed gas analyses of samples taken during the drilling of Ooraminna-2 (EP82) showed a helium content of 0.22% and a nitrogen content of 10.5%. Such an analysis result may point the way to commercial helium production. If this helium were to be extracted with the nitrogen from the total gas composition then the resultant extracted gas would have a nitrogen content of 97.9% and a helium concentration of around 2.1%. Helium extracted at the BOC-Linde Group helium plant at Port Darwin has a reported average helium concentration of c.3% after commercial quantities of natural gas are extracted.

The gas flows from the Ooraminna well were low and stabilised at around 150,000 cubic feet per day, however it was noted that the gas was derived from tight formation (Pioneer Sandstone) which may be amenable to 'non-conventional' development, such as horizontal drilling and/or fraccing stimulation in parts of the prospect. It was also noted that the Ooraminna structure may potentially host a very large gas field possibly over 1,000 km^2 in area and that the host reservoir, the Pioneer Sandstone, may occur over most of the Ooraminna prospect.

The Pioneer Sandstone occurs over a wide area of Central's leases, including the Waterhouse prospect to the east which may be drilled in a later drilling campaign.

Another gas field hosting helium is the Magellan operated Palm Valley Field (Non-CENTRAL), with gas from that field from the Pacoota Sandstone also being reported as containing helium in a similar concentration to that found at Ooraminna 2.

The Magee-1 well, now within Central's EP 125 Magee Prospect Block in joint venture with Oil and Gas Exploration Limited, flowed helium at 6.3% to surface from the basal sub-salt Heavitree Formation.

A conceptual study by METTS Pty Ltd (attached herewith) concludes that co-production of mini-LNG for the transport industry and helium may have commercial outcomes if sufficient gas with similar compositions to the gas analysed at Ooraminna-2 were to be found in the greater Ooraminna structure or in other prospects hosting the Pioneer Sandstone, Pacoota Sandstone or Heavitree Formation.

"Contingent plans for the drilling of Magee-2, a helium-gas-condensate target have been delayed in favour of the drilling of Surprise-1, an oil prospect in EP 115 but the surprisingly high helium concentration found at Ooraminna-2 provide the Company with further encouragement for the ongoing analysis of the Ooraminna structure in particular and for helium exploration in general" said Central's Managing Director, John Heugh today.

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merlin WEST PTY LTD ABN 59 114 346 968

central GREEN PTY LTD ABN 84 128 245 876

central GEOTHERMAL PTY LTD ABN 86 128 245 885

central PETROLEUM SERVICES PTY LTD ABN 57 140 628 155

Attachments :

- Recent Technical Note CTP 22 November 2010
- Recent report by METTS Pty Ltd 22 November 2010
- A previous announcement on low volume helium extraction dated 19 April 2010

John Heugh
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Central Petroleum Limited

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NOTICE: The participating interests of the relevant parties in the respective permits and permit applications which may be applicable to this announcement are:

- *EP 115 Central subsidiary Frontier Oil & Gas Pty Ltd ("FOG") 90%, Trident Energy Limited ("TRI") 10%.*
- *EP-82 (excluding the Central subsidiary Helium Australia Pty Ltd ("HEA") and Oil & Gas Exploration Limited ("OGE") (previously He Nuclear Ltd) Magee Prospect Block) - HEA 100%*
- *Magee Prospect Block, portion of EP 82 – HEA 84.66% and OGE 15.34%.*
- *EP-93, EP-105, EP-106, EP-107, EPA-92, EPA-129, EPA-131, EPA-132, EPA-133, EPA-137, EPA-147, EPA-149, EPA-152, EPA-160, ATP-909, ATP-911, ATP-912 and PELA-77 - Central subsidiary Merlin Energy Pty Ltd 100% ("MEE").*
- *The Simpson, Bejah, Dune and Pellinor Prospect Block portions within EP-97 – MEE 80% and Rawson Resources Ltd 20%.*
- *EP-125 (excluding the Central subsidiary Ordiv Petroleum Pty Ltd ("ORP") and OGE Mt Kitty Prospect Block) and EPA-124 – ORP 100%.*
- *Mt Kitty Prospect Block, portion of EP 125 - ORP 75.41% and OGE 24.59%.*
- *EP-112, EP-118, EPA-111 and EPA-120 - FOG 100%.*
- *PEPA 18/08-9, PEPA 17/08-9 and PEPA 16/08-9 - Central subsidiary Merlin West Pty Ltd 100%.*
- *EPA-130 - MEE 55% and Great Southern Gas Ltd 45%.*

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Potential volumetrics of gas or oil may be categorised as Undiscovered Gas or Oil Initially In Place (UGIIP or UOIIP) or Prospective Recoverable Oil or Gas in accordance with AAPG/SPE guidelines. Since oil via Gas to Liquids Processes (GTL) volumetrics may be derived from gas estimates the corresponding categorisation applies. Unless otherwise annotated any potential oil, gas or helium UGIIP or UOIIP figures are at "high" estimate in accordance with the guidelines of the Society of Petroleum Engineers (SPE) as preferred by the ASX Limited but the ASX Limited takes no responsibility for such quoted figures.
As new information comes to hand from data processing and new drilling and seismic information, preliminary results may be modified. Resources estimates, assessments of exploration results and other opinions expressed by CTP in this announcement or report have not been reviewed by relevant Joint Venture partners. Therefore those resource estimates, assessments of exploration results and opinions represent the views of Central only. Exploration programmes which may be referred to in this announcement or report have not been necessarily been approved by relevant Joint Venture partners and accordingly constitute a proposal only unless and until approved.

Amadeus Basin Helium Deposits – A Summary of Potential Monetisation

(CTP Technical Note 10.11.22)

Central Petroleum Limited ("Central") has recently completed its Ooraminna 2 gas well. The well confirmed the presence of natural gas in the Ooraminna geological structure. The gas that was produced however also contained helium in concentrations (0.22%) that may be recovered if this natural gas was ever converted into Liquefied Natural Gas (LNG) in a micro or mini LNG plant for budding road, rail and mining power diesel substitution supplies . (See CTP ASX announcement 10.04.19.) The helium content at Ooraminna 2 was not verified until sometime after the well was completed and accurate helium analyses from submitted samples was available. Any removal of the relatively high 10.5% nitrogen content of the Ooraminna gas would also remove the helium with it, thereby producing a by product gas offtake mix with a relatively high and probably commercially extractable helium concentration of 2.3%.

The Ooraminna gas flow that contained helium came from the Pioneer Sandstone that is found over a wide area of Central's leases, including the Waterhouse prospect that may be drilled in a later drilling campaign.

Previous drilling at the Magee 1 prospect in Central's EP 82 (currently part of the Magee prospect block in joint venture with Oil and Gas Exploration Limited earning a 25% interest) recorded gas, condensate and helium to surface with a very high helium concentration of some 6.2%.

A 2010 report by Negotiaction (See CTP ASX announcement 10.04.19.) quoted a CIF Shanghai price expectation for Grade A helium of US$170-190 per thousand cubic feet in bulk industrial volumes. A 2010 report by METTS and Duncan Seddon and Associates (See CTP ASX announcement 10.04.19.) quoted a NPV range at 8% discount rate for a conceptual helium and mini LNG extraction and marketing operation of between AU$111-556 million.

Central Petroleum holds virtually a whole of basin position in the WA and NT portions of the Amadeus Basin (170,000 km2). In addition to conventional and unconventional hydrocarbons, Central believes the basin's unique geological framework presents several opportunities for helium entrapment. Helium is a rare and strategically important gas in terms of exploration potential and economic importance, with the intrinsic value of the gas in bulk industrial volumes on the international market being up to 50 times that of domestic sales gas in Australia.

Known Occurrences Of Helium in the Amadeus Basin

Beneath the Amadeus Basin, radiogenic basement is likely a widespread source of helium which has migrated up through the sedimentary section to several reservoir-seal couplets. Helium is extremely mobile but several ubiquitous seals, including two regional salt seals, have sufficient integrity to entrap helium. Hence the widespread presence of a tripartite basement source - reservoir - salt seal system marking the base of the Amadeus sequence is a compelling factor.
Given only very sparse drilling coverage in the basin, it is very encouraging that, although the highest concentration of helium yet recorded has been from the lowermost Heavitree Formation, helium has been recorded in significant concentrations at three separate stratigraphic levels, viz :

1) Heavitree Formation reservoir/ Gillen Salt seal: A gas flow of 63 mcfd was recorded from the Heavitree Formation (Willouran) in Magee 1. Helium made up 6.2% of the gas stream which is very high by world standards. For example in Qatar and India, Helium is recovered from the tail gas of LNG production at saturations of 0.04% and 0.05% respectively.

2) Pioneer Sandstone reservoir/ Pertatataka Formation seal: A gas flow of about 150 mcfd was recorded from the Pioneer Sandstone (Marinoan) in Ooraminna-2 compared with 12 mcfd recorded in Ooraminna-1. Helium made up 0.22% of the gas

stream in the former but was not analysed in the latter. These saturations compare favourably with those in the afore mentioned commercial deposits.

3) Pacoota Sandstone–Stairway Sandstone reservoirs / Stokes Siltstone seal. These Ordovician reservoirs produce gas at the Palm Valley field where the operator noted Helium contents of 0.15% Helium in the gas stream.

Regional Exploration Potential

1) Heavitree Formation Helium Targets

The aforementioned tri-partite Helium charge system occurs at reasonably shallow drillable depths over a huge fairway covering thousands of km^2 in the southern Amadeus Basin (Fig.1). Two prospects, Mt Kitty and Magee-2, are ready to drill and both target the Heavitree Formation for gas and/or helium. This region is very heavily structured with a plethora of entrapment possibilities. The play fairway for Heavitree helium targets occurs below: Note that the play probably extends beyond the mapped area.

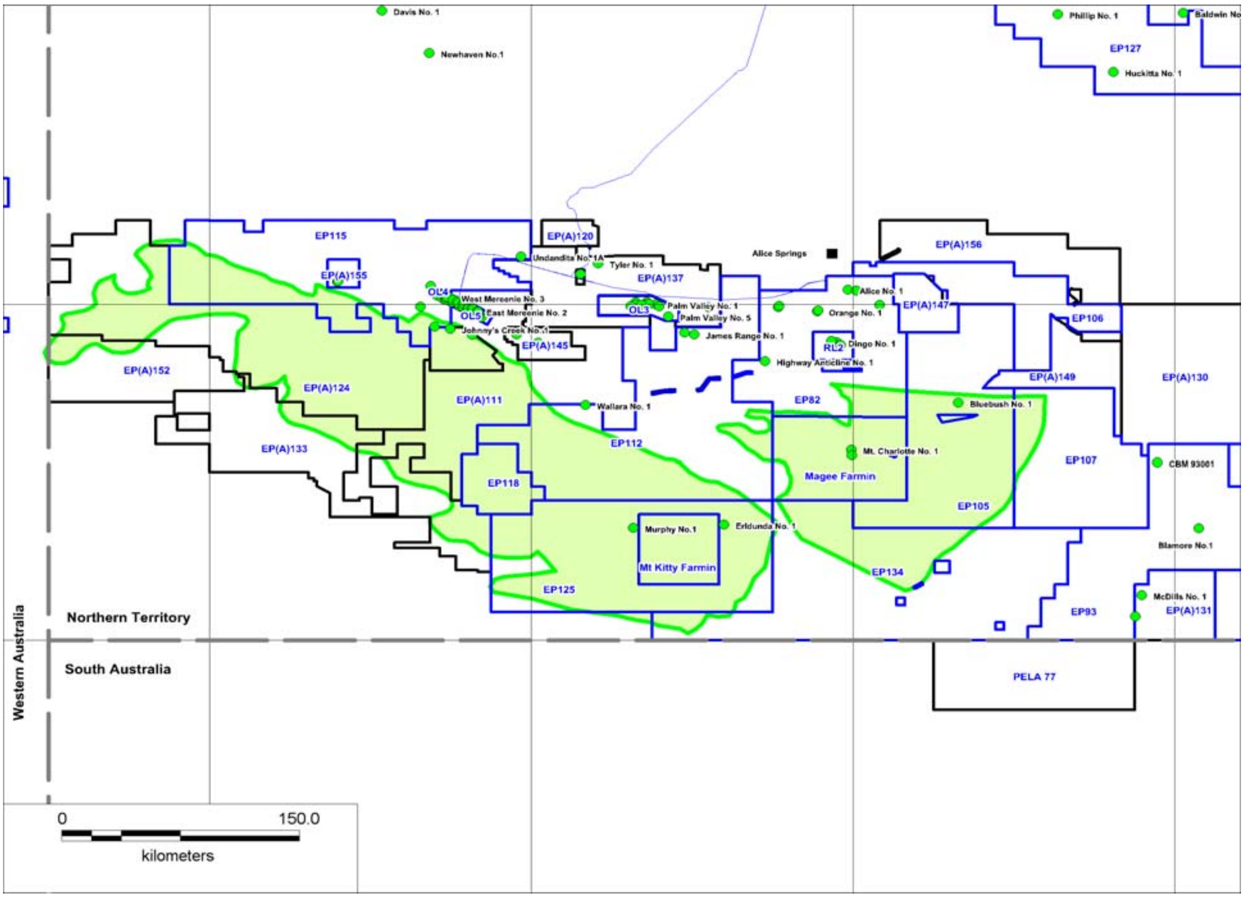
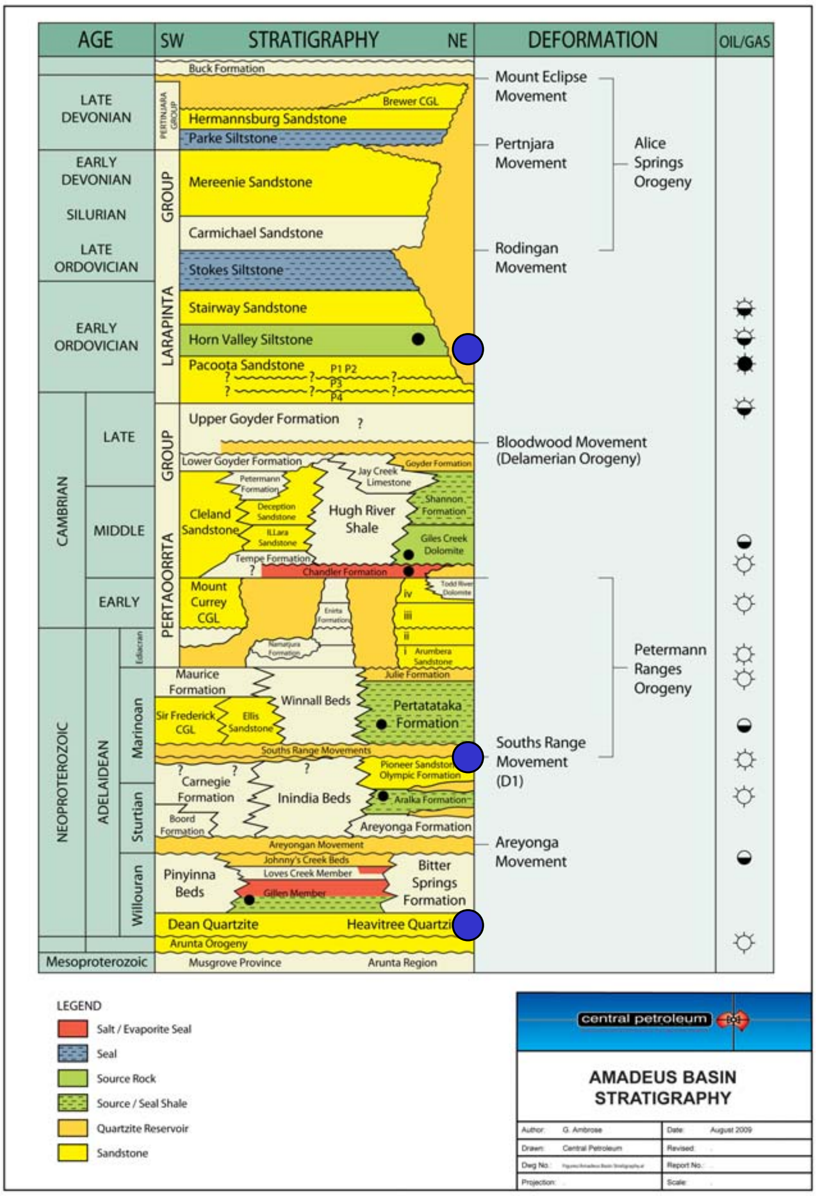


Figure 1: The play fairway for Heavitree Formation gas/condensate/Helium targets.

2) Pioneer Sandstone Helium Targets

The Pioneer Sandstone gas/helium play has only been drilled once in closure (Ooraminna Prospect). The pale green area denotes Pioneer Sandstone prospectivity where 4-way dip closures define the main targets (Fig.2). Halo rim plays are shown in the northern part of the basin. A critical component of the play, the Pertatataka Fm seal provides regional seal over the entire area and is a viable gas source rock in its own right. The Waterhouse Prospect is a substantial anticline of approximately 300 km^2 approximately 60 km west of the Ooraminna field. The structure has robust surface expression but the deepest exploration well on the prospect was terminated prior to penetrating the Pioneer Sandstone, which is consequently deemed an attractive gas/helium target. The prospect is ready to drill and could provide critical incremental gas /helium reserves in support of a possible Ooraminna field helium/LNG project.



Helium occurrence

Figure 2 Stratigraphic Table with Helium occurrence

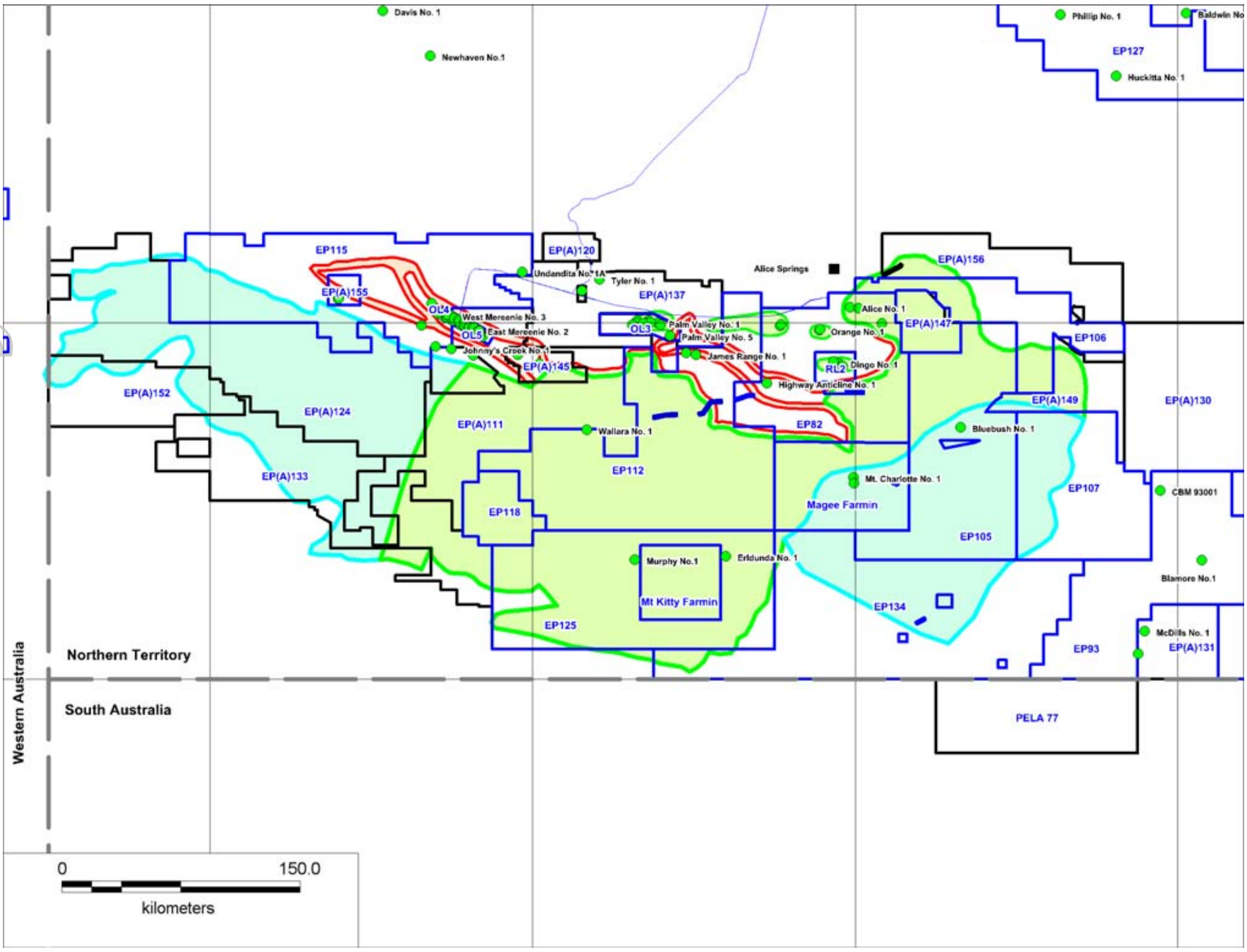


Figure 3 : Play Fairway Pioneer Sandstone for Helium (Green Area). The Blue Area depicts viable Aralka Fm source rocks but the Pioneer Sandstone is deemed absent.

3). Pacoota Sandstone – Stairway Sandstone Helium Targets

The Pacoota Sandstone – Stairway Sandstone gas/oil fairway is outlined in yellow in Figure 4 but this boundary is defined in part by proximity to mature Horn Valley Siltstone source rocks. The basement sourced Helium potential, which is more dependent on the extent of the Stokes Siltstone seal, would probably extend to areas well beyond those outlined limits which can be regarded as a minimum delineation.

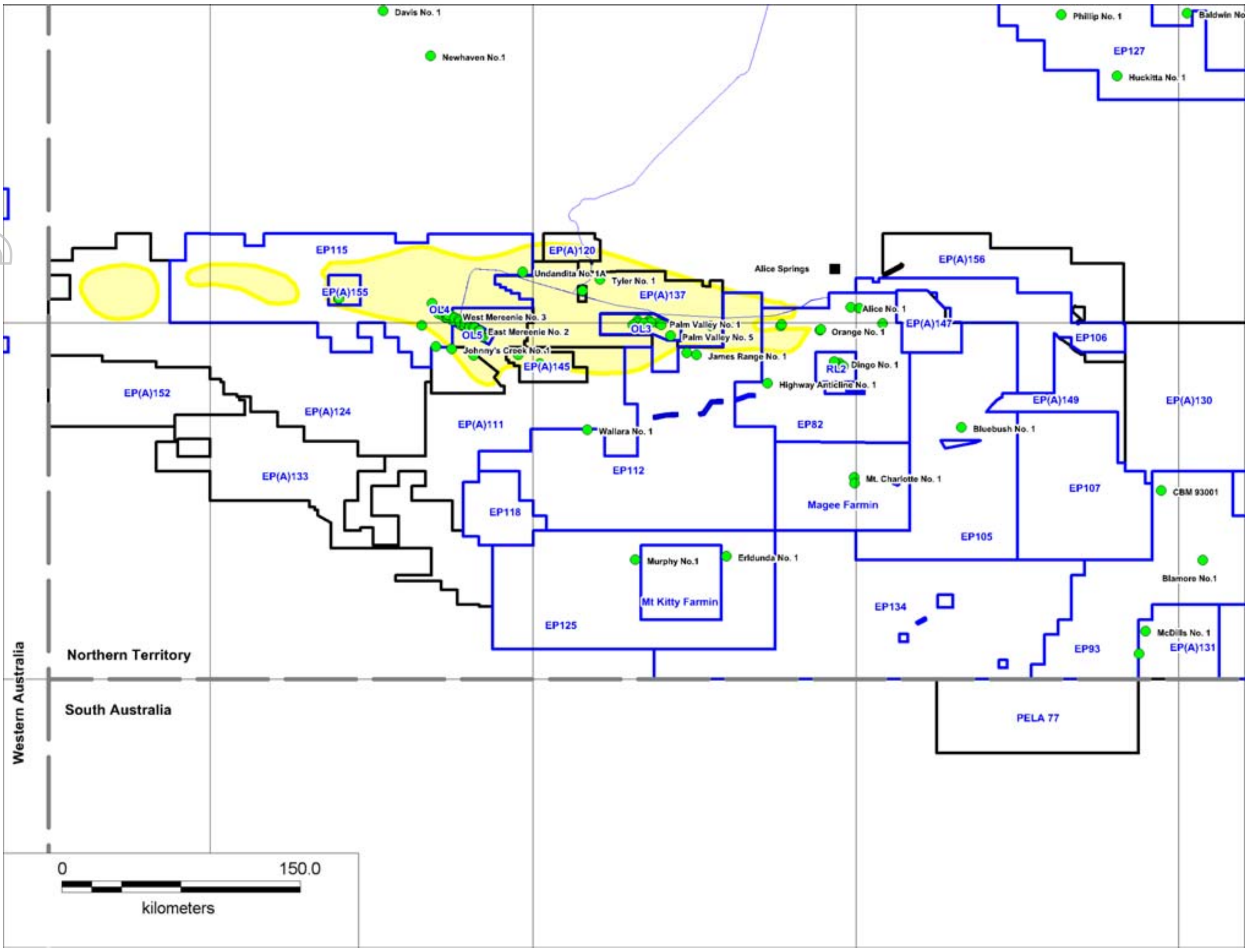


Figure 4 : Pacoota Sandstone / Stairway Sandstone Helium target fairway

Commercial Potential of Helium Projects

At this stage of exploration, two possible economic scenarios exist for exploitation of the basin's helium resource ie one for high helium content targets in the Heavitree Formation (eg Magee-1) which may be amenable for gas into GTL processing, and secondly for low concentration Helium recovered from nitrogen and helium separation prior to mini- LNG production from Pioneer ss and / or Pacoota ss – Stairway ss gas streams as encountered at Ooraminna-1 and Palm Valley field respectively.

To produce commercial quality LNG, most of the nitrogen needs to be separated from the gas stream. The Palm Valley gas stream (He at 0.15%) contains only 2% nitrogen compared with the gas stream tested from the Pioneer Sandstone in Ooraminna-2 (He at 0.22%) which contained 10.5% Nitrogen. The Magee-1 gas stream contained 43% nitrogen and 6.2% Helium. There is considerable potential for new discoveries adjacent to the Ooraminna field (eg Waterhouse Prospect) and a commercial helium project could spin off from LNG production. If high helium (and nitrogen) contents occur in extensive exploration fairways adjacent to Magee-1 (eg Mt Kitty Prospect, Maryvale Prospect) the converse may be true ie LNG Project(s) could supplement primary helium production.

In time all economic scenarios will be assessed thoroughly but at this early stage Central believes the Amadeus Basin in central Australia is a potential helium province with widespread but unique geological criteria and encouraging gas stream analyses both supportive of potential helium monetisation.

GJ Ambrose
Manager Geology
22 November 2010

References

Clarke, M.C. (METTS Pty Ltd), 2010. Recovering and Monetising Ooraminna Helium. Consultants Report prepared for Central Petroleum By M.E.T.T.S Pty Ltd. Unpublished Report.

Clarke, M.C., (METTS Pty Ltd) and Duncan Seddon and Associates Pty Ltd, 2010 Preliminary Pre-feasibility Study on Low Volume Commercial Extraction of Helium for Central Petroleum Limited.

Negotiaction, 2010 Preliminary Report "Supplying Helium to Asia and Factors Influencing Future Helium Pricing."

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Commercial-in-Confidence

OORAMINNA HELIUM

Recovering and Monetising Ooraminna Helium

22 November 2010

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5. No Comment on Commercial Feasibility

The findings, observations and conclusions expressed by METTS are not, and should not be considered as, an opinion concerning the commercial feasibility of the property or asset but based on certain assumptions, are considered to provide pre-feasibility scoping parameters for such a project should exploration and development of an appropriate helium reserve be successful.

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If the reader should become aware of any inaccuracy in or change to any of the facts, findings or assumptions made either in METTS's report or elsewhere, the reader should inform METTS and the Client so that it can assess its significance and review its comments and recommendations. This report shall be read as a whole and sections should not be read or relied upon out of context.

7. Consent

The authors give their consent to the public release of this report and/or any conclusions reached therein to the Client without reservation other than expressed herein.

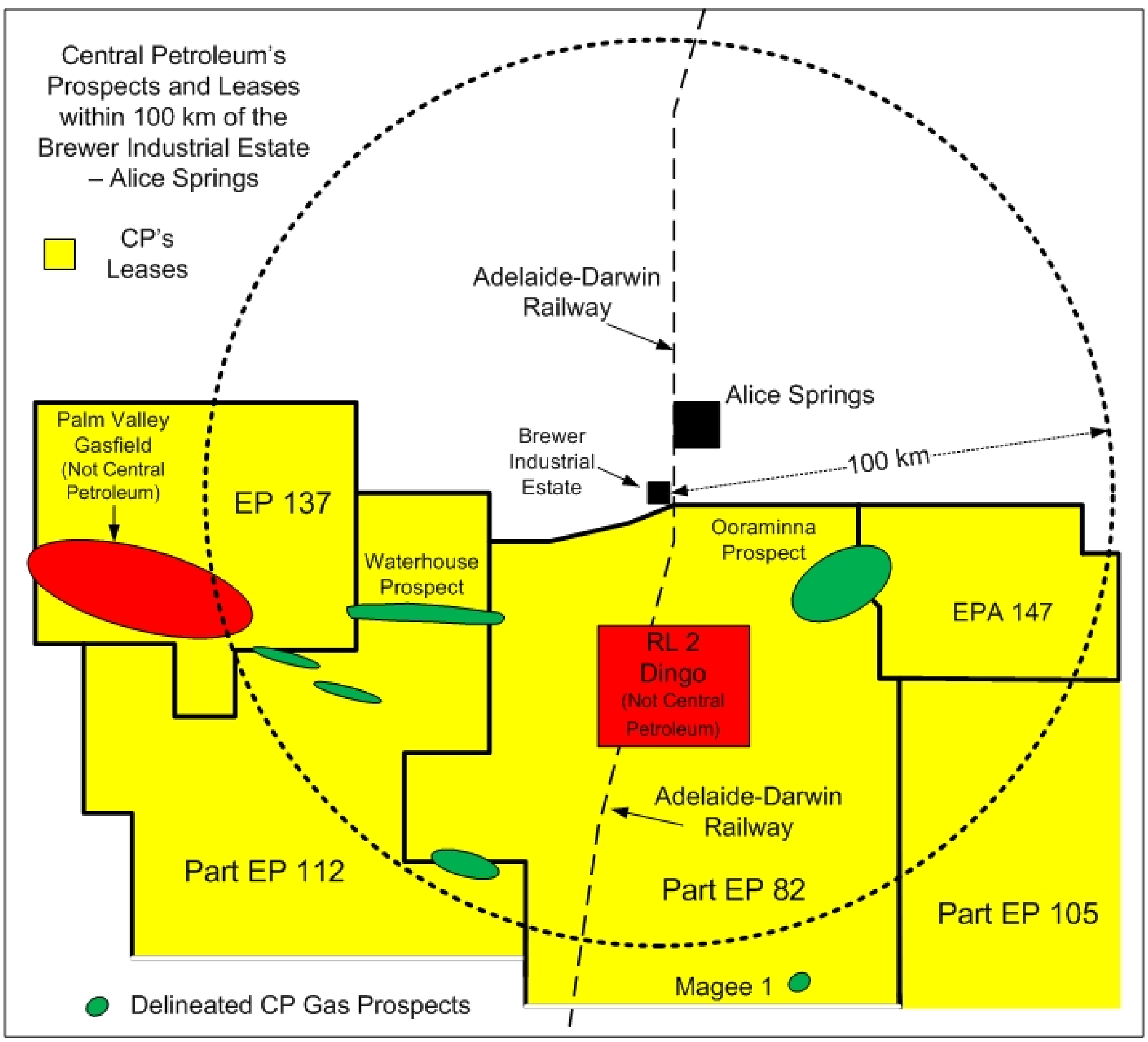
Disclaimer

Dr. Michael Clarke, the CEO of M.E.T.T.S. Pty. Ltd. holds 120,000 CTP shares. Dr. Clarke purchased these shares and options before he undertook any consulting for Central Petroleum Ltd.

Recovering and Monetising Ooraminna Helium

Central Petroleum Limited ("Central") has recently completed its Ooraminna 2 gas well. The well confirmed the presence of natural gas in the Ooraminna geological structure. The gas that was produced however also contained helium in concentrations that may be recovered if this natural gas was ever converted into Liquefied Natural Gas (LNG) in a micro or mini LNG plant for budding road, rail and mining power diesel substitution supplies . (See CTP ASX announcement 10.04.19 attached herewith). The Liberal Party of Australia has recently pledged support for the development of logistics systems for LNG as a transport fuel and in the USA and in Australia the use of LNG in trucking fleets is burgeoning, The helium content at Ooraminna 2 was not verified until sometime after the well was completed and accurate helium analyses from submitted samples became available.

The Ooraminna gas flow that contained helium came from the Pioneer Sandstone which occurs over a wide area of Central's leases, including the Waterhouse prospect to the east which may be drilled in a later drilling campaign. . On the following map, both the Ooraminna and Waterhouse prospects are indicated, as well as the Dingo find (Non Central) that has been reported to host over 25 BCFG in contingent recoverable resources but with no helium recorded. It was possibly not analysed for.



The gas from the Pioneer Sandstone in the Ooraminna 2 well had the following averaged analysis:

Gas Constituent	% Mole Fraction
Methane	85·5
Ethane	3·3
Propane	0·4
Butanes	0·08
Pentanes	0·06
Hexane+	0·06
CO_2	0·30
Nitrogen	10·5
Helium	0·22
Argon	0·01
H_2S	BDL
Oxygen	0·03
SE HHV	32 MJ/Nm^3
SE HHV	908 kJ/SCF

BDL Below Detectable Limits

As can be observed, the raw gas is essentially a 'dry' gas with little C_{2+} fractions. The main non-combustible gas is nitrogen that would be rejected in a liquefaction process if LNG was the final product. Note: The nitrogen could be of some value if used in future under-balanced well drilling and power generation.

The carbon dioxide concentration is low and would not be a problem with either the production of LNG or Gas-To-Liquids (GTL). Helium was found at possibly useful concentrations. The Specific Energy (SE) of the raw gas is appropriate for GTL production.

Using reverse calculations, LNG potentially produced from this gas would have a specific energy (SE) around 38 MJ/Nm^3 once the nitrogen was removed, making it a good and valuable product. The small quantities of ethane and heavier hydrocarbons would be a useful component of any LNG that were to be produced.

The gas flows from the Ooraminna well were low and peaked at around 150,000 cubic feet per day - 150 MCFD (177m^3/hour), however it was noted that the gas was derived from tight formation (Pioneer Sandstone) which may be amenable to 'non-conventional' development, such as horizontal drilling and/or fraccing stimulation. It is also noted that the Ooraminna structure is potentially a very large gas field possibly over 1,000 km^2 in area and that the host reservoir, the Pioneer Sandstone, is very extensive over this area.

Another gas field hosting helium is Palm Valley Field (Non-CENTRAL), with gas from that production also being reported as containing helium in a similar concentration to that found at Ooraminna 2.

Helium and Ooraminna Geological Structure

The helium concentration of the analysed gas in the Ooraminna 2 well was a fairly consistent 0·22 mol%. This is not high, especially when compared with what was found in the Magee 1 well (6·2%-1992, EP 82) , however it is high when compared with some project input gas where helium is recovered from the tail-gas of LNG production, eg Qatar 0·04% and India 0·05%.

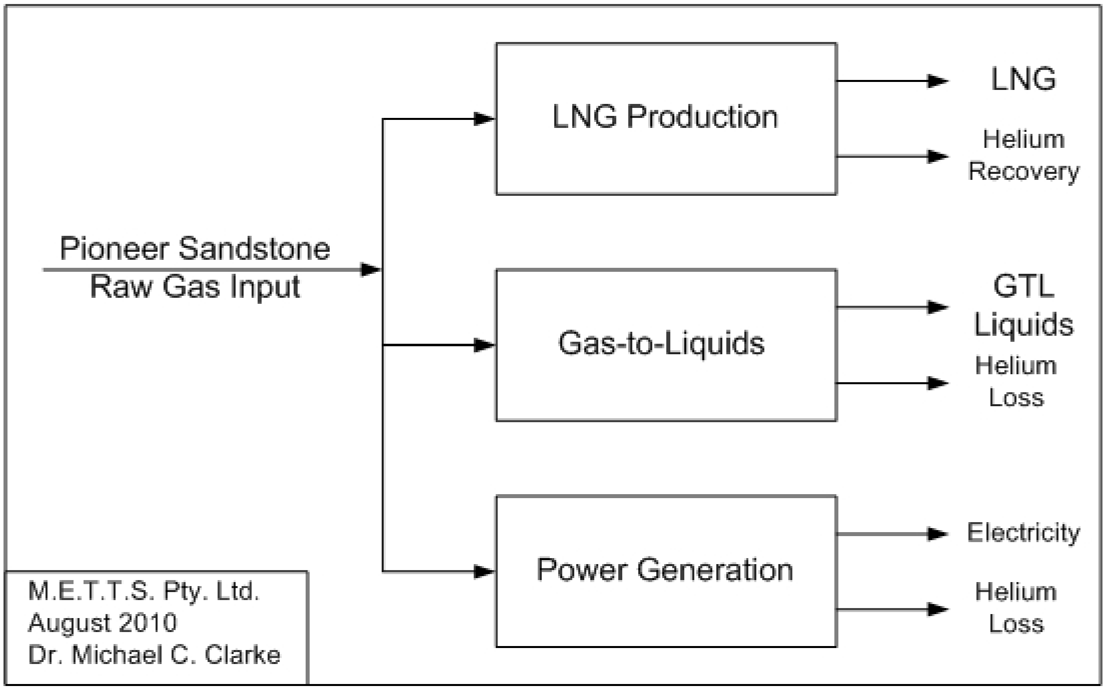
To produce commercial quality LNG most of the nitrogen would need to be removed. The separated nitrogen would host the helium (and argon if present) and thus the concentration of helium in the separated nitrogen would be around 2·3%. This is a relatively high helium percentage for subsequent separation.

Note 1: The source of helium that is produced at the new BOC-Linde Helium Plant in Darwin is natural gas from offshore gas production that goes through a LNG plant. The LNG tail-gas going into the Darwin BOC Helium plant has reported average helium content of around 3%.

Note 2: It is noted that helium at 0·15% was found in the Palm Valley gas by its operators, and at one time this helium was considered to be of national strategic importance, with possible embargos on extraction being considered.

Considering analysis of the helium found at Magee 1, Ooraminna 2 and the Palm Valley Field, it is fair to consider that Central Australia is a potential helium province that may be developed in the future subject to proving of sufficient volumes of gas with similar compositions .

Some Possible Processing and Production Scenarios (subject to sufficient gas being proved and extractable)



For LNG production a 'pure' natural gas (methane) feed is required. With respect to Ooraminna 2 gas, this is 'pure' with the exception of the high nitrogen content. To produce LNG from this gas the nitrogen would need to be removed, with this being a cryogenic (low temperature) process. Since helium exists in the feed gas, and will report to the nitrogen stream during separation, the recovery of helium will cover the cost of nitrogen extraction, and where in sufficient quantity, may produce a positive and substantial additional cash-flow over that obtained from LNG sales.

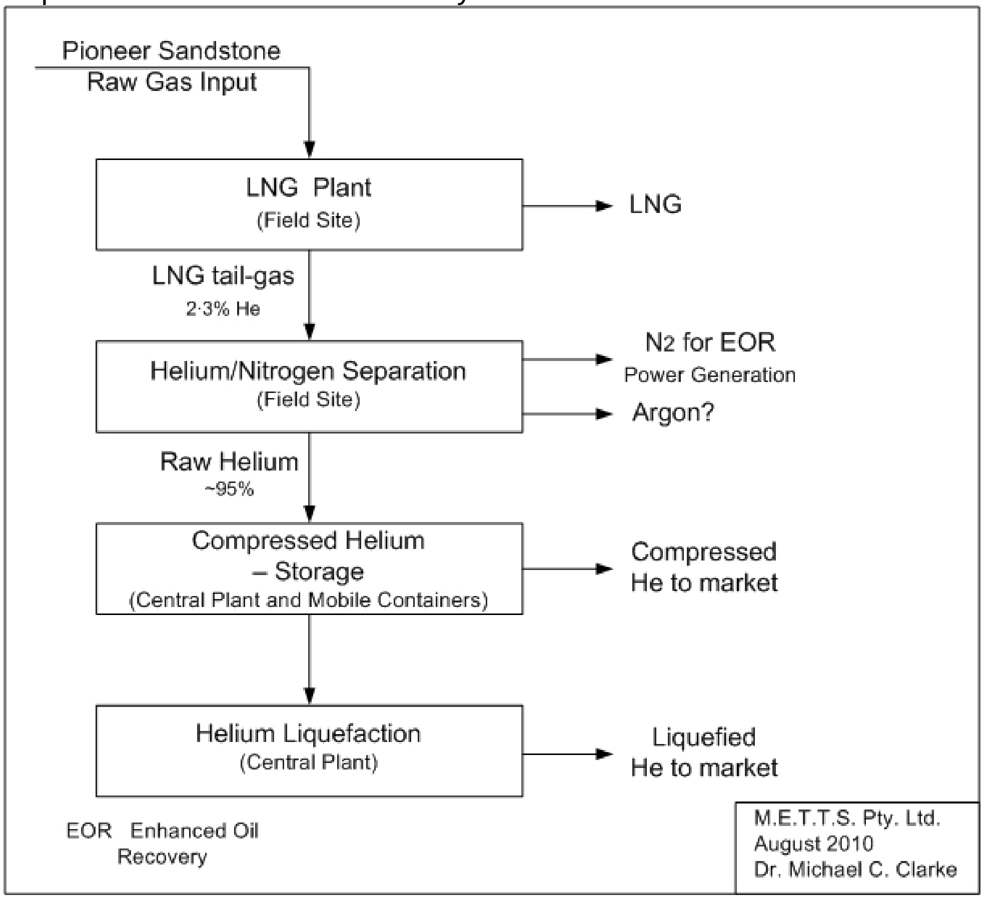
If nitrogen (with helium) was removed from the gas stream, the residual nitrogen stream, following helium stripping, could find use as:

- an inert gas for drilling,
- a gas for enhanced oil recovery,
- as a fire suppression agent, and/or
- as a complementary gas in power generation through expansion in gas turbines.

Note: The production, use and marketing of nitrogen would essentially be a cost recovery operation. If the nitrogen was utilised in power generation, there could also be some additional benefits through lowering the overall process carbon footprint.

In a Gas-to-Liquids and/or power generation operation, the nitrogen (and helium) would not be separated and would pass harmlessly into the process waste stream thence to atmosphere. Its recovery would not be economically feasible in these utilisation options.

The Pioneer Sandstone raw gas would be relatively simple to process in a LNG process train, with pre-treatment to remove carbon dioxide and hydrogen sulphide not being required, whilst the cryogenic plant would only be required to separate methane from inert gas (nitrogen and helium), with the small quantities of C_{2+} fractions being soluble in the LNG. Argon if present could be separated, or included in the nitrogen by-product. The processing would be split between field sites (LNG production) and a central helium processing plant – see the M.E.T.T.S. and Negotiaction Helium Reports – announced to the ASX by Central on 10.04.19.



If Pioneer Sandstone Gas wells can be aggregated to produce a commercial resource, then the production of liquid helium at a central processing plant may be possible, along with a valuable LNG stream produced at one or more sites. If Magee and/or Mt Kitty produced more concentrated helium, that could be purified and liquefied at the same central plant, possibly located at the Brewer Industrial Estate.

Medium Sized Processing Facilities in Central Australia

The Brewer Industrial Estate (E133·837, S23·881) is a dedicated industrial estate 25 km south of Alice Springs. It has hosted a mini-LNG plant (20tpd) that is now mothballed and is ideal for petrochemical industries. It has excellent logistics, since it is astride the Stuart Highway and the Adelaide-Darwin railway. It also has good proximity to a city (Alice Springs) and a workforce. For a medium sized processing operation, it offers existing infrastructure and hence lower set-up costs.

For the potential monetising of future production of hydrocarbons (LNG and GTL liquids) and helium, the Brewer Estate may provide a good base of operations and it is important that Central has significant Pioneer Sandstone gas prospects within 100 km of its centre.

Helium Production and Demand, in Australia and Beyond

Negotiaction Ltd found in March 2010, that, ‘Helium demand is being driven by the electronics sector, namely display panel and semi-conductor manufacturing in Japan, China, Korea and Taiwan.’

Australia (Darwin) produces around 2 – 3 % of World Demand (BOC-Linde 2010), which is equivalent to Australia's demand. If Asia's demand for helium continues to grow, there will be need for future helium production which may come from resources controlled by Central Petroleum Ltd. It is significant that Centrals exploration ground includes extensive geological fairways favouring the entrapment of helium at various stratigraphic levels.

Dr Michael Clarke-METTS Pty Ltd
November 2010

References :

- **ASX Announcement April 19, 2010**
- **April 2010 Preliminary Pre-feasibility Study on Low Volume Commercial Extraction of Helium-METTS Pty Ltd and Duncan Seddon and Associates Pty Ltd**
- **April 2010 Preliminary Report : Supplying Helium to Asia and Factors Influencing future Helium Pricing-Negotiation**

Annexure 1

Resume: Michael Cassin Clarke (ADB – Format)

1.	**Name of Expert**	Michael Cassin Clarke		
2.	**ADB CSRN**	-------------		
3.	**Position**	Consultant		
4.	**Date of Birth**	July 14, 1948	**Citizenship**	Australian
5.	**Education**	*Degree*	*Date*	*Institution*
		PhD, Chemical Engineering	1988	University of Sydney, Australia
		Dip. Ed. Technical	1984	Newcastle CAE, Australia
		MEngSc. Mining	1976	University of Sydney, Australia
		BE (Hons). Mining	1972	University of NSW, Australia
		Cert. Risk & Hazard Identification	2000	University of NSW, Australia
6.	**Membership in Professional and Honor Societies**	Registered Professional Engineer Qld. Mining & Chemical Fellow, Institution of Engineers, Australia (FIEAust.CENTRALEng) Member, Chem & Env Colleges Fellow, Australasian Institute of Mining and Metallurgy (FAusIMM) Past Member, Australia-Philippine Business Council (APBC) Associate Member, Federation of Engineering Institutions of S.E. Asia and the Pacific (FEISEAP) Member, Waste Management Association of Australia Member, Australian Nuclear Association - Queensland Member, Australian Coal Preparation Society, Qld Chapter Member, International Advisory Committee on Combustion, Incineration, Pyrolysis and Emission Control – JGSEE, King Mongkut University, Bangkok – since December 2008		
7.	**Other Training**	Licensed Powderman, NSW Blasting Explosives Explosive Gas Tester, NSW Coal Industry		
8.	**Countries of Work Experience**	Australia, Indonesia, Philippines, Pakistan, Thailand		

9.	**Language and Degree of Proficiency**	*Language*	*Reading*	*Writing*	*Spoken*
		English	Excellent	Excellent	Excellent

10. **Employment Record**

From: 1989 **To:** Present
Employer: METTS Pty. Ltd. Consulting Engineers: Infrastructure and Resource Development & Environmental Management, Brisbane, Queensland
Position Held: Principal (Own Consulting Firm)

From: June 2000 **To:** Nov. 2003
Employer: Griffith University,
Position Held: Senior Lecturer, Environmental Engineering

From: 1982 **To:** 1988
Employer: New South Wales, Dept of Technical Education
Position Held: Lecturing in Coal Mining

Work Experience

11. Energy Related Work	12. Work Undertaken that Best Illustrates Capability to Handle the Tasks Assigned
	Consulting to Central Petroleum Ltd. Helium processing and logistics, LNG and coal logistics – 2009/2010. Extended consulting
	Consultant to the Asian Development Bank, Carbon Capture in S. E. Asia, Technical Assistance. October – December 2010
	Consulting to Thermotek on options for extraction of coal wastes from tailings dams – 2009 – completion of BMA study.
	Consulting to Knetic Energy Ltd on Biomass Gasification for Power Generation, Feb/March 2009
	Consulting to BHP-Billeton Mistsubishi Alliance (BMA – Coal) on coal recovery from tailings, late 2008
	Consulting to Ellis Engineering on Small and Remote Power Generation using Coal Wastes and Biomass, late 2008.
	Consulting to EESTech on Carbon Capture Technology, late 2007 and early 2008; project was expected to restart late 2009
	Formation of Power Factor Correction Technology Pty Ltd, with John Garrard: Theme - the development and use of intelligent PFC technology June 2008
	Queensland Centre for Advanced Technology/CSIRO - Brisbane April/June and September/October 2006 Consulting on particulate emissions control using ultrasonic plant. The control systems were designed for underground diesel coal mining plant.
	Review of Combustion Plant, Late, 2005, Brisbane, QCAT/CSIRO/ComEnergy–Brisbane, Consultant Consulting on the effectiveness and safety of the ComEnergy Rotary Kiln combustion unit.
	Heat Supply for Cane Drying, March/June 2005 Nambour, Queensland, Australia, Biocane Ltd, Consultant Consulting on the design and construction of a coal fired Fluidised Bed Combustor for cane drying.
	Coal-To-Liquids Project Scoping, June-December, 2004, Brisbane, CSIRO (through Dr Patrick Glynn) sub-consultant Proposal with scoping engineering for the production of coal to liquids for two central Queensland collieries. Fuel and process review.
	Coal Lease Appraisal, 1983 Mudgee, New South Wales, Gold Mines of New England: mining engineer The appraisal of the Genders coal leases of the Mudgee region for utilisation in local power stations. Work carried out in association with Eng. John Hodge.
	Coal Ash Utilisation, 1988, Hunter Valley NSW, Donald Catchpool: mining engineer Undertaking studies of coal ash utilisation options
	Energy from Waste, Cebu, 1993–97, Philippines, SEAPC: team leader and project design engineer Team leader of the SEAPC consortium in the design of a co-fired

	(wastes and coal) fluidised bed combustor, Cebu, Philippines. Dorr-Oliver, ABB, Flakt and Barkley Mowlem corporate team members.
	Engineering Laboratory Design, 1998, Indonesia, OPCV/ADB Specialist Engineer The design of engineering laboratories with inclusion of clean coal technology in Indonesia. The project was ABD financed.
Environmental Engineering/Power	A Review of Carbon Capture Technology, Nov – Dec 2007, Brisbane, EESTech. Consulting Engineer The review of an amine carbon capture system in post combustion and the utilisation of the captured carbon dioxide in Enhanced Oil Recovery.
Environmental Engineering	Energy Efficiency 2003 Brisbane, P&H Shovels: Mining /Environmental Engineer *Consulting to P&H Shovels on the emission intensities of diesel versus electric mining plant. (Work carried out as an academic for Griffith University.),*
Water Technologies	Consultant (in-house) to TSI-Asia Ltd (Bangkok) desalination technologies, December 2008 – May 2009.
	Thermal Desalination Process Design2004 – 6, Queensland, Aquadyne Ltd : Team Leader process validation Consultant to Aquadyne Ltd. (water purification engineers, Queensland). The use of thermal desalination plant, either alone or as a hybrid with Reverse Osmosis plant.
Education, Training and Skills Transfer Activities	Mining Education, 1983 – 86, New South Wales, NSW TAFE: Teacher-in-Charge, Mining Teaching at a coal mining institute (Kurri Kurri College of TAFE, New South Wales); including new course design in coal mining, preparation, environment and management.
Project Management with skills transfer	Petrochemical Plant Shutdowns. 1986-93 Sydney Techniskill, Project Manager Providing industrial worker induction for Tecniskill Co-operation Ltd, facilitation engineers.
Research work in terms of Articles, Publications and Conference Presentations	**Recent Articles/Papers** Underground Coal Gasification – Coal Seam Methane, Interrelationships and synergies. AusIMM Bulletin, No1 February 2010, pp 51 - 54 Security Ramifications for Power Generation, Energy Generation, Oct-Dec 2009, pp 51-53 Energy Efficiency in the Developing World, July 2009 Asian J. Energy & Env. 2009, 10(03), pp 133-141 Environmentally Friendly Minerals Transport, M. C. Clarke & R. A. Beatty, AusIMM Bulletin, July/August 2008 Desalination in Mining. The Australian Mining Club Journal. December 2006 Coal Seam Methane Associated Water, a barely tapped asset. The Australian Mining Club Journal. February 2006. Co-firing Wastes; an innovative technology. P. Glynn and M. C. Clarke, Inside Waste, WMAA, October 2005. Managing Asbestos. P. McGarry and M. C. Clarke.

Inside Waste, WMAA, October 2005.

Business Continuity Management in the Mining & Energy Industries. The Australian Mining Club Journal. October 2005.

Risk Management: Tsunamis and the WA petroleum Industry. The Australian Mining Club Journal. June 2005.

Coal-to-gas-to-liquids, energy security for Australia. The Australian Mining Club Journal. February 2005.

Spontaneous Combustion: The curse of coal miners and a health and environmental hazard to all. The Australian Mining Club Journal. November 2004.

Energy Security, Business Continuity Management and the Terrorist threat. The Australian Mining Club Journal. September 2004.

Disappearing environmental opportunity – the proper use of waste coal as an environmental measure. The Australian Mining Club Journal. March 2004.

Recent lectures, talks and interviews.

Bio-fuels: Solution or Spin. Joint Speaker, SSEE IEAust, Engineering House, Brisbane, July 16, 2008

The Use of Waste Coal as Resource Recovery and Environmental Management Measures, Coal Refuse Conference, Hunter Valley, NSW, Nov. 30, 2009

Sustainable Coal. Gust speaker. JGSEE, Bangkok, January 24, 2008

Desalination for Queensland: ABC Radio Queensland, 4:30 pm 12th September, 2007

Coal in Asia. Two Talks. ADB Manila June 2007 and EGAT Bangkok October 2007.

Continuity in the supply of energy & water. Continuity Forum, KPMG Brisbane, 1st Nov. 2006

Nuclear Energy for Desalination: ABC Radio Queensland, 4pm 28th June, 2006

Review Papers and Conference Presentations

Clean-Coal-Technology and Enhanced Oil Recovery, Matches and Mismatches. The Environmental Engineer, 10(3), 2009

Energy Security and Power Generation, Asian J. Energy & Env. 2009, 10(04), pp 194-200

Coal versus Nuclear. ANAQ – Conference, Brisbane, September 2009

Energy efficiency: scope, benefits, synergies and pitfalls for the developing world, Asian J. Energy & Env. 2009, 10(03), pp 133-141

CTL/GTL Products, their transport, processing and meeting market expectations. Coal-to-Liquids/GTL Conference, Brisbane, February 2009

Manure-to-Power, JGSEE CIPEC Conference, Chaing Mai,December 2008

Carbon Dioxide, Geo-sequestration and Enhanced Oil Recovery - Synergies and Pitfalls" - has been accepted and added to the EzineArticles.com directory: Jan. 2008 http://EzineArticles.com/?id=891812

Clean Coal Technology: How CLEAN is it and how CLEAN can it be? M. C. Clarke & P. Bennett (ACIRL). IEAust. Brisbane, October 8, 2007

Clean and Secure Transport Fuels for Australia, Challenges and Promise. Invited presentation to the CTL/GTL Conference Brisbane. February 22/23, 2007.

Co-firing Domestic Waste with Energy Recovery as an Environmentally Sound Incineration Practice, M. C. Clarke and P. Glynn, The Environmental Engineer, Vol 7, No 2, Winter 2006

Desalination and Queensland Water. Conference Presentation. Queensland Water Conference, Aug. 29 - 30, Brisbane Australia, 2006 (informa.com.au/qldwater06)

Desalination and Power Generation: their interrelationships. Conference Presentation. Water Management in Power Generation, June 26 - 27, 2006, Brisbane Australia (informa. com.au/waterinpower)

Clean Water from Clean Gas – A Possibility. The Environmental Engineer. M. C. Clarke and C. Putt. Vol 7, No. 1 Autumn 2006

Managing the Terrorism Threat. Journal of Homeland Security and Emergency Management 2(4), Article 8, 2005.

Terrorism, Engineering & the Environment: their interrelationships. Terrorism & Political Violence, Volume 16, Number 2 / April–June 2004, pp 294-304

Bushfire, Storms and Soil Erosion. A. P. Hammond and M. C. Clarke. National Environmental Conference, Brisbane June 2003.

The Missing Link in Clean Coal Technology; the Proper Use of Waste Coal as an Environmental Measure. The Bulletin, AusIMM, No. 2. March/April 2003

Cleaner Production: An ASEAN Case Study The Environmental Engineer, Vol. 4 No 1, Autumn 2003.

The Business Case Against the Ratification of the Kyoto Protocol. The Environmental Engineer, Vol 3, No 3, Spring 2002

The Realities of Solutions to the Energy Question; are Renewable and Sustainable Options Practical? 4th Queensland Environmental Conference, Brisbane, May 30/31, 2002.

Coal. It Future as a Fuel, and the Environmental Ramifications of its Use. M. C. Clarke & A. H. Rintoul. Presentation to the 'Four Societies - Australian Nuclear Assn., The Royal Soc. Of NSW., Australian Inst. Of Energy and Inst. Of Engineers, Australia, February 13, 2001. Harrick's Auditorium, IEAust. Sydney.

Burning Natural Gas with Increased Radiance. M. C. Clarke and D. R. Ebeling. Chemical Engineering in Australia, Vol 22, No. 2, June 1997.

Sewage and Waste Management in Cebu - The Future. Seminar presentation for The Philippine Department of

	Science and Technology, Division 6. Sep. 1996, Cebu City. Philippines - The Outlook for Domestic Coal Production and Imports. World Coal Outlook Conf., Sept 13, 1995, Sydney Options for the Conversion of the Bataan Nuclear Power Plant to Fossil Fuel Firing. M. C. Clarke, D. R. Ebeling and D. L. Cordero. Conference: Energy Efficiency and Demand-Side Management. Manila Philippines, January 1995.

13. **Certification**

I, the undersigned, certify to the best of my knowledge and belief state that this CV correctly describes my qualifications, and my experience

Michael C. Clarke	March 1, 2010
Michael C. Clarke	Date of Signing

M.E.T.T.S. Pty. Ltd.

ABN 66 050 710 015
Consulting Engineers, Resource & Infrastructure Development
Dr. Michael C. Clarke, CPEng., F.I.E.Aust., F.Aus.I.M.M., RPEQ. Managing Director

in association with

Duncan Seddon and Associates Pty. Ltd.
ABN 84 679 534 269
Dr. Duncan Seddon, FRACI, MSPE, Managing Director

Preliminary Pre-feasibility Study on Low Volume Commercial Extraction of Helium for Central Petroleum Limited

16th April 2010

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EXPLANATORY STATEMENT

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7. Consent

The authors give their consent to the public release of this report and/or any conclusions reached therein to the Client without reservation other than expressed herein.

Disclaimer

Dr. Michael Clarke, the CEO of M.E.T.T.S. Pty. Ltd. holds 120,000 CTP shares and 200,000 CTPOA options. Dr. Clarke purchased these shares and options on the market. 120,000 CTP shares and 100,000 CTPOA options were purchased before he undertook any consulting for Central Petroleum Ltd.

Acknowledgements

This Preliminary Report has been produced by M.E.T.T.S. Pty Ltd (Dr. Michael Clarke) in association with Duncan Seddon and Associates Pty Ltd (Dr. Duncan Seddon) at the request of Mr. John Heugh, MD Central Petroleum – see Annexure 1. The Report has been written with the acknowledged inputs from:

David LaFerla and Johnathan Gomez of Negotiaction for their major contribution understanding helium markets and pricing – see Annexure 2.

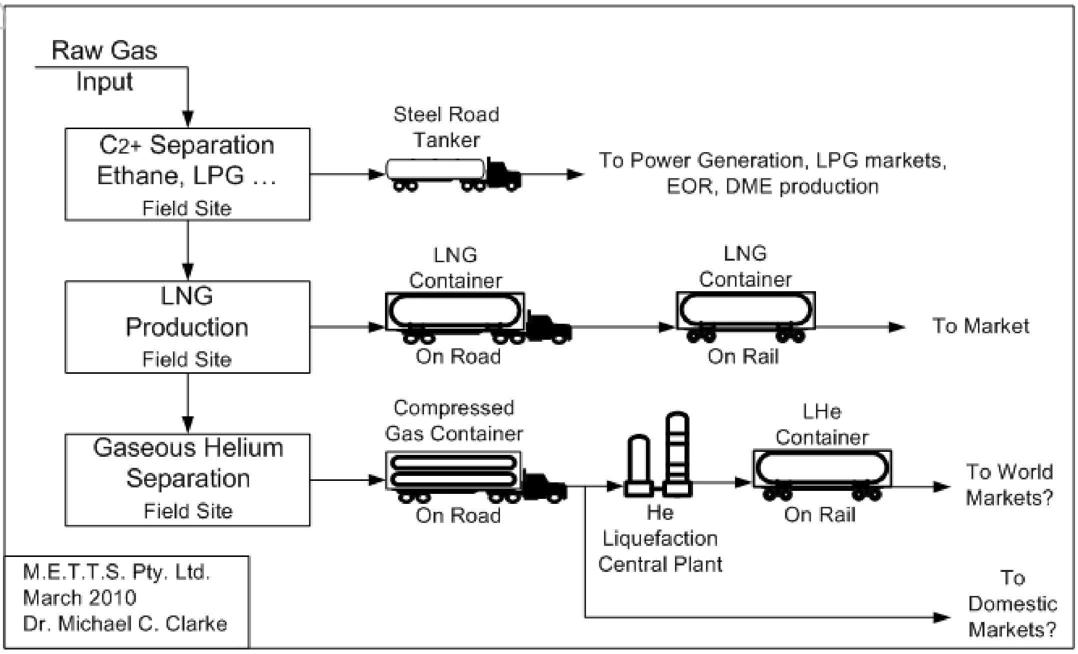
Ben Hooker (Newpoint Gas),
Dr Arne Jakobsen (Hamworthy),
Dr. Clarence Hardy,
David Parkinson (FreightLink),
Dr. Michael Nesbitt (Port of Darwin), and
David Holt (HCP).

The resumes of Drs. Clarke and Seddon are presented in Annexures 6 and 7 respectively.

Study Highlights

Central Petroleum Ltd ("CENTRAL") has sought to create a pathway for the monetisation of its potential helium resources and associated hydrocarbons. This study that has created that pathway is based on the helium content of a previous technically successful gas gas-well that was drilled at Magee, Northern Territory in 1992 by Pacific Oil and Gas.

The pathway can be described in the following figure:



Products, Returns and Project NPV

- The three principal products are, A-grade Liquid Helium (>99.995% purity), Liquefied Natural Gas (LNG) and Liquefied Petroleum Gas (LPG). The production scenario and gross cash inflows are described in the following table based on the only known composition from the Magee 1 well:

PRODUCTS	tonnes/ day	$/tonne	Annual Return from Sales $AUm	Monetisation Basis
HELIUM	6·032		64.8	$US 135/1000 SCF, CIF*
HELIUM	6·032		84.0	$US 175/1000 SCF, FOB, Darwin
LNG	157·76	500/1000	26.1/52.2	Sale to local road and rail transport
LPG	36·34	600	7.2	Sale to local energy users
			98.1/143.4	Yearly Gross Revenue
NPV $AU 110.6m (base $US 135/1000 SCF CIF*) **$AU 555.6m** (base $US 175/1000 SCF FOB Darwin)				

*A nominal North Asian port destination

- The split of returns from products sales strongly points to the importance of the helium product, however LNG and LPG will be significant contributors to the cash-flow,

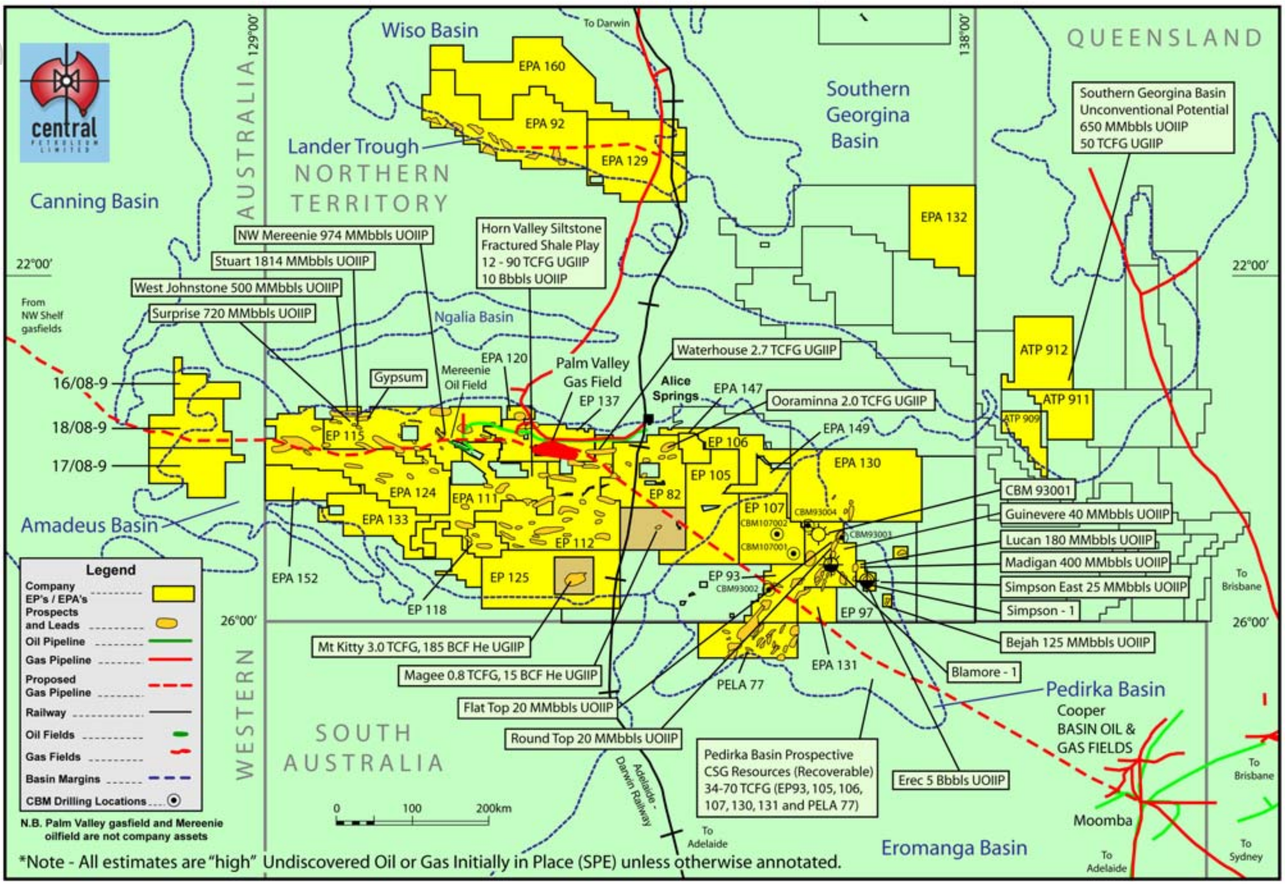
- LNG produced from the helium recovery operations could conceivably be supplemented by methane production from other future resources, including methane from Underground Coal Gasification in other CENTRAL project areas,

- The gross annual return from helium sales would be around $AU 64,800,000. The revenue from all gas sales (He, LNG and LPG) is estimated to be $98,100,000. At a more optimistic price of $US 175/1000 SCF FOB Darwin, the revenue increases to $AU 143,400,000 for total gas sales.

- In discussions with the nominated fabricators of the major plant items, they stated that CAPEX savings of up to 30% could be achieved if (when) they moved their manufacturing facility from the USA to Asia,

- Returns from helium sales are twice as great as from LNG and LPG combined, however the LNG and LPG prices are related to the oil price, a price that is increasing since the end of the GFC, and

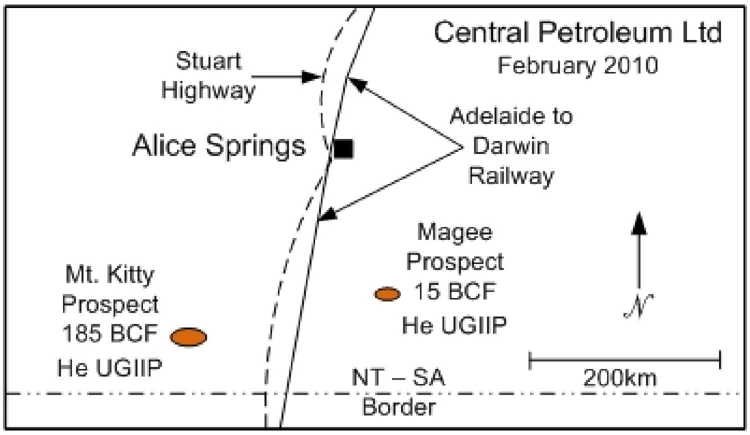
- The recent move towards using LNG for long distance road (and rail) transport (as discussed at recent – 2010 – CSM and shale-gas conferences in Brisbane) will probably create new markets for LNG for which the CENTRAL prospects are well placed. Prices ‘at the pump’ could exceed $AU 1000 per tonne for direct retail supply.



Executive Summary

This desktop study has two major themes, these being firstly the understanding of separation technologies applicable to helium production from Central Petroleum's helium prospects, and the second being the delineation of logistics scenarios for those products. Since CENTRAL does not yet have helium production wells, a scenario based on four 'STANDARD WELLS' situated in two small regional gas-fields producing twenty million standard cubic feet per day (20 MMSCFG/day – 566,400 scm/day) with gas concentrations the same as the 1992 Magee 1 well-flow, was used for technology selection and calculations.

Two helium prospects have been selected from a number delineated by Central Petroleum. These are the Mt. Kitty and Magee prospects being the most advanced. Magee is slated for redrilling in 2010 subject to various contingencies. As can be seen from the map below, they straddle the Adelaide to Darwin Railway and the Stuart Highway and are in reasonable proximity to Alice Springs.



A simple map of the Mt. Kitty and Magee helium prospects.

UGIIP – Undiscovered Gas Initially In Place at high estimate (the estimated resource)

The original Magee well flowed gas with the following composition:

Gas	CH_4	C_2	C_3 – C_4 (LPG)	C_5 – C_{6+}	CO_2	N_2	He	Ar	SE
%	39·3	6·1	3·0	0·5	0·8	43·6	6·3	0·5	22·9 MJ/m^3

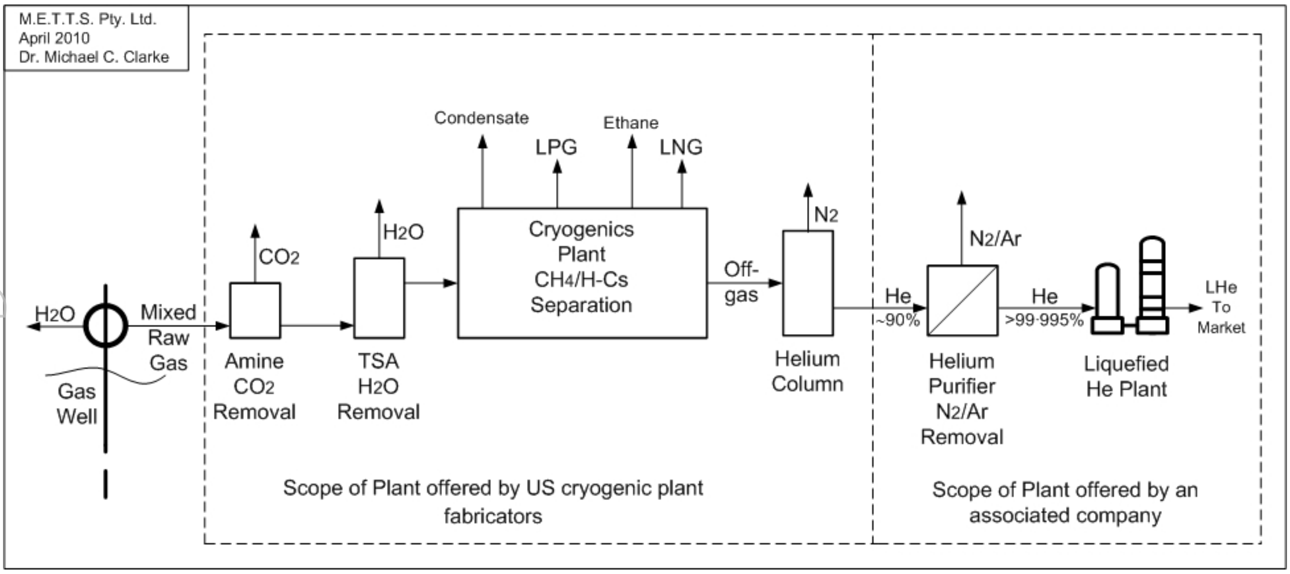
With a helium content of 6·3%. the 'Fields' could be expected to produce around 1,260,000 SCF/day (or 35,600 scm/day) with an expected 100% He recovery. This production translates into a gross return on helium production of $US 170,000 ($AU 200,000) per day, at a conservative liquid helium price of $US135/1000 SCF ($US 4·8/scm) at point of sale – CIF a nominal North Asian port. The gross annual return from helium sales would be around $AU 64,800,000. The revenue from all gas sales (He, LNG and LPG) is estimated to be $98,000,000. At a more optimistic price of $US 175/1000 SCF FOB Darwin, the revenue increases to $AU 143,400,000 for total gas sales

The choice of processing plant has involved the consideration of many factors. These have included the form in which products are produced (eg as compressed or liquefied gas), the maximising percentage recovery, understanding full scope of products, and the logistics of plant location and transport.

It was found early in the study that there were no suitable 'off-the-shelf' plants available, and that a plant to fit the projected situation, as is now envisaged, was required to be designed. A number of gas plant designers and fabricators were approached, however these companies were on the whole not prepared to undertake even pre-feasibility design and budget costing at this early stage of development of the proposed project. A US cryogenic plant design and fabrication group was approached for a pre-feasibility study (with budget costings). That group through its engineers/directors has provided such a budget costed pre-feasibility report.

In the figure below, the production of crude helium (to 90% He by volume) is envisaged close to the wellhead (remote site). That crude helium will be transported to a central purification and liquefaction plant situated in the Alice Springs vicinity. The primary product from the central processing plant would be liquid A-Grade helium (>99·995% He), with the possibility of some production of A-Grade compressed helium, plus liquid nitrogen (required for liquid helium transport).

Note 1. Negotiaction (see Annexure 2), suggested a more optimistic liquid helium price of $US 155/1000 SCF to $US 175/1000 SCF FOB Darwin.



Separations and Gas Flows

Budget Costings for Separation Plants

The hydrocarbon cryogenic plant inclusive of carbon dioxide and water stripping, C_2 – C_4 plus condensate recovery, LNG production and raw helium production, is budgeted at $US 45m each with two being required. The helium purification and liquefaction plant with capacity to service two 10 MMSCF/day plants is budget priced at $US 35m.

Gas Logistics and Transport

During the study the feasibility of major bulk gas/liquid product movements using a ‘rolling pipeline’ became very apparent. The rolling pipeline is a series of road and/or rail, trailer/flat-top mounted containers carrying compressed gas or liquefied gas. For compressed gas two systems were evaluated (so far as available information allowed) these being the mini containers and the other composite tubes. The composite tubes system appears most suited for transporting gaseous helium.

Liquid helium transport using the specialist 41,000 litre LHe container that is being adapted to rail transport is the likely choice for sending helium to market [2]. The combination of the composite tubes system [3], [4], for gaseous helium cartage to the liquefaction plant thence liquid helium cartage in the specialist rail container appears to be an excellent combination of two technologies, with four composite tube units being required to fill one specialist LHe container. It can also be noted that both container systems can be trans-loaded from road trailer, to rail and thence to ship.

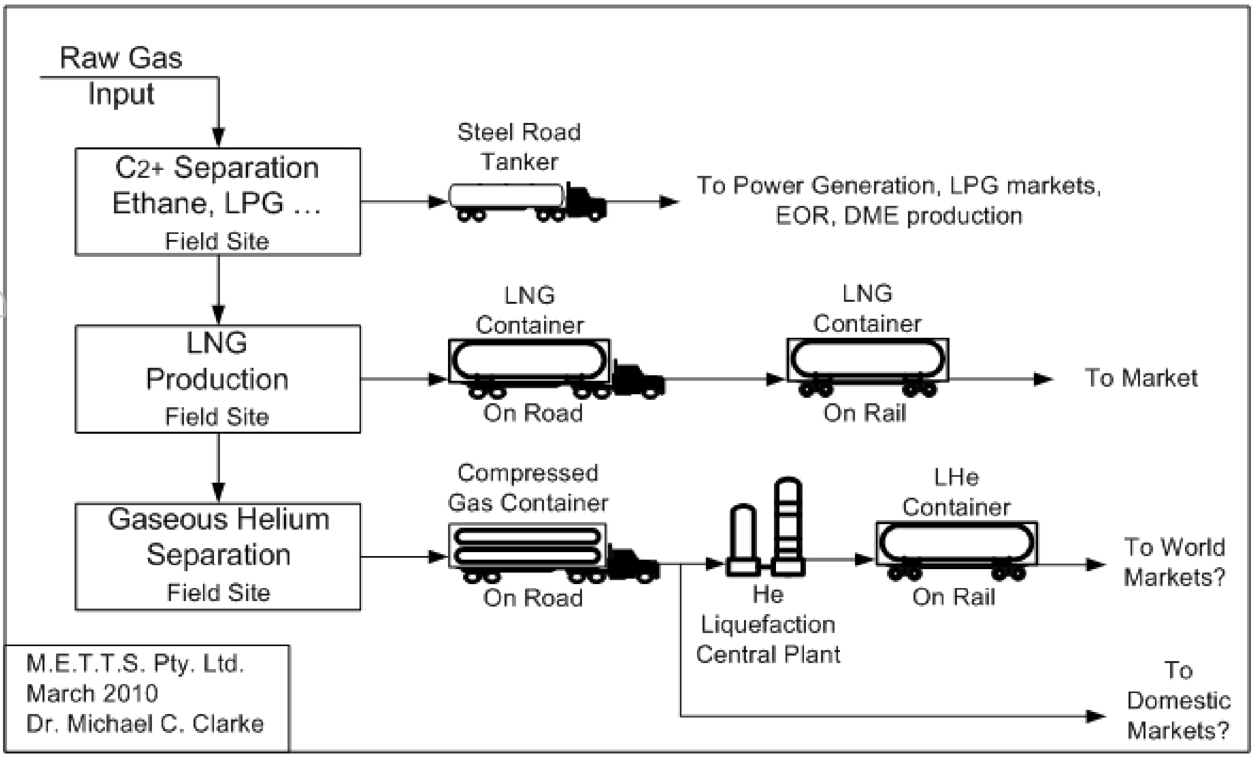
At a budget price of $US 1·2m per specialist liquid helium rail container the units are expensive, and multiple units will be required, with some being filled, some in transit (rail and ship) and some being discharged at their destination.

Note 2:The use of these units gives Central Petroleum the chance of being independent of other helium producers in seeking to enter the World helium market.

Note 3: The composite tube compressed gas units, at a budget price of $US 450k may offer the prospect of compressed helium haulage to Adelaide and thus access to the Australian market.

Note 4: It would be counterproductive to re-gasify this LNG to facilitate CNG transportation. The following is a three product, C_{2+} gases, LNG and He, separation and logistics schematic.

A local LNG handling group recommended that LNG road/rail containers (40' ISO) with a capacity 18 metric tonnes of LNG be used for methane transport. This is equivalent to 24,500 scm (870,000 SCF) of gaseous methane. The budget price of LNG rail containers is $US 200,000 each. The LNG could be offered of the Darwin LNG trains as additional pre-prepared product.



A three product production and logistics schematic emphasising the use of the rolling pipeline

The production of helium during a 330 day production year would be around 1635 kL which is equivalent to 380 x 41 kL tanker loads of LHe. With a 30 day turnaround, and some spare capacity, 32 LHe container tanks would be required, at a budget cost of $AU 45m. An 113kL LHe storage tank will cost around $AU 2·9m, whilst compressed gas tankers that will transport the raw helium from the remote sites to the central purification and liquefaction plant (x 4) will cost around $AU 2.4m.

Project Finances and Projections

Project Finance Summary

Summary Item	Helium Sales – CIF N. Asia $AUm pa	Helium Sales – FOB Darwin $AUm pa
CAPEX	420.7	420.7
OPEX	38.2	33.6
Discounted after tax earnings (20 years)	531.3	976.3
NPV	110.6	555.6

In the above table two sales scenarios are presented. The first is a CIF price to a N. Asian Port, nominally Busan, Korea and the second price an FOB price, Darwin Australia. (Busan is chosen since it has been stated to be the destination of the regionally produced helium exported out of Australia and Busan is also the 5th largest port in the world and a hub for goods and materials transport in N. Asia.) Darwin FOB offers the chance for future customers to take control of their purchases as they leave Australia.

The prices of helium are drawn from the Negotiaction report. The lower price $US 135/1000 SCF is extracted from the Text Box of the Negotiaction Report – Annexure 2 (page 44 of this consolidated report), whilst the higher US 175/1000 SCF, from the figure on page 47 of the same report.

Both scenarios show positive rates of return, and the figure FOB Darwin shows the advantage of finding customers willing to take LHe product FOB Darwin. Note: If higher prices can be found for sales of LNG and LPG the profitability of the whole project will increase.

As more plant fabricators become available (outside the USA), there could be opportunities for significant reductions on CAPEX. This would also assist the bottom line of this project and future hydrocarbon monetisation projects based on CENTRAL's other possible resources.

Index **Pages**

Glossary

Ar	**argon**
C_{2+}	**Ethane (and/or ethylene) plus heavier gases and liquids**
CSM	**Coal Seam Methane**
CHe	**Compressed helium gas**
CH_4	**methane**
CO_2	**carbon dioxide**
COS	**carbonyl sulphide**
CENTRAL	**Central Petroleum Ltd**
DME	**Dimethyl Ether**
EOR	**Enhanced Oil Recovery**
F-T	**Fischer Tropsch**
He	**helium,**
LHe	**Liquid helium**
LN_2	**Liquid nitrogen**
SCF(G)	**Standard Cubic Foot (Gas)**
MMSCF	**One million SCF)**
BCF	**Billion Cubic Feet**
TCF	**Trillion Cubic Feet**
scm	**standard cubic metre (also known as a normal cubic metre - Nm^3)**
tpd	**tonnes per day**
UCG	**Underground Coal Gasification**

Unit Conversion

Ten MMSCF ≈ 283,200 scm (Note: One standard cubic foot is equivalent to 0·02832 standard cubic metres)

Notes

1. This report is written using SI units, as is now Australian practice in commerce, industry, engineering and science. Some American customary units, that are still common in petroleum engineering, are mentioned, specifically Standard Cubic Feet and Standard Cubic Feet per day when referring to gas quantities and flow. The quantities and flows in SI units are however also provided.

2. Central Petroleum will use Rolling Pipeline as a generic descriptive of road/rail transport for rapid bulk gas movement.

3. Definition of Stranded Gas: “Gas is considered stranded when it is not near its customer and a pipeline is not economically justified.” Dr. Michelle Foss, Centre for Energy Economics, University of Texas, Jan. 2007.

4. The original Terms of Reference divided the duties for undertaking this desktop study amongst three specific groups. Since the receiving those ToRs (week 1, October 2009) the participants have changed and thus duties division has changed. The content of this report reflects those changes.

Concept, focus and structure of the study

Concept and Focus

The main focus of the study is to be on the possibility for short-term cash flow initially (John Heugh, October 2009). Towards that end a group of engineers and engineering consultancies were asked to participate in a study that concentrated on the Helium prospects of Central Petroleum, prospects that are soon to be the subject of a drilling exploration programme. On the 4th October 2009 a general proposal Terms-of-Reference (see Annexure 1) was agreed upon.

Central Petroleum expects to be drilling two prospective areas for Helium during 2010. The prospect areas of focus are Mt. Kitty and Magee, with Magee having had a flow of helium rich gas during past exploration. The areas are roughly located as indicated in Figure 1.

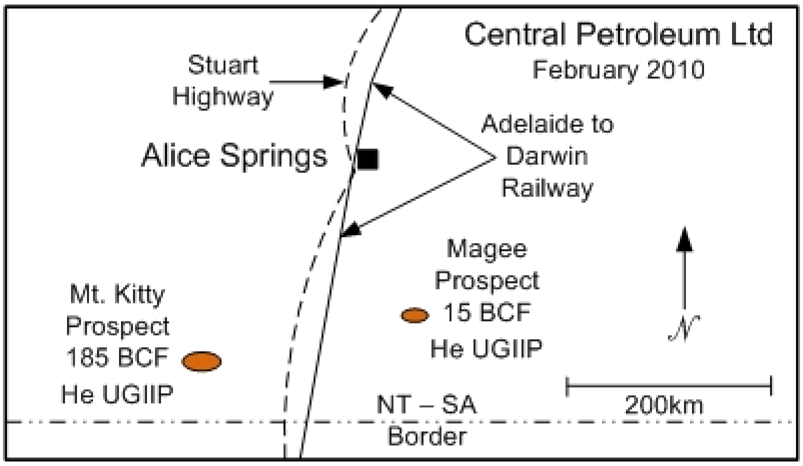


Figure 1. A simple map of the Mt. Kitty and Magee helium prospects.

UGIIP – Undiscovered Gas Initially In Place (the estimated total helium resource)

Estimates based on seismic studies and the understanding of similar structures in other helium/natural gas fields have produced estimates of 5·2 and 0·4 billion standard cubic metres (185 and 15 BCF) respectively for the Mt. Kitty and Magee potential helium fields. Along with the helium these prospective fields have the estimated potential to host up to 85 and 22 billion standard cubic metres (3·0 and 0·8 TCF UCIIP) respectively of natural gas, plus condensate credits.

Project Team Structure

This Preliminary Report has been produced by M.E.T.T.S. Pty Ltd (Dr. Michael Clarke) in association with Duncan Seddon and Associates (Dr. Duncan Seddon) with the acknowledged inputs of: Ben Hooker (Newpoint Gas), Dr Arne Jakobsen (Hamworthy), David Parkinson (FreightLink), Dr. Clarence Hardy and Doug White (Central Petroleum).

Dave Holt (HCP) has assisted with the financial analysis. Of notable later inclusion in the team is NEGOTIACTION Pty Ltd, a group that has been provided a good understanding helium markets and off-shore logistics – see Annexure 2.

The questions of raw product make-up, product separation, product usage scenarios and product logistics are however heavily interrelated and thus deserve an embracing and co-operative approach to the study.

Central Petroleum and its extended prospects

Central Petroleum Ltd operates the largest portfolio of exploration ground in Australia at over 250,000 km^2. The prospects include traditional oil and gas targets, over 170,000 km^2 of ground in the Amadeus Basin prospective for helium, and over two trillion tonnes of proven and probable coal resources.

The coal is generally too deep for traditional extraction for steaming or coking export sale and would need the development of very considerable infrastructure if ever traditional mining was to be considered. However the coal, and its associated strata, may host coal seam gas (SCG) but this has yet to be proven. The coal also has a considerable potential for Underground Coal Gasification (UCG), but again this potential needs to be studied further and if further drilling is successful, JORC compliant reserves estimated.

The immediate interest is in the Company's helium prospects. Two seismically defined large prospects have been mapped for early attention in helium exploration, these being Magee and Mt Kitty in the Northern Territory of Australia. The Company is presently devising an exploration programme for one or more of the prospects that is expected to the undertaken through 2010.

The Company wishes to have commercialisation options ready if discoveries are made. These options will include the separation and transport of helium and the separation, transport and use of co-separated gases, including hydrocarbons.

The prospectivity of the Magee lease is demonstrated by a previous well drilled in 1992, Magee 1 which flowed gas and condensate to surface with helium at a 'high' concentration of 6·3%. Unusually, the nitrogen content of this well was also high at 43·6% although high nitrogen contents are a characteristic of helium producing gases in similar geological environments in the SW USA where most of the world's helium has been produced to date.

Other drivers for emphasising helium exploration (and if successful, early monetisation) are:

1. The existence of JV partners who are positive in their interest in helium exploitation,
2. The good marketability of helium,
3. The relatively high price of helium currently escalating at an average ten year growth of 11.53% per annum – see Annexure 2, and
4. The prospect of producing and marketing useful hydrocarbon by-products.

Some agreed parameters for the Central Petroleum in terms of helium exploration and development

The 1992 Magee well did not prove a marketable resource of helium. It did however indicate that the area is very prospective for helium and did provide a gas analysis, see below.

Table 1. The 1992 exploration produced with a gas flow with the following composition:

Gas	CH_4	C_2	$C_3 – C_4$ (LPG)	$C_5 – C_{6+}$	CO_2	N_2	He	Ar	SE
%	39·3	6·1	3·0	0·5	0·8	43·6	6·3	0·5	22·9 MJ/m^3

The above gas analysis indicates:

1. That helium is in a comparatively very high concentration compared to most other resources,
2. The nitrogen content is very high (however comparable to some SW USA resources),
3. Acid gas content is low, with no H_2S (however CO_2 will need extraction),
4. The C_{2+} H-Cs content indicates a 'wet' natural gas (however the LPG fraction is low),
5. The relatively low LPG content would suggest that the best use for $C_2 – C_{6+}$ gas would be power generation unless very high total quantities of gas are found and/or the $C_3 – C_4$ (LPG) fraction significantly increases, and
6. There is sufficient methane in the composition to consider separation thence liquefaction (LNG) or pipeline transport to markets (depending on quantities, well logistics and access to pipelines).

It has been agreed that the initial exploitation scenarios will be based on the Magee1 well analysis.

Presently, the Magee and Mt Kitty prospects have no indication of potential flow-rates. It has therefore been agreed that a modular approach be taken at this stage, with the raw gas flow into separation units and transport systems being a nominal 283,200 scm/day (10 MMSCF/day) per field with the production scenarios being roughly as set out in Table 2.

Table 2: Prospective Gas Flows – per field of two producing gas wells.

Gas	CH_4	$C_2 – C_6$	He	N_2	CO_2
Flow - m^3/day	111,000	25,500*	17,800	123,000	2200
Flow - tonnes/d	79 (as LNG)	50*	23·6 kL/day		

* Only 18 tpd as LPG, Some $C_2 – C_4$ gases will be contained in the LNG.

The monetisation of the helium depends on it purity and the form it is delivered to the market (as compressed gas or liquid). For helium with a purity of >99·995% and presented in liquid form, conservative to average indicative price is around $US4500 - 5500/kL (~$US 135 - 165/1000 SCF).

Helium separation would consist of a carbon dioxide stripping unit, a cryogenic system for C_2 – C_{6+} gas removal thence the liquefaction of the methane. The next step would be the separation of helium from nitrogen (and argon) in a pseudo-pressure swing adsorption (PSA) unit. The budget price for plant from amine plant to raw helium production was set at $US 45m with a 90% raw helium product. Figure 2 is a process schematic of the process.

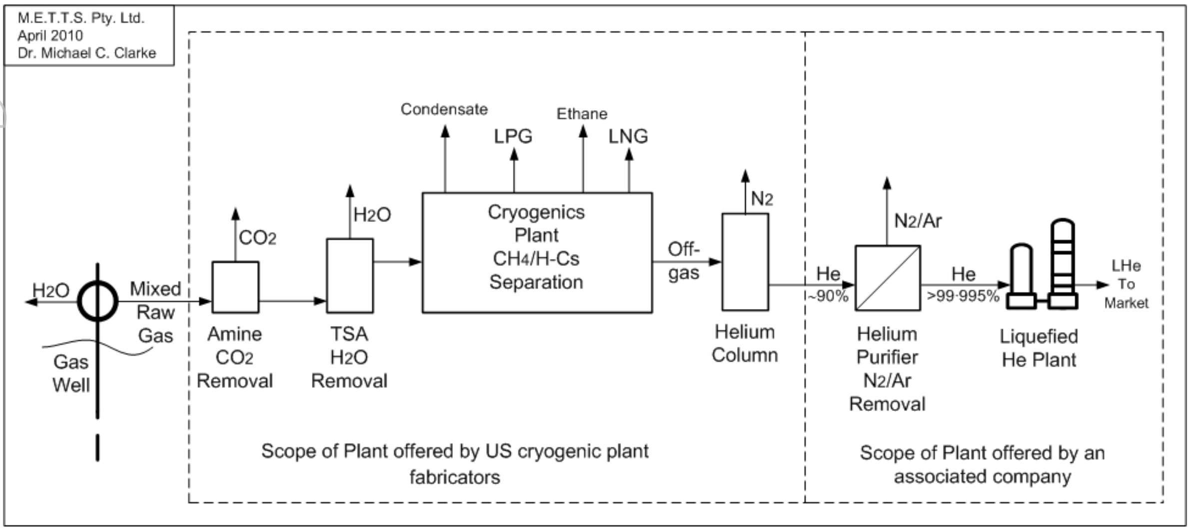


Figure 2. Separations and Gas Flows

Helium movement from well to port

The prospective helium resources of Central Petroleum are located around the geographic centre of Australia. The Magee and Mt Kitty prospects are on either side of the Adelaide to Darwin railway and Stuart Highway, some 150 – 250 km south of Alice Springs.

The northern rail and road infrastructure plus a gas pipeline from Alice Springs to Darwin offer opportunities for the movement of future product from the wellheads, through a processing train, thence through a transport 'train' to Darwin or south to Adelaide with rail and road transport. The costs of transport will however be relatively high given the distances (Alice Springs to Darwin 1500 km) and the need for local ancillary infrastructure that may include but not be limited to, local road refurbishments (up to 200 km in length), rail sidings, specialised helium rail tanks, compressed helium road haulage units, LNG holding tanks, LNG rail tankers, compressed gas systems plus human inputs to make the system work will be part of the cost.

Major steps for helium transport are generally shown in the following transport schematic.

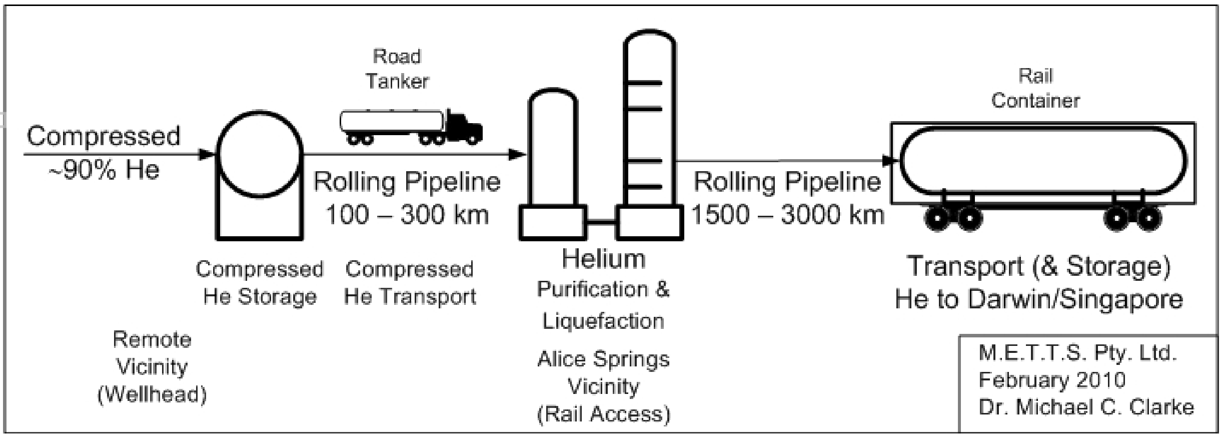


Figure 3. An Extended Helium Rolling Pipeline

The specialist LHe container fabricators are in the process of designing a liquid helium container system that will be suitable for rail. The unit will consist of a standard 41,000 Litre LHe tank, that will be carried as an ISO 40' container, and is capable of being directly trans-loaded to a ship. The holding time for the LHe is 30 to 45 days before gas release will be required. Multiple 41,000 Litre (equivalent to 31,000 scm [1,095,000 SCF] He gas) LHe tanks would be the ‘rolling’ He pipeline the Alice Springs region to Darwin/Singapore (or Adelaide/N. Asia) and in effect they would also act as LHe receival and major storage units.

The budget price of 41,000 Litre (41 kL) LHe containers suitable for rail was put at $US 1·2 each for delivery in 2011.

The use of compressed gas transportation for delivery of raw helium to a central liquefaction plant is considered to be a suitable system. The composite tank manufacturer produces a four tank system in an ISO 40’ container with a capacity of 7504 scm ~ 1252 kg for helium.

(Note: Energy Developments Ltd use a similar system to cart CNG from Palm Valley to Yulara some 440 km.) The budget cost per composite unit is $US 450,000, November 2009. Note: Compatibility between the LHe and CHe system, is that four CHe units would be required to fill one LHe rail tank.

Natural Gas, Co-LNG Production and the C_2 – C_{6+} gases/liquids.

Around 79 tpd of LNG would nominally be produced from each STANDARD FIELD. In the future additional LNG could be produced by Coal Seam Methane extraction, some being in conjunction with Underground Coal Gasification – Annexure 7. Other gas production possibilities for Central Petroleum include their prospects for traditional natural gas and gas from oil production.

The production of LNG would complement the production of helium. If however natural gas were preferred in a gaseous form for pipeline transportation, re-gasification would be required. The production and pipeline transport of gaseous natural gas, as compressed gas in bullets or as LNG may depend on what access CENTRAL has to the northern gas pipeline and the cost of rail transport.

C_2 gas (predominantly ethane but probably with some ethylene) can to a small extent be blended back into LNG with the result being a gas with a marginally increased SE. The use of separated C_2 – C_{6+} gases/liquids for power generation is a reasonable usage of the fuel, where there is demand for the power in running the CO_2 amine separation plant, the hydrocarbon gas separation unit (including the liquefaction plant), plus power for the compression of the helium for cartage as CHe.

The ‘Virtual Pipeline’ offered by the mini-container manufacturer has many similarities to the system offered by the composites group. The mini-container system is specifically intended for the transport of CNG over short to medium distances. If the raw gas produced by a particular well was low in nitrogen with negligible carbon dioxide, a system that utilised a compression system for C_3 – C_6 removal thence compressed transport of the methane/ethane mixture with or without helium would be feasible. Note the composite units are not compatible with C_{3+} gases and liquids.

Comparative CNG/LNG Rolling Pipeline Capacities

A LNG transport technology group recommended that LNG road/rail containers (40' ISO) with a capacity 18 metric tonnes of LNG be used for methane (natural gas) transport. In comparison the mini-container system when loaded into road containers (40' ISO) will carry 5·34 tonnes of CNG. With the composite tube CNG transport units each road container (40' ISO) will carry 7·38 tonnes of CNG. On a production of 79 tpd NG, the relative shipping requirements are thus are presented in Table 3.

Note 1: The budget costs for containers in Table 3, includes no allowance for associated infrastructure. Note 2: If the transport of Natural Gas Liquids (C_3 – C_6) were required an additional and independent transport system based on steel pressurised tanks would also be needed.

Table 3. Comparative capacities of Natural Gas transport systems per gas field.

Container	Capacity	Fills per day	Budget Cost of Containers
LNG*	18 tonnes LNG	4·2	$US 200,000
CNG mini container	5·34 tonnes CNG	14·3	To be advised
CNG Composites	7·38 tonnes CNG	10·3	$US 450,000

*Investigations are being made to the availability of inexpensive 40 tonne LNG transport bullets out of China.

Recommendation: A study of prospective customers for LNG delivery in 40’ ISO containers should be undertaken throughout the Northern Territory and South Australia. That study could include the SA electricity commission, the Olympic Dam mine – South Australia, the iron mining operations in the Northern Territory, the Moomba gas and oil hub, and Power and Water – Northern Territory.

Product Flows

NEGOTIACTION Pty. Ltd. (David la Ferla and Jonathan Gomez) have put considerable effort into examining the international and national flows of helium. With respect to helium, this report should be read in conjunction with the NEGOTIACTION report, and the earlier report on helium use by Dr. Clarence Hardy.

It can be noted from Figure 2, that there is no recycle from the helium purifier. This system still allows for 99+% helium recovery.

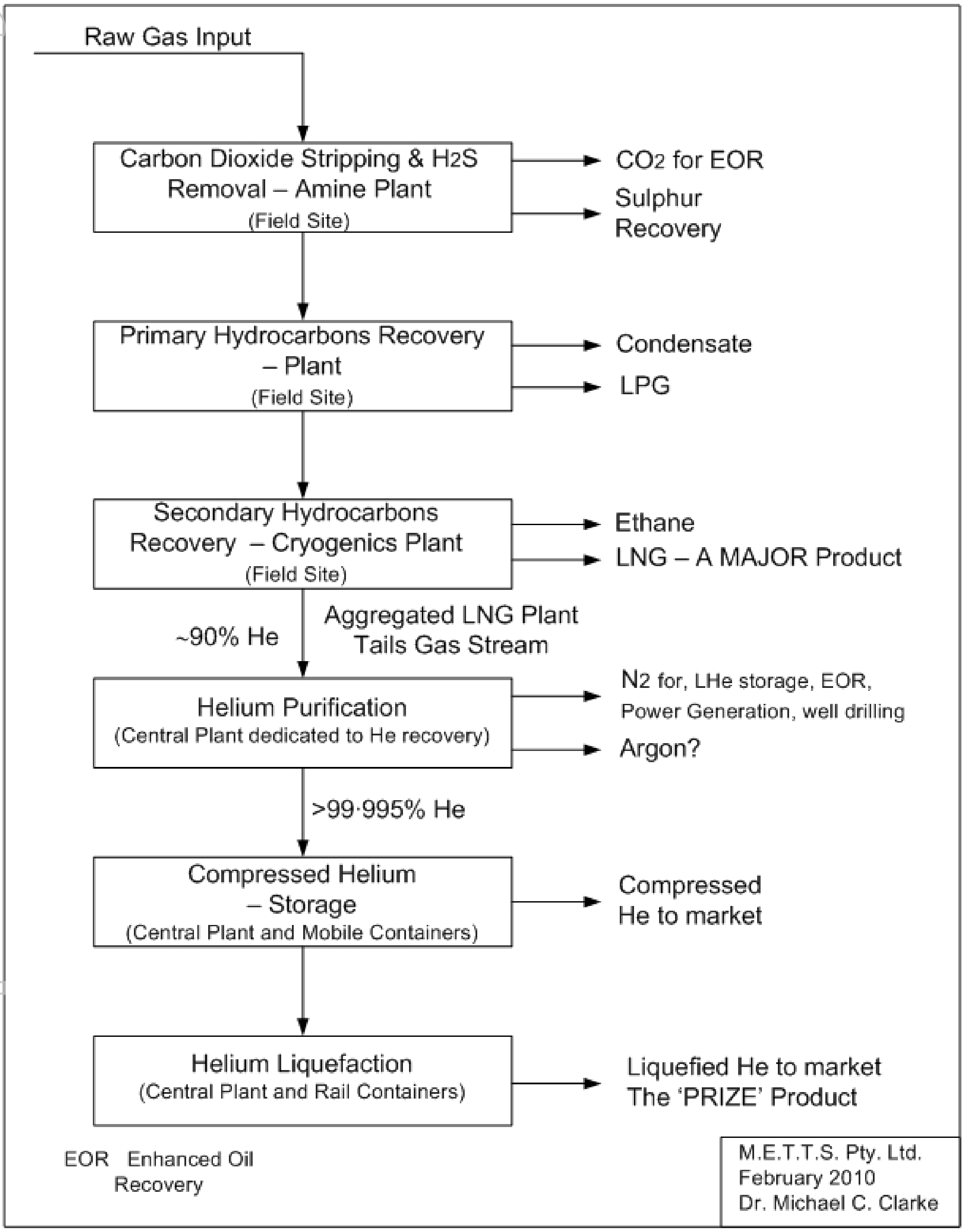


Figure 4. Possible Product Flows

On a per STANDARD FIELD basis the recovery of the small carbon dioxide production for Enhanced Oil Recovery (EOR) may not be justifiable, unless a strong case can be made for lowering the carbon footprint (and thus avoiding carbon taxes) by such a move. CENTRAL's development of aboral carbon sinks (that are already being planted) should be a counter to the release of relatively small quantities of carbon dioxide. The disposal of spent amine will need to be managed in an environmentally sensitive way.

If all the C_2 – C_{6+} product were utilised in power generation, around 18 MWe would be generated in an open-cycle system. This electricity would be available for running the CO_2 stripping plants, the hydrocarbon gas separation unit (including the LNG plant), plus power for the compression of the helium for cartage as CHe, with surplus being offered to the Alice Springs grid and/or over-the-fence customers at the Brewer Industrial Estate if the separation was carried out in a central processing complex.

An alternative use for C_3 – C_5 product would be enhancing Dimethyl Ether that would be produced from reformed methane. The addition of C_3 – C_5 product to DME increases the SE of the DME, and allows for its use in LPG systems with minimal or no modification – see Annexure 5.

LNG will be a major product of the separation system described in Figure 4.

Liquid nitrogen can be used as an 'expansion gas' in G/T power generation. It can be also used in Enhanced Oil Recovery where gas miscibility is not a key factor in the EOR. It can also be used as an inert gas in mining and petrochemical applications and in well drilling applications. Some liquid nitrogen will also be required for liquid helium transport. In a Central Australian context the release of the nitrogen to atmosphere is a more probable immediate proposition.

A small quantity of argon is contained in the raw gas. Argon does have value and is a by-product of cryogenic air separation. In a Central Australian context the release of the argon with the nitrogen to atmosphere is a more probable immediate proposition however future recovery should be considered.

When and what to consider break-overs from container transport to pipeline

The flexibility of the rolling pipeline provides great advantages in the initial development of CENTRAL's prospective resources. It essentially means that what CENTRAL has resources that cannot be considered 'stranded' provided that reasonable quantities are available (eg for He rich resources, say 280,000 scm/day – 10 MM SCF/day total gas flow per field would be the minimum for development). The rolling pipeline concept provides continuity between road, rail and ship, and a good degree of corporate independence for CENTRAL, especially for He marketing.

The serious consideration of traditional pipeline transport may be looked upon as an opportunistic exercise, in that if the existing northern pipeline (and its right-of-way) became available for sale or long-term lease then consideration could be given to using it for natural gas transport (including NG with low quantities of He), or even duplicating the pipeline for carrying greater volumes.

If new pipelines were to be considered, a pipeline to the Moomba Hub may be better a better prospect than sending gas to Darwin to compete with the N W Shelf gas producers. The Moomba link could have welcome fuel security implications for Australia, however the Moomba hub operators may chose to be excessively difficult in business arrangements and essentially deny Central Petroleum commercial independence in marketing its products.

A risk with new pipelines comes from native title and environmental challenges. Improving roads leading to rail junctions should have far less native title and environmental risk and local communities should appreciate the improved road access.

The other consideration in the choice of moving pipeline or actual pipelines will be the attitudes of the northern rail operators (FreightLink) and the road authorities of the region and the relative cost of insurance of rolling stock and cargoes. Excessive rail or road costs will push the balance in favour of traditional pipeline. These points will require additional study.

Allowing for flexibility in well outputs (gas analysis and flows)

It has been stated that developing wells with low He analyses and total gas flows of less than 10 MMSCF/day (280,000 scm/day) would be difficult to justify in terms their CAPEX and OPEX requirement. It should also be noted that wells that produce natural gas from the Mereenie and Palm Valley leases produce gas flows with very wide ranges of gas composition with little or no helium.

It is likely that CENTRAL will find similar variabilities in gas composition across the Company's very large lease holdings. The concept of a rolling pipeline assists with meeting these variabilities and indeed assists in commercialising smaller gas flows. The rolling pipeline is also highly transportable technology and can be relocated as old well deplete and new well come online.

Marketing and Commercial Considerations

Internationally traded bulk helium is normally presented to the market in liquid form. If compressed gaseous helium was produced, it is estimated that it would attract a 20% discount (per com Ben Hooker, Newpoint Gas, October 2009). In an Australian context the market for the supply of compressed gaseous helium delivered through Adelaide should be investigated. LHe delivered to Darwin would be available to the World market through Singapore, and its supply by CENTRAL could complement/supplement helium that is already being extracted in the Darwin LNG works from gas that is supplied from offshore rigs in the Timor sea. Note: It is understood that the Darwin LHe product is directly delivered to Korea at present.

The market for LNG or CNG will need to be developed. New markets may include metals smelting from such operations as the Francis Creek iron ore or sulphides smelting at copper and base metal mining operations, food processing and new transport fuels such as LNG for operating the railway.

Energy Security for Australia and the future role of Central Petroleum

CENTRAL's leases and prospects occur around the centre of Australia. The future development of those leases and prospects has fuel security connotations for Australia. In mid 2009, the National Security Science and Technology (NSST) Branch, of the Department of Prime Minister and Cabinet, did call for applications for Research Support in the field of National Security.

CENTRAL was not then in a position to take advantage of the funding offer, since the company does not yet have actual fuels production. There are however opportunities for the submittal of ad hoc applications and the participation in future funding rounds. Such funds could be utilised in planning fuel production facilities and supply logistics that have a relevant security context.

Taking a holistic view of Central Petroleum's need for separation technology and product logistics

CENTRAL's range of prospects include, traditional oil and natural gas, gas associated with helium, coal seam methane (CSM), syn-gas produced from Underground Coal Gasification (UCG) and possibly mined coal. Traditional petroleum could be sent by rail tanker north or south, and find markets with refiners both in Australia and/or Asia. Traditional natural gas may be converted directly into LNG (provided the quality meets specification). Likewise CSM may be converted directly into LNG especially if the quality is similar to that found in Queensland. If the traditional natural gas and/or CSM have 'impurities' then separations as described in this paper could bring it to LNG or pipeline quality. The aggregation of methane, either with or without, gas separation may go into CENTRAL's total gas inventory and either be offered to the market as one product or possibly multiple products if inclusions such as low concentrations of helium occur in some resources.

From information that is gradually being gleaned from UCG demonstration plant operators, the syn-gas that is being produced has very variable compositions and will need careful and thorough cleaning/separations to be used even in the most basic application such as power generation using reciprocating gen-sets. Two process flows for UCG syn-gas are shown below.

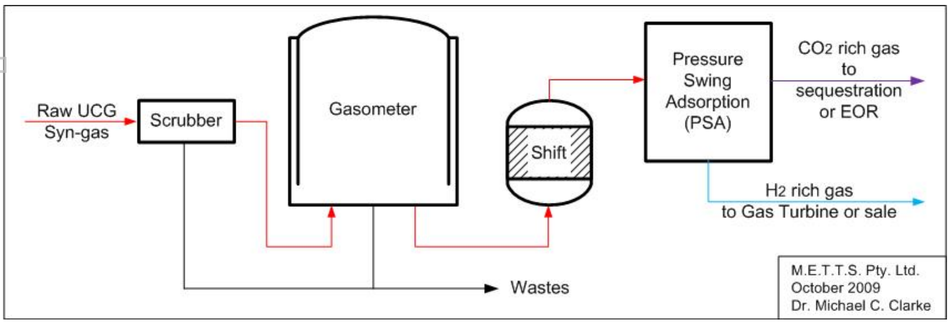


Figure 5a. UCG hydrogen production and power generation

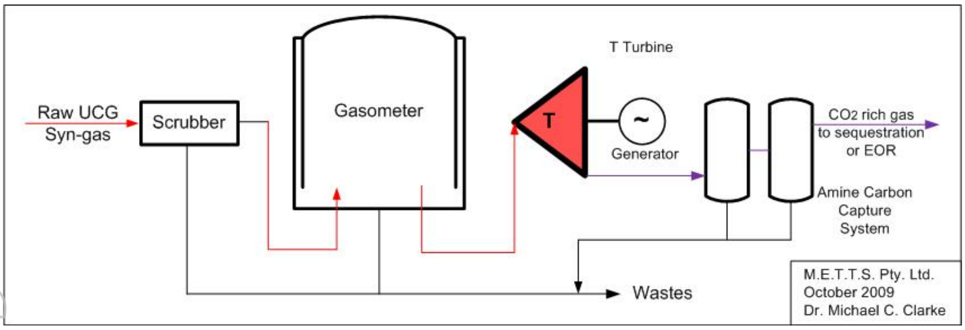


Figure 5b. UCG post power generation carbon capture

In Figures 5a and 5b raw UCG syn-gas is sent to a scrubber for the removal of particulates, soluble and insoluble organic liquids (including tars) and unwanted gases (such as H_2S, COS and complex sulphur compounds). The gasometer is used for gas averaging and the precipitation of remnant impurities. The carbon dioxide can be sent to sequestration and/or Enhanced Oil Recovery (EOR).

The syn-gas may contain considerable un-reacted methane. This gas could be separated, cleaned and added to CENTRAL's natural gas inventory. The syn-gas once cleaned and with the ratios of H_2 and CO adjusted could be used for the production of DME, F-T synthetic crude, methanol, ammonia and/or urea.

Given the immaturity of the UCG science, engineering and industry, it is strongly recommended that a watch-in-brief be kept over UCG technology developers over the next three years (minimum) before any commitment to UCG is made by CENTRAL towards using the technology to monetise its coal reserves.

CENTRAL has considerable indicated coal resources as a visible exploration target (~2 trillion tonnes – estimate non-JORC). If resources were proven with stripping ratios and qualities that could justify mining and thence gasification, the production of syn-gas in well-tested gasifier technologies would be possible. The operation of the gasifiers could also be adjusted to produce a coal-char that could have major benefits to Australian agriculture.

Maximising Revenues from All Possible Revenue Streams

The development of possible helium resources and associated hydrocarbon resources offers the Company opportunities for relative rapid cash-flows from product sales. The development of strategies for the monetisation of natural gas and other hydrocarbon resources across Central Petroleum's broad acreage of tenements offers very significant (and probably greater) opportunities for future cash-flows than does helium production. Helium production has the possibility of being a useful contributor to future cash-flows, and will be largely independent of the oil/gas price

The Company's discovered extensive coal resources provide good scope for the development of unconventional fossil fuel resources through UCG technology developments, as do the shale-gas and shale-oil prospects through recent developments in extraction of gas and oil from 'tight strata'. Methane extracted from UCG-Gas can also contribute to the Company's future cash-flows from LNG production.

The use and adaptation of LNG, LPG and GTL/CTL process technologies gained from the co-production of hydrocarbons in helium production is a natural progression from a niche monetisation to a generalised monetisation of hydrocarbon resources derived from multiple resources. The future development of a step-wise fuels production, logistics and sales scenarios to maximise the return from all products as they come online is an appropriate pathway to develop. The finding of JV partners with specific expertise in fuels management, logistics and marketing could quicken the pace of development, create new avenues for finance and reduce technical and corporate risk.

The close following of the environmental carbon debate is both a useful risk management measure and a possible means creating new revenue streams from developing markets. The use of LNG in transport can reduce carbon emissions by over 25% when compared to diesel use. Future possible bounties for LNG substitution (in place of diesel) and the provision of LNG fuelling facilities could be used to improve the Company's bottom-line. The recent move towards using LNG for long distance road (and rail) transport (as discussed at recent – 2010 – CSM and shale-gas conferences in Brisbane) will create new markets for LNG for which the CENTRAL prospects are well placed. Prices 'at the pump' could approach $AU 1000 per tonne for direct retail supply. The cost of infrastructure, that being LNG outlets with storage facilities, will need however need to be taken into account.

Preliminary Budget Estimates

Revenue Streams

Negotiaction have carefully studied LHe prices – Annexure 2. They have suggested that an attainable price range FOB Darwin is in the range of $US155 – 175/1000 SCF. They also have looked at the at US Geological Survey, Mineral Commodity Summary 2010, price of $US 125 – 145/1000 SCF. It has thus been decided to base the price calculations for this study on two price projections, these being $US 135/100 SCF CIF N. Asia and $US 175/100 SCF FOB Darwin, representing conservative and optimistic price projections respectively.

The price of LNG is strongly related to the oil price. A price range of $AU 500 – 600/tonne could be looked upon as an 'average' wholesale price, however a retail price that reflects local diesel prices would be around $AU 1000/tonne. LPG prices are very variable and indeed seasonal. Again the possibility of offering LPG at a near retail price in Central Australia should be investigated.

Table 4a - 1. Revenue Streams for LHe, LNG and LPG

Product	Helium Pricing – CIF N. Asia*		Helium Pricing – FOB Darwin	
Liquid Helium	$US 135/1000 SCF	$AU 64.8m	$US 175/1000 SCF	$AU 84.0m
LNG	$AU 500/tonne	$AU 26.1m	$AU 500/tonne	$AU 26.1m
LPG	$AU 600/tonne	$AU 7.2m	$AU 600/tonne	$AU 7.2m
		$AU 98.1m pa		$AU 117.3 pa

* To a nominal N. Asian destination

Table 4a - 2. Revenue Streams for LHe, LNG and LPG

Product	Helium Pricing – CIF N. Asia*		Helium Pricing – FOB Darwin	
Liquid Helium	$US 135/1000 SCF	$AU 64.8m	$US 175/1000 SCF	$AU 84.0m
LNG	$AU 1000/tonne	$AU 52.2m	$AU 500/tonne	$AU 52.2m
LPG	$AU 600/tonne	$AU 7.2m	$AU 600/tonne	$AU 7.2m
		$AU 124.2m pa		$AU 143.4 pa

* To a nominal N. Asian destination

The best and worse case pricing scenarios are thus taken to provide an annual revenue of $AU 143.4m and $AU 98.1m respectively.

CAPEX Calculations

Table 4b. Well and Field Costa – See Annexure 9.

Item	Installed Cost $AU
Well Drilling and Completion	24,000,000
Well Head Facilities	3,200,000
S/Total	27,200,000

Table 4c. Helium and Fuel Gas Separation Plant(s), LNG Production – See Annexure 9.

Item	Hardware Cost $AU	Installed Cost $AU
Processing Plant Facilities (a)		34,000,000
Inlet Compression		14,000,000
H-C (Fuel Gas and Crude Helium) Separation	106,000,000	160,000,000
Ancillaries – Road Upgrade		4,000,000
S/Total		212,000,000

a. Inclusive of Stationary Storage Tanks

Table 4d. Helium Purification and Liquefaction – See Annexure 9.

Item	Hardware Cost $AU	Installed Cost $AU
Processing Refining and Processing Facilities (a)		14,000,000
Helium Purification and Liquefaction	41,200,000	57,600,000
S/Total		71,600,000

a. Inclusive of Stationary Storage Tanks

Table 4e. Transport Containers (Tanktainers)

Item	Cost $AU
CHe ISO Containers x 6	3,180,000
LNG ISO Containers x 30	7,500,000
LPG ISO Containers x 5	600,000
NGL ISO Containers x 2	240,000
LHe ISO (Rail) Containers x 32	45,440,000
S/Total	56,960,000

Table 4f. CAPEX Summary

Item	Cost $AU
Total Budget Helium CAPEX	367,800,000
Owner's Costs	36,800,000
S/Total	404,600,000
Cost of Financing 100% Equity – 4% Brokerage Commission	16,200,000
	420,800,000

The major items, that being the Fuel Gas and Crude Helium Separation and Helium Purification and Liquefaction plants will be skid mounted. Once concrete pads are laid and services put in place, the inter-skid wiring and piping should be accomplished relatively quickly.

The supply of the LHe ISO (Rail) Containers (presently only available from one US supplier) will take time to complete. In a critical-path view the supply of the LHe containers will be production limiting. In the intervening period other suppliers may come online and these suppliers should be contacted. If non-rail LHe containers can be used, they may be available from container pools owned by helium supply companies.

Competitively priced LNG transport bullets of say 40 – 60 kL may be available to replace LNG ISO Containers. These units would complement production of LNG from other CENTRAL future resources.

OPEX Calculations

Table 4g. OPEX Calculations two helium sales scenarios

Opex Item	Helium Sales – CIF N. Asia $AUm pa		Helium Sales – FOB Darwin $AUm pa	
Downhole workover every 4 years		1.0		1.0
Wellhead Facilities and Flowlines	4.5% Capex 0.14		4.5% Capex 0.14	
Inlet Compression Facilities	4.5% Capex 0.63		4.5% Capex 0.63	
Processing Plant Facilities	4.5% Capex 1.53		4.5% Capex 1.53	
LNG Plant & Ancillaries	4.5% Capex 7.2	9.5	4.5% Capex 7.2	9.5
Liquids & CHe Trucking Costs		5.5		5.5
Access Road Maintenance		0.4		0.4
Central Freight Terminal Operation		2.5		2.5
Liquefaction / refining facility		2.3		2.3
Electricity and Services Supply (Brewer)		3.6		3.6
LHe tanktainer Rail Freight [AS – Darwin]		1.0		1.0
LHe tanktainer Rail Freight [Darwin – AS]		1.0		1.0
LHe tanktainer Sea Freight [Darwin – Busan – Darwin]		4.3		0
LHe Cargo Insurance		0.3		0
Insurance & Rates (Plant & Equipment)		6.8		6.8
Totals		38.2		33.6

Table 4h. Project Finance Summary

Summary Item	Helium Sales – CIF N. Asia $AUm pa	Helium Sales – FOB Darwin $AUm pa
CAPEX	420.7	420.7
OPEX	38.2	33.6
Discounted after-tax earnings (20 years)	512.2	984.9
NPV	110.6	555.6

Calculations Base

Table 4i. Input Data to Spreadsheet

Item	Helium Sales – CIF N. Asia	Helium Sales – FOB Darwin
Helium Selling Price $US/1000 CSF	135	175
Exchange rate USD:AUD	0.85	0.85
Capacity factor	0.9	0.9
Owners costs (% of total plant cost)	10%	10%
Cost of Financing 100% Equity – Brokerage Commission	4%	4%
Depreciation Transport Containers (Years)	10	10
Depreciation Fixed plant (Years)	15	15
NPV Calculation Period (years)	20	20
Inflation rate (LRA)	2.75%	2.75%
LTGBond Rate	5.90%	5.90%
Credit Foncier (15 year)	10.00%	10.00%
Royalties (% of wellhead value)	16.00%	16.00%
Discount rate (assume LTGBR + 2%)	7.9%	7.9%
LNG (in Swap Container ex Brewer NT) A$/tonne	500.0/1000.0	500.0/1000.0
LPG (in Swap Container ex Brewer NT) A$/tonne	600.0	600.0

Notes on Input Data.

1. The exchange rate forecast 0.85 (Long Run Average - LRA method),
2. The capacity factor is high and is based on the advice of plant designers and fabricators,
2. Owner's costs are low to moderate given the modular nature of what is proposed – M.E.T.T.S.,
4. LTGB – Long Term Government Bond Rate,
5. Royalties are based on net returns and are governed by the NT Petroleum Act, and
6. Foncier: - see below for a definition:

Wikipedia gives a simple description "In modern banking terminology a 'credit foncier' loan is a loan for a fixed period with regular repayments where each repayment includes components of both principal and interest, such that at the end of the period the principal will have been entirely repaid."

Extended and other possible revenue streams.

LNG is expected to become a major transport fuel for heavy vehicles in the medium to long-term future. It has economic and environmental benefits over diesel. BOC are involved in the construction of LNG plants in Tasmania, Victoria, Western Australia and Queensland, with the provision of LNG to transport being the major market. Heavy vehicle manufacturers are offering duel fuel (say 90% LNG and 10% diesel) options on new trucks, whilst it is possible to have on existing vehicles converted to duel fuel firing.

CENTRAL's prospective natural gas resources straddle the north-south railway and Stuart highway. Providing LNG for truck and train fuelling could make a very useful and expanding contribution to the Company's cash-flow. Note: Prices 'at the pump' could approach $AU 1000 per tonne of LNG for direct retail supply. Another possible future use is in fuelling mining vehicles (haul packs). Studies for fuelling such vehicles are being undertaken by Westport Inc Canada.

2. The LPG could be supplemented/blended with Dimethyl Ether (DME) to provide fuel for local Territory communities – see Annexure 5.

3. Synthesis gas (hydrogen and carbon monoxide plus contained methane) produced from Underground Coal Gasification, could provide fuel for power generation and be another methane (natural gas) stream for additional LNG production – see Annexure 4.

4. The LNG transport group pointed out that carbon dioxide is one of the most traded gases in the world. He advised that CENTRAL should be cognisant of CO_2 in all wells drilled and look for opportunities for monetising even moderate flows of CO_2.

5. Liquid nitrogen will be a by-product of helium production. Some will be used in the cooling of the LHe containers and some could be used for drilling. Greg Hall has stated that we could tweak the helium column to get more nitrogen reporting to the helium purifier, if we have a market for LN_2.

6. The Mereenie gas/oil field (non Central Petroleum) has a low concentration of helium – 0.15%. It is possible that 'normal' gas resources found by CENTRAL will also have marginal helium contents. Where this is the case, the use of LNG processing to produce a relatively helium rich process off-gas could add to CENTRAL's helium inventory.

Conclusion

A system of monetising CENTRAL's helium prospects has been developed with the assistance of the US plant designers. A feature of this system is that it does much of the processing at the remote wellhead sites. The plants will be modular and relocatable, in that over a period of six to eight weeks a plant could be relocated and recommissioned on another wellhead site.

The wellhead located plant produces a high-grade industrial helium product to 90% purity, but also a LNG product. The ratio of the two products in terms of volume is 6:1 (methane to helium), a fact that suggests that LNG is the appropriate form to be transporting methane from the remote sites that being eight 20 tonne tanks per day. The wellhead plants will also produce C_2 – C_6 gases and liquids in modest amounts. The immediate use will be generating power for the LNG and associated plants. Excess C_2 – C_6 gases and liquids could be trucked to the centrally located helium purification and liquefaction plants with the aim again to provide power for the CENTRAL plant. An investigation of the developing electricity market in Central Australia should be undertaken as CENTRAL moves closer to fuels production.

Helium from the CENTRAL plants will likely go to market as LHe, however there could be possibilities for CHe to be sent into the Australian market. This option should be investigated further

The concept of a 'rolling pipeline' creates opportunities for the development of diverse gas resources. It also offers the flexibility of developing extraction scenarios for relatively small gas resources that will have limited production lives. If the CENTRAL leases contain numerous small helium and hydrocarbon deposits, the creation of central helium processing and dispatching facilities makes sense.

With respect to facilitating the early monetisation of helium resources as they are found, the rolling pipeline, combined with relocatable gas separation units offers a good solution, so long as the resources are adequate and the CAPEX and OPEX of plant is not excessive. It can also be noted that the rolling pipeline combined with relocatable gas separation units have least native title and environmental approval risk. The rolling pipeline concept is presented below for a three-product flow.

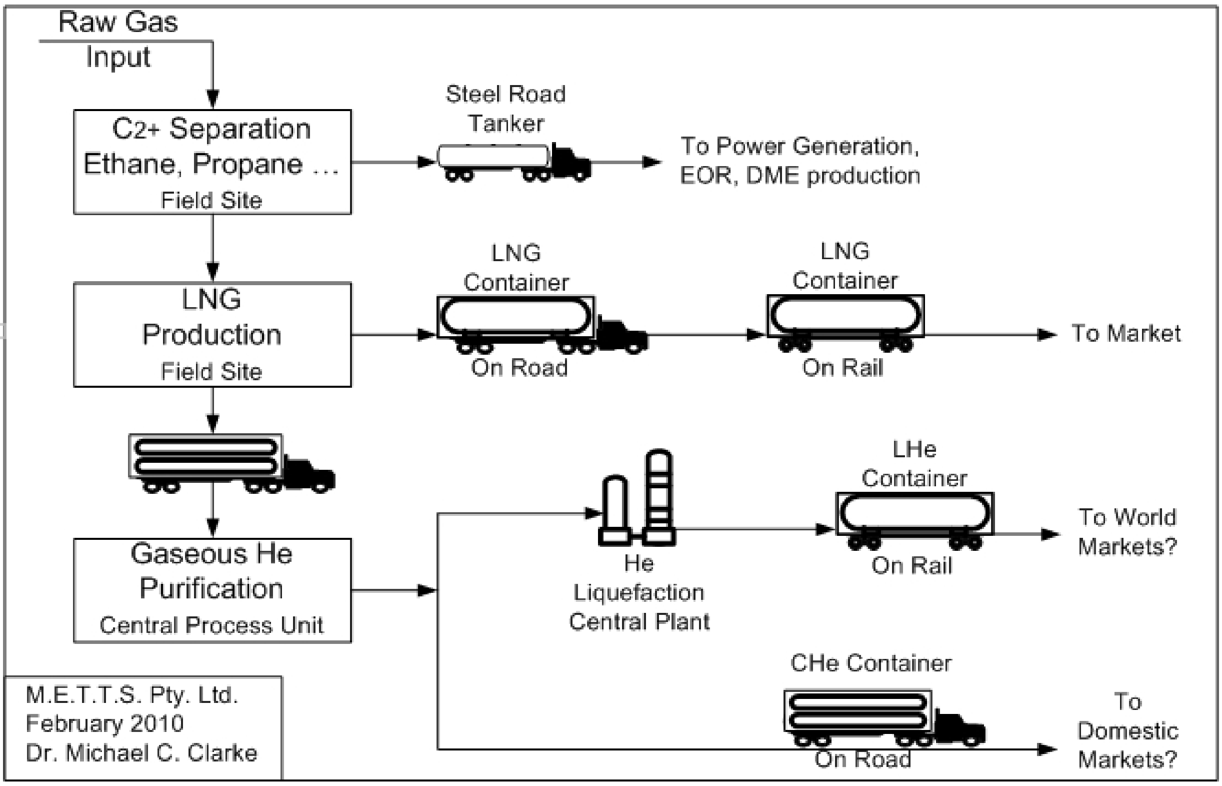


Figure 6. A three product production and logistics schematic emphasising the use of the rolling pipeline

Product transport by pipeline may have a future role in CENTRAL's operations. This role could be through the participation in the operation of the existing northern gas pipeline. If product volumes were such as to warrant additional pipeline capacity, a parallel (or new pipeline of greater carrying capacity) using the old 'brown-fields' route would have less native title and environmental approval risk. An alternative pipeline would be to the Moomba gas hub located in South Australia.

The recent move towards using LNG for long distance road (and rail) transport (as discussed at recent – 2010 – CSM and shale-gas conferences in Brisbane) will create new markets for LNG for which the CENTRAL prospects are well placed. Prices 'at the pump' could exceed $AU 1000 per tonne for direct retail supply. The cost of infrastructure, that being LNG outlets with storage facilities will need however need to be taken into account.

This report is very much helium centric. Central Petroleum however has multiple prospects that include, traditional oil and gas, unconventional gas (as shale gas) and Underground Coal Gasification (UCG)-Gas. The recovery of helium will also involve the recovery of natural gas (methane) plus some heavier hydrocarbons. It is considered that an integrated approach to managing fuel products be developed as various fuel resources come on-line.

Traditional gas, shale gas and UCG-Gas can all be feed stocks for the synthesis of ultra-clean liquid fuels. The transport system for such liquid fuels that are produced in central Australia should be the Adelaide to Darwin railway.

With good fortune in exploration coupled with the astute development of discovered resources, Central Petroleum may be a major player in helium production, industrial fuels production (natural gas and UCG-Gas), electricity generation, and liquid transport fuels production. Central Petroleum can be a significant contributor to Australia's fuel security.

Annexure 1.

Draft Proposal CTP Future Vision Initial Focus

1. EMM (Ian Miller) and METTS (Michael Clarke) and Technip (Alan Fleming) severally and jointly carry out some specific studies, with these studies being :

2. Oil extraction and marketing, small scale 500 bbls/day to 5,000 bbls/day, break-over from trucking, to truck/railing to pipelining.

3. Helium extraction and marketing from Nitrogen and Methane (principally METTS) and options for using the methane and transporting the helium 10 MMCFG/day to 100 MMCFG/day composite field based gas flow, small scale, break-over threshold into large scale GTL/helium.

4. Dimethyl Ether (DME) marketing and payback potential as against diesel use (principally EMM),

5. DME production from specific fuels that may be available from exploration and development, and that may include, CSM, syn-gas from UCG and/or natural gas (EMM and METTS),

6. Mini LNG production (principally EMM),

7. Looking at the development of new opportunities (essentially smelting and power) for future fuel supplies from CENTRAL (principally METTS), and

8. Looking at the energy security questions towards obtaining Commonwealth assistance (principally METTS).

Could you please confirm this allocation of responsibilities plus any amendments and variations.

The studies are bounded by available funds, which are a maximum of (initially) $30,000 to be shared between METTS, EMM and Technip.

METTS, Technip and EMM to be in regular contact and CENTRAL to provide information and contacts as appropriate.

The main focus to be on short term cash flow initially.

John Heugh
Managing Director
Central Petroleum Limited

Annexure 2.

PRELIMINARY REPORT:
Supplying Helium to Asia and Factors Influencing Future Helium Pricing

Produced for Central Petroleum by Negotiaction

NEGOTIACTION

Project Leaders:
David La Ferla, Managing Director
Jonathan Gomez, Executive Director

Note: This report is written as a component of the larger report being compiled by consultants for Central Petroleum, rather than acting entirely as a standalone report.

Please refer to the ***Negotiaction Helium Research Database*** compiled for:

- Profiles of Significant Helium Players
- Profiles of Asian Helium Markets by Country
- Forecast of Future Helium Supply and Demand
- Profiles of Recent Key Helium Projects
- Statistics on Global Helium Use, Demand, Production, Reserves, Resources

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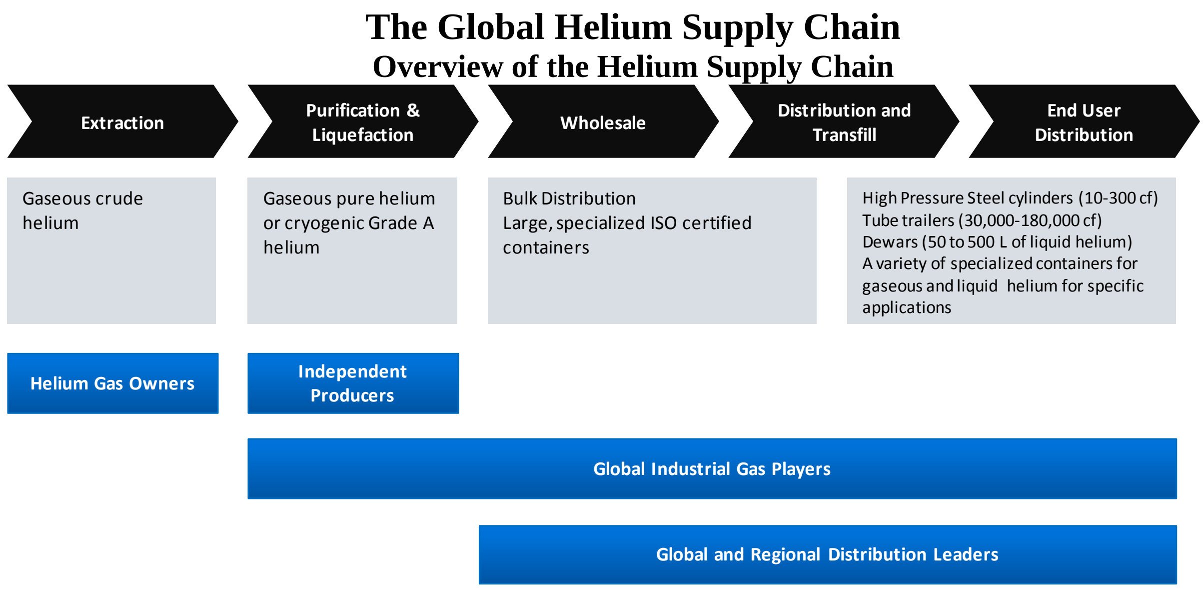

Figure 1: The Helium Supply Chain

Source: Revision of Air Products diagram by Negotiaction

The supply chain for helium begins with its origin as a component of natural gas. The first step in the ultimate delivery of helium is composed of extraction and processing of natural gas, the end product of which is crude helium. The second step involves further refinement and cooling processes to produce a liquid form of helium refined to a defined level of purity. The wholesale, distribution and transfill process involves the sale and transport of helium in bulk volumes, with the final step in the chain being distribution to end users.

As characteristics of gas fields differ, the commercial viability of extracting helium for sale is different from case to case. Currently, helium is mainly extracted from sources in the US, Algeria, Poland, Russia and Qatar, with new extraction facilities recently coming online in Australia. The main conditions under which the process of extracting and purifying helium becomes economic include:

- The natural gas field is of sufficient volume and helium concentrations so that the future stream of helium is sufficient to offset the initial helium purification capital costs involved. A rough range of helium concentrations in natural gas fields for helium extraction to be commercially viable is 0.1 to 0.3 percent. Concentrations as low as 0.04 percent have been noted as commercially viable for operations involving helium extraction as part of the process of producing liquefied natural gas. [1]
- Total project economics are acceptable in terms of meeting internal rate of return requirements.
- Transportation costs across the value chain do not make production economically unfeasible.

Stages and Economics of the Helium Supply Chain

Extraction

Extraction of the natural gas stream and crude helium has often been undertaken by the company with rights over the gas field and with initial interest in producing a natural gas product. Processing of the natural gas stream to obtain crude helium typically involves three operations. First, impurities including water, carbon dioxide, mercury and hydrogen sulphide are removed from the gas, before high-molecular-weight hydrocarbons are removed. Finally, cryogenic distillation separates and

[1] Selling the Nation's Helium Reserve, National Academic Press, section 1-8

removes a majority of the remaining methane gas. The end product at this stage is crude helium of purity between 50% and 70%.
As producing high purity helium requires expertise and technology generally not held within the original company in ownership of the gas field or with interests in producing natural gas products, these organisations have historically involved the large industrial gas companies in the purification and liquefaction stages. Due to the higher price levels seen in the helium market over the last five years, an increasing number of LNG project developers have been exploring the potential of helium monetisation, and their ability to secure a value added premium.

Purification and Liquefaction

Final purification of helium is often done in multiple stages; the exact method dependent upon the purity required and intended end use. These steps involve cooling to condense and remove nitrogen and methane, leaving a gas of approximately 90% helium. The gas is then warmed and oxygen added before passing over a catalyst allowing oxygen and hydrogen to combine into water vapour, which is subsequently removed. What remains is then processed in a pressure swing adsorption (PSA) unit that yields helium at greater than 99.995% purity.

The final step is to convert the helium to a liquid form. Due to the relative economics involved for helium transport and export, a majority of helium production plants liquefy the helium for sale to customers. Liquefaction is the highest energy consuming step, on a per unit cost basis, in the whole process of extraction and purification. Liquefaction also requires capital intensive equipment and technology, leading to heavy capital costs.

The companies involved in the purification and liquefaction stage are mainly the large industrial gas companies, as they are the main centres of expertise in helium purification and have the capital to make the large investments required. The two most prevalent companies with expertise in the liquefaction stage of the process are Linde Kryotechnik and Air Liquide.

Economics of Extraction, Purification and Liquefaction

The economics of the purification and liquefaction stage of the process has significant impact on the viability of producing a helium product, as this stage involves costly infrastructure. Some points on the economics of helium production to the liquid stage include: [2]

1. In U.S. facilities, one of the largest costs of purified helium is the royalty paid to the natural gas owner for an off-gas feed - usually 1/8 of the price of crude helium for a company that takes the off-gas stream then processes it to crude and refined helium in succession.
2. Investment assigned to the unit cost of helium. Helium production is not justified for rates of less than 100 MMscf/yr due to economies of scale.
3. Energy consumption – a significant cost related to compression in the processing and liquefaction stages.

In the US in FY2009 the price range for private industry produced Grade-A gaseous helium was in the range of US$125 to US$145 per thousand cubic feet (US$4.51 to US$5.23 per cubic meter), while the US Government price for crude helium was US$62.25 per thousand cubic feet (US$2.25 per cubic metre). [3]

Working further down the helium value chain requires very high investment and creation of a core business similar to industrial gas companies.

[2] Helium Extraction and Production Techniques, James West, Specialty Gas Report, Q3 2009
[3] U.S. Geological Survey, 2010, Mineral commodity summaries, p. 72.

Helium Distribution

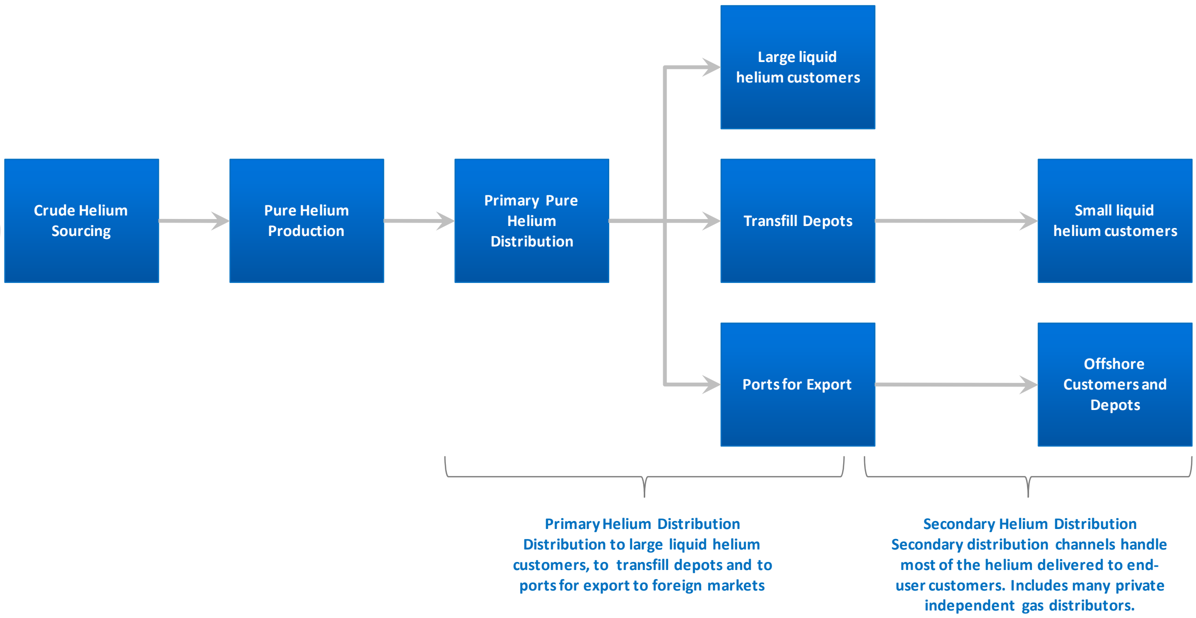

Figure 2: Structure of Distribution

Source: Revision of USGS diagram by Negotiaction

The above diagram shows a simplified representation of the helium supply chain. The initial links involve the extraction, purification and production of helium in a liquefied form. The next link in the supply chain is in transferring liquid helium into the primary distribution system, where it is trucked to very large customers, redistribution/transfill facilities and ports for shipping to export markets. The final stage in the supply chain is secondary helium distribution where the helium is packaged and transported in a fashion that meets the end users' requirements.

This stage of the process has its own financial considerations as the standard for transport is an 11,000 gallon cryogenic container costing approximately US$1.1m. If helium is to be transported to a separate facility in gaseous form to be liquefied then it would require approximately 5 gaseous helium tankers costing US$300,000 each (US$1.5m) in place of every 11,000 gallon liquid helium container. [4] Additional decisions must be made in relation to whether a distribution partner with transfill facilities is selected, if use of transfill facilities can be contracted, or if investment in construction of new transfill facilities should be made.

As a result of the large variations in transportation and packaging costs, determining the ultimate price to end users of helium can be complicated. There are significant costs related to the packaging and delivery for each of the typical types of final container, including bulk cryogenic containers, tube trailers, cylinders and dewars. Pricing of the end product has to also include the cost for transporting helium through primary distribution channels and then delivery to transfill depots for secondary distribution or alternatively to ports for export. In determining pricing to export markets, pricing is further complicated by cost and variations in the cost of shipping and the additional trucking costs from port to inland transfill facilities.

1.1.1 Primary Distribution (Bulk Distribution)

[4] Discussion with Dr. Michael Clarke, Managing Director of M.E.T.T.S., January 2010

Primary distribution of liquid helium from refining plants to large customers, transfills or ports for export is undertaken in very large tankers (1.5 MMscf capacity) or in special International Organisation for Standardisation (ISO) containers (1.1 MMscf capacity). Transportation by ISO container allows direct delivery to large end users, but can also be transported as deck cargo on container ships before being used to transport to a transfill or large customer. Helium can be stored in these ISO containers without significant loss of helium for 30-45 days.

The large industrial gas companies are involved in the supply chain from production of refined helium through to servicing end customers. However, they also purchase helium from other sources before distributing and marketing it. Additionally, they have significant access to the global population of end users and technology in helium use and recycling.

1.1.2 Secondary Distribution (Small Volume Distribution)

Secondary distribution channels handle most of the helium delivered to small and medium end users that do not have the scale that makes it feasible to invest in liquid helium storage. The companies dominant in secondary distribution are again the large industrial gas companies in addition to many privately owned independent industrial, medical and specialty gas distributors.

Delivery to small and medium volume customers is performed in high pressure cylinders (10 – 300 cf gaseous helium), high pressure tube trailers (30,000 – 180,000 cf of gaseous helium), dewars (50 – 500 L liquid helium) and other specialised containers.

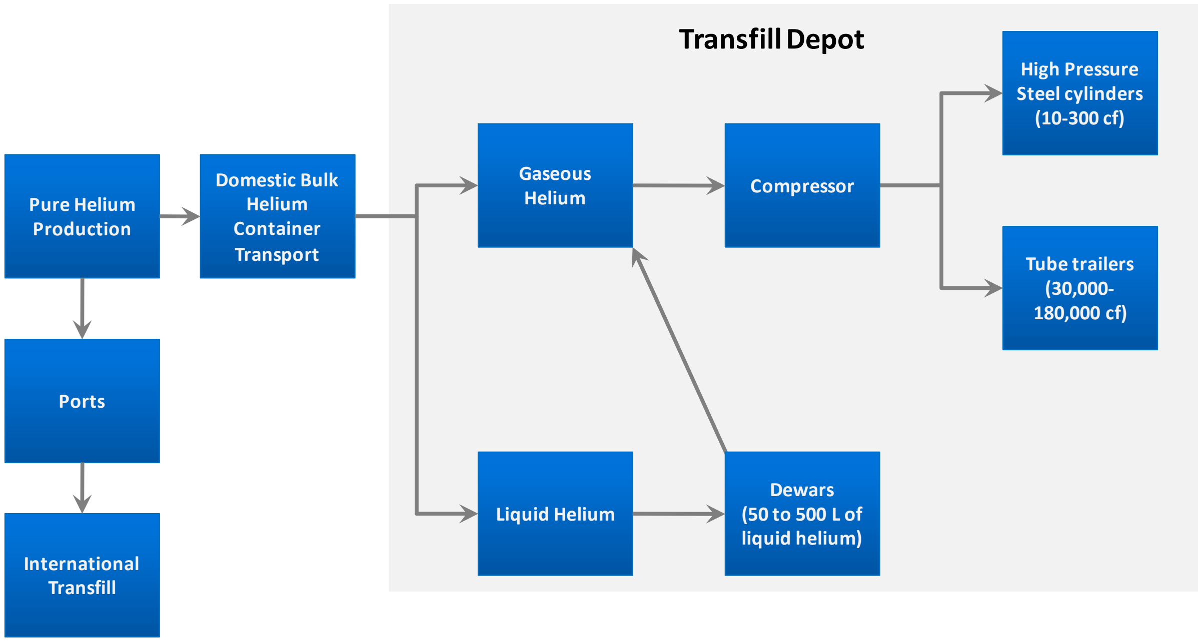

Figure 3: Helium Distribution and Transfill

Source: Revision of AirGas diagram by Negotiaction

2 Significant Players in the Global Helium Market

Significant Players

Group & Players	Description
Big 5 Global Industrial Gas Players: BOC / Linde BOC (UK) Praxair (US) Air Products and Chemicals (US) Air Liquide (France) Taiyo Nippon Sanso Corp / Matheson Tri-Corp (Japan)	• Involved in the helium value chain from helium production to distribution to end users. • Possess expertise in helium refinement, liquefaction, transport and end use. • Large global distribution networks. • Significant financial size. • Operations in a portfolio of other gases and related services/products.
Regional Distribution Leaders: Iwatani International Corp (Japan) Messer Group GmbH (Germany) Air Water (Japan) Sapio (Italy) Cryoinfra (Mexico) Indura (South America) Airgas (US)	• Involved in the helium value chain from distribution of bulk helium to end users. • Transfill networks tend to be strong within specific regions/countries. • Generally smaller in financial size compared to the largest global industrial gas companies. • Operations in a portfolio of other gases and related services/products.
Global Distribution Leaders Global Gases Group (Dubai)	• Company with significant focus on helium, global transfill facilities and distribution network.
Upstream Players RasGas (Qatar) KRIO (Poland) Cimarex (US) Sonatrach (Algeria) Gazprom (Russia)	• Gas field asset owners with their main business being outside of helium. • Often invested in the refinement and liquefaction of helium. • Agreements with an industrial gas player to carry out non-domestic distribution and sales.

Figure 4: Global Helium Player Descriptions

Refer to **Negotiaction Helium Research Database** for detailed information on each player's involvement and interests in helium.

Global Industrial Gas Players

Dominance of Industrial Gas Players

The global helium landscape is dominated by the global industrial gas players (there are five main ones including: Air Products, Air Liquide, Linde/BOC, Praxair and Taiyo Nippon Sanso Corp) and these players accounted for 67% of revenues in the industrial gas industry during 2006. Apart from their involvement in helium they also have a significant portfolio of operations in other industrial gases, related services and products. Characterising each of these organisations is their involvement in the value chain from purification and liquefaction all the way through to distribution and wholesale. In addition to their size, the factor that makes them unique as compared to other groupings is their direct involvement in helium production.

The global industrial gas players each have access to their own helium production facilities. A common thread that can be observed among these companies is that they have each levered their in-house engineering expertise to advise on, plan, construct and operate purification and liquefaction plants. The path of appointing the large industrial gas companies to assist in planning and construction of helium purification and liquefaction is one that has been taken by many gas field owners in the past, but is certainly not the only one. The global industrial gas players still engage others with liquid helium supply (independently produced) for additional sources of helium to meet demand.

Company Highlights

Company	Description
Linde Group	BOC, part of The Linde Group (the merged entity of The BOC Group and Linde AG). Operates 47 transfill facilities worldwide, 20 of which are located in the Middle East and Asia. Known to partner with Sonatrach on helium extraction projects.
Praxair	Praxair accounted for approximately 30% of the world helium market in 2002.[5] The leading industrial gas supplier within China, with over 1,200 employees and investment exceeding US$600m.
Taiyo Nippon Sanso Corp and Matheson Tri-Corp (subsidiary)	Leading helium supplier in the Japanese market. Matheson Tri Gas is the US subsidiary of TNS.
Air Products & Chemicals Inc.	AP has about 33% of the world's 6 billion cu ft/year helium capacity.[6] Air Products is the known market leader in helium.
Air Liquide	French based industrial gas company with the second largest revenue. Commonly known to partner with Air Products in helium extraction. Asia based gas and services revenue was €2,490m.

Market Share

Although the exact current market share of helium for each of the global industrial gas players is uncertain the following points are known:

- Air Products holds as much as 32 percent of the helium gas market with capacity of nearly 60 million cubic meters (2118.8 MMscf/yr).[7]
- Taiyo Nippon Sanso Corp (TNS) total helium supply was 525 MMscf/yr in 2006.[8] This implies TNS holds a market share of around 9 percent in the helium market.
- Praxair's market share in helium was known to be 30 percent in 2002.

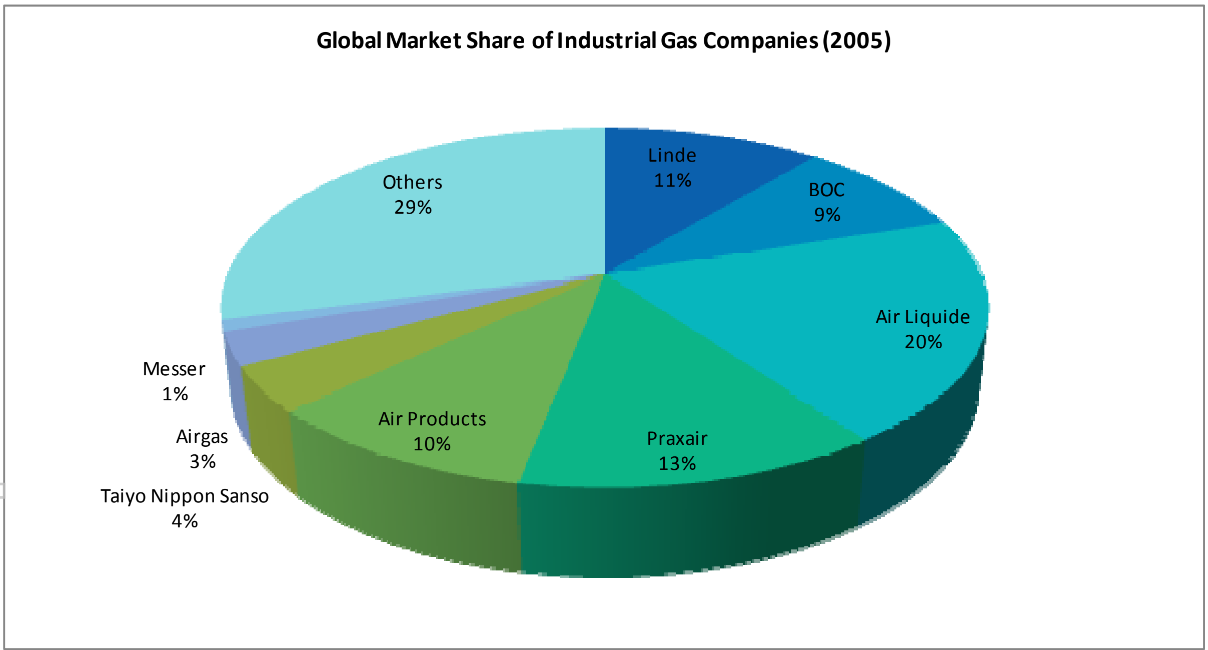

Figure 5: Global Industrial Gas Industry Market Share 2005

Source: Industrial Gases Processing, Wiley

[5] Chemical Week, Natasha Alperowicz, May 8 2002

[6] Chemical Week, 2002

[7] CryoGas International, March 2008

[8] CryoGas International, October 2006

The chart below indicates the relative breakup of revenues among the major international players for the global industrial gas market. This data provides an approximation of relative size of market share held by these players in the helium market. The data for this pie chart reflects market share prior to the Linde BOC merger where certain assets and contracts were sold to TNS due to anti-trust issues. However, the following 2008 revenue comparison chart below indicates that relative size across the Big 5 has been roughly maintained. The five largest industrial gas players are dominant forces across the world, yet the regional distribution leaders have maintained significant operations within their own domains. The Big 5 hold approximately 63 percent of the industrial gases market.

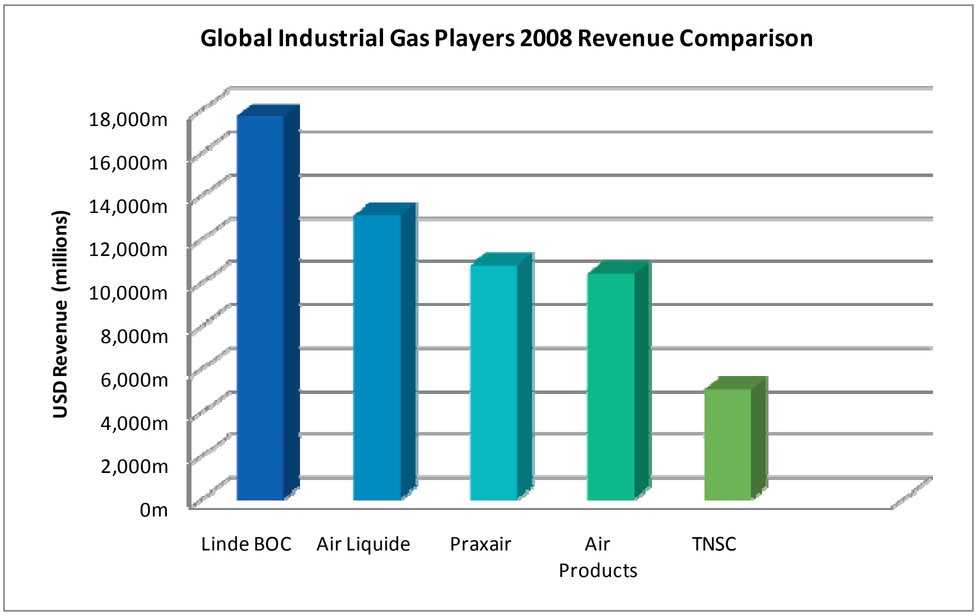

Figure 6: Global Industrial Gas Players Revenue Breakdown in USD

Regional Presence

Each of the five largest industrial gas companies maintains a presence in most major Asian markets. Within the Japanese market TNS and Iwatani are the two dominant forces in helium, which is a market that accounted for approximately 41% of Asian demand in 2006 (Air Products and Chemicals). Praxair is reported to be the leading industrial gas supplier in China, yet the remaining large industrial gas companies also maintain a presence in China.

Refer to the **Negotiaction Helium Research Database** for detailed information on each player's involvement and interests in helium.

Regional Distribution Leaders

The regional distribution leaders are characterised by being of smaller size relative to the global industrial gas players and are without direct access to helium production. Their industrial gas distribution networks are typically concentrated within specific geographies, though many have additional distribution operations globally. The global and regional distribution leaders are involved purely down the end of the value chain. Their business is in the wholesale and distribution of helium. Specliasing in downstream procurement, marketing, distribution and sales, the major global and regional distribution procure their helium supply from the industrial gas majors and other upstream players, mainly oil and gas players. This is due to the fact that the major industrial gas players and upstream players control all upstream helium production and supply.

Global Distribution Leaders

Global Gases Group is an interesting case in that it specialises in helium distribution and wholesale across a number of regions while not having the same scale as the major regional distribution leaders. Global Gases is based in Dubai, with production and distribution facilities in Dubai, Singapore, Kuala Lumpur, Baku, Perth and Cape Town – the group is strategically located to service the buoyant offshore industry of the Middle East, Indian Sub-Continent, South East Asia, Caspian, Maghreb region, Mediterranean and West Africa.

Upstream Players

Upstream players include oil and gas companies with the original rights to the gas fields. Their original interest was in natural gas. However, the presence of helium has lead to them becoming involved in the production of helium. The players that have expanded down the helium value chain include large national companies such as Sonatrach, RasGas (subsidiary of Qatar Petroleum), KRIO (division of Polish Oil and Gas) and Gazprom. These players have chosen similar paths to bring their helium to market which includes selling and distributing a certain percentage of the helium themselves while having contracts in place with one or more of the major five industrial gas companies for sale of the remaining helium. This is the case for RasGas, KRIO and Sonatrach; companies that hold full ownership of the helium plants except for Sonatrach that holds a 49% stake in the Skikda helium plant.

End Users

A survey of helium contracts and sales agreements highlighted a handful of large end user buyers. For example, NASA contracted with four of the five global industrial gas players. This was the only instance of a large end customer contracting with multiple gas players. Analysis reveals large numbers of smaller disperse buyers across a varied number of markets, industries and geographies. Small users generally make supply agreements with a single industrial gas player.
Most of the end user sales contracts examined were in the form of long term five- to ten-year helium supply contracts, generally between the global industrial players and end user markets or in some cases regional distribution leaders. Refer to the **Negotiaction Helium Research Database** for detailed information on end user supply contracts.

Prospective Buyers for Central Petroleum's Anticipated Helium Supply

Potential Buyer	Role of Buyer	Companies	Advantages	Disadvantages	Factors to Consider
Global industrial gas player	Crude helium offtake Liquid helium production Liquid helium sales and distribution	Air Products Air Liquide TNS Praxair Linde Group	Purification and liquefaction expertise and technology Access to key markets and established distribution channels	Likely to squeeze profit margins Bargaining power	Access to expertise in helium extraction Technology licensing Knowledge and experience Risk profile of CTP Access to markets and customer relationships
Direct to regional distribution leaders	Liquid helium sales and distribution	Iwatani (Japan) Jinhong Gas (China)	Likely to accept liquid helium purchases from a regional port (able to get high liquid helium price) May be seeking alternative buyers to the global industrial gas players (willingness to negotiate) Marketing of proportion of helium production	Strict quality and price requirements Supply and transport requirements	Ability to meet strict quality requirements Price of import Access to high demand regions
Direct to global distribution	Liquid helium sales and distribution	Global Gases Group	Specialises in pure helium distribution and sales. Access to global markets and end customers Major transfill facilities (including Perth) – transport efficiencies	Limited upstream experience Strong negotiator with suppliers of pure liquid helium	Access to markets and customer relationships (global versus regional access)

Table 1: Prospective Helium Buyers for Central Petroleum

Global Supply and Demand

Helium Supply

The primary world helium producer is the US with up to 16 on-stream helium extraction plants. Russia, Poland and Algeria are additional sources of world helium supply.

In recent years, Qatar and Algeria have provided significant incremental world helium capacity, with Algeria producing as much as 11 percent of world supply in 2005. By 2006, the combined production of the plants in Arzew and Skikda, Algeria and Ras Laffan, Qatar increased their combined share of world supply to 17 percent in 2006.

Since 2006, the only helium extraction plant in the southern hemisphere, located in Darwin, Australia, came online in 2009 with production capacity of 150 MMscf/yr.

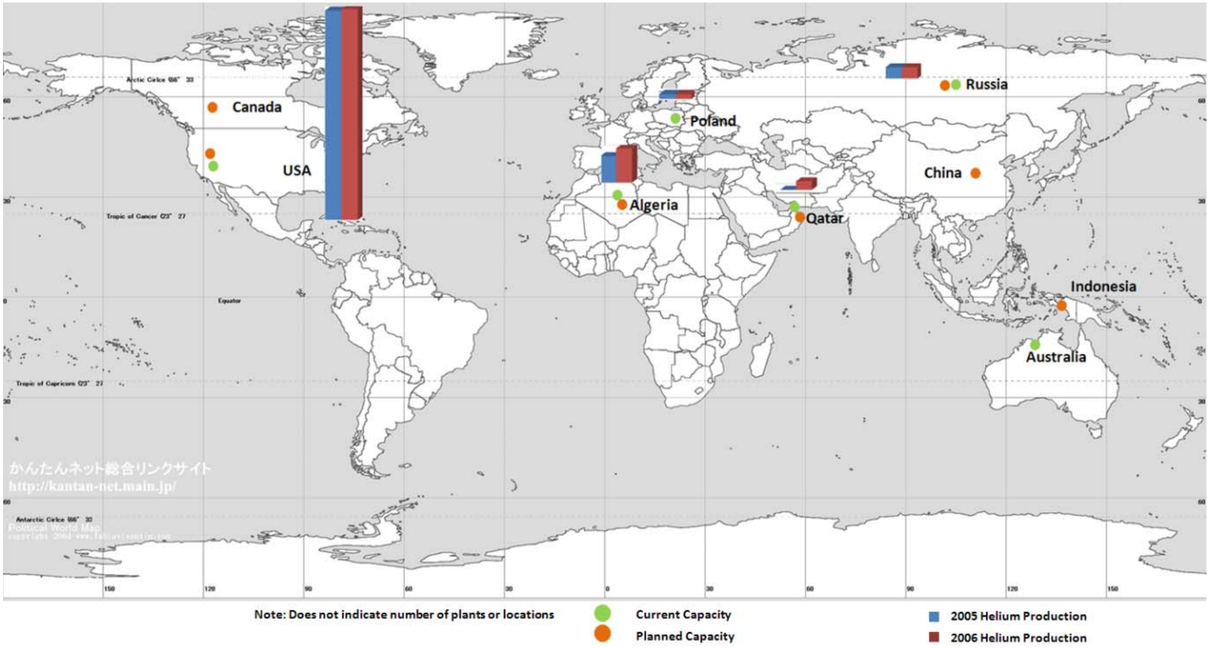

Figure 7: Global Helium Production

Note: Contains 2005 and 2006 production figures. Australia was not a production centre in 2005/06.

Helium Resources

According to the USGS (2009)[9] estimate of the world helium reserve base, the US, Algeria, Qatar and Russia hold 89 percent of the world's helium reserves.

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[9] U.S. Geological Survey, Mineral Commodity Summaries, January 2009 Appendix B

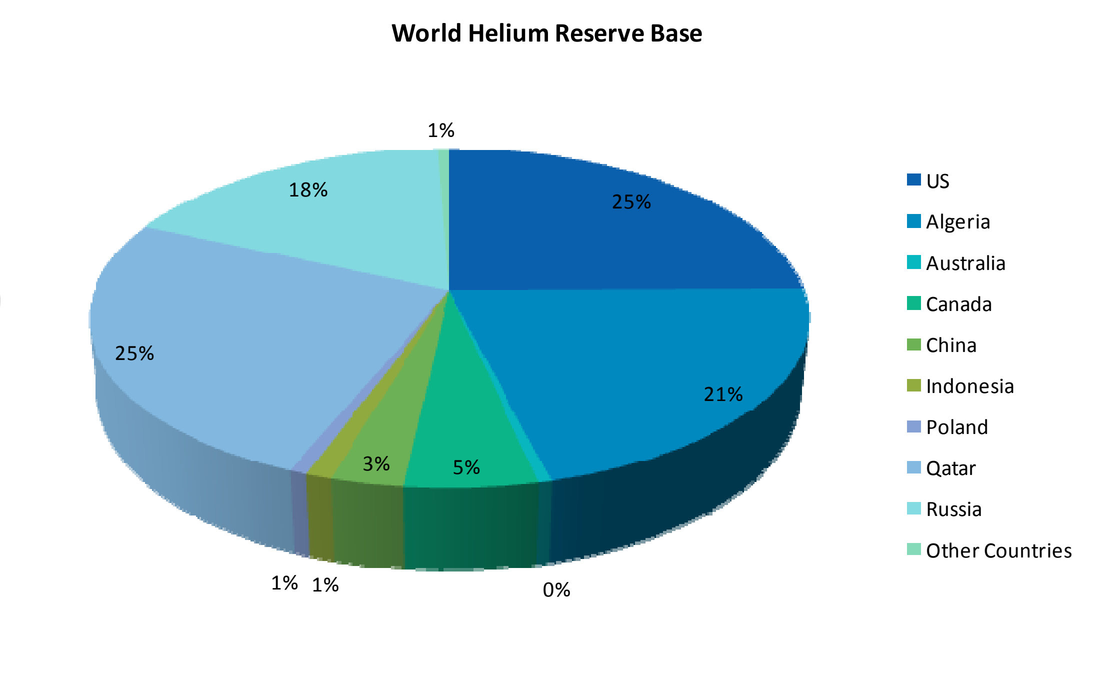

Figure 8: Helium Reserve Base

Source: USGS

Canada, Indonesia, Iran and other countries may also have significant helium reserves that may be extracted in the future, if deemed to be economically viable.
Indonesia is expected to add globally significant incremental capacity to helium supply into the world market should its helium extraction plant, adjacent to the Tangguh LNG project, be commissioned in 2011/12.

China, although having helium resource potential, is unlikely to produce a significant amount of helium for commercial purposes, due to helium extracted in China being used mainly for national defence and medical purposes only. China is therefore likely to continue to be import dependent for its helium requirements.

Reserve Base: That part of an identified resource that meets specified minimum physical and chemical criteria related to current mining and production practices, including those for grade, quality, thickness, and depth. The reserve base is the inplace demonstrated (measured plus indicated) resource from which reserves are estimated. It may encompass those parts of the resources that have a reasonable potential for becoming economically available within planning horizons beyond those that assume proven technology and current economics. The reserve base includes those resources that are currently economic (reserves), marginally economic (marginal reserves), and some of those that are currently subeconomic (subeconomic resources). The term "geologic reserve" has been applied by others generally to the reserve-base category, but it also may include the inferred-reserve-base category.

Reserves: That part of the reserve base which could be economically extracted or produced at the time of determination. The term reserves need not signify that extraction facilities are in place and operative. Reserves include only recoverable materials; thus, terms such as "extractable reserves" and "recoverable reserves" are redundant.

World Helium Extraction Plants

The US has as many as 16 on stream helium plants. Recent additions to supply have been Arzew, Algeria (1995), Ras Laffan, Qatar (2005), Skikda, Algeria (2006) and Darwin, Australia (2009).[10]

	State	Country	Name/Town	Status	Commissioned / Start-up Date
1	Texas	USA	Sherhan	On Stream	1963
2	Kansas	USA	Otis	On Stream	1964
3	Kansas	USA	Scott City	On Stream	1965
4	Wyoming	USA	Shute Creek	On Stream	1986
5	Colorado	USA	Ladder Creek	On Stream	1986
6	Kansas	USA	Satana	On Stream	1993
7	Texas	USA	Sunray	On Stream	1993
8	Kansas	USA	Lakin	On Stream	1995
9	Utah	USA	Mcab	On Stream	1995
10	Oklahoma	USA	Keyes	On Stream	1996
11	Texas	USA	Fain	On Stream	1997
12	Kansas	USA	Liberal	On Stream	1991
13	Kansas	USA	Ulysses	On Stream	1998
14	Texas	USA	Rock Hill	On Stream	2001
15	Kansas	USA	Offerie	On Stream	NA
16	New Mexico	USA	Shiprock	On Stream	NA
17	n/a	Russia	Orenburg	Operational	1993
18	n/a	Poland	Odolanow	Operational	1977
19	n/a	Algeria	Arzew	Operational	1995
20	n/a	Qatar	Ras Laffan	Operational	2005
21	n/a	Algeria	Skikda	Operational	2006
22	n/a	Australia	Darwin	Operational	2009

Recently Commissioned Helium Extraction Plants

Recently commissioned plants in Qatar (Ras Laffan), Algeria (Skikda) and Australia (Darwin) have a combined new capacity of approximately 1,350 MMscf/yr, which is a significant proportion of the world helium market. However due to startup delays, plants in Qatar and Algeria are running below capacity. Australia's first helium plant in Darwin was commissioned in 2009 and is expected to produce 150 MMscf/yr at capacity, mainly supplying domestic demand, New Zealand and Asia Pacific markets.

State	Country	Name/Town	Status	Commissioned/Start-up Date	Actual Production (MMscf/yr)	Capacity (MMscf/yr)
n/a	Russia	Orenburg	Operational	1993		230
n/a	Poland	Odolanow	Operational	1977		106
n/a	Algeria	Arzew	Operational	1995		565
n/a	Qatar	Ras Laffan	Operational	2005	300	600
n/a	Algeria	Skikda	Operational	2006	240	600
n/a	Australia	Darwin	Operational	2009		150

Figure 9: Recently Commissioned Helium Plants

[10] Speciality Gas Report, Q3, 2009.

Ownership and Off-Take Arrangements in Recent Helium Plants

Major global industrial gas companies have formed joint venture arrangements (shared capital investment and equity) with natural gas producers. For example, Arzew, Algeria is owned jointly by Air Products, Air Liquide and Sonatrach, an Algerian oil and gas player. Linde Group combined with Sonatrach on the Skikda plant.

Other oil and gas players, like RasGas, QatarGas, KRIO (a Polish Oil and Gas subsidiary) and Gazprom own and operate helium extraction facilities, adjacent to their LNG and gas operations, and engage the specialised services of industrial gas players, such as BOC/Linde, Air Products and Air Liquide in handling downstream non-domestic, international distribution and sale of helium.

Country	Plant Name	Capacity (MMscf/yr)	Plant Owner	Gas Supply Owner	National, Regional Distributor	Global Distributor	Known Supply Locations
Russia	Orenburg	230	Gazprom	Gazprom	Gazprom		Russia
Poland	Odolanow	106	KRIO	KRIO	KRIO	BOC	Poland (KRIO) and European markets (BOC)
Algeria	Arzew	565	Sonatrach, AP, AL	Sonatrach		AP, AL	75 percent to Europe
Qatar	Ras Laffan	600	RasGas (I), RasGas (II) and QatarGas	RasGas (I), RasGas (II) and QatarGas		Linde Group, AL	Middle East and Asia
Algeria	Skikda	300-600	Linde, Sonatrach	Sonatrach		Linde Group	
Australia	Darwin	150	Linde (BOC Australia Ltd)	Darwin LNG Pty Ltd	Linde Group	Linde Group	Australia, New Zealand, Asia Pacific markets

Figure 10: Helium Plant Summary Table

Planned Helium Extraction Plants

Future helium capacity in Qatar, Algeria, Russia, USA, Indonesia and India is expected to bring about additional capacity of approximately 2,500 MMscf/yr. Qatar II, Irtusk (Russia) and Arzew II (Algeria) are expected to be online by 2011, if there are no delays or startup problems. Qatar is expected to continue to supply to centres of rising demand in Asia, with Russia and Algeria more likely to supply to key European markets and customers.
Asia is expected to see a significant capacity boost with the introduction of a helium extraction plant in Indonesia alongside the Tangguh LNG project, and has an expected start up date of 2011/2012.

State	Name/Town	Country	Status	Commissioned/Start-up Date	Actual Production (MMscf/yr)	Capacity (MMscf/yr)
n/a	Qatar II	Qatar	Construction	2011		700
n/a	Irkutsk	Russia	Construction	2011		270
n/a	Arzew II	Algeria	Construction	2010/2011		600
n/a	Cimarex	Wyoming	Construction			300
Texas	Sofamco	USA	Construction			
n/a	Tanguh	Indonesia	Construction	2011/2012		560

Figure 11: Expected Helium Plants (2011-2012)

2.1.1 Helium Capacity Projections

Supply projections of helium are based on known new planned capacity. Six new plants are expected to come online and add additional capacity through to 2013. The model assumes delays to full capacity production, with staged introduction capacity of 50 percent in the first year and the remainder in the following year.

However, significant uncertainties continue to exist regarding timelines, design capacity and expected startup. Projections are compiled based on information current at the time of forecasting.

			<2005	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Known Helium Production				5650	6003								
Additional Capacity/Plant Startup:													
Arzew	Algeria	1995	565										
Ras Laffan	Qatar	2005		300					300				* 2007 Air Products & Chemicals
Skikda	Algeria	2006			240				60				* 2007 Air Products & Chemicals
Darwin	Australia	2009						150					
Qatar II	Qatar	2011								300	400		* Assumed Delays to full capacity
Irkutsk	Russia	2011								270			
Arzew II	Algeria	2010/201								300			
		1									300		* Assumed Delays to full capacity
Cimarex	Wyoming	2012									300		
Sofamco	USA												
Tanguh	Indonesi	2011/201									300		
	a	2										260	* Assumed Delays to full capacity
Total Helium Production Capacity				**5650**	**6003**	**6003**	**6003**	**6153**	**6513**	**7383**	**8683**	**8943**	

Source: Negotiaction analysis, various.

Figure 12: Forecasted Plant Capacity to 2013 (Negotiaction Model)

Projections show current capacity of just over 6,000 MMscf to rise to around 9,000 MMscf based on the assumption that all planned plants become operational with staggered start up. This figure could be potentially much lower based on feasibility studies and delays being as long as 1.5 years.

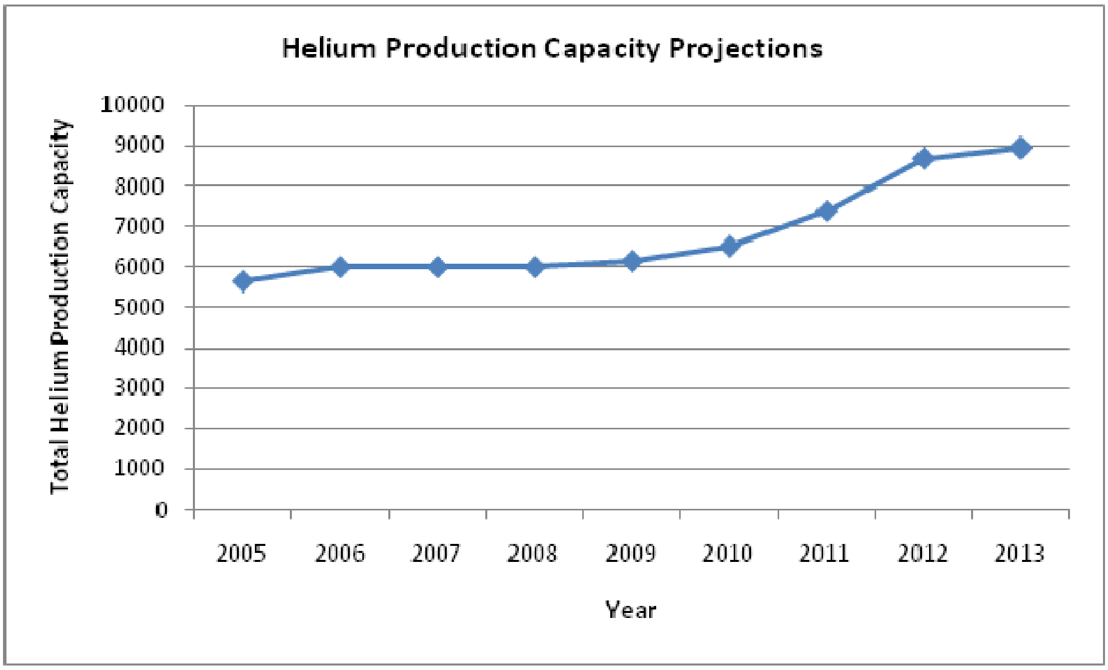

Figure 13: Projected Helium Production to 2013

Key Supply Issues

The US Federal Helium Reserve

The US Department of Interior's Bureau of Land Management (BLM) is steward of the Federal Helium Reserve. The Federal Helium Reserve consists principally of the Bush Dome Reservoir, which is a naturally occurring underground structural dome near Amarillo, Texas, where government owned crude helium is stored. The Federal Helium Reserve also consists of a helium pipeline system running through several states, connecting crude helium extraction points, helium refining facilities and the Bush Dome Reservoir.

Currently the Helium Reserve supplies over one half of the US demand for helium and approximately one third of the helium consumed globally each year. Over the last ten years the net amount of helium delivered from the Helium Reserve has increased as demand and world helium prices have increased. Based on recent draw down rates it has been estimated that the Reserve will last for between ten and fifteen years. It is possible that change in government policy could result in reduced draw down of the US Federal Helium Reserve.

Qatar and Algeria Plant Delays

Current supply shortages in helium are attributed to production and start up delays in new plants located within Algeria and Qatar.

The Skikda helium plant in Algeria, which was initially designed to have capacity of 600 MMscf/yr, came on line in April 2007, however it is currently producing at approximately 240 MMscf/yr. It is anticipated by Air Products & Chemicals that maximum capacity of the Skikda plant will be approximately 300 MMscf/yr.[11] The Ras Laffan plant in Qatar with designed capacity of 600 MMscf/yr is still producing at approximately 300 MMscf/yr.[12]

LNG Projects

Future helium supply is heavily dependent on the production of LNG. While clearly the supply of helium is limited by the availability of natural gas containing appropriate levels of helium, development of LNG projects under the current helium pricing environment is likely to stimulate increased focus on helium monetisation.

Helium Demand

In 2008-2009, helium demand dropped from its 2007 highs due to the global economic slowdown.

Major Geographies

The US, Europe and Japan are expected to be regions of significant helium demand. The prominence of US based demand for helium is likely to decrease over time. In 2006, as much as 59 percent of global helium demand came from the US, with Europe absorbing 23 percent.
Japan alone accounted for as much as 7 percent of the global demand for helium in 2006. However, demand for helium in Japan is expected to remain flat due to its low GDP growth potential.

Growth in Asian Demand

Significant growth is expected in Asian markets, driven mainly by China as well as other manufacturing centres, including Taiwan and Korea. The increasing sophistication of manufacturing in markets such as China and the current high level of sophistication in manufacturing within Taiwan and Korea are expected to continue to boost helium demand.

Emerging Uses of Helium

Nuclear power is likely to a major driver of the future demand for helium. (Refer to Section 5.5.2). Additional applications within emerging markets exist in heavy lifting, military applications and border surveillance UAV's (Unmanned Aerial Vehicles), plus new applications in electronics and

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[11] World Wide Helium Shortages - CryoUsers Meeting - Air Products – Presentation - Sep 12-13, 2007

[12] World Wide Helium Shortages - CryoUsers Meeting - Air Products – Presentation - Sep 12-13, 2007

display unit manufacturing. Thus emerging market uses of the unique properties of helium are expected to drive the demand for helium.[13]

2.1.2 Helium Demand Projections

The demand for helium is estimated to grow at 5 to 6 percent annually over the next decade. A major growth market is China, which grew at 16 percent over the five years to 2006 and is likely to play a significant role in world helium demand.

World Production CAGR Figures:	
USGS CAGR (1980-2003)	5.3%
USGS CAGR (1980-2008)	5.0%
USGS (2005-2006) Growth[14]	6.3%
Air Products (2006-2010) CAGR[15]	5.1%
Average Growth Scenario	5.4%
High Growth Scenario	6.8%

Figure 14: Demand Growth Estimates

Implicit growth rates from USGS and Air Products analysis are provided in the table above. Average demand projected to 2013 sits between the 5 and 6 percent annual growth expected. A high growth scenario of 7 percent relying on rapid Chinese demand growth and generally buoyant global economic health has also been included.

Under the growth scenario of 5 to 7 percent, helium demand growth is expected to be met by significant new capacity in Qatar, Algeria, Russia and Indonesia. However, significant uncertainty and delays are likely to leave capacity below the projected 2013 levels.

In the high growth scenario with demand growth driven by China, supply is not capable of meeting demand. This will be particularly so if capacity is lower than expected, as the experiences of recent delays in plants in Qatar and Algeria have shown.

[13] Specialty Gas Report, Q2 2009

[14] US Geological Survey, http://minerals.usgs.gov/minerals/pubs/commodity/helium/

[15] World Wide Helium Shortages - CryoUsers Meeting - Air Products – Presentation - Sep 12-13, 2007

Supply and Demand

Geographic Distribution of Demand and Supply

- The US helps meet demand in Europe, Asia and South America.
- The US meets all of India's demand for helium.
- 55 percent of US exports are made to Asia, of which 38 percent goes to Japan.
- European demand is met mainly by the US, Poland, Russia and Algeria.
- Algerian, Russian and Polish production is almost exclusively sold into their domestic and nearby European markets.
- Qatar's helium production is exported exclusively to Asian markets.
- Darwin, Australia meets demand in the domestic market, New Zealand and Asia Pacific markets.

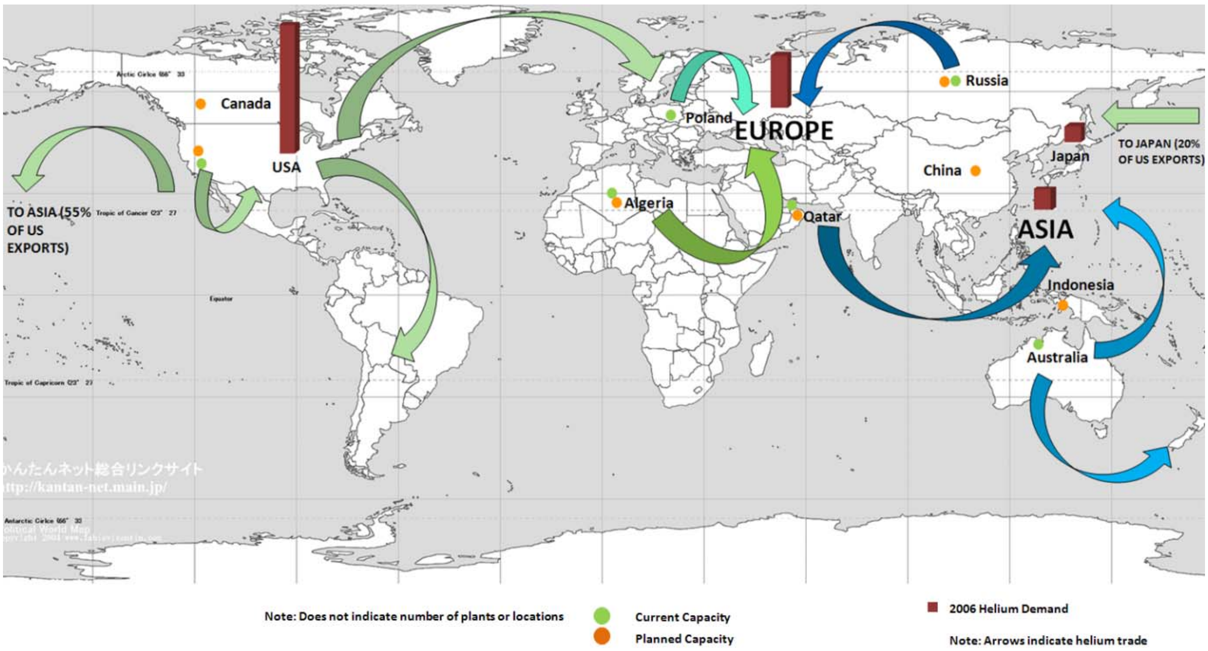


Figure 15: Meeting Global Demand

Demand and Supply Projections

With incremental supply known up to 2013, and assuming no new helium production plants are established in this timeframe, average demand meets capacity near the year 2015-2016. There is however significant uncertainty as to whether all planned projects will actually be completed and operate at full planned capacity. Beyond 2016-2019, currently planned capacity is unlikely to satisfy global helium demand.

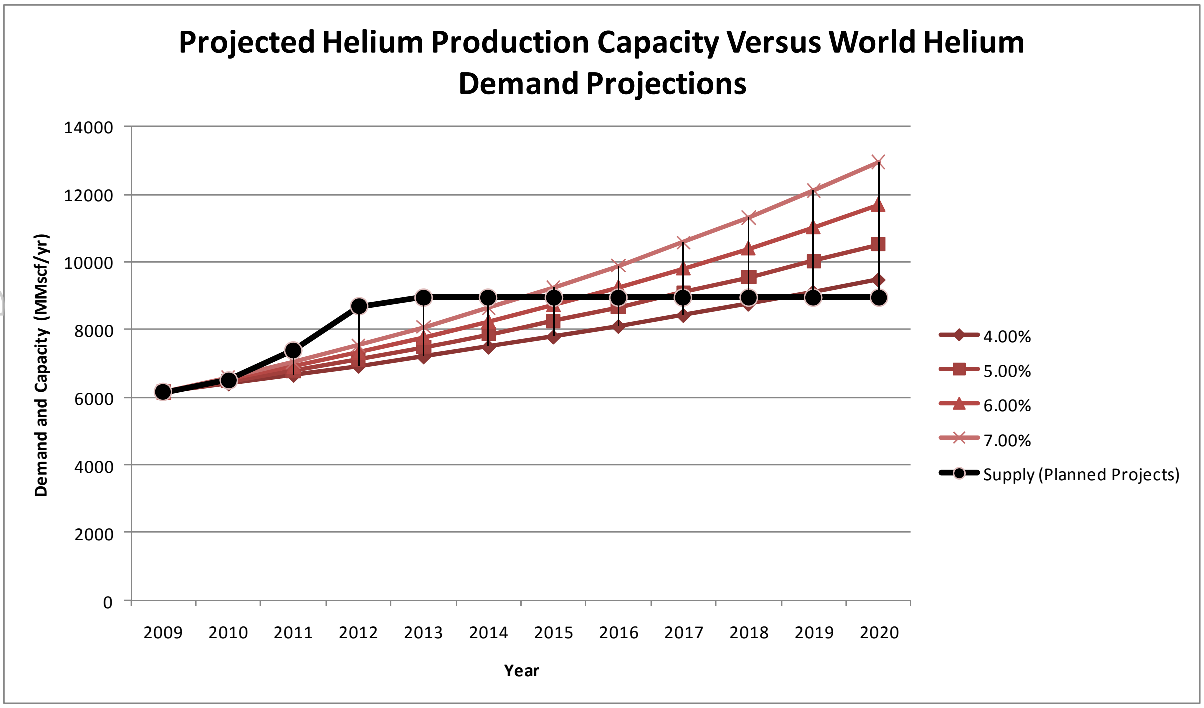


Figure 16: Supply and Demand Projections to 2013

Helium Extraction Plants Required to Meet Global Demand

The divergence between projected demand and supply can be used to anticipate the approximate number of Helium extraction plants that would be required to meet demand levels in the future. For instance, in 2015, there is market demand for at least two additional 150 MMscf capacity plants. The number of Helium plans required to meet demand grows at a rapid rate beyond 2015 as known availability of supply is increasingly unable to meet the world's helium demand.

Number of 150 MMscf/yr Helium Liquefaction Plants Required to Meet Demand-Supply Gap

Demand CAGR (%)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
4.00%											2	4
5.00%									1	5	8	11
6.00%		1						3	6	10	14	19
7.00%		1					2	7	11	16	22	27

Figure 17: Helium Production Capacity/Plants Required (Negotiaction Model)

Pricing

Current Helium Pricing

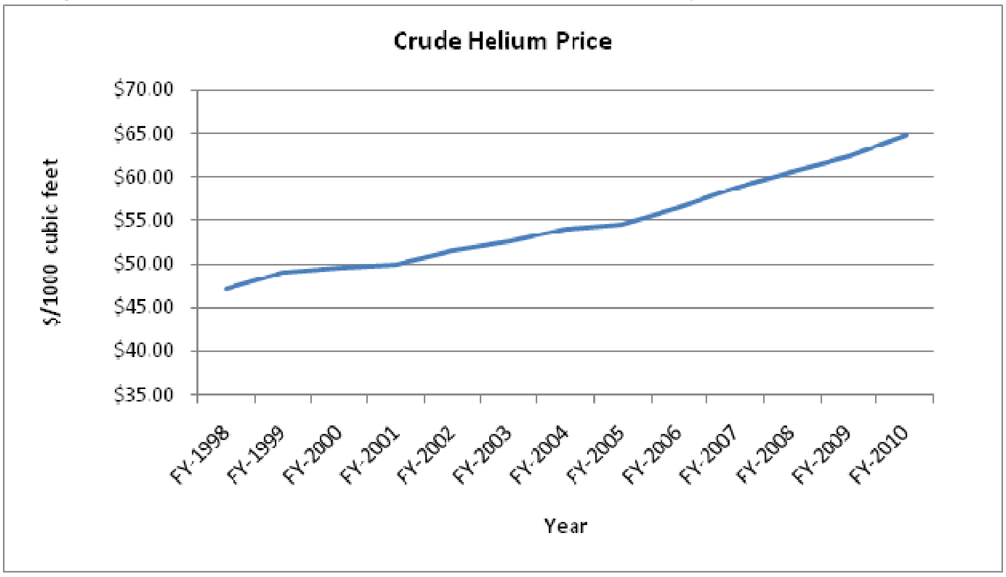
In spite of the global economic slowdown in 2008-2009, pure, refined helium prices remained at or near 2007 highs. Pricing is anticipated to remain stable in 2010 owing to a slow recovery and upturn in global economies.

> "*The Government price for crude helium was $2.25 per cubic meter ($62.25 per thousand cubic feet) in fiscal year (FY) 2009. The price for the government-owned helium is mandated by the Helium Privatization Act of 1996 (Public Law 104-273). The estimated price range for private industry's Grade-A gaseous helium was about $4.51 to $5.23 per cubic meter ($125 to $145 per thousand cubic feet), with some producers posting surcharges to this price.*"
> Source: U.S. Geological Survey, 2010, Mineral commodity summaries, p. 72.

Historic Helium Pricing

Crude Helium Pricing

Crude helium has between 50 to 70 percent purity and contains a mixture of other gases, including nitrogen. Price data from the USGS, commissioned by BLM is shown below:



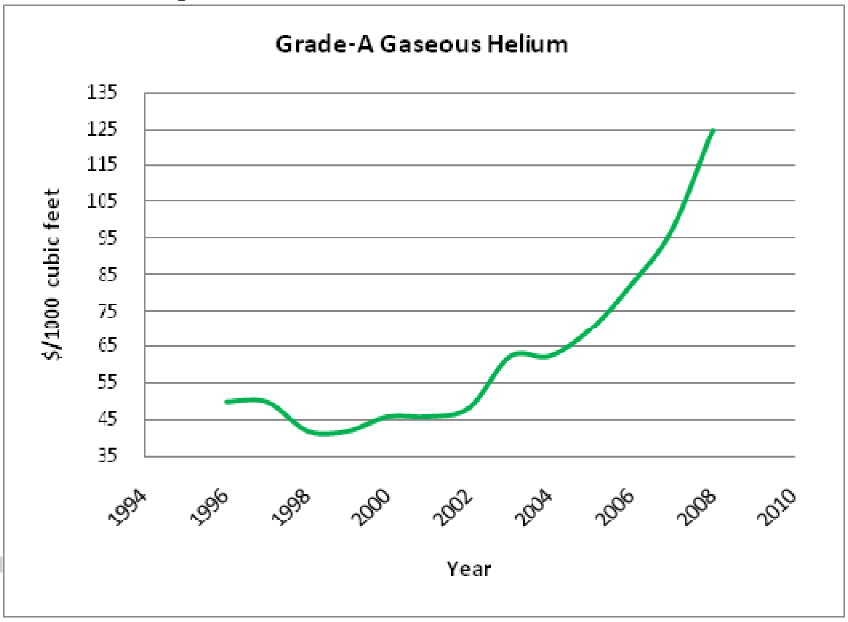
Grade A – Gaseous Helium Pricing

According to *Helium Statistics and Information, USGS,*[16] Grade-A gaseous helium prices are as follows:

	USD Per Cubic Metre			USD Per Thousand Cubic Feet		
	Mid-Point	Lower Range	Upper Range	Mid-Point	Lower Range	Upper Range
1996	$1.80	$1.80	$1.80	$50.00	$50	$50
1997	$1.80	$1.80	$1.80	$50.00	$50	$50
1998	$1.51	$1.51	$1.51	$42.00	$42	$42
1999	$1.51	$1.51	$1.51	$42.00	$42	$42
2000	$1.66	$1.51	$1.80	$46.00	$42	$50
2001	$1.66	$1.51	$1.80	$46.00	$42	$50
2002	$1.75	$1.62	$1.87	$48.50	$45	$52
2003	$2.25	$2.16	$2.34	$62.50	$60	$65
2004	$2.25	$2.16	$2.34	$62.50	$60	$65
2005	$2.53	$2.42	$2.63	$70.00	$67	$73
2006	$2.97	$2.88	$3.06	$82.50	$80	$85
2007	$3.52	$3.24	$3.79	$97.50	$90	$105
2008	$4.51	$4.15	$4.87	$125.00	$115	$135

Table 2: Gaseous Grade A Pricing

Note that these prices are private industry prices, higher than the government prices which are mandated by the Helium Privatization Act of 1996. In 2008, the government price of crude helium was US$2.18 per cubic meter.



Price Growth:

5 Year Average Growth: 14.92%

10 Year Average Growth: 11.53%

Future Helium Pricing

Factors Affecting Future Helium Pricing

Factors Likely to Increase Future Pricing	Factors Likely to Decrease Future Pricing
Asian Economic Growth Economic growth is a significant factor in boosting the demand for helium and putting upward pressure on pricing. 9.01 percent growth in 2008 and 8.50 percent growth in China in 2009 will have a significant impact on the country's demand for	**Downward Drivers Affecting Future Helium Pricing** Significant Capacity Start-up (Qatar and Algeria) A number of new plants in Qatar, Algeria, Russia, USA and Indonesia are expected to add nearly 2,500 MMscf/yr of new capacity up to 2013 if planned capacity is maintained at

[16] US Geological Survey, http://minerals.usgs.gov/minerals/pubs/commodity/helium/

helium. China is expected to account for nearly 70-80 percent of helium growth in Asia.[17] Low GDP growth potential will have a significant influence in Japan which is likely to see flat helium demand.

Market Sophistication
Industrial development of key markets is likely to create demand for helium. High tech electronics manufacturing will boost short term helium demand in markets like China, Taiwan and Korea. Refer section to 5.5.1 for further discussion on Asian demand side specifics.

Depletion of US Federal Helium Reserve
If new sources of supply are not established to replace the depleting US Federal Helium Reserve, given its role satisfying global demand, there is potential for significant upward pressure on helium pricing.

Delays in New Capacity
Delays to new capacity in light of growing demand has put significant upward pressure on helium prices (see gaseous Grade A price trend between 2006 onwards). Delays in production of plants in Qatar and Algeria have forced gas suppliers to cut helium supply to key markets, causing upward price pressure. Delays in supply capacity have resulted in an inability to meet market demand causing prices to rise sharply.

Development, Feedstock and Extraction Costs of Developers
A key price point in the helium supply chain is the cost of crude helium. Oil and gas companies with an ownership interest in natural gas fields set pricing structures for crude helium. These asset owners commonly demand high value for the crude product before refining. Cost escalations in development, feedstock and extraction costs contribute to price escalations of the crude product, which has a carry on effect on liquefied helium prices.

New markets and new uses of helium
The unique properties of helium are being used in a number of emerging technologies, creating new demand for helium. Refer to section 3.2.3 for further discussion.

currently expected levels. Helium potential may exist in countries like Canada and Iran, which may significantly add to supply in the medium term. High capacity plants in Qatar and Algeria, if able to operate at maximum capacity, will add significantly to world supply, driving prices down.

New Cost-Efficient Supply Sources
New supply sources in Asia and Oceania (Indonesia, Australia)) contribute to a slight downward pressure on prices through lower transport and shipping costs, mainly due to their proximity to Asian markets. Quicker access to major transfill distribution facilities in major demand centres like China make for greater cost efficiencies in terms of maintaining cryogenic helium at appropriate temperatures, as well as fewer losses due to time and temperature induced leakages.

Entry of New Helium Players
An increase in competitive dynamics, such as the entry of TNS into the helium market, contributes to driving prices down. Global Gases Group specialising in global distribution of pure helium is likely to see efficiencies arising out of greater competition and specialisation in a more globalised market.

Alternatives to Helium
Gases like argon are used as a substitute for helium in applications such as welding. In certain lifting applications, hydrogen can be combined with helium in certain proportions to reduce the flammability of the mixture of gases.[18] Hydrogen may also be substituted for helium in deep-sea diving applications. However, there is no true substiteu for helium if temperatures below -269 ° C are required.[19]

Liquid Helium and Implications for Central Petroleum

FOB Darwin Price Estimation

Negotiaction estimated the current liquid helium price for FOB Darwin by working from known retail prices in Shanghai and US ex works prices, and subsequently calculating CIF Shanghai at USD 170-190 in order to determine FOB Darwin pricing (the price at which helium FOB Darwin would be competitive). FOB Los Angeles is estimated to be USD 150-170 based on an ex-works price of USD 140-160. Shipping costs between Los Angeles and Shanghai are assumed to be higher than Darwin to Shanghai, which has been taken into account in computing FOB Darwin pricing. The FOB Darwin price is estimated at USD 155-175, which takes into account transport, export duty, and related costs. This is compared to FOB Los Angeles prices of USD 150-170.
All prices were calculated in USD per Thousand Cubic Feet.

Refer to **Appendix (Section 6.3)** for further information regarding this analysis.

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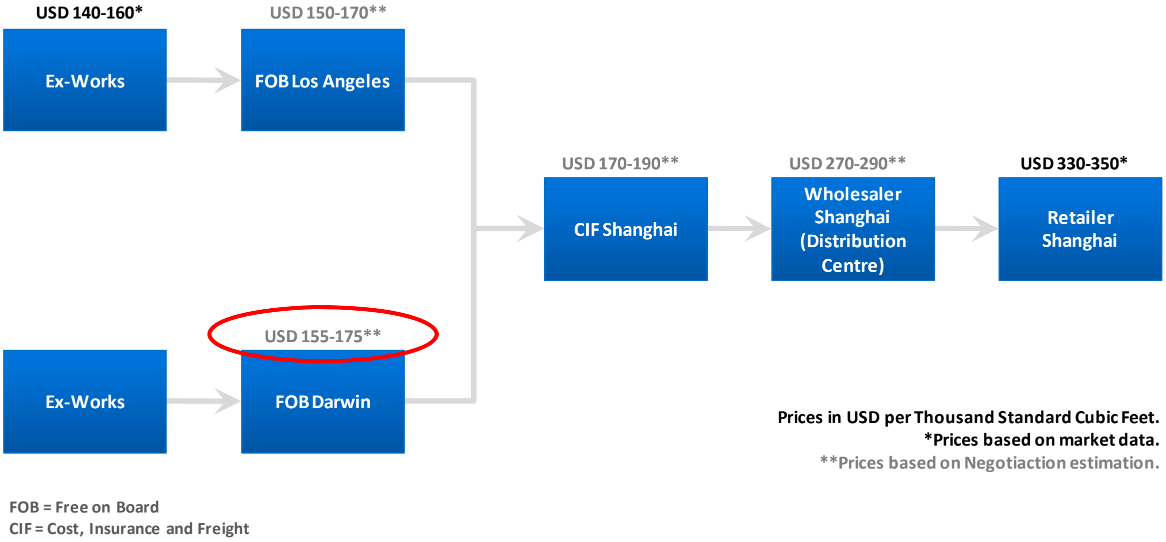
[17] Negotiaction estimate, GDP growth comparisons

[18] Discussion with Dr. Michael Clarke, Managing Director of M.E.T.T.S., January 2010

[19] U.S. Geological Survey, 2010, Mineral commodity summaries 2010: U.S. Geological Survey, p. 72.



Other Factors to consider in FOB Darwin Pricing

Downstream node – Pricing is anticipated to vary based on sale and transport of helium to a central distribution facility, such as Singapore, compared with directly to regional markets.

Length of contract – Long term supply contracts over a period of five to ten years are likely to have different price structures in comparison to annual supply contracts.

Helium in Asia

Market Size

In 2006, the size of the Asian helium market, excluding Japan, was 596 MMscf. This represented 10 percent of the global helium market which was 5,796 MMscf in 2006. By 2010, total Asian demand for helium is expected to be approximately 1,130 MMscf, up from 596 MMscf in 2005, accounting for up to 15.55 percent of the total world market for helium in 2010.[20]

Due to lack of accurate market data, the distribution of Helium demand across Asia (excluding Japan) is unknown, however is likely to be concentrated in China, Korea, Taiwan and Singapore given leadership in key manufacturing sectors requiring Helium use.

China is expected to be a major driver of future Asian demand. Japanese demand, which accounted for 7 percent of global demand in 2006, is expected to remain flat, resulting in Japan accounting for a reduced proportion of global helium demand.

[20] World Wide Helium Shortages - CryoUsers Meeting - Air Products – Presentation - Sep 12-13, 2007

Distribution of Key Supply and Demand Nodes

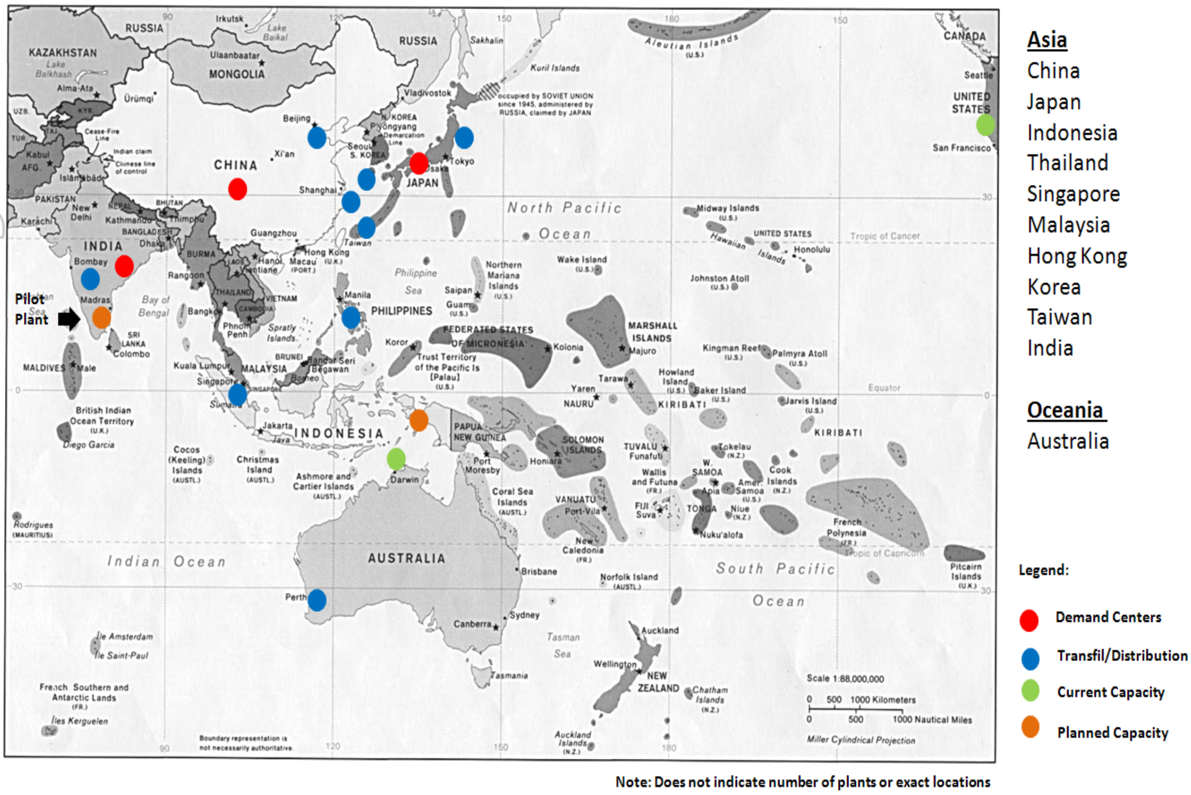


Figure 18: The Asian Helium Market

Major Helium Transfill/Distribution Facilities:
Australia (Perth)
Singapore
Philippines
Japan
Korea
China
Taiwan

Major Helium Demand Centres:
China
Japan
Others – India, Korea, Taiwan

Current Capacity:
Darwin, Australia - only helium producing facility in the southern hemisphere

Planned Capacity:
Tangguh, Indonesia
India (Indian helium extraction pilot plant completed)

Key Insights

- Asian demand for helium is met primarily by helium production in the US, Qatar and Australia. 55 percent of US exports are to Asia. Helium produced in Qatar is sold almost exclusively to Asian markets. Australia supplies to New Zealand as well as Asia Pacific markets.

- China is likely to be one of the fastest growing markets for helium – reaching as much as 16 percent annual growth over the five years to 2006, according to BOC. [21] Demand is mainly being driven by market sophistication in sectors like MRI, fibre optics and semiconductor manufacturing. China is likely to remain import dependent for helium, with no expected domestic commercial helium production.

- Helium demand is being driven by the electronics sector, namely display panel and semi-conductor manufacturing in Japan, China, Korea and Taiwan.

- In 2006, Japan's demand for helium was approximately 512 MMscf. Helium demand growth is expected to be flat, driven by low GDP growth potential. In comparison, China is expected to demand between 900 and 960 MMscf of helium by 2010, accounting for up to 80 percent of Asian demand, excluding Japan.

- India currently meets its domestic helium demand through imports of approximately 6 MMscf/yr, which is sourced mainly from US imports. ONGC recently set up a pilot helium extraction plant in India and is likely to help India overcome its helium import dependence.

- Singapore is a major regional shipping hub making it an important part of the helium distribution chain for further distribution throughout Asia. Global Gases Group and Air Products are known to have transfill facilities in Singapore. There is also potential for helium demand in Singapore due to electronics and semi conductor manufacturing in Singapore.

- Similar to Taiwan, Korea is expected to see higher helium demand due to electronics and LCD manufacturing operations. Air Products and Praxair are known to operate transfill facilities in Korea.

- Indonesia is expected to be a significant new helium producer and exporter to the Asian market. A helium extraction facility in Tangguh, Indonesia is expected to come online in 2011/2012 with capacity of 16 MCM (560 MMscf/yr), which can be considered a globally significant source of helium.

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[21] *Chemie* website, news release 28 June 2006.

Figure 19: Tangguh LNG Project (planned helium plant)

- The helium extraction plant in Darwin, owned by the Linde Group, is currently the only helium production facility in the southern hemisphere. At full capacity the BOC Darwin plant has the potential to produce 2.5% to 3% of world supply. The size of Australia's helium market is estimated to be between A$8m and A$12m[22]. The 150 MMscf/yr plant is expected to meet domestic demand, New Zealand and other Asia Pacific markets.

- Australia also has a helium transfill facility in Perth operated by the Global Gases Group. It has the opportunity to benefit from geographical proximity to Asia, the world's fastest growing helium market. Domestic opportunities also exist within Australia's MRI market.

- CIGI (A Member of the Linde Group) maintains the first and only known helium transfill facility in the Philippines.

[22] Helium Market Assessment Report - Glen Haven Consulting - December 2009

Significant Players in Specific Asian Markets

Country	Global Industrial Gas Players Presence	Regional Distributors	Additional Information
China	At present, commercial helium in China is supplied by each of the major global industrial gas players, such as **BOC-Linde Group, Praxair, Air Products, Air Liquide** and **TNS. Praxair** is reported to be one of the market leaders in the Chinese helium market and the largest industrial gas supplier in the country.	All of the global industrial gas players have transfill distribution facilities in China. **BOC** recently opened the largest commercial helium facility in China, a distribution centre located in Suzhou. **Praxair -** Transfill in Kunshan, Jiangsu Province of China with annual capacity of 30 million cubic feet. **TNS** - Shanghai, China - Distribution centres/transfill facilities. Regional Distribution Leaders - Jinhong Gas operates a transfill facility in Jiangsu Province. **Messer's** first China based helium transfill facility was built in Wujiang, September 2004.	Several small to medium sized joint ventures have been established between the five largest industrial gas players and local companies, sponsored by local governments. **BOC** supplies significant quantities of helium to MRI manufacturers and most of the new NMR original equipment manufacturers in China.
Japan	**TNS** is the leading industrial gas supplier in Japan and **Iwatani** another important domestic player.	**TNS** owns transfill facilities (7 in total) across Japan – Japan Helium Centre. **Air Products** -Nagasaki, Japan; Osaka, Japan; Sapporo, Japan; Tokyo, Japan. **Iwatani International Corporation**	Japan's helium supply chain is well-established.
Indonesia			Globally significant helium production potential (nearly 600 MMscf/yr). Indonesia is considering helium as an export product and is likely to service the Asian market.
Taiwan	**Air Products**	**Air Products** - Chupei, Taiwan (Air Products San Fu Co. Ltd, Air Product subsidiary - transfill facility).	Potential boost in demand for helium likely, due to electronics and LCD manufacturing.
Korea	**Praxair** and **Air Products**	**Praxair** has a Korean transfill facility. **Air Products** – Seoul.	Potential boost in demand for helium likely, due to electronics and LCD manufacturing.
India	**Air Products** and **Praxair** are known to operate transfill facilities in India	**Praxair** Inc. announced the start up of a new helium transfill facility in Murbad, India. **Air Products** operates a transfill facility in Bombay, India. **Global Gases Group** supplies to India. **K-Air** - small gas distributor.	ONGC in 2008 set up India's first pilot helium extraction plant with a view to overcoming its import dependence to the US.
Singapore	**Air Products**	**Air Products** – Singapore. **Global Gases Group** (transfill centre)	Singapore is a major regional shipping hub making it an important part of the helium distribution chain for further distribution throughout Asia.
Philippines	**BOC**	**BOC** Member Company, CIGI, operates the first and only helium transfill in the Philippines.	
Australia	**Linde Group BOC** - production facility in Darwin (150MMscf/yr) - operational Significant gas companies in Australia include, **BOC Gases Australia**, **Air Liquide Australia, Linde Gas Pty Ltd** and **Air Liquide W.A.**	**Global Gases Group** - Perth Helium transfill facility. **Linde Group BOC** transport and distribution related infrastructure and operations in Australia.	

Table 3: Key Players in Specific Asian Markets

The global industrial gas players maintain a presence in most Asian markets. There is a degree of regional dominance by the global industrial gas players. For instance, TNS is the leading helium and industrial gas supplier in Japan. Larger markets like China have seen market penetration and continual growth in distribution channels by all of the global industrial gas players.

Given the sheer scale of markets like China, there is abundant scope for medium to small size distributors, including some smaller distributors, to operate secondary distribution channels to smaller and medium size customers.

Smaller markets, like Malaysia and Thailand, are likely to be serviced by local gas distributors, importing helium from the global industrial gas players as well as regional distribution players.

Specific End Users in Asia

The large end users across Asia tend to be major electronics and MRI manufacturers. This includes names such as Toshiba, Sharp and General Electric. Other known MRI manufacturers include:[23]

- Esaote Biomedica
- Fonar
- GE Medical Systems
- Hitachi Medical Systems
- Millennium Technology Inc.
- Odin Medical Technologies
- Oni Corporation
- Neusoft
- Philips Medical Systems
- Shimadzu
- Siemens Medical Solutions
- Toshiba Medical Systems

The predominance of high tech industry in Japan, China, Taiwan, Korea and Singapore drive demand for helium in those countries through use in production of semiconductors, LCD screens and other high tech products.

Some known Asia-based helium sales contracts are highlighted below:

- Chi Mei Optoelectronics (CMO) is a known Asian TFT-LCD supplier from Air Products San Fu (Taiwan).
- Samsung Electronics agreement for air separation plant with Praxair Inc.
- Siemens Medical Systems extension of contract to supply helium for MRI manufacture from Air Products.

High Growth End-Use Markets in Asia

LCD Manufacture

A boost in demand for helium is likely to be driven by the high demand for helium in the electronics sector - especially in flat panel display manufacturing for LCD and plasma televisions. A number of major manufacturing plants have been established in China, Korea and Taiwan and will drive the demand for helium over the next few years. China is likely to see a greater boost due to such manufacturers being relocated from Taiwan to mainland China.

Asian manufacturers of LCDs are forecasting a strong 2010 with improved demand. The introduction of new display technologies for televisions, electronic-book readers and touch-screen mobile devices is expected to drive strong growth for the flat-panel industry and hence helium.[24]

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[23] MagNET Webpapge: magnet-mri.org /resources/links/manufacturers/systems.htm

Nuclear Power in Asia

Cooling systems in new generation gas cooled nuclear reactors are expected to consume much larger quantities of helium in the future. Helium acts as a direct heat carrier from the generator's turbines, thereby eliminating the need for a separate heat exchanger. This is expected to increase electrical efficiency of a nuclear reactor from around 30 percent to over 50 percent.[25] Significant proportions of helium are expected to be required by a single new generation nuclear reactor. The volume of helium needed per reactor has been estimated to be approximately 1 MMcf, with a loss rate of approximately 0.1 MMcf per year.[26]

In Asia there are over 111 nuclear power reactors in operation. According to the World Nuclear Association, 21 are under construction and plans exist to build about a further 150 reactors. Growth in nuclear power is expected to be concentrated in China, Japan, South Korea and India.[27]

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24 Asia's LCD Manufacturers Upbeat about Demand, Prices for 2010 - Wallstreet Journal (WSJ) - JAN 26, 2010

25 He Nuclear (HEN) Investment Profile - Martin Place Securities – – 13 Nov 2009

26 Selling the Nation's Helium Reserve – Committee on Understanding the Impact of Selling the Helium Reserve; National Materials Advisory Board -National Research Council - 2010

27 World Nuclear Association - world -nuclear.org/info/inf47.html

Appendix

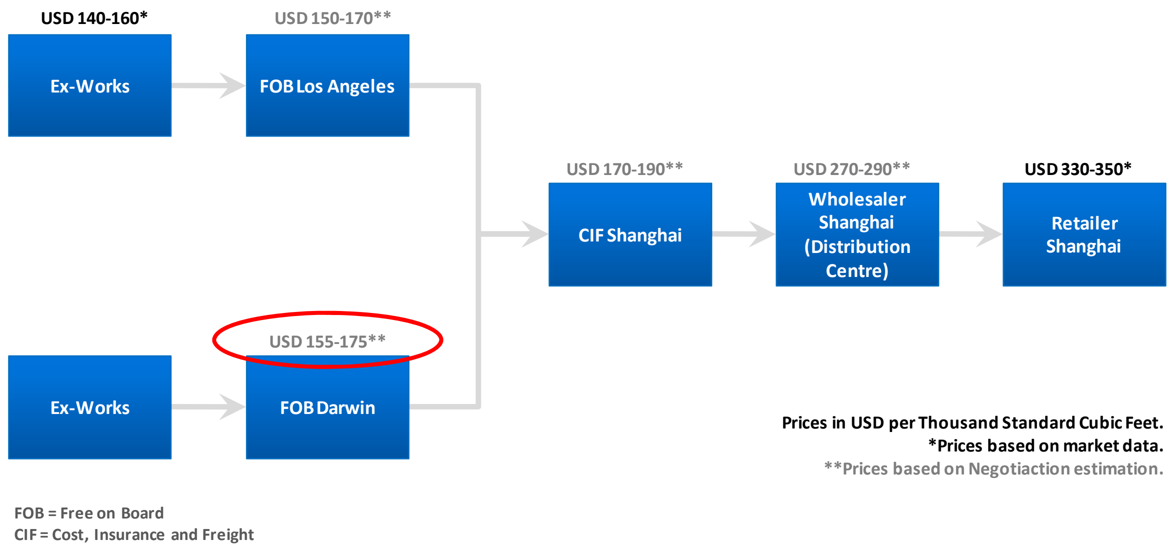
Terms, Definitions and Abbreviations

Term	Definition
MMscf/yr	Million standard cubic feet per year
MMscf	Million standard cubic feet
Cf	Cubic feet
MCM	Million cubic meters
Transfill Depot	Key part of global helium supply chain/helium distribution operations, where bulk inbound helium is converted to meet end user requirements, by processing into liquid dewards, high pressure gas cylinders and gas tube trailers by means of compression and re-gasification
Dewars	Liquid helium dewars are necessary to minimize the heat flow into the liquid helium, and are designed for transport.
FOB	Free/Freight-on-board – pertaining to the shipment of goods, location of transfer of ownership and which party pays for shipping and loading costs
CIF	Cost, Insurance and Freight - Seller must pay the costs and freight to bring the goods to the port of destination as well as insurance for the buyer
BLM	Bureau of Land Management – U.S. Department of the Interior - manages the Federal Helium Reserve, the only significant long-term storage facility for crude helium in the world. Plays a critical role in satisfying US and global helium needs.
ISO	International Organization for Standardization – Liquid helium transport occurs in large ISO-certified containers.

Unit and Currency Conversions

1 cubic foot = 0.0283168466 cubic meters
1 cubic meter = 35.3146667 cubic feet
216.09 Norm Cubic Feet = 5.988 Norm Cubic Meters = 8 Litres Liquid at 1013 bar = 1 kg[28]
1 Chinese yuan (RMB) = 0.146486 U.S. dollars, 1 U.S. dollar = 6.82659094 Chinese yuan (RMB)[29]

FOB Darwin Price Estimation



A 'required price projection model' was built to determine the level of pricing at each node of the supply chain required for Central Petroleum's anticipated liquid helium product to maintain price competitiveness.

Key Assumptions

1) Distribution to Helium market in China as depicted above in supply chain diagram.

2) Assume liquid helium products of equal quality can be produced, a fundamental requirement of entering this market. The grade-A standard is 99.995% helium.

28 Source: lindegas.com.cn/international/web/lg/cn/likelgcn.nsf/docbyalias/prod_calcu.

29 Currency conversion as at 9 Feb 2010

3) Although the distance between Darwin to Shanghai is far less than the distance between Los Angeles to the same Chinese port, the benefit of this factor may be negligible, because helium is a high value-added product, different from dry, bulk cargos such as coal, iron ore or grains. This makes the marginal profit contribution of lower seaborne freight costs negligible. Shipping (and insurance) costs of Darwin to Shanghai have been estimated to be 75% of Los Angeles to Shanhai.

4) The critical point is the price comparison on an FOB basis, more precisely, the FOB Darwin price and the FOB Los Angeles price, which shows the necessary inputs to produce the equivalent-quality products (depreciation excluded and allowing a 10% profit margin). This requires calculation of the CIF Shanghai price (see below).

5) In the Negotiaction model, it is assumed that Central Petroleum produces helium products that are directly cost-competitive with the products produced by other established firms. Based on this assumption, for Central Petroleum helium products, the CIF Shanghai price should be at the same level or slightly lower.

Calculation of CIF Shanghai

No.	Price	Value per 1000 Cubic Feet	Method of Calculations/Items taken into account	Sources, Assumptions and Extra Values Assumed
1	Ex works	USD 140-160	All costs to produce liquid helium, including producers' profit.	Grade A gaseous helium USD 125-145 per 1000 cubif feet. Source: *http://minerals.usgs.gov/minerals/pubs/commodity/helium/* USD 15 per 1000 cubic feet for Grade A gaseous helium liquefaction.
2	FOB Los Angeles	USD 150-170	Ex work price, plus inland delivery costs, all taxes included.	USD 10 per 1000 cubic feet.
3	CIF Shanghai	USD 170-190	FOB Los Angeles, plus seaborne freight rate by liquid gas tankers, insurance included.	USD 20 per 1000 cubic feet.
4	Wholesaler Shanghai (Distribution Centre)	USD 270-290	CIF Shanghai, plus import tax, plus inland delivery costs (inward shipping by tankers and packaging by cylinders), plus wholesaler's profit margin.	USD 100 per 1000 cubic feet. Delivery cost USD15. Profit margin 20%. Favourable Chinese import duty of 5.5%. Value added tax 17%. Source: *china-customs.com/customs-tax/28/04/*
5	Retailer Shanghai	USD 330-350	Wholesaler price, plus tax, plus outward shipping costs from distribution centre to retailer, plus retailer's profit margin.	USD 60 per 1000 cubic feet. Delivery cost, administration cost and marketing cost USD10. Profit margin 10-15%, which is very volatile, subject to regional demand and supply.

Retail estimate verification:

The retail price for a 1kg or 8 litre liquid helium container in Shanghai is approximately RMB 500-600 (USD73-87). If calculated in cubic feet, then the retail price would be USD337-402 per 1000 cubic feet, which is within the range of our estimate.[30]

[30] Source: http://china.alibaba.com/ - Leading Chinese B2B electronic platform

Annexure 3. Dimethyl Ether (DME) Production, Use and the Development of Markets

DME – as diesel substitute

Dimethyl Ether is an interesting fuel and process feed chemical. It is being produced in ever increasing quantities in China, and recently Pertimina (Indonesia) has announced a project to build 1·7 Mt/y production facility in Kalimantan, with the feedstock being low-grade coal. The Indonesian DME will be utilised as a commercial and domestic fuel replacement for LPG, kerosene and diesel. It will be produced firstly for domestic markets, markets that will need to be established.

Dimethyl Ether (DME) is looked upon as a replacement fuel for LPG and diesel. DME is produced in a similar process to the Fischer-Tropsch synthesis. That process includes first producing syn-gas (with the correct balance of the active components, hydrogen and carbon monoxide) and reacting those the syn-gas in either a one or two stage process to produce DME. The structural formulae for DME is:

CH3-O-CH3 It is an oxygenate fuel like methanol and ethanol. Unlike Diethyl Ether it is not excessively reactive and can be handled in a reasonably safe manner in a similar way to LPG.

DME has the following properties in comparison to LPG, methane and diesel:

Table 6: Fuel Properties (Duncan Seddon & Associates)

		Methanol	DME	Propane	Butane	Gasoline	Diesel
Boiling Point	^oC	65	-25	-43.7	-0.5	30-190	230-360
Flash point	^oC	11	-41	-104	-60	-43	>63
Specific volume	L/t	1278	1493	1998	1928	1360	1182
Higher Heating Value	GJ/t	22.7	31	50.33	49.45	46.7	45.9
Lower Heating Value	GJ/t	19.5	28	46.36	45.67	42.5	43.0
Research Octane No.		100	<20	110	96	90-100	
Cetane No.		<10	55	<10			45-55

Note a 'typical blend' for LPG has an SE 50·4 (MJ/kg) and a liquid density 0·508 kg/L Source: AGL Gas Handbook

One very attractive property of DME in a Central Australian sense is its use as a diesel replacement. It also has excellent performance as a fuel for power generation and with minimal modification can be used with LPG infrastructure. (One Australian east coast coal mining operation is considering installing a DME plant using converted coal wastes to fuel its haul-truck fleet.) On the negative side, DME has a lower SE than LPG and has a significant carbon footprint during production.

Central Petroleum and DME

CENTRAL has the possibility of being able to produce DME in both the short-term (from reformed C_2 - C_6 gases/liquids and/or CH_4) and later from syn-gas produced Underground Coal Gasification. In the Magee I gas mix, ethane was approximately two thirds of the C_2 - C_6 gases/liquids. If the ethane (plus C_{5+} gas/liquids) was separated from the C_2 - C_6 gases/liquids and reformed, with DME being produced from the syn-gas, the LPG fraction could be blended with the DME (say to 10-15% LPG) to make a LPG replacement fuel that would be very compatible with LPG power plant and systems.

The production of DME could be the first step in the production of liquid fuels and chemicals derived from Central's very extensive coal resources. The technology, as well as being similar to F-T crude synthesis, is also similar to methanol synthesis and ethanol synthesis (under development).

Annexure 4. Underground Coal Gasification (UCG)

Underground Coal Gasification (UCG) is primarily seen as a means of producing synthesis-gas (syn-gas) from 'stranded' coal measures. The possible uses of the syn-gas are in the generation of electricity, the production of, Fischer-Tropsch liquid fuels, methanol, dimethyl ether and other oxygenates, or ammonia and urea, and possibly its reticulation to industry as a natural gas replacement (as coal gas) or even conversion to synthetic natural gas.

Syn-gas has as active components hydrogen and carbon monoxide, and inactive components, carbon dioxide, nitrogen and water vapour. Syn-gas can also contain considerable quantities of methane, with this component being formed during syn-gas production, or simply being un-reacted (residual) coal seam methane (CSM). In using syn-gas for power generation or for the production of electricity or synthetic natural gas, the presence of residual natural gas (methane) in the feed syn-gas is welcome, for it is part of the fuel mix in power generation, or simply a fraction of the total product gas in synthetic natural gas production.

In the Fischer-Tropsch synthesis, the production of oxygenates or ammonia and urea, residual methane has no role and simply dilutes the active syn-gas components. The means of utilising this gas and indeed enhancing the production of this methane need to be understood.

Underground Coal Gasification Technology

Figure 6 is a simplified UCG 'production cell'. The syn-gas product exiting the production is a cocktail of gases, volatile and not so volatile compounds, particulates and water vapour.

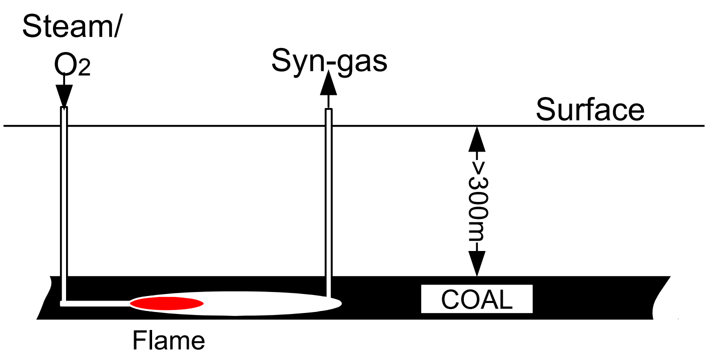


Figure 7. A UCG production cell

In its 'raw' state syn-gas is virtually a useless commodity and needs an initial cleaning to be of use in power production, or as a reticulated heating gas. The gas must be cooled, and the water content lowered, and tars and particulate removed. For simple uses it should be passible as a coal-gas, which in reality it is. (Note: Traditional coal-gas or town gas is the product of the destructive pyrolysis of coal in a retort with limited addition of oxidant. It traditionally was the gas used for industry and domestic applications before the advent of reticulated natural gas.)

For Central Petroleum the production of syn-gas from is extensive indicated coal resources presents great opportunities but also many challenges. UCG offers the prospects of CENTRAL becoming a serious player in the production of synthetic liquid fuels and the generator of significant amounts of electricity. One of the challenges is the choice of a proven UCG technology, the second major challenge will be the managing (cleaning, blending and storing) syn-gas, and the third is the selection of utilisation scenarios that will maximise the return to the Company. UCG will need to be seriously considered in the medium-term future.

Annexure 5. A Regional Helium Plant

Notes and Comments

1. A regional helium plant was reported to have cost $AU 33m in 2006 with a later figure of $AU 40m being mentioned – 2009,

2. The plant takes LNG off-gas at 3% He and produces 150 MMSCF/year of Helium – the NEGOTIACTION Report,

3. Provision can be made for doubling capacity, if the demand exists,

4. The helium is essentially a similar unit to the purifier and liquefaction plant that proposed for CENTRAL and budget costed at $US 35m ($AU 39m).

5. It has been reported that the regional helium plant has ten special road containers for LHe export (two were observed in the loading docks in February 2010) plus a stationary LHe tank,

6. A shipping company officer stated that the regional plant product is sent to Korea, and

7. By comparison, the CENTRAL Standard Field would produce some 230 MMSCF/year from a 6·3% He feed.

Conclusion: The CAPEX of the CENTRAL purifier and liquefaction plant appear reasonable in the light of the regional helium plant. The estimate of CENTRAL requiring 15 LHe containers also seems validated.

The regional plant had the following general layout.

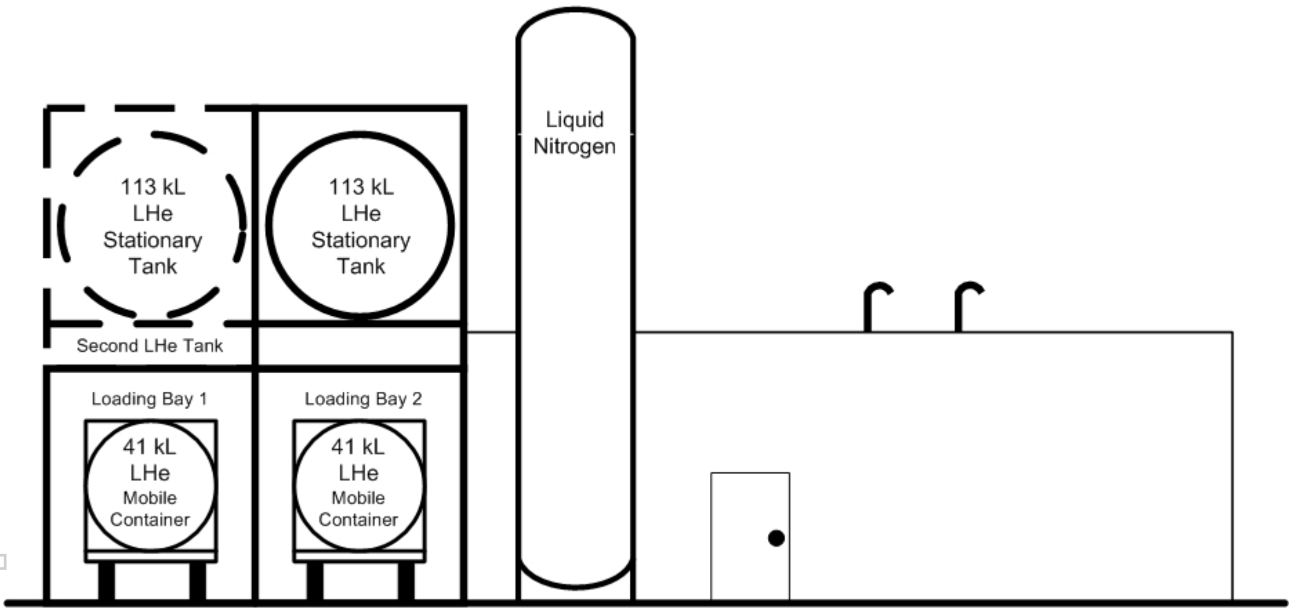


Figure 8: A liquid Helium Filling station, as observed in Australia – with an additional Stationary Storage Tank.

Annexure 6

Resume: Michael Cassin Clarke (ADB – Format)

1.	**Name of Expert**	Michael Cassin Clarke		
2.	**ADB CSRN**	-------------		
3.	**Position**	Consultant		
4.	**Date of Birth**	July 14, 1948	**Citizenship**	Australian
5.	**Education**	*Degree*	*Date*	*Institution*
		PhD, Chemical Engineering	1988	University of Sydney, Australia
		Dip. Ed. Technical	1984	Newcastle CAE, Australia
		MEngSc. Mining	1976	University of Sydney, Australia
		BE (Hons). Mining	1972	University of NSW, Australia
		Cert. Risk & Hazard Identification	2000	University of NSW, Australia
6.	**Membership in Professional and Honor Societies**	Registered Professional Engineer Qld. Mining & Chemical Fellow, Institution of Engineers, Australia (FIEAust.CENTRALEng) Member, Chem & Env Colleges Fellow, Australasian Institute of Mining and Metallurgy (FAusIMM) Past Member, Australia-Philippine Business Council (APBC) Associate Member, Federation of Engineering Institutions of S.E. Asia and the Pacific (FEISEAP) Member, Waste Management Association of Australia Member, Australian Nuclear Association - Queensland Member, Australian Coal Preparation Society, Qld Chapter Member, International Advisory Committee on Combustion, Incineration, Pyrolysis and Emission Control – JGSEE, King Mongkut University, Bangkok – since December 2008		
7.	**Other Training**	Licensed Powderman, NSW Blasting Explosives Explosive Gas Tester, NSW Coal Industry		
8.	**Countries of Work Experience**	Australia, Indonesia, Philippines, Pakistan, Thailand		

9.	**Language and Degree of Proficiency**	*Language*	*Reading*	*Writing*	*Spoken*
		English	Excellent	Excellent	Excellent

10. **Employment Record**

From: 1989 **To:** Present
Employer: METTS Pty. Ltd. Consulting Engineers: Infrastructure and Resource Development & Environmental Management, Brisbane, Queensland
Position Held: Principal (Own Consulting Firm)

From: June 2000 **To:** Nov. 2003
Employer: Griffith University,
Position Held: Senior Lecturer, Environmental Engineering

From: 1982 **To:** 1988
Employer: New South Wales, Dept of Technical Education
Position Held: Lecturing in Coal Mining

Work Experience

11. Energy Related Work	12. Work Undertaken that Best Illustrates Capability to Handle the Tasks Assigned
	Consulting to Central Petroleum Ltd. Helium processing and logistics – 2009/2010. Extended consulting
	Consulting to Thermotek on options for extraction of coal wastes from tailings dams – 2009 – completion of BMA study.
	Consulting to Knetic Energy Ltd on Biomass Gasification for Power Generation, Feb/March 2009
	Consulting to BHP-Billeton Mistsubishi Alliance (BMA – Coal) on coal recovery from tailings, late 2008
	Consulting to Ellis Engineering on Small and Remote Power Generation using Coal Wastes and Biomass, late 2008.
	Consulting to EESTech on Carbon Capture Technology, late 2007 and early 2008; project was expected to restart late 2009
	Formation of Power Factor Correction Technology Pty Ltd, with John Garrard: Theme - the development and use of intelligent PFC technology June 2008
	Queensland Centre for Advanced Technology/CSIRO - Brisbane April/June and September/October 2006 Consulting on particulate emissions control using ultrasonic plant. The control systems were designed for underground diesel coal mining plant.
	Review of Combustion Plant, Late, 2005, Brisbane, QCAT/CSIRO/ComEnergy–Brisbane, Consultant Consulting on the effectiveness and safety of the ComEnergy Rotary Kiln combustion unit.
	Heat Supply for Cane Drying, March/June 2005 Nambour, Queensland, Australia, Biocane Ltd, Consultant Consulting on the design and construction of a coal fired Fluidised Bed Combustor for cane drying.
	Coal-To-Liquids Project Scoping, June-December, 2004, Brisbane, CSIRO (through Dr Patrick Glynn) sub-consultant Proposal with scoping engineering for the production of coal to liquids for two central Queensland collieries. Fuel and process review.
	Coal Lease Appraisal, 1983 Mudgee, New South Wales, Gold Mines of New England: mining engineer The appraisal of the Genders coal leases of the Mudgee region for utilisation in local power stations. Work carried out in association with Eng. John Hodge.
	Coal Ash Utilisation, 1988, Hunter Valley NSW, Donald Catchpool: mining engineer Undertaking studies of coal ash utilisation options
	Energy from Waste, Cebu, 1993–97, Philippines, SEAPC: team leader and project design engineer Team leader of the SEAPC consortium in the design of a co-fired (wastes and coal) fluidised bed combustor, Cebu, Philippines. Dorr-Oliver, ABB, Flakt and Barkley Mowlem corporate team members.
	Engineering Laboratory Design, 1998, Indonesia, OPCV/ADB Specialist Engineer The design of engineering laboratories with inclusion of clean coal technology in Indonesia. The project was ABD financed.

Environmental Engineering/Power	A Review of Carbon Capture Technology, Nov – Dec 2007, Brisbane, EESTech. Consulting Engineer The review of an amine carbon capture system in post combustion and the utilisation of the captured carbon dioxide in Enhanced Oil Recovery.
Environmental Engineering	Energy Efficiency 2003 Brisbane, P&H Shovels: Mining /Environmental Engineer *Consulting to P&H Shovels on the emission intensities of diesel versus electric mining plant. (Work carried out as an academic for Griffith University.),*
Water Technologies	Consultant (in-house) to TSI-Asia Ltd (Bangkok) desalination technologies, December 2008 – May 2009.
	Thermal Desalination Process Design2004 – 6, Queensland, Aquadyne Ltd : Team Leader process validation Consultant to Aquadyne Ltd. (water purification engineers, Queensland). The use of thermal desalination plant, either alone or as a hybrid with Reverse Osmosis plant.
Education, Training and Skills Transfer Activities	Mining Education, 1983 – 86, New South Wales, NSW TAFE: Teacher-in-Charge, Mining Teaching at a coal mining institute (Kurri Kurri College of TAFE, New South Wales); including new course design in coal mining, preparation, environment and management.
Project Management with skills transfer	Petrochemical Plant Shutdowns. 1986-93 Sydney Techniskill, Project Manager Providing industrial worker induction for Tecniskill Co-operation Ltd, facilitation engineers.
Research work in terms of Articles, Publications and Conference Presentations	**Recent Articles/Papers** ■ Underground Coal Gasification – Coal Seam Methane, Interrelationships and synergies. AusIMM Bulletin, No1 February 2010, pp 51 - 54 ■ Security Ramifications for Power Generation, Energy Generation, Oct-Dec 2009, pp 51-53 ■ Energy Efficiency in the Developing World, July 2009 Asian J. Energy & Env. 2009, 10(03), pp 133-141 ■ Environmentally Friendly Minerals Transport, M. C. Clarke & R. A. Beatty, AusIMM Bulletin, July/August 2008 ■ Desalination in Mining. The Australian Mining Club Journal. December 2006 ■ Coal Seam Methane Associated Water, a barely tapped asset. The Australian Mining Club Journal. February 2006. ■ Co-firing Wastes; an innovative technology. P. Glynn and M. C. Clarke, Inside Waste, WMAA, October 2005. ■ Managing Asbestos. P. McGarry and M. C. Clarke. Inside Waste, WMAA, October 2005. ■ Business Continuity Management in the Mining & Energy Industries. The Australian Mining Club Journal. October 2005. ■ Risk Management: Tsunamis and the WA petroleum Industry. The Australian Mining Club Journal. June 2005. ■ Coal-to-gas-to-liquids, energy security for Australia. The Australian Mining Club Journal. February 2005. ■ Spontaneous Combustion: The curse of coal miners and a health and environmental hazard to all. The Australian

- Energy Security, Business Continuity Management and the Terrorist threat. The Australian Mining Club Journal. September 2004.
- Disappearing environmental opportunity – the proper use of waste coal as an environmental measure. The Australian Mining Club Journal. March 2004.

Recent lectures, talks and interviews.

- Bio-fuels: Solution or Spin. Joint Speaker, SSEE IEAust, Engineering House, Brisbane, July 16, 2008
- The Use of Waste Coal as Resource Recovery and Environmental Management Measures, Coal Refuse Conference, Hunter Valley, NSW, Nov. 30, 2009
- Sustainable Coal. Gust speaker. JGSEE, Bangkok, January 24, 2008
- Desalination for Queensland: ABC Radio Queensland, 4:30 pm 12th September, 2007
- Coal in Asia. Two Talks. ADB Manila June 2007 and EGAT Bangkok October 2007.
- Continuity in the supply of energy & water. Continuity Forum, KPMG Brisbane, 1st Nov. 2006
- Nuclear Energy for Desalination: ABC Radio Queensland, 4pm 28th June, 2006

Review Papers and Conference Presentations

- Clean-Coal-Technology and Enhanced Oil Recovery, Matches and Mismatches. The Environmental Engineer, 10(3), 2009
- Energy Security and Power Generation, Asian J. Energy & Env. 2009, 10(04), pp 194-200
- Coal versus Nuclear. ANAQ – Conference, Brisbane, September 2009
- Energy efficiency: scope, benefits, synergies and pitfalls for the developing world, Asian J. Energy & Env. 2009, 10(03), pp 133-141
- CTL/GTL Products, their transport, processing and meeting market expectations. Coal-to-Liquids/GTL Conference, Brisbane, February 2009
- Manure-to-Power, JGSEE CIPEC Conference, Chaing Mai,December 2008
- Carbon Dioxide, Geo-sequestration and Enhanced Oil Recovery - Synergies and Pitfalls" - has been accepted and added to the EzineArticles.com directory: Jan. 2008 http://EzineArticles.com/?id=891812
- Clean Coal Technology: How CLEAN is it and how CLEAN can it be? M. C. Clarke & P. Bennett (ACIRL). IEAust. Brisbane, October 8, 2007
- Clean and Secure Transport Fuels for Australia, Challenges and Promise. Invited presentation to the CTL/GTL Conference Brisbane. February 22/23, 2007.
- Co-firing Domestic Waste with Energy Recovery as an Environmentally Sound Incineration Practice, M. C. Clarke and P. Glynn, The Environmental Engineer, Vol 7, No 2, Winter 2006
- Desalination and Queensland Water. Conference Presentation. Queensland Water Conference, Aug. 29 - 30, Brisbane Australia, 2006

- Desalination and Power Generation: their interrelationships. Conference Presentation. Water Management in Power Generation, June 26 - 27, 2006, Brisbane Australia (informa.com.au/waterinpower)
- Clean Water from Clean Gas – A Possibility. The Environmental Engineer. M. C. Clarke and C. Putt. Vol 7, No. 1 Autumn 2006
- Managing the Terrorism Threat. Journal of Homeland Security and Emergency Management 2(4), Article 8, 2005.
- Terrorism, Engineering & the Environment: their interrelationships. Terrorism & Political Violence, Volume 16, Number 2 / April–June 2004, pp 294-304
- Bushfire, Storms and Soil Erosion. A. P. Hammond and M. C. Clarke. National Environmental Conference, Brisbane June 2003.
- The Missing Link in Clean Coal Technology; the Proper Use of Waste Coal as an Environmental Measure. The Bulletin, AusIMM, No. 2. March/April 2003
- Cleaner Production: An ASEAN Case Study The Environmental Engineer, Vol. 4 No 1, Autumn 2003.
- The Business Case Against the Ratification of the Kyoto Protocol. The Environmental Engineer, Vol 3, No 3, Spring 2002
- The Realities of Solutions to the Energy Question; are Renewable and Sustainable Options Practical? 4th Queensland Environmental Conference, Brisbane, May 30/31, 2002.
- Coal. It Future as a Fuel, and the Environmental Ramifications of its Use. M. C. Clarke & A. H. Rintoul. Presentation to the 'Four Societies - Australian Nuclear Assn., The Royal Soc. Of NSW., Australian Inst. Of Energy and Inst. Of Engineers, Australia, February 13, 2001. Harrick's Auditorium, IEAust. Sydney.
- Burning Natural Gas with Increased Radiance. M. C. Clarke and D. R. Ebeling. Chemical Engineering in Australia, Vol 22, No. 2, June 1997.
- Sewage and Waste Management in Cebu - The Future. Seminar presentation for The Philippine Department of Science and Technology, Division 6. Sep. 1996, Cebu City.
- Philippines - The Outlook for Domestic Coal Production and Imports. World Coal Outlook Conf., Sept 13, 1995, Sydney
- Options for the Conversion of the Bataan Nuclear Power Plant to Fossil Fuel Firing. M. C. Clarke, D. R. Ebeling and D. L. Cordero. Conference: Energy Efficiency and Demand-Side Management. Manila Philippines, January 1995.

13. **Certification**

I, the undersigned, certify to the best of my knowledge and belief state that this CV correctly describes my qualifications, and my experience

Michael Clarke (signature)

March 1, 2010

Michael C. Clarke — Date of Signing

Annexure 7

Resume: Duncan SEDDON, BSc. (Hons), PhD, FRACI, CChem.

DATE OF BIRTH: October 10th, 1948
NATIONALITY: British Subject, Australian Resident
ADDRESS: 116 Koornalla, Cres., Mount Eliza, Victoria, 3930, Australia.
TEL . (61-3) 9787 4793;
FAX (61-3) 9770 1699:
seddon@ozemail.com.au

ACADEMIC QUALIFICATIONS AND HONOURS

1967-1973 B.Sc. Special Hons. (First Class), Chemistry; University of Sheffield, U.K.
1970-1973 Ph.D. (Sheffield)
1973-1974 Personal Fellow of the Science Research Council at Imperial College, London.
1987 Fellow of the Royal Australian Chemical Institute.

EXPERIENCE

2000 - to date: Principal, Duncan Seddon and Associates Pty. Ltd.

Consultancy services to energy intensive and related industries. Expertise on fuels and refinery operations and petrochemical operations. Presenter of Master-classes on petrochemical and refinery economics, Gas to Liquids and Coal to Liquids technology and economics. . Promotion of small scale GTL projects. Book "Gas Usage and Value", PennWell, 2006.

1988-2000 Managing Director of Hindsford Pty. Ltd. Mount Eliza, Victoria, Australia.

Promotion of the development of natural-gas conversion opportunities. Expertise on geological and economic analysis of gas production and field development and gas utilisation. Consultants to oil and gas industry groups on the development of un-utilised gas fields. Advice and courses covering all aspects of the petroleum refining and petrochemical industries. Detailed economic and technical appraisals of Fischer-Tropsch, Methanol to Gasoline and MTBE technologies. Publication of monographs detailing the production economics of methanol, ethylene, MTBE and LPG.

1982-1987 Broken Hill Proprietary Co. Ltd, 140 William Street, Melbourne, Australia.

Coordinator of gas conversion research team at the Company's Melbourne Research Laboratories; responsible for the ongoing technical development of the project and extensive liaison and management of joint research with CSIRO and a wide range of University groups.

1974-1982 ICI PLC (Petrochemicals Division), The Headquarters, Wilton, Cleveland, United Kingdom.

Research into the fundamental properties of polymerisation catalysts; Project Leader for development of catalysts for the aromatics business - technical, commercial analysis and legal activities; Energy Manager, (Oil Works, Billingham). 1980, seconded to ICI (Australia) Pty. Ltd., 1 Nicholson Street, Melbourne, Australia in order to build a team aimed at research and evaluation of new routes to petrochemicals from natural gas. .

Professional Activities

Fellow of the Royal Australian Chemical Institute; Member Australian Institute of Energy and Society of Petroleum Engineers. Served as a member of the Biological Committee of the AusIndustry *START* program. Dr. Seddon has over 120 publications covering refereed papers, patents and conference papers and general articles.