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RESEARCH
INDEPENDENT INVESTMENT RESEARCH

Blue Star Helium Limited (ASX:BNL)

June 2020

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INDEPENDENT INVESTMENT RESEARCH

Blue Star Helium Limited

(ASX: BNL)

Note: This report is based on information provided by the company as at 17 June 2020

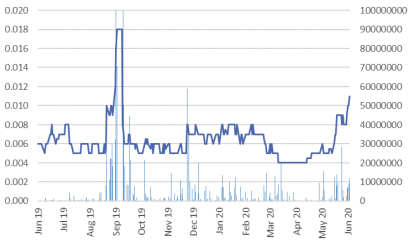
Investment Profile	
Share Price ($) at 17 June 2020	0.012
Issued Capital (subject to shareholder approval):	
Ordinary Shares post issue (M)	964.0
Options post issue(M)	187.9
Performance Shares	
Fully Diluted (M)	1151.9
Market Capitalisation (A$M)	11.6
12 month L/H ($)	0.004-0.020

Board and Management

Directors:
Ross Warner - Chairman
Joanne Kendrick - Managing Director
Trent Spry - Executive Director

Major Shareholders at 28 May 2020	
Board & Management	4.5%
Pamplona	4.8%
Ms Chunyan Niu	4.2%
BNP Paribas Nominees	3.0%
Top 20	48.8%

Share Price Performance



The investment opinion in this report is current as at the date of publication. Investors and advisers should be aware that over time the circumstances of the issuer and/or product may change which may affect our investment opinion.

HIGH GRADE HELIUM RESOURCE VALUE ADD FOR BNL

Blue Star Helium Limited has strategically rotated out of the energy price exposed US oil and gas sector into the helium business. The barriers to entry into helium production are principally access to a high grade helium source, and the company is moving rapidly on that front. Its lease portfolio is located along structure from the Model Dome helium field in Colorado USA, which historically was one of the world's highest grade helium producers. This report uses US oil and gas industry volume units (M=thousand and MM= million). There is an appendix detailing abbreviations and conversions in the back of this report.

KEY POINTS

Highly prospective geology – Blue Star is building a land package around the Model Dome field which produced a nitrogen/helium gas at around 8% helium. The US Geological Survey surveyed their database of US wells drilled and found 13,684 wells containing traces of helium. Of those, only 0.5% contained more than 6% helium, and 0.2% more than 8%. Blue Star believes their leases contain the same reservoir and seal strata, and sources gas from the same source as Model Dome. Reservoir consultant Sproule estimates Net Prospective Resources of 1U 641MMscf, 2U 3021 MMscf, and 3U 6391 MMscf of recoverable helium net to Blue Star. This Resource is contained in under 20% of BNL's lease portfolio.

Land package is appreciating in value – Bidding for leases in the Las Animas region where Blue Star is exploring has become more competitive in the March 2020 quarter, following ownership changes at two helium producing companies in the region. The new owners are likely to be more growth oriented, and also more asset acquisitive.

Low cost drilling commencing shortly – The target reservoir strata are shallow at 1000 feet or 300 metres below surface. Vertical exploration wells are expected to cost US$300,000 for a dry hole and US$400,000 for a completed producer. The first successful hole should result in a significant re-rating in the company's share price. Based on Model Dome well production history, we estimate that a 2Mscf/day starter project could be supplied by up to five wells at a total cost of US$2 million. Subject to shareholder approval, cash on hand in July 2020 should be around A$2.5 million plus an additional A$1 million if 1cps options are exercised.

Excellent drilling and logistical support services available – The US Mid West is home to an oil and gas industry of long standing, and there is existing helium industry infrastructure, including technical consultants, drilling and logistical contractors available at relatively short notice, and with considerable experience and competence. This human infrastructure considerably reduces the risk to a junior company entering the industry.

Processing plants available for lease – There is also considerable physical infrastructure in place, particularly in the region starting 100 miles to the east of Blue Star's leases. There are existing dedicated helium pipelines, helium separators and liquifiers with spare capacity, and specialty companies that build and lease helium separation plants to third parties. This means that once Blue Star has the well network in place, the balance of the capital equipment required can be leased rather than purchased, reducing pre-production capital costs.

The business is scalable – Depending on the reserves and the market demand, this business can be grown in size without being constrained by supply of capital. The critical factor is the operating cost and competitive position of the business as a reliable supplier. This will be underwritten by the high helium content, if it proves up as expected. The valuation leverage to increasing project size is considerable.

Potentially strong competitive position – There is some significant supply scheduled to come on line between now and 2026, and forecasting the impact on price will depend on the strength of demand, which has experienced supply shortages for a number of years. In this environment, we believe it is important to emphasise the competitive strength of any project that manages to find 8% Helium. If the Prospective Resource grade proves up, we expect Blue Star to be a low cost producer, with little debt on its balance sheet, making it a durable and profitable business, throughout the price cycle.

VALUATION

At this early stage of development, we are not able to value Blue Star. We cannot value Prospective Resources and there are no easily comparable pure play helium companies that can be used as valuation comparisons. We have constructed a Indicative Financial Model of what a project would look like based on reserves the same size as the announced Prospective Resource. At an ex-field selling price of US$200/Mscf for A Grade helium, that Indicative Project would be worth between US$18 million and US$176 million, with a pre-production capital cost we estimate of US$5 million (Table 8). The NPV/Capex ratio is 3.6x to 35x. We believe we have been conservative in our cost estimates.

INVESTMENT PROPOSITION

LOW PRE-PRODUCTION CAPEX ENTRY TO LONG TERM CASH FLOW

This is an appropriate business for Blue Star to be in

- The pre-production capital cost to enter the business is low (we estimate $3M).
- Exploring for gas is risky, but in this case, the well depths will be 1000 feet or 300 metres, making each exploration hole cheap at US$0.3 million per dry hole.
- The support infrastructure is considerable, which significantly reduces the technical risks relating to exploration, construction and operation, with a large community of contractors, consultants and equipment providers.
- Discoveries are scalable. Blue Star can start small and grow on the back of cash flow.
- If the expected helium grade of 8% is realised, Blue Star will have one of the highest grade helium resources in the world, and with that comes a competitive cost position that will allow it to maintain cash flow throughout the price cycle.
- There are a number of offtake parties, and the market, while opaque, is highly developed, with a number of producers signed up on long term contracts with specialty gas corporations.
- Helium price outlook - COVID-19 is a significant demand disruption, and forecasting the recovery adds difficulty. Before the virus impact, spot helium prices anecdotally appeared to be strong (ie around US$400/Mscf) and the supply demand balance favoured producers. The forecast in the public domain vary, but the implication was that supply would remain tight until 2022 when significant new capacity from the Amur project in Russia starts coming on line.
- We are comfortable that the current contractual market for helium in the US is between US$200/Mscf and US$300/Mscf, and there are likely spot prices above that level. We have assumed US$200/Mscf in our Indicative Financial Model, which we believe is conservative enough to avoid potential for significant disappointment, and possibly have room for the company to achieve higher prices.

Value adding stages

- Blue Star Helium has to deliver on a number of steps, each of which should be rewarded by the market, subject to general market conditions outside Blue Star's control.
- Step 1 is to convert the prospective resource into a reserve. This is likely to require 2-3 successful wells confirming delivery of helium to surface, and supporting positive economics. The cost would be US$0.3 million to US$0.4 million for each well, or US$0.8-1.2 million, plus evaluation costs.
- Step 2 is to deliver a Feasibility Study combined with offtake contracts. Other small capitalization project developers have demonstrated that major gas companies are prepared to offer offtake contracts at the project stage.
- Step 3 is funding, with considerable likelihood that the plant is leased from the manufacturer, and transport capital is funded by haulage contractors. We expect that Blue Star will have to provide the capital for the drilling and well completion, the access roads support buildings and general support infrastructure, and start up working capital. Some of this may be funded by debt, but for now we assume the only source of funding is equity.

- Step 4 is project execution into full production.
- Step 5 is to upscale and grow the business, using operating cash flow to further exploration, and adding additional production modules to increase sales volumes. This would be low risk organic growth, supported by the lease portfolio the company has been accumulating.

VALUATION

- So far we have not found any listed helium pure play producers to use as a value yardstick to assess what Blue Star would be worth if it drilled out a commercial reserve and commenced production. Most comparisons that are listed produce or plan to produce significant hydrocarbons. The pure helium producers we know of are unlisted, with no visible market valuation.
- As an alternative, we have attempted to develop an Indicative Financial Model for a target project, which suggests that if Blue Star can deliver Reserves in line with the Prospective Resources, it will own an asset worth between A$17.9M and A$176.1M at a selling price of US$200/Mscf. We emphasise that this is not a valuation of Blue Star's project, but one that can be used by investors as a starting point against which to assess Blue Star's progress.
- The last BLM helium auction sale occurred in August 2018 at US$280/Mscf, and there have been no auctions since. This US$280/Mscf is still a much talked about price level, so we have provided our model value at that price. However, to be on the conservative side, we are using US$200/Mscf as our base case. Renergen announces a US$200/Mscf long term offtake price for its project, providing a clear benchmark for a Blue Star project.
- Blue Star has published an unrisked Prospective Resource. This is an exploration target, but one with sufficient data to allow the size of the prospective target to be dimensioned. However, until the target is drilled, there is no certainty of the existence of helium, the quantity, the quality, nor the flow rate, all of which are required as the basis for an evaluation.
- However, owning a share in Blue Star is to effectively own an option on the company's potential success. Again we will have trouble valuing the option, but we can provide some clarity on the parameters of a potential project.

Indicative helium operation as a benchmark

- We have reviewed the publicly available information available on helium operations in the US Mid West, and have generated estimates of the economics of an indicative helium operation in the region. Those assumptions and the sources behind them are detailed in the Economics section.
- We have run a model based on assuming the Prospective Resources in the Blue Star announcement of 27 May 2020 are converted unchanged into Reserves. We repeat that Prospective Resources can fail to appear when drilled. However, the Indicative Financial Model's purpose is to an approximate answer the question: "what if drilling proves up a Reserve somewhere between 1U 641MMscf and 3U 6391MMscf of recoverable Helium net to Blue Star".

Table 1 NPV of indicative helium operation in US$M

Helium Price	150	200	250	280	400
Reserve MMscf					
Equivalent to 1U 641 MMscf	9.2	17.9	26.5	31.7	52.4
Equivalent to 2U 3021 MMscf	50.8	91.5	132.1	156.5	253.9
Equivalent to 3U 6391 MMscf	99.6	176.1	252.6	298.4	482.0

Source IIR Estimates

- Our estimation and modelling suggest that any project is sensitive to both the size of the Reserve and the long term helium price, but with the bias to the upside for the Blue Star share price. Blue Star appears to have made a strategically sound decision to invest in this industry, and is executing that strategy in a competent manner.
- Determining the current helium price is difficult, and the future price more so. Renergen (ASX:RLT) signed an offtake contract for US$200/Mscf escalating with US CPI over time for A Grade (98% He) product contracted in either second half of 2018 or first half of 2019. This sets the centre of our valuation table, and we have run sensitivities of minus US$50/Mscf, and plus US$80/Mscf. The higher price captures the last BLM auction price. The positive cash flow and NPV at the lower price demonstrates an ability to survive downturns.

- There are anecdotes suggesting the current spot price is closer to US$400/Mscf, and if that turned out to be the long term price, the valuation range would be US$52 million to US$482 million, depending on the size of the reserves.
- The table below shows the financials for the life of reserve that generates the NPV's in the table above at US$200/Mscf selling price.
- We have determined a discount rate of 11.2% based on the Capital Asset Pricing Model formula and the market assumptions as detailed in Table 10 as appropriate for valuing this company.
- Given the currently high level of volatility in the AUDUSD rate, all financial numbers in this report are in USD, and the reader can convert at whatever the rate is at the time of reading. In this report, when we convert values into AUD we use an AUDUSD rate of 0.69.

We believe we have been conservative on costs and operating parameters

- The reader will see a number of sensitivities later in this report. We include a quick summary here.
- Our Base case is a selling price of US$200/Mscf vs indications that the current market is closer to US$300/Mscf.
- Average well production is assumed to be 500Mscf/d declining a 5%, where initial production could be 1000Mscf.
- Operation costs are assumed to be US$70/Mscf on a gross basis, or US$82/Mscf on a net of royalties basis. The US$70/Mscf could be lower than US$50/Mscf.
- We cost in additional three additional wells (eight vs five) to allow for failures.

Table 2 Life of operating financial metrics at US$200/Mscf selling price and different Reserves

Assumed Net Reserve MMscf Helium	641	3021	6391
Revenue Calculation			
Selling Price at Spiggot US$/Mscf	200.0	200.0	200.0
Gross Gas Sold MMscf	738.2	3428.5	7393.4
Gross Revenue US$ million	147.6	685.7	1478.7
Royalty US$ million	-22.1	-102.9	-221.8
Net Revenue US$ million	125.5	582.9	1256.9
Financials US$ million			
Net Revenue	125.5	582.9	1256.9
Opex	-51.4	-238.6	-514.5
D&A	-3.2	-6.4	-6.4
EBIT	70.9	337.9	736.0
Tax (BNL has tax losses, which are not accounted for)	-19.5	-92.9	-202.4
NPAT	51.4	245.0	533.6
Cash Flow US$ million			
Pre Production Capex	-3.2	-3.2	-3.2
Sustaining Capex	0.0	-3.2	-3.2
Free Cash Flow	51.4	245.0	533.6
NPV	17.9	91.4	176.1
Operating Assumptions			
Helium Sales MMscf/yr	51.0	277.3	500.0
Production Wells	4.0	12.0	22.0
Well Flow Rate Mscf/d	500.0	1000.0	1000.0

Sources: IIR estimates (see Economics section of this report)

How to think about these numbers

- Blue Star has a market capitalization of A$11 million, which means that the company's share price is factoring in a probability of delivering the 3021 MMscf reserve and US$200. Mscf price of US$91.4 million outcome as 12%. The implied factors of success for the other scenarios see Table 3.

- The Prospective Resources are categorized as 1U if there is a 90% chance it exists, 2U if there is a 50% chance, and 3U if there is a 10% chance. The odds are related to the height of the gas column in the trap structure. If the structure seal has failed there could be no gas, and the probability assessment does not capture that aspect of risk.

Table 3 Probability of delivering the NPV for each scenario implied by the current share price of Blue Star

Helium Price	150	200	250	280	400
Reserve MMscf					
Equivalent to 1U 641 MMscf	NA	56%	38%	31%	19%
Equivalent to 2U 3021 MMscf	20%	11%	8%	6%	4%
Equivalent to 3U 6391 MMscf	10%	6%	4%	3%	2%

Source: IIR estimates (see Economics section of this report)

Corporate interest in the sector is picking up

- The March 2020 quarterly, the company noted that there had been a marked increase in competition for acreage in Las Animas County. On average, Blue Star has seen a doubling to the bid prices for leases in its region since December 2019, with some leases seeing a 10x increase, presumably due to either high prospectivity or strategic value.
- The timing of increased interest coincides with ownership changes of some pure play helium producers that may now have stronger growth ambitions supported by stronger balance sheets. We note that the increased competition started after Tumbleweed Midstream completed the purchase of DCP's Ladder Creek helium production network. Another US helium pure play called Tacitus LLC has had a major change in it shareholder base, and may also be on a more aggressive acquisition strategy.
- Unfortunately all these shareholder transactions are off market and are confidential.

FINANCIAL POSITION

- Cash on hand at 31 March 2020 was A$507,480. The company has just raised A$2.30 million at A$0.01/sh. A$0.98 million has been received, and a further A$1.322 million will be received in July 2020, subject to shareholder approval. Post issue, Blue Star will have around A$2.5 million. If the current outstanding 1cps options are exercised, the company will have an additional A$1 million.

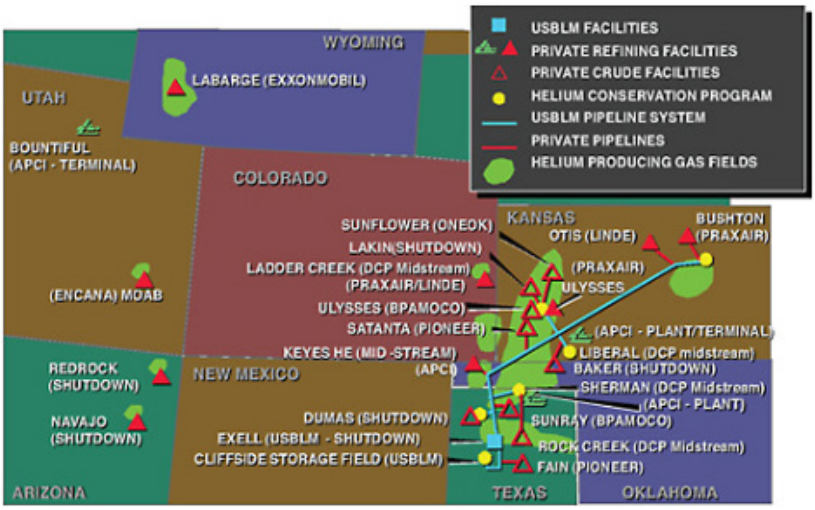
RISKS

- **Exploration success** – The value of the helium resource will depend on size and helium concentration. Concentrations as high as 8% helium are very rare. There is solid grounds for believing that the Prospective Resource exists, but this can only be demonstrated by drilling.
- **Helium price** – Discovering the current helium price likely to be paid at the production facility is difficult to impossible without actually signing a contract. The good news is that long term take or pay contracts are typically negotiated, so once Blue Star has a contract, there will be a significant reduction in selling price uncertainty. Until that deal is done, the current price is opaque, and forecasting future prices from an unknown starting point is risky. On top of which, while supply demand appears tight in 2021, there is potential for a surplus supply from 2022. Again, the offset to any potential oversupply is that if Blue Star has an 8% helium resource, it is likely to be cost competitive throughout the price cycle.
- **Project Execution** – A junior company starting production always carries execution and operating risk. This is offset if the company employs quality contractors and consultants, and the US oil patch has operated on this basis for years.

LAS AMINAS HELIUM PROJECT

Location – Close to significant helium processing infrastructure and expertise

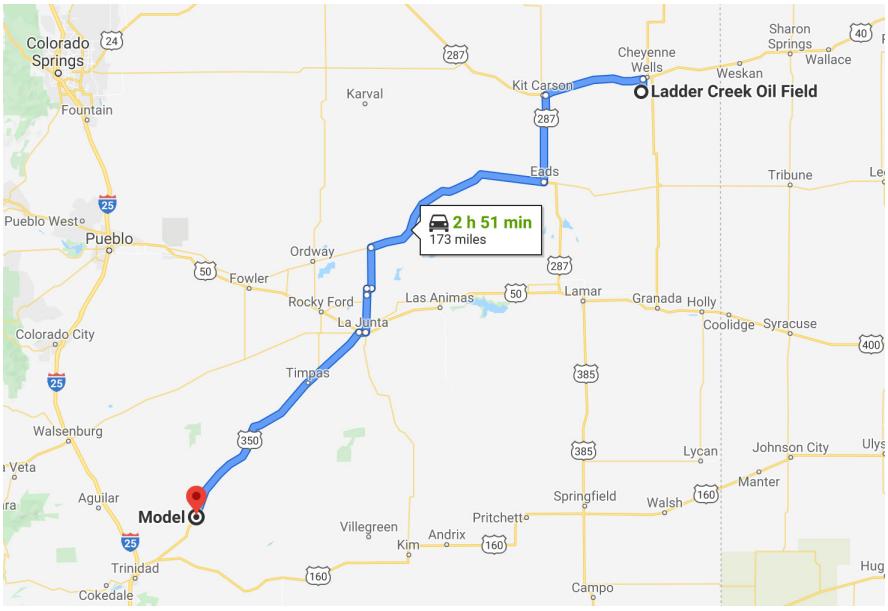
Figure 1 Location of US Helium Resources



Source: https://www.nap.edu/read/12844/chapter/7#75

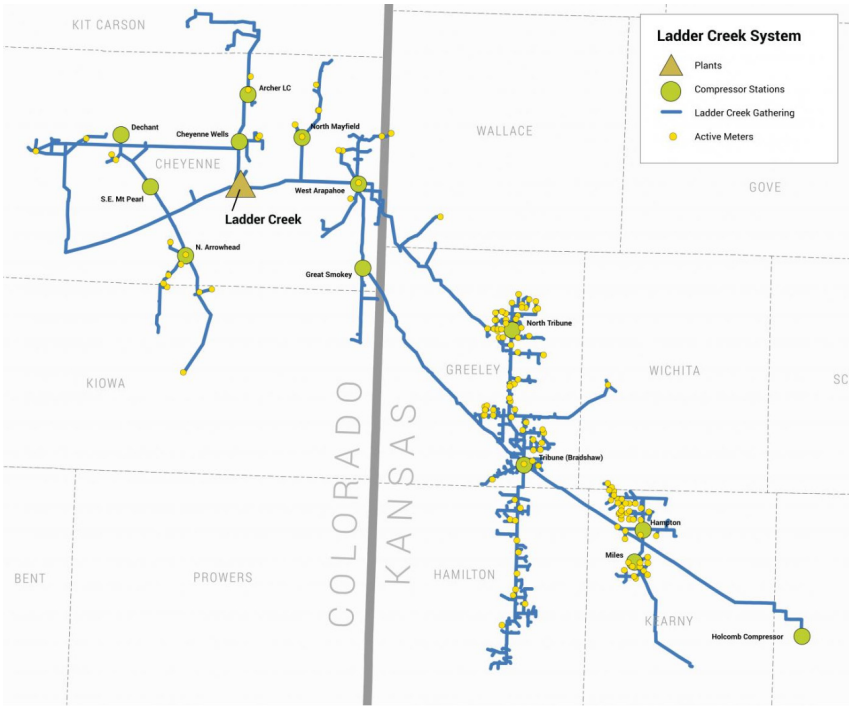
- The Blue Star lease portfolio is near the town on Model in Las Animas County, Colorado, and is 173 miles or 3 hours drive south west of the Ladder Creek oilfield that has extensive helium processing infrastructure, and 250 miles or a four hour drive to the major helium storage and processing facilities of the US Bureau of Land Management at the Cliffside Field near Amarillo, Texas.
- The helium production corridor running from western Kansas to north western Texas is responsible for around 40% of the worlds helium production. There is a highly developed community of specialist contractors available to support all the production aspects of the helium business in the region, significantly reducing the start up risk a junior company would normally experience.
- There are 14 helium refining operations in the US, including two in Colorado, five in Kansas, and four in Texas, with more distant plants in Arizona (1), Oklahoma (1) and Wyoming (1). The Kansas and Oklahoma plants have a history of toll treating the raw helium gas from third parties to any market specification and there are a number of haulage contractors able to supply transport, many associated with or owned by the major gas buyers.

Figure 2 Route from Model to Ladder Creek Helium Processing Infrastructure



Source: Google Maps

Figure 3 Ladder Creek helium collection and processing network



Source: https://www.tumbleweedmidstream.com/ladder-creek-system

- The Ladder Creek assets were recently purchased by Tumbleweed Midstream from DCP Midstream in January 2020. The CEO of Tumbleweed is Durell J. Johnson, who was project engineer during the original construction of the network. It is reasonable to expect he plans to grow the business, and a processing deal with Blue Star should be possible.
- Current processing capacity at the Ladder Creek cryogenic processing plant is 40 million cubic feet of natural gas per day (MMcf/d), easily expandable to 50 MMcf/d.
- The plant has the capacity to extract and liquefy 1.5 MMcf/d of helium, with extraction and liquefaction to purity levels of 99.999 percent. Blue Star's initial production is planned to be 0.14MMscf/d.

PROSPECTIVE RESOURCE

When it comes to helium deposits, what is an exciting resource?

- In this report, we try to demonstrate that helium is a business that a small company like Blue Star can enter, because of the huge skill base in the oil and gas industry available at call from contractors, and the capital intensive plant required to purify the helium gas can be leased. The main barrier to entering the business is having a helium resource.
- An exciting helium resource is one with a high percentage of helium, and preferable having waste gas components that can vent to atmosphere (ie nitrogen). Waste gas containing sulphide or methane requires extra processing, because those gasses cannot be vented, and venting carbon dioxide will probably be restricted in due course.
- In 2018, the US Geological Survey reviewed the entire USGS and Bureau of Land Management (BLM) US drill hole database and found 13,648 wells which flowed gas containing traces of helium.

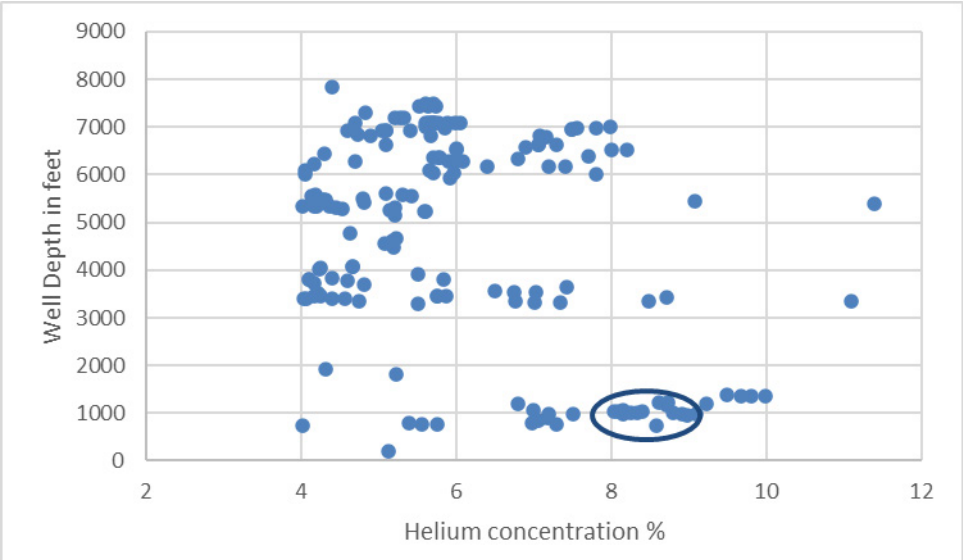
Table 4 Helium Concentration distribution within the USGS well database

Equal or more than	Trace	1%	2%	3%	6%	8%
Number of Wells	13648	1236	479	209	66	29
Percentage	100%	9.06%	3.51%	1.53%	0.48%	0.21%

Source: Helium concentrations in United States wells

- Of all the 13,648 wells the USGS found that contained helium, only 0.48% contained more than 6% helium and 0.21% more than 8%. These percentages would be lower if all US wells drilled were included.

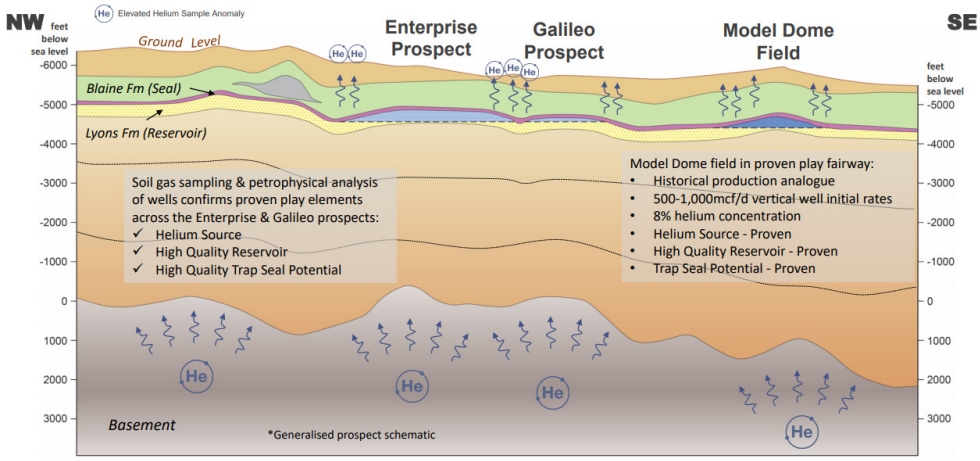
Figure 4 USGS Well Survey - Helium Concentration v Depth for highest grade wells (Model Dome wells circled)



Source: Helium concentrations in United States wells

- A major cost of developing a gas field is the drilling of exploration, then development, wells, so the shallower the target, the lower cost the drilling program will be. In the figure above, there are a number of wells encountering helium at good concentrations, only 1000 feet below surface, Fields of this nature would be relatively low cost to develop.
- The sweet spot when looking for a helium deposit would therefore be to generate exploration wells that plotted in the lower right hand quadrant of the figure above.
- The Model Dome field would be an example of an excellent target for development. Its helium grade is around 8%, and typical well depth is 1000 feet.
- The Blue Star Enterprise and Galileo prospects are six miles (10 Km) to the west of Model Dome, and at a similar depth. They have the same reservoir and seal formations, and the same helium source rocks.

Figure 5 Relationship between the Model Dome Helium Field and Blue Star's Enterprise and Galileo prospects



Source: BNL presentation 1 June 2020

Exploration target between 641MMcf and 6391MMcf at first two targets

- Blue Star's Prospective Resource is the result of evaluation work by consultancy group Sproule, and signed off by Blue Star Executive Director Trent Spry.

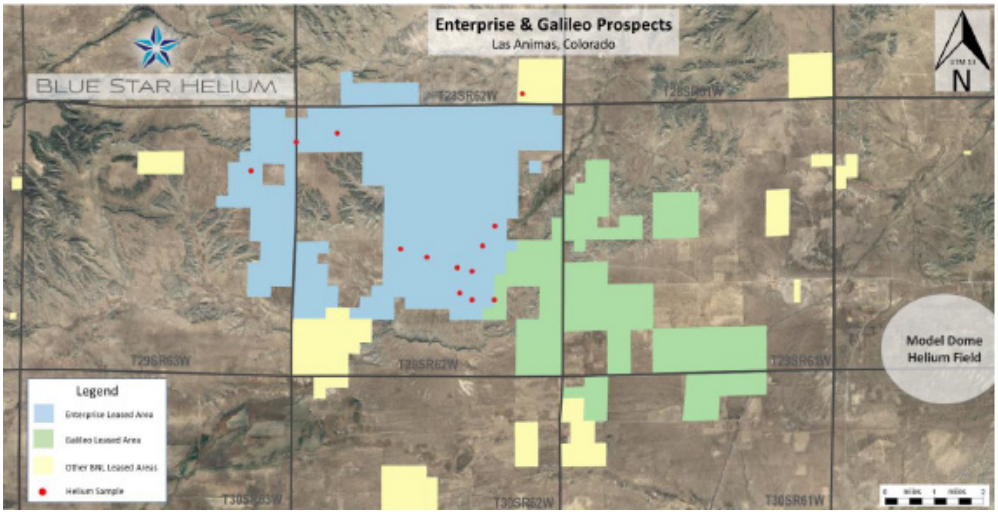
Table 5 Unrisked Prospective Resource

	1U (P90)	2U (P50)	3U (P10)
Net Recoverable Helium (MMscf)			
Enterprise	372	2296	5003
Galileo	270	725	1389
Total	641	3021	6391
Weighted average Royalty			
Enterprise	15.0%	14.4%	14.6%
Galileo	12.5%	12.6%	13.6%
Total	14.1%	13.9%	14.4%
Gross Recoverable Helium (MMscf)			
Enterprise	438	2681	5861
Galileo	309	829	1607
Total	746	3510	7469
Gross Recoverable Raw Gas @ 8% (MMscf)			
Enterprise	5473	33512	73263
Galileo	3857	10364	20093
Total	9330	43877	93356

Source: BNL release 27 May 2020

- While this is a prospective resource, and therefore an exploration target requiring drilling to confirm existence, the statements directors make in respect of such targets are tightly controlled by the market regulatory authorities. The company's release provides clarity on a number of factors that support the prospective estimate.

Figure 6 Leases over Enterprise and Galileo Prospects, and location of Model Dome helium reservoir



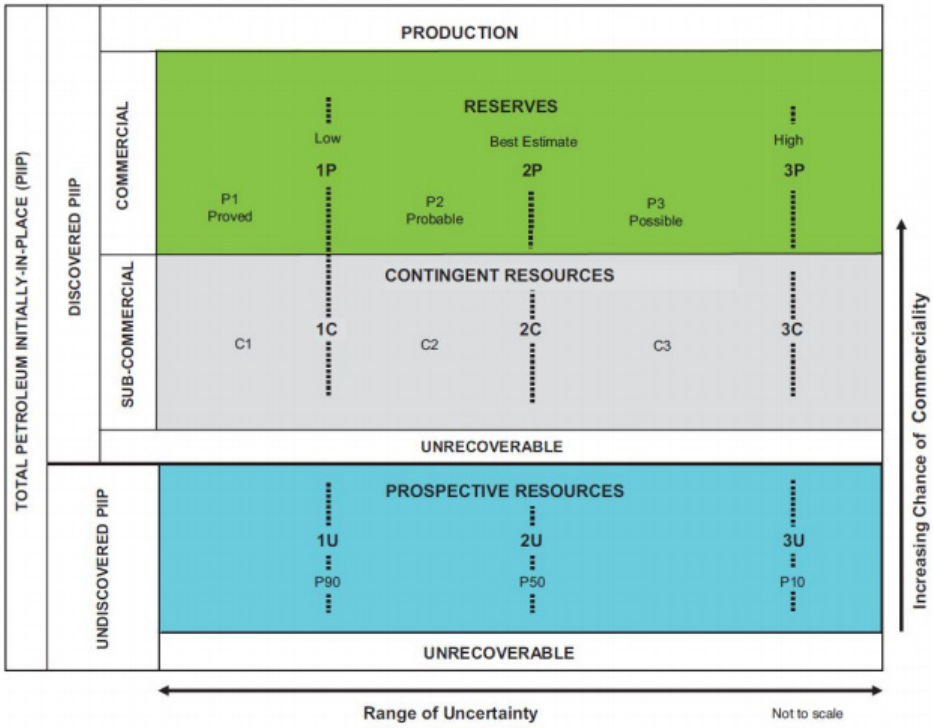
Source: BNL release 27 May 2020

Factors supporting the Prospective Resource

- The Enterprise and Galileo prospects are close to the Model Dome Helium Field that produced before World War II. That field produced at a helium concentration of around 8% at rates of between 500Mcf/day and 1000Mcf/d per well.
- The target gas bearing strata is the Lyons Formation. Blue Star and Sproule have access to the well logs drilled within and without the company's leases, as well as gravity and magnetic surveys over the leases, that have allowed Sproule to estimate 200-250 feet of structural closure at the top of the Lyons Formation.
- Soil samples have detected traces of helium (the red dots in the figure above), which is a highly positive sign that there is helium in the strata below. All gas traps leak to some extent, particularly around the edges of interpreted trap structures. Helium traces can only be sourced from subsurface helium, ie from the radioactive decay of uranium and thorium. Methane traces can be produced by plant and bacterial activity in the topsoil, giving false readings, whereas helium cannot.

- The difference between 1U, 2U and 3U Resources is uncertainty over the height of the gas column in the structure. The more gas that is caught in the structure, the higher the vertical column of gas and the larger the Resource.
- Risks include the failure of the top of the structure to seal, which would have allowed the gas to escape. The presence of traces still in the soil suggest escape is still continuing, and there is still gas in the structure below.
- Other risks include low porosity (reducing the total gas volume in place), low permeability (reducing the flow rate without more expensive drilling), and low gas pressure (reducing the flow rate without more expensive water or gas injection to increase drive). These variables have been estimated from the Model Dome core, wireline logs and the drill stem tests (pressure and flow rates) from the surrounding wells, including those at Model Dome.
- Helium fields have a fundamental difference to conventional methane producing gas fields, in that helium is the smallest molecule of any element or compound, and it main companion Nitrogen (N2) is also much smaller than a methane molecule, so helium fields can produce more gas at a faster rate than a methane field with the same permeability and drive pressure.

Figure 7 Petroleum reserve and resource classifications

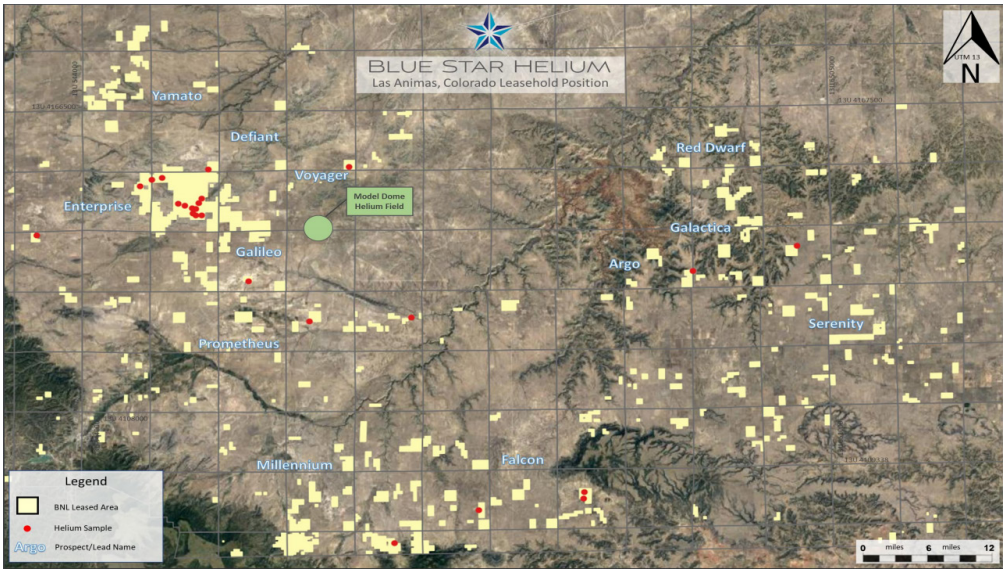


Source: Petroleum Resource Management System June 2018 release

Lease portfolio growing quickly

- As at 30 March 2020, Blue Star had a gross land package of 121,086 acres, and 64,924 acres net.

Figure 8 Total lease portfolio at 30 March 2020 – Resources apply to Enterprise/Galileo only



Source: BNL presentation 1 June 2020

- The lease tenure varies depending on whether the owner of the mineral rights is a local landowner (Private), State land (State), or Federal land (BLM).
- The local landowners and the Bureau of Land Management which handles access to Federal lands appear to be settling for a 12.5% royalty and a 5 year plus right to renew for 5 more years in the case of Private deals, and 10 years in the case of the BLM.
- The State of Colorado is settling for a 20% royalty.
- Blue Star will also be paying an annual rental averaging US$2/acre across the lease portfolio.
- Once in production, the leases can be "held by production" which means as long as there is production and royalty payments are being made, the leases remain with the lease holder. Production of helium can be sufficient to satisfy the "held by production" criteria.

Table 6 History of lease acquisition to 30 March 2020

		Gross Acres	Net Acres	Cumulative Net	Owner	Royalty	Years	US$/ acre
22-Aug-19	Enterprise	1800	700	700	Private	12.5%	5+5	
19-Sep-19	Enterprise	3320	310	1010	Private	12.5%	5+5	
9-Oct-19	Enterprise	0	300	1310	Private	12.5%	5+5	
31-Oct-19	Voyager	160	160	1470	Private	12.5%	5+5	
26-Nov-19	Enterprise	21824	21824	23294	State	20.0%		2.5
28-Nov-19		59510	3784	27078	Private	12.5%	5+5	
5-Dec-19		1640	2280	29358		12.5%	5+5	
12-Dec-19			5406	34764		12.5%	5+5	
19-Dec-19			5406	40170		12.5%	5+5	
25-Feb-20		6483	1645	41815	Private	12.5%	5+5	
25-Feb-20		11129	11129	52944	State	20.0%		2.5
30-Mar-20		7566	7566	60510	BLM	12.5%	10	1.5,2.0
30-Mar-20		3465	4415	64925				

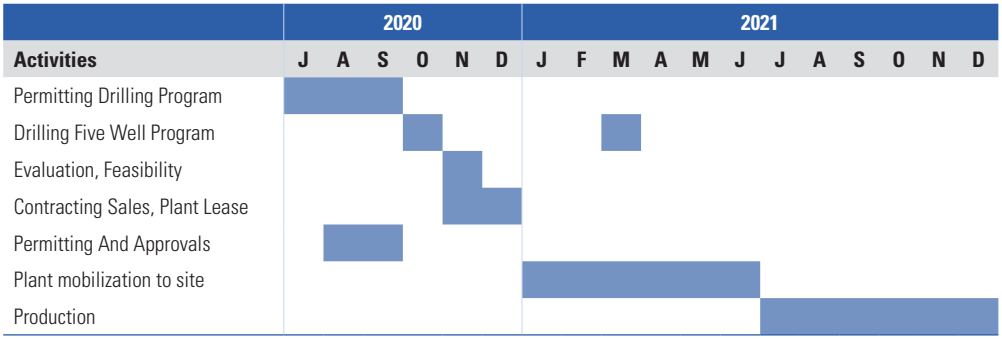
Source: BNL releases in 2019 and 2020. Note our estimated gross acres do not total to the 30 March 2020 total, indicating there have beed adjustants to the previously reported gross arces.

INDICATIVE HELIUM PRODUCTION ECONOMICS AND FINANCING

Blue Star project development plan

- In a release dated 26 November 2019, Blue Star management provided guidance as to how they see the project developing. The plan includes:
  - Design, permit and drill 5 wells. In the release of 27 May 2020 the cost of these wells was estimated to be US$300,000 for a dry well and US$400,000 for a well completed for production.
  - Commercial production would require the installation of a separation plant to produce A Grade Helium (ie over 97.5% He). This is most likely to be a standard modular Pressure Swing Adsorption (PSA) plant supplied in 2 MMscf/d capacity units capable of processing 5-10% He input gas into a 98% product stream. These plants are available for lease from the manufacturer (eg IACX).
- The time line into production requires drilling permit approval, which we expect will be completed by September, then a month of drilling in October, subject to the success of the initial wells, followed by feasibility study of up to three months, then mobilization, which the company presentation of 1 June 2020 says would take around 6 months. All up, from today, Blue Star could be in production in 6-12 months time, ie some time between January and June 2021.

Figure 9 Timeline to production



Source: IIR estimates

What would an indicative target project look like?

Table 7 Indicative production from a single 2MMscf/d helium separation module assuming 8% helium in feed gas

	Per Day	Per Month	Per Year
Modularized Plant Capacity MMscf/period Raw Gas	2.00	60.0	730
Uptime	90%		
Gas Processed MMscf/period	1.80	54.0	657
Helium Concentration	8.0%		
Recovery	95%		
Helium Recovered MMscf/period	0.137	4.10	50
Product He grade	98%		
Sale Gas Volume MMscf/period	0.14	4.19	50

Source: IIR estimates based on the 2MMscf/d input and 50 MMSCF/yr Helium production commentary in the BNL presentation of 1 June 2020 p12. The intermediate data are IIR estimates based on the helium concentration used in the Prospective Resource announcement of 27 May 2020.

- For a 5 year lease contract on the separation plant modules, a reserve of 3,650 MMscf of raw gas would be required, which is three times covered by the 1U Prospective Resource of 9330 MMscf of raw gas, which the consultants have estimated at a 90% probability.
- The Enterprise and Galileo leases represent ~20% of the company's gross land package of 121,086 acres as at 30 March 2020. There is plenty of scope for significant discoveries elsewhere in the tenement package.

Helium Contract Pricing

- Helium pricing is opaque, with no spot market, and no systematic disclosure of contract pricing. With the bulk of production subject to long term contracts, including base price/escalation, even the average realised selling prices of existing producers is not a good guide to current price levels.
- Sales Contracts are typically 10 years or more, with the producer having the right to market around one in every 10 or 12 trailers, to get a first hand feel for market pricing. The sales point could be at the spigot or outlet tap at the production site, or the producer could deliver tube trailers of compressed or liquified gas to end customers.
- Renergen (ASX:RLT) is building a LNG plant in South Africa with a helium byproduct. It announced a contract with Linde on the following terms, which were probably set with respect to market conditions in late 2018 or early 2019 (Source: Renergen Prospectus 6 June 2019 p29,p132).
  - US$200/Mscf base price
  - Escalating at US CPI
  - Take or pay up to 24MMscf/yr
  - Contract term, sales point not published, but contract is likely to be long term ie 5-10 years, and sales point is in South Africa, so close to the local market but a long way from major demand centres, and hubs of global price formation.
- Tacitus LLC is a Helium pure play currently producing in the US and it through a major change of shareholders in early 2020. While it is unlisted, the general market commentary at the time the interest was being marketed in late 2019 suggested that its new contracts would be priced at closer to US$400/Mscf, while its legacy contracts were at lower price levels.

Assessment of pre-production capital costs

Table 8 Estimated pre-production capital costs

	Number	Unit Cost US$ million	Total Cost US$ million	Total Cost A$ million
Pre Production Capital Cost				0.65
Drill Exploration/Development wells	8	0.300	2.4	3.7
Completion as producer wells	4	0.100	0.4	0.6
Completed as Salt Water Disposal Wells	2	0.100	0.2	0.3
Plugged and Abandoned	2		0.0	0.0
Total	8		3.0	4.6
Supporting Infrastructure			0.2	0.3
Total Site Capital Cost			3.2	4.9

Source: BNL release 27 May 2020, for costs, IIR estimates for the number of holes

- **Well network** - Blue Star has indicated that it intends to drill five wells into the Enterprise and Galileo targets. If the successful wells perform like the wells at Model Dome, they will produce at between 500Mscf/d to 1000Mscf/d. To produce 2Mscf/d between two and four wells will be needed, and one well or more may be required for Salt Water Disposal (SWD). It is likely that the company will drill some unsuccessful wells, adding US$300,000 of cost per dry hole. For the purposes of our indicative model. We assume eight wells are drilled, with three to four completed as producers, two as Salt Water Disposal wells and two unsuccessful holes which are plugged and abandoned. The total cost of the eight wells would be us$3 million
- **Infrastructure** -There will need to be support infrastructure comprising roads and buildings. We have allowed US$0.2M for these items. In more detail, they would include:
  - Helium truck loading facility
  - Access and service roads (gravel)
  - Office and Laboratory
  - Warehouse
  - Electrical reticulation
  - Inlet header, inlet separator and inlet coalescing filter

- **Separation Plant** – These plants can be leased. IACX is particularly active in this role with a number of similar plants at various sites in the US.

Assessment of operating cost

- We have estimated the operating costs of a 2MMscf/d nameplate capacity plant producing 50MMscf/yr of helium using data from a number of publicly available sources. The reader should take these as a guide only. The sources are identified, and the reader is encouraged to review those sources and form her or his own view
- The resultant estimated operating cost is US$70/Mscf of Helium produced, or US$291,000/month.
- This costing assumes that the company is the operator of the gas wells and the separation plant, delivering directly into compressed tube tank trailers, which are used as site storage and transport. We assume that the helium buyer purchases the helium at the plant spigot or outlet tap, and the company does not pay for transport. Power is to be delivered by leased on site generators fuelled by trucked LNG, and is part of the Separation Plant Operating Cost. In reality, the separation plant is likely to be operated by the plant supplier, and the lease costs will combine both the capital and operating cost of the separation plant.

Table 9 Summary of operating costs

Operating Cost	US$/Mscf Raw	US$/Mscf He	US$'000/mth	US$'000/yr
All calculations based on 1.8MMcf/d raw gas input, 50MMcf/y He output, 98% He in product gas				
Lifting Expenses	0.50	6	27	324
Separation Plant Operating Cost	1.85	24	100	1200
Separation Plant (ie $3M @ 20% lease)	0.31	4	17	200
Trailer Lease (three trailers)	1.90	25	103	1233
General and Admin	0.83	11	45	540
Total	**5.40**	**70**	**291**	**3497**

Sources: see text below, with internet references at the back of this report

- **Gas production (lifting) costs** - Once the production wells are drilled, the cost of gas production is well known but dependent on volume and scale. In natural gas production, almost 100% of the gas produced is saleable methane. Production costs range from US$0.10/Mcf (Chesapeake Energy Marcellus field), A$0.20/Mcf (Chesapeake Energy Haynesville field) producing 800-1000Bcf/yr. Blue Star will be very small by comparison, but is also operating shallower wells, so we are comfortable using a gas extraction costs of US$0.50/Mcf, and we would expect the actual cost to be lower.
- **Gas separation costs** – The DBK helium field is located on Navajo land in New Mexico but in generally the same US Mid West environment as Blue Star, and is larger but comparable. The DBK plant produces 380Mscf/d of 98+% helium, from a ~5% helium feed gas. In 2019, this plant cost US$75,000/month to operate. The initial Blue Star single module is targeting 140Mcf/d from 7-8% helium feed gas, so should cost less from a power consumption perspective. The DBK power cost is US$35,000/month supplied from the grid. Our indicative operation would be about a third of the power usage, but more expensive on a unit basis because it carries the cost of generator hire, operations and LNG fuel costs. We have assumed the same overall US$/month cost to be conservative.
- **Separation plant lease costs** – The Bruin Point Energy Limited 51-101 report dated 25 Aug 2017 mentions a capital cost for modular helium plants being between US$700,000 and US$950,000, without specifying the plant capacity or exact purpose (ie extracting helium and nitrogen from natural gas or extraction of helium from nitrogen). We have no data on the cost of leasing a plant, but assuming a 20%pa lease rate on a plant that would cost US$1 million purchase, the lease cost would be US$17,000/month.

Figure 10 Modular PSA Helium separation unit

Source: BNL presentation 1 June 2020

- **Product storage cost** - DBK trucks gas trailers of helium to Ladder Creek for sale, and it also uses gas tube trailers for gas storage on site. This is a simple solution to compressed gas storage, and the trailers in DBK's case is leased. DBK has to truck 380Mscf/d 660 miles to sale point, and uses 18 compressed gas trailers, whereas Blue Star's initial target of one module producing 140Mscf/d and trucking 173 miles to the same sales point. In theory that could be achieved with 1.8 trailers. We have assumed three trailers are leased. DBK pays a rental of US$34,250/mth per trailer (DBK Due Diligence Report), so on the same basis, leasing the three trailers would cost US$102,750/mth. We assume the offtaker pays the actual haulage cost.

Cost of Capital

Table 10 Weighted average cost of capital 11.2% assuming zero debt

Cost of Equity	Blue Star
Beta	1.95
Risk free rate (Rf)	1.8%
Market Risk over Rf	4.8%
Market premium (Rm)	6.6%
Cost of Equity	11.2%
Gearing	
Gearing D/(D+E)	0.0%
Gearing E/(D+E)	100.0%
Nominal WACC	
Cost of Equity Ke	11.2%
Cost of Debt Kd	6.8%
Tax Rate	27.5%
Weighted Average Cost of Capital	11.2%

Source: RBA, Yahoo Finance, Market Risk Premia.com, IIR estimates

ASSESSMENT OF COMPETITIVE POSITION

- The bulk of the operating cost is related to the raw gas being processed, so the more helium in the raw gas feed the lower would be the operating cost. Our estimated operating cost is US$70/Mscf of gross helium. At lower concentrations of helium that operating cost rises dramatically.
- Most helium operations, the helium is a byproduct. The table below shows how much methane has to be produced per Mscf of Helium to return the cost to US$70/Mscf Helium. This is a rudimentary calculation and does not take into account the extra costs relating to the methane production.

Table 11 Impact of lower helium grade in operating cost

Helium Grade	0.5%	1%	2.0%	4.0%	8.0%
Operating Cost	584	310	173	104	70
Natural Gas production offset Mcf (@ US$3.50/Mscf)	147	69	29	10	0

Source: IIR estimates. Natural Gas price assumed in offset calculation is a long term price of US$3.50/Mcf. The current spot price is around US$1.80/Mscf, and if that price were used, the Natural Gas production offset production numbers would double.

SENSITIVITY TO OPERATING COSTS

- We believe our cost estimates are very conservative at US$70/Mscf helium product saleable at site.
- There is potential for the operating costs to be as low as US$50/Mscf, or possible lower. The sensitivity of the Net Present Value to operating costs and Reserve size is shown in the table below.

Table 12 NPV in US$ million assuming lower operating unit costs at different Reserve sizes

Operating Cost US$/Mscf	90	70	50
Reserve MMscf			
Equivalent to 1U 641 MMscf	13.8	17.9	21.9
Equivalent to 2U 3021 MMscf	72.4	91.5	110.5
Equivalent to 3U 6391 MMscf	140.3	176.1	211.8

Source: IIR estimates, based on selling price of US$200/Mscf

- The flow rates from the Model Dome wells were between 500 Mscf/d to 1000Mscf/d. For our lowest valuation, ie the 641MMscf Reserves case, we assumed all four wells operate at lowest rate of 500Mscf/d. Higher production rates on constant unit costs improve the NPV. The reality is that higher flow rates would also lower the unit operating cost, adding more valuation upside.

Table 13 NPV (US$M) sensitivity to production well flow rates (Base Case 500 Mscf/d)

Output per well Mscf/d	500	750	1000
Project NPV A$M	17.9	24.8	29.1

Source: IIR estimates, , based on selling price of US$200/Mscf

INDICATIVE FINANCIAL MODEL

Table 14 Indicative financial model assuming Reserves equal to 1U Resources, processing capacity is one 2MMscf/d unit, selling price US$200/Mscf

	Dec-21	Dec-22	Dec-23	Dec-24	Dec-25	Dec-26
Revenue Calculation						
Selling Price at Spiggot US$/Mscf	0	200	200	200	200	200
Gas Sold MMscf	0	51	49	46	44	42
Revenue US$ million	0.0	10.2	9.7	9.2	8.8	8.4
Royalty US$ million	0.0	-1.5	-1.5	-1.4	-1.3	-1.3
Net Revenue US$ million	0.0	8.7	8.2	7.9	7.5	7.1
Financials US$ million						
Net Revenue	0.0	8.7	8.2	7.9	7.5	7.1
Opex	0.0	-3.5	-3.4	-3.2	-3.1	-2.9
D&A	0.0	-0.2	-0.2	-0.2	-0.2	-0.2
EBIT	0.0	4.9	4.7	4.4	4.2	4.0
Tax	0.0	-1.3	-1.3	-1.2	-1.2	-1.1
NPAT	0.0	3.5	3.4	3.2	3.1	2.9
Capex	-3.2	0.0	0.0	0.0	0.0	0.0
Free Cash Flow	-3.2	3.8	3.6	3.4	3.3	3.1

Source: IIR estimates

- We emphasise that this is not a valuation of Blue Star. This model represents an estimate of one on a number of potential outcomes, depending on the outcome of exploration drilling which we expect to occur in the second half of 2020.
- This model is based on our lowest reserve expectations, where Reserves equal the1U Prospective Resource. The helium concentration is assumed to be 8%.
- The total initial or pre-production capital is estimates by us to be US$3.2 million. This includes four successful production wells, producing at the low end 500Mscf/d, two unsuccessful production holes that were plugged and abandoned, two Salt Water Disposal wells, and infrastructure capital.
- The selling price is assumed to be US$200/Mscf at the production plant spigot or outlet value.
- Operating costs are assumed to be US$70/Mscf, as estimated earlier in this section.
- The separation plant is leased, as are the power generators, and the helium tube trailers, which are used for both on site gas storage and gas transport.

Table 15 Indicative financial model assuming Reserves equal to 1U Resources, processing capacity is one 2MMscf/d unit, selling price US$200/Mscf

	Dec-21	Dec-22	Dec-23	Dec-24	Dec-25	Dec-26
Well Performance						
Capacity MMscf/d		2000	1905	1814	1728	1645
Availability		90%	90%	90%	90%	90%
Production Mscf/d		1800	1714	1633	1555	1481
Production MMscf/yr		657	626	596	568	541
Helium Content		8.0%	8.0%	8.0%	8.0%	8.0%
Contained Helium MMscf/yr		53	50	48	45	43
Separation						
Input Contained Helium MMscf		53	50	48	45	43
Recovery		95%	95%	95%	95%	95%
Output Helium MMscf		50	48	45	43	41
Sales Gas Grade		98%	98%	98%	98%	98%
Sales Gas Production MMscf		51	49	46	44	42
Capex US$ million						
Production Well Cost	1.6	0.0	0.0	0.0	0.0	0.0
Salt Water Disposal Well Cost	0.8	0.0	0.0	0.0	0.0	0.0
Dry Holes	0.6	0.0	0.0	0.0	0.0	0.0
Infrastructure	0.2	0.0	0.0	0.0	0.0	0.0
Total Capex	**3.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Operating Expense						
Lifting US$/Mscf Raw	0.0	0.5	0.5	0.5	0.5	0.5
Separation US$/Mscf Raw	0.0	1.9	1.9	1.9	1.9	1.9
Sep. Plant Lease US$/Mscf Raw	0.0	0.3	0.3	0.3	0.3	0.3
Transport US$/Mscf Sales Gas	0.0	24.5	24.5	24.5	24.5	24.5
G&A US$/Mscf Sales Gas	0.0	10.7	10.7	10.7	10.7	10.7
Lifting US$ million	0.0	0.3	0.3	0.3	0.3	0.3
Separation US$ million	0.0	1.2	1.2	1.1	1.1	1.0
Sep. Lease US$ million	0.0	0.2	0.2	0.2	0.2	0.2
Transport US$ million	0.0	1.3	1.2	1.1	1.1	1.0
G&A US$ million	0.0	0.5	0.5	0.5	0.5	0.5
Total US$ million	0.0	3.5	3.4	3.2	3.1	2.9

Source: IIR estimates

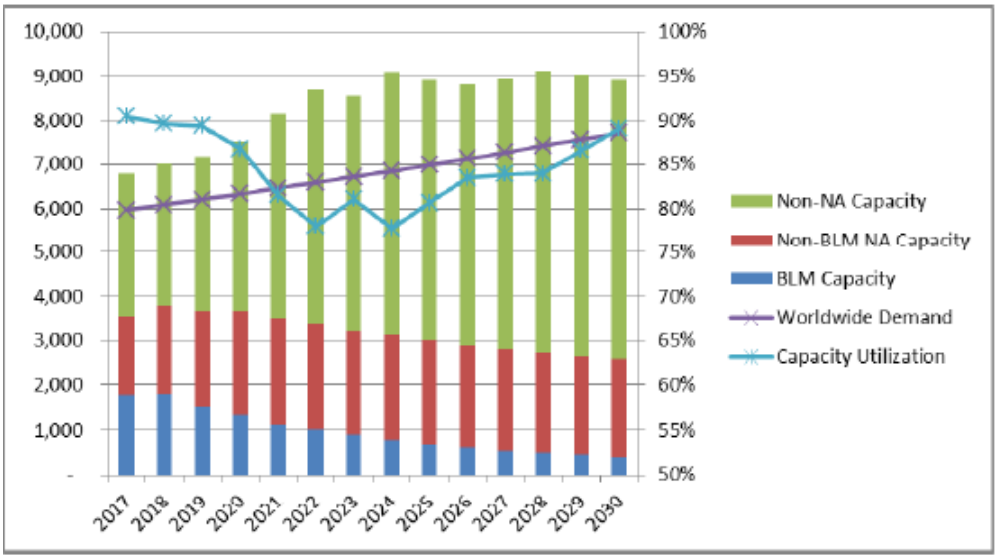
HELIUM INDUSTRY OVERVIEW

- When the US Geological Survey refers to helium by volume, it is referring to a standardized gas measured at 101.325 kilopascals absolute (14.696 psia) and 15 °C.
- 27.737 cubic meters of helium = 1,000 cubic feet of helium at 70 °F and 14.7 psia. This tends to be the defacto standard worldwide.
- The gas can be crude helium, which is between 50% and 80% helium and the balance nitrogen, or A Grade helium which is typically over 97.5% helium, and the balance nitrogen.

SUPPLY DEMAND BALANCE

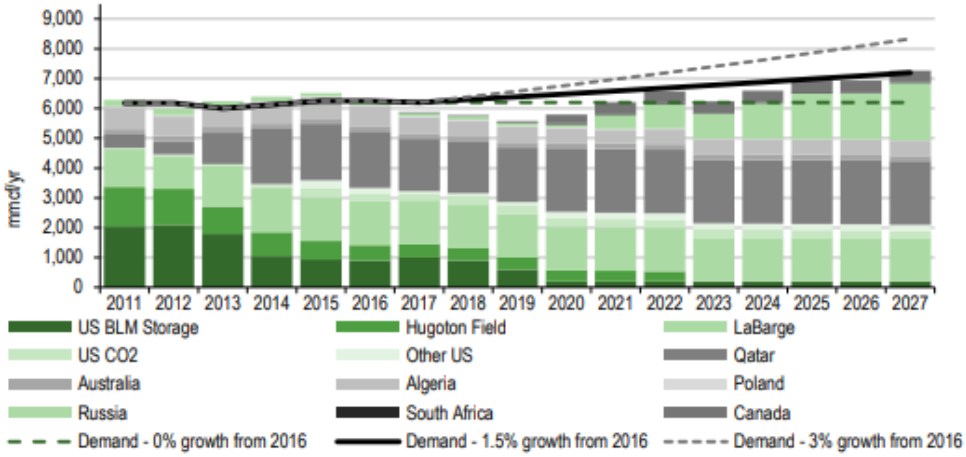
- We have included two supply demand forecasts prepared by Mercury Carbon and Edison.
- Mercury Carbon is forecasting 9Bscf/yr supply capacity from 2022 vs the Edison Base Case of 6.5Bscf of production, presumably at full capacity. The difference is large, but difficult to pinpoint without both groups providing more data.
- The difference probably relates to the Edison assumptions regarding the likely declines of existing US and Polish production. Both forecasters assume lower releases from the BLM stockpile including after the stockpile is sold in 2021.
- The two forecasts also diverge on whether there will be an oversupply or not from 2022.
- On the Mercury Carbon forecast, the implication is that 2020 sould be seeing a decline in capacity utilization, and therefore a fall in price, but the reverse appeared to be happening up to April when the Corona Virus hit. The virus adds significant uncertainty to the demand outlook.
- Corona Virus aside, if demand returns to normal, the anecdotal price action at the start of this year suggests the Edison's forecast of a deficit for this year and next may be closer to the mark than the Mercury Carbon study, which also undermines Mercury Carbon's view of the longer term.
- Longer term demand growth is the other major variable. Edison use three growth scenarios (0%, 1.5%pa and 3%pa). The 3% scenario results in deficits, the 1.5% a generally balanced market with some undersupplied periods. Mercury Carbon uses a 2%pa growth rate.
- Given we have been through a period of shortage in the last few years, apparent demand may have been depressed by the lack of supply, and if there is a demand rebound as more supply comes on line, the effect could be to reset the demand base at a higher level, shifting the supply demand balance to deficit, even at the higher production levels.
- If the Helium market remains tight even after the addition of significant supply (Qatar and Amur), then the outlook for helium pricing would be very strong. If not, we believe a business based on an 8% helium grade will be cost competitive throughout the price cycle.

Figure 11 Mercury Carbon helium supply demand balance in MMscf



Source: Market Study on Global Helium Gas Market Prepared for Helium One, September 2019

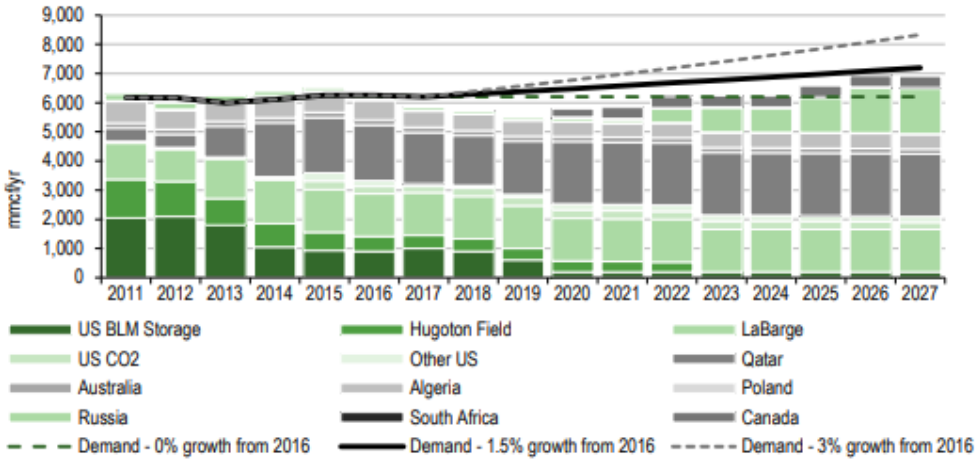
Figure 12 Edison base case forecast for supply demand balance



Source: Helium – Macro View Update by Edison Investment Research dated February 2019

- Anyone interested in the helium industry and particularly the supply demand outlook should download and read "Helium – Macro View Update" published by Edison Research dated February 2019.
- In the figure below, Edison has delayed the arrival of the Amur supply by 24 months from the 2021 time Gazprom has announced.
- Correctly estimating the start and ramp up of these large additions to supply can be difficult. The RasGas Helium 1 plant started production in August 2005, but did not reach full capacity until 2008, 1.5 to 2.5 years later. The helium percentage in the feed gas at RasGas and Amur is very low, and an estimation error of =/- 0.01% on a 0.05% helium grade could materially impact the ultimate production levels.

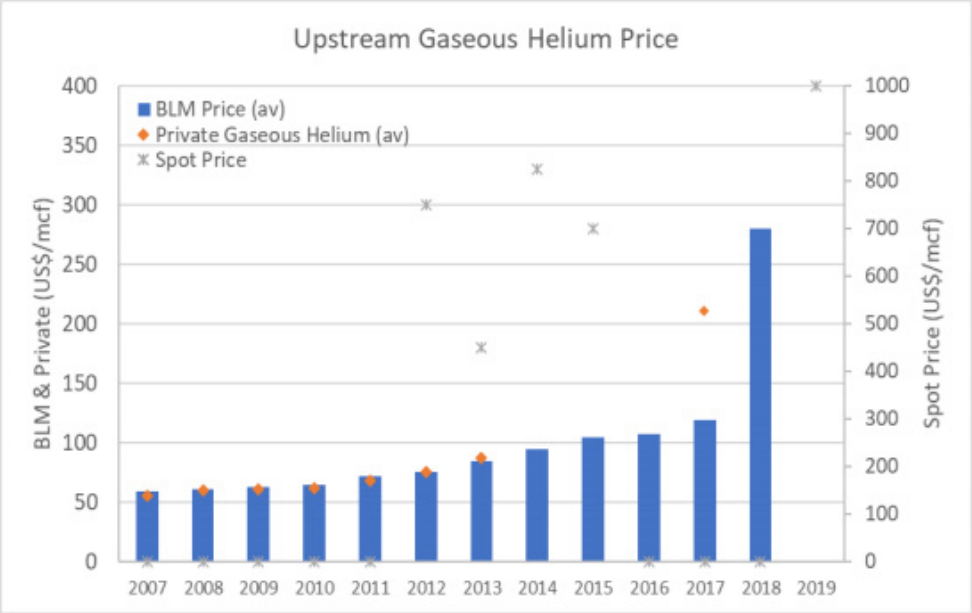
Figure 13 Edison supply demand scenario assuming Amur is delayed 24 months



Source: Helium – Macro View Update by Edison Investment Research dated February 2019

HELIUM PRICES

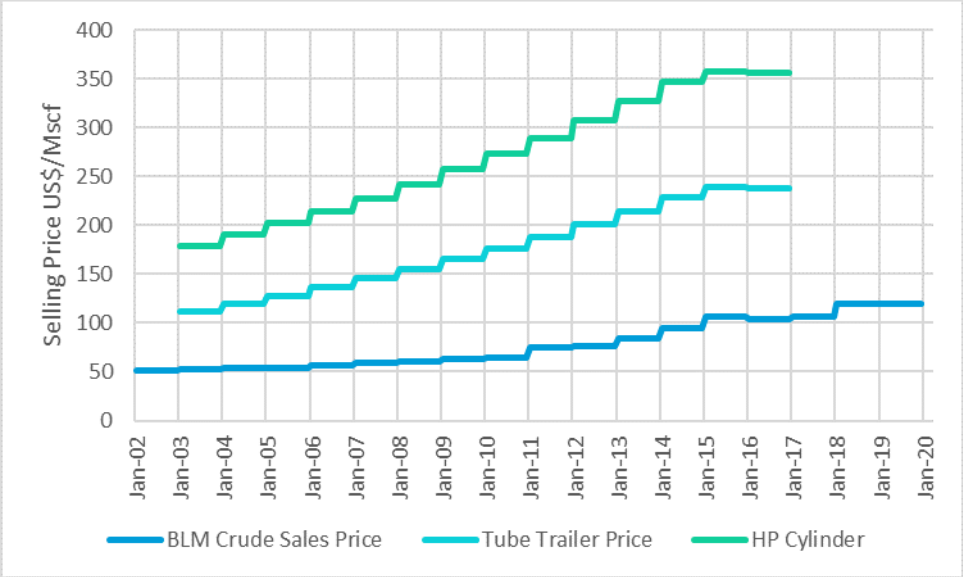
Figure 14 Price points in an opaque market



Source: BNL presentation 1 June 2020

- The dots on the figure above are derived from anecdotal reports available to Blue Star management, and represent indications of where the spot price may have been at those times.
- Th figure below are time series for Bureau of Land Management auction prices, and more recently BLM estimates of where the contract market might be. The BLM series is for crude helium which can be between 50% and 80% helium, and in need of further processing to be saleable. As such is would be a discount to the A Grade product that Blue Star intends to produce.
- Of the two time series ending in 2016, the A Grade helium in tube trailers is the price and product category that Blue Star is aiming for.
- The Qatar Petroleum annual report notes that the average sale price for liquid 99.99% helium from Ras Laffan was US$174/Mscf in CY2018 and US$169/Mscf in CY2017. We would expect that price to be discounted by the freight required to get to market, and would be contract prices, set in 2003 and 2006, when the plants were being financed.

Figure 15 Available helium price time series



Source: BLM quoted in USGS Helium Yearly Summaries, Tube Trailer and HP Cylinder prices from Helium: A Commercial Discussion by Jeremy Jordan of IACX.

HELIUM SUPPLY

- Most of the worlds helium supply comes from either helium produced as a by-product of natural gas production, or from the rundown of the US helium stockpile stored in the Cliffside facility near Amarillo Texas and administered by the Bureau of Land Management, a US government agency.
- Production of helium as the main or sole product is unusual. Most of the expansion in capacity forecast is coming from large LNG projects such as RasGas in Qatar, and Gazprom's Amur LNG project in eastern Siberia.

Table 16 Major helium supply expansions (IIR estimate of ramp up schedule)

	MM scf/yr	2020	2021	2022	2023	2024	2025	2026
RasGas Helium 3	430	100	300	430	430	430	430	430
Gazprom Amur 1	700		200	500	700	700	700	700
Gazprom Amur 2	700			200	500	700	700	700
Gazprom Amur 3	700					200	500	700
Irkutsk Oil	250		50	150	250	250	250	250
Total	2530	100	550	1280	1880	2280	2580	2780

Source: https://cen.acs.org/business/instrumentation/Help-helium-users-way/97/i46, IIR estimates of the ramp up

RasGas IN MORE DETAIL

- RasGas is worth a case study, because it embodies both the threats and opportunities faced by a new entrant to the helium industry like Blue Star.
- RasGas supplies 25% of the worlds helium, but all shipments ceased during a period where Qatar was blockaded by Saudi Arabia in 2017, highlighting to offtakers the issues of being too dependent on a single source of supply.
- Based on source quoted in Table 17, an operation like RasGas has a cash operating cost of US$95/Mscf for A Grade helium as an integrated plant, ie using all the energy efficiencies of the adjacent large scale LNG plant. If that plant was separate from the LNG operation, its operating cost would be more like US$190/Mscf.
- The capital costs are less useful, given economies of scale, but the US$307,969/Mscf/d capacity suggests a 2Mscf/d plant could be in the region of US$0.6 million, which provides some support for the US$1 million estimate we used earlier.
- If Blue Star discovers sufficiently high grade helium, it is likely to be able to operate at equal or lower operating cost than the RasGas estimates.

Table 17 Estimated RasGas helium capital and cash operating costs

	Integrated	Separate
Input Feedstock MMscf/yr	256	256
Helium Concentration	70%	70%
Output Helium MMscf/yr	179	179
Capital Cost US$ milliom	249	216
Operating Cost US$ million/yr	17	34
Capital Cost US$/Mscf/d	355020	307969
Operating Cost US$Mscf/d Feed	66	133
Operating Cost US$Mscf/d Helium	95	190

Source: Helium Recovery From Sales Gas

RasGas background and history

- RasGas is owned by Qatar Petroleum (70%) and ExxonMobile (30%). Qatar Petroleum is the operator.
- Ras Laffan Helium 1 was announced in 2003 and came on stream two years later. Ras Laffan Helium 2 began production in the third quarter of 2013, and Helium 3 is due to start on 2020.
- Liquid helium from the Ras Laffan Helium 1 plant fulfils sales contracts with the Linde Group (previously known as BOC Group) and Air Liquide.

- The first liquid helium was produced in August 2005, and reached its designed production capacity of 700 million standard cubic feet per year (or more than 9 tonnes per day) in 2008, ie a 1.5-2.5 year ramp up.
- The customers for liquid helium from the Ras Laffan Helium 2 plant are Air Liquide (50%), Linde Gases (30%) and Iwatani Corporation (20%). The annual capacity of the Helium 2 plant is 1.3 billion standard cubic feet per year.
- Although the North Field contains only a trace amount of helium, estimated at 0.04%, the vast size of the reservoir means that the helium available is expected to be enough to meet world demand for the next 30 years. And with both helium plants operating at full capacity, Qatargas will supply approximately 25% of the world's total helium production.
- On 14 June 2017, Qatar closed its two helium production plants because of the economic boycott imposed by other Arab states.
- The helium plants operated by RasGas, a subsidiary of state-owned Qatar Petroleum [QATPE.UL] (QP), were shut after Saudi Arabia closed its border with Qatar, blocking overland exports of the gas, a QP official told Reuters. RasGas is 70 percent owned by QP and U.S. giant Exxon Mobil (XOM.N) has 30 percent.
- The closure of the plants was a sign of how the rift between Qatar and Arab powers could affect commodities markets. Saudi Arabia, the United Arab Emirates, Egypt and Bahrain cut diplomatic and transport ties, accusing Qatar of supporting terrorism, a charge Doha denied.

RasGas Economics

- This information comes from "Helium Recovery From Sales Gas" by Arif Habibullah dated April 2020. It refers to the Barzan Project, a two stage development of the North Field in Qatar that feeds the Ras Laffan LNG complex, including the Helium Plants.

Table 18 RasGas Barzan helium concentrations through the process

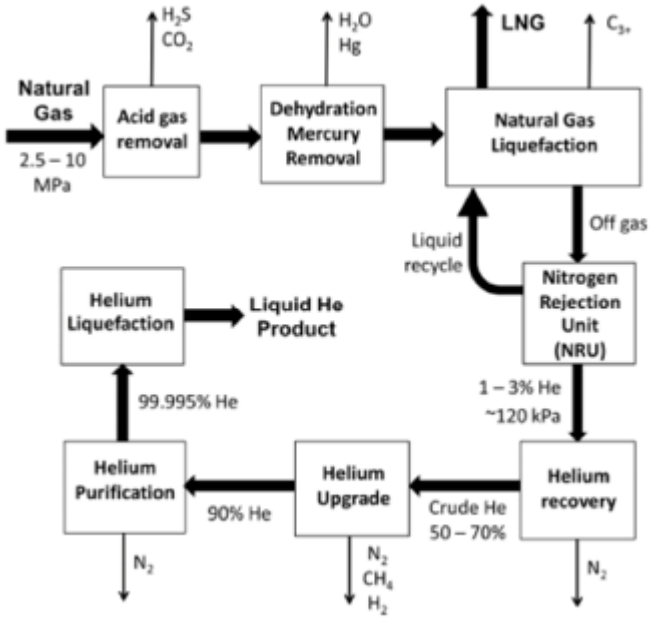
	Ex NGL Plant	Ex NRU Plant	Into HRU Plant
Methane	91.711%		
Nitrogen	8.168%	100.00%	30.00%
Helium	0.050%	0.61%	70.00%
Carbon Dioxide	0.002%		
Ethane	0.069%		
Propane	0.001%		

Source: Helium Recovery From Sales Gas (Note NGL = Natural Gas Liquids, NRU= Nitrogen Recovery Plant, HRU=Helium Recovery Plant see Figure 16)

- The output from the Barzan platform is processed to remove Natural Gas Liquids, and the output from that process has 8.168% nitrogen and 0.05% helium. The gas then goes through the LNG plant where the methane sales gas is liquified, and then passed through the Nitrogen Removal Unit (NGU). The helium travels with the nitrogen.
- The helium makes up a very low 0.61% of the nitrogen/helium content, but the paper refers to the feed from the NRU into the Helium Recovery unit at being 70% helium. There may definitional issued in the paper regarding at what point the NGU starts. Figure 16 highlights Helium Recovery and Helium Upgrade, and the input to the recovery stage would be the 0.61% He and the input to the upgrade stage would be the 70% He.
- However, the LNG process is designed to eliminated the nitrogen to improve the LNG product quality, and that is a cost to the LNG product stream. The Helium product picks up the costs after the extraction of the nitrogen/helium "waste" gas. The economic analysis we are using picks up the costs for the helium stream when the feed is 70% helium.

Technology of helium production

Figure 16 Basic Flowsheet for helium separation from natural gas



Source: Process Technologies for Helium Recovery from Natural Gas

Separation processes

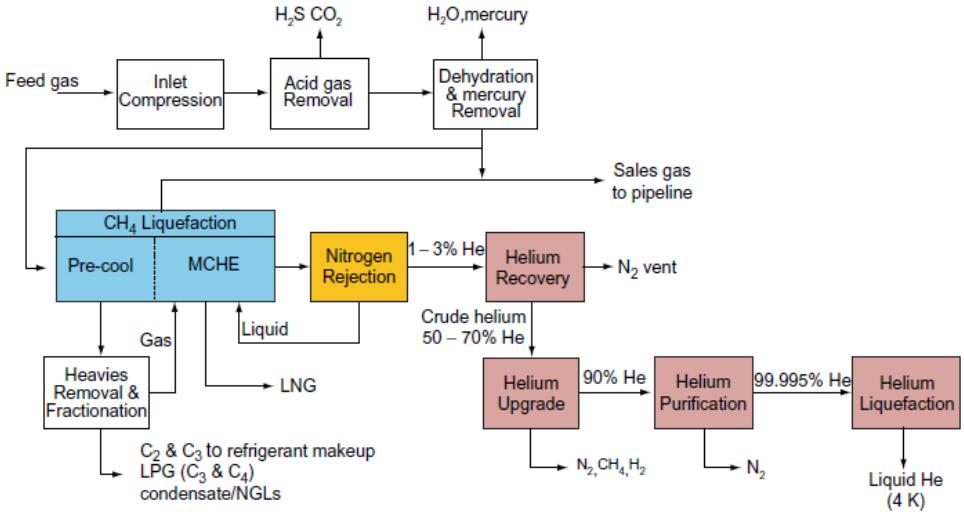
Table 19 Relative merits of different helium recovery and purification technologies

Technology	Advantages	Disadvantages
Cryogenic Fractionation	1. Widely used	1. High capital cost
	2. High recovery ie over 95%	2. High operating cost (energy)
	3. High Purity 99.999% He	
	4. Easy scale up	
	5. Micro plants available	
Pressure Swing Adsorption	1. No fluid phase changes	1. Requires high purity feed for high recovery
	2. Lower energy consumption	2. Low recovery from direct separation ie <65%
	3. High Purity 99.995%	
	4. Lower capital cost	
Membrane	1. No fluid phase changes	1. Requires cleaned high purity gas feed
	2. Lower energy consumption	2. Technology early in commercialization
	3. Small footprint	3. High pressure ratios ie high operating cost
	4. Lower capital cost	

Source: Process Technologies for Helium Recovery from Natural Gas

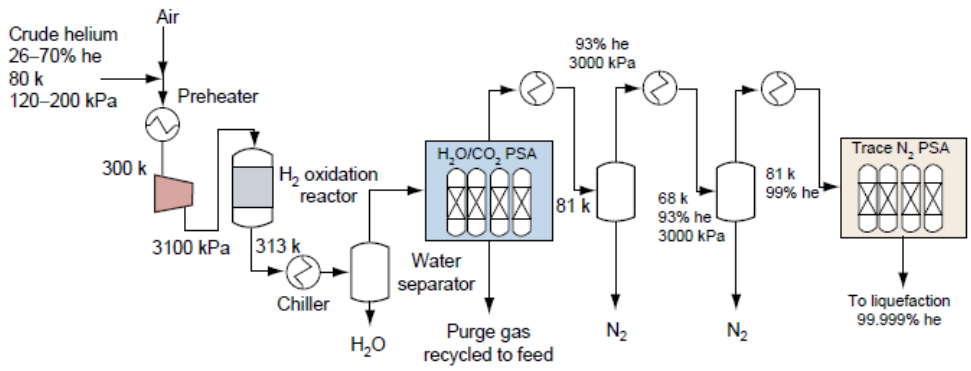
- In cryogenic technologies, separation is achieved at temperatures below -65 °C. Cryogenic separations can accomplish up to 90% helium recovery. Cryogenic processes are divided into two groups: multi-flash cycles and high-pressure distillation column processes. Where helium is produced at LNG plants, the cost of the front end refrigeration is carried by the hydrocarbons (methane etc) recovered.
- Pressure Swing Adsorption (PSA) methods are based on the adsorption of gases on solid surfaces and operates at near-ambient temperatures. These processes are mainly used in the pre-treatment, nitrogen rejection, upgrading and purification steps of helium recovery from natural gas. This technology is particularly appropriate where there is little or no hydrocarbons present, and where the helium is to be sold in gaseous form.
- Membrane technologies effectively separate gas mixtures by means of synthetic membranes made from various materials and are based on the theory of Fick's Law. Membrane technologies have not yet advanced like cryogenics and PSA separation methods, but is improving efficiencies all the time.

Figure 17 Overview of LNG process and location of helium concentration operations using cryogenic process



Source: A Review of Conventional and Emerging Process Technologies for the Recovery of Helium from Natural Gas. Note MCHE stands for Main Cryogenic Heat Exchanger

Figure 18 Helium upgrade flowsheet using Pressure Swing Adsorption (PSA) technology



Source: A Review of Conventional and Emerging Process Technologies for the Recovery of Helium from Natural Gas

Table 20 World natural gas reserves and potential for helium

Region	Country	Proven Natural Gas NG Rsrv (Tcm)	NG Rsrv (Tcf)	Charaterization Of Existance/Status of Helium	Est % Cntnd Helium
North America	U.S.	8.4	304.6	Yes, Significant, Developing	0.35%
	Canada	1.9	68.2	Yes, Moderate, Not Developed Yet	0.10%
	Subtotal	10.3	373		
South America	Argentina	0.3	11.7	NA	
	Venezuela	5.4	195.1	NA	
	Brazil	0.4	14.0	NA	
	Chile	0.1	3.5	Yes, Limited, Not Developed	NA
	Subtotal	5.8	209		
Europe	Russia	46.8	1688.2	Yes, Significant, Developing	NA
	Norway	2.0	73.1	NA	
	Poland	0.1	3.2	Yes, Moderate, Developing	0.10%
	Subtotal	48.9	1,765		
Afr/MidEast/Ind	Iran	32.9	1187.0	Yes, Significant, Not Developed	0.04%
	Qatar	24.7	890.0	Yes, Significant, Developing	0.04%
	Saudi Arabia	8.0	287.8	Yes, Limited, Not Developed	0.18%
	Turkmenistan	7.4	265.0	NA	
	UAE (Abu Dhabi)	6.0	215.0	NA	
	Algeria	4.4	159.1	Yes, Significant, Developing	0.19%
	Iraq	3.1	111.5	Yes, NA, Not Developed	0.04%
	Kazakhstan	2.4	85.0	NA	
	Libya	1.5	54.6	Yes, Significant, Not Developed	0.10%
	India	1.2	43.8	Yes, Not Significant, Not Developed	0.01%
	Pakistan	0.7	24.0	NA	
	Subtotal	92.2	3,323		
APR	China	3.4	124.2	Yes, Not Significant, Developed	0.02%
	Indonesia	3.0	108.4	Yes, Significant, Not Developed	0.04%
	Australia	1.2	43.0	Yes, Significant, Developing	0.31%
	P New Guinea	0.2	5.5	NA	
	Subtotal	7.8	281		
Total Worldwide (Calculated)		164.7	5,937		
Total Worldwide (Total Estimate)			6,707		

Sources: U.S. Energy Information Administration (EIA), International Energy Statistics, Proved Reserves of Natural Gas, 2013 and Oil and Gas Journal, Survey of Natural Gas Reserves, January 1, 2013.

- As at 2006, the USGS estimated that the world helium resource was 1874 Bcf of helium. Since then, the US stockpile has reduced, but the Russian and Qatar projects have emerged in size. The world is not faced by a lack of helium resources.
- From the table above, the bulk of the worlds helium is contained in very small percentages, within natural gas reservoirs.

HELIUM DEMAND

Table 21 Apparent helium demand in the US for 2019

Application	MMscf	Million cm	Share
Magnetic Resonance Imaging	424	12.0	30%
Lifting Gas	240	6.8	17%
Analytical & Laboratory	198	5.6	14%
Welding	127	3.6	9%
Engineering	85	2.4	6%
Leak Detection	71	2	5%
Semiconductor Manufacture	71	2.0	5%
Other	198	5.6	14%
Total US Apparent Consumption	1412	40.0	100%

Source: USGS Mineral Commodity Summary 2020

- Global demand is around 6 Bscf/yr and split in a broadly similar way to that of the US.

Applications in more detail

- Liquid helium is used in medical diagnostic equipment such as MRI (Magnetic Resonance Imaging) to cool the superconductive magnets (the largest use of helium). There are some 36,000 MRI machines in the world and each machine uses around 1,700 litres of liquid helium.
- Liquid helium is used in magnetoencephalography (MEG).
- Liquid helium uses in non-medical equipment include low temperature Móssbauer spectroscopy.
- Cooling thermographic cameras and equipment used by search and rescue teams and medical personnel to detect and monitor certain physiological processes.
- Helium-neon lasers for eye surgery.
- Breathing gas for divers (a mixture of 20% oxygen and 80% helium).
- Optical fibre manufacturing.
- In arc welding as an inert shielding gas.
- Leak detection in pipelines.
- Other industries use helium to detect gas leaks in their products.
- Manufacturers of aerosol products, tires, refrigerators, fire extinguishers, air conditioners and other devices use helium to test seals before their products come to market.
- In gas lasers as a buffer or carrier gas.
- Cooling medium for High Temperature Nuclear Reactors.
- In neon signs in mixture with neon and argon.
- For filling large balloons for upper atmosphere and cosmic ray studies, for filling smaller balloons used in weather forecasting, and also for filling toy balloons.
- As a calibration gas and to balance gas calibration mixtures.
- Carrier gas for gas-liquid and gas-solid chromatography.
- NASA uses helium to keep hot gases and ultra-cold liquid fuel separated during lift off of rockets.
- The CERN Large Hardon Collider uses helium for cooling.

HELIUM MARKET STRUCTURE

- Helium is sold in various containers and points in the production cycle.
- Point of sale can be
  - At spigot or at the outlet tap of the field production facility in crude (70% He) or A Grade gas form
  - At spigot from a refrigeration facility in liquid form, suitable for long haul, international export or cryogenic use as A Grade Gas.
  - Delivered to customer in gas or liquid form as A Grade Helium

- Helium transport containers include (source: Low Volume Extraction of Helium - CTP)
  - Compressed gas composite tube container for road or rail transport. Typically a tube or tank system is built into an ISO standard 40 foot shipping container with a capacity of 265,000scf or 7504scm (1252 kg helium). The cost was US$450,000 per CTP 19 April 2010, and given the low inflation of the last decade, is likely to cost about the same now.
  - Liquid Helium container for road, rail or ship transport containing 41,000 litres or 1,095,000scf of helium. These containers are good to contain the Helium for 30-45 days before release is required. The unit is fitted into a ISO standard 40 foot shipping container. The cost was US$1.2M per CTP 19 April 2010, and given the low inflation of the last decade, is likely to cost about the same now.
  - Truck trailers exist in a bigger variety of sizes, for both compressed and liquified helium.

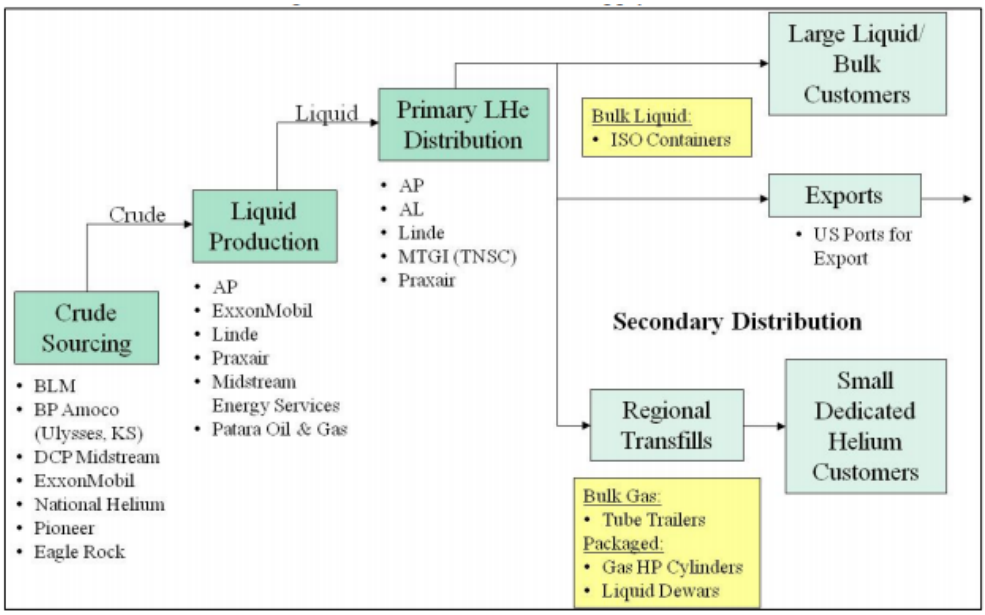
Figure 19 Refrigerated Trailer for liquid helium

Source: BNL Presentation 1 June 2020

Figure 20 Tube trailer for gaseous helium

Source: BNL Presentation 1 June 2020

Figure 21 Diagram of helium market structure in North America



Source: Determination of Fair Market Value Pricing of Crude Helium. DCP Midstream has sold to Tumbleweed Midstream and Linde and Praxair have merged.

- In 2013, The bulk market (compressed gas and liquid gas trailers and ISO containers) represented 40% of final end consumer demand in the US. The balance was for packaged helium in Dewars (ie liquid helium) and cylinders/gas bottles (ie compressed gas). See "Determination of Fair Market Value Pricing of Crude Helium" p7.
- Below is a list of bidders for crude helium from the last public helium auction conducted by the Bureau of Land Management. These are the companies that are potential buyers of any Blue Star production. There is a good range of large global off takers and smaller players who can keep the bigger players from exercising too much market power.
  - Air Products
  - Praxair, Inc (Now merged with Linde)

- Linde Gas North America LLC
- Keyes Helium Company
- IACX
- Air Liquide Helium America, Inc.
- Pioneer Natural Resources
- Matheson Tri-Gas, Inc.
- Airgas Merchant Gases
- Global Gases America, Inc.
- Linn Operating, Inc.
- Uniper Global Commodities North America LLC
- Weil Group Resources LLC
- NAH USA Helium Marketing, Inc.
- Progressive Chemical Technologies, LLC

Industry participants

- Crude Helium Producers
  - ExxonMobil-United States
  - Gazprom-Russia
  - Qatar Gas-Qatar
  - Sonatrach-Algeria
  - Polskie Górnictwo Naftowe i Gazownictwo SA (PGNiG)-Poland
  - Renergen-South Africa
  - Weil Group-Canada-USA
  - ConocoPhillips-Australia
  - Castleton Commodities International – USA
  - Tumbleweed Midstream - USA
  - Pioneer Natural Resources – USA
  - Denbury – USA
  - ONEOK – USA
  - Tenawa Resource Management – USA
- Primary Liquid Helium Distributors
  - Linde
  - Air Liquide
  - Air Products (Also
  - Matheson Tri-Gas
  - Messer Group
  - Badger Midstream
  - Speciality Gas Traders
  - Uniper Global Commodities Germany
  - Iwatani Japan
  - Marubeni Japan
  - Global Gasses (UAE)
  - Itochu Japan
  - Sojitz Japan
- Small Field Operators – Non Hydrocarbon Associated
  - IACX Energy
  - Weil Group
  - Nasco Energie und Rohstoff AG
  - Tacitus LLC
  - American Helium
  - Triomphe Energy
  - Bruin Point Helium

Product standards

- The technology Blue Star intends to use is capable of converting 8% helium input to 98% helium output, which would make the gas suitable for delivery to the lifting users like weather balloons, party balloons etc.
- For applications requiring higher purity, further processing may be required.

Table 22 Helium purity standards for various applications

Limiting characteristics	Maxima for gaseous helium							
	H	J	K	L	M	N	P	G
Helium, min.%	97.5	99.0	99.99	99.995	99.995	99.997	99.999	99.9999
Water (Vapor)				15	9	3	1.5	
Dew point °F (°C)							–100 (–73.3)	Sum of all these impuri-ties less than 1 ppm
Total Hydrocar-bon Content (as CH_4) Oxygen				5	5 3	1 3	0.5 1	
Nitrogen + Argon					14	5*	5	
Neon					23	23	2	
Hydrogen					Sum = 37 ppm	1	1	
Carbon dioxide							Sum = 0.5 ppm	
Carbon monoxide		10						
Odor		none						
Buoyancy	yes							
Identity		yes						
USP		yes						

*Maximum 5 ppm nitrogen only.
Adapted from CGA G-9.1 1992.
The typical uses (not all inclusive) of the above grades are:
H Balloons
J USP
L Welding, blanketing, heat treating
N Cooling, purging, leak detection, analytical, diving/respiratory applications P Cooling (MRI), analytical, fiber optics
G Semiconductor manufacturing, fiber optics

Source: Compressed Gas Association – from Helium in Natural Gas - Occurrence and Production (USP = are applications where the helium is part of a gas they is breathed in, ie by divers, or hospital patients with lung issues)

SHAREHOLDERS AND CAPITAL STRUCTURE

Table 23 Major shareholders prior to June/July 2020 share issue

28-May-20	Undiluted	Fully Diluted
Board and Management	4.5%	16.40%
Pamplona	4.8%	6.3%
Ms Chunyan Niu	4.2%	3.3%
United Equity Partners	3.5%	5.3%
BNP Paribas Nominees	3.0%	2.40%
Top 20	48.8%	54.4%

Source: BNL presentation 1 June 2020

- On 16 June 2020, Blue Star announced the raising of A$2.30 million via a share placement in two tranches. Tranche 1 of 98.06 million shares raising A$0.981 million has been issued, and subject to a shareholder vote in July 2020, Tranche 2 will issue a further 132.2 million shares raising A$1.32 million.
- The exercise of the June 2020 options would add A$1 million to cash to the balance sheet. 16.875 million are owned by Trent Spry, and 10 million by Paloma Capital.
- 66 million 31 December 2021 options are owned by Ross Warner, Joanne Kendrick and Trent Spry.
- 12 million 31 December options are owned by Pamplona Capital prior to the June/July 2020 share issue, and in payment for assisting with that issue, Pamplona will receive an additional 8 million options on the same terms (1.2c exercise, 31 December 2021 expiry).

Table 24 Capital structure post issue

Secutities in millions	28 May 2020	Issue	New
Issued Shares	733.7	230.3	964.0
Unlisted Options 1c expiring 30 June 2020	101.9		
Unlisted Options 1.2c expiring 31 December 2021	78.0	8.0	86.0
Diluted Capital	913.6	238.3	1151.9

Source: BNL presentation 1 June 2020, Option detail Appendix 3G report dated 1 May 2020, Issue release 16 June 2020

BOARD AND MANAGEMENT

Mr Ross Warner Executive Chairman

- Ross is an experienced natural resources executive. He has held executive and non-executive director roles in several public companies listed on AIM and the ASX and a number of private companies.
- He has been involved in ventures with interests in operated and non-operated oil and gas assets in Texas, Louisiana and Oklahoma and upstream and gas to power projects in Indonesia.
- He practiced as a corporate finance lawyer with Mallesons Stephen Jaques in Perth and Melbourne and Clifford Chance in London.

Ms Joanne Kendrick Managing Director

- Joanne is a seasoned industry professional with over 20 years experience in technical and executive roles with Woodside Petroleum, Newfield Exploration, Gulf Canada, Clyde Petroleum and Nido Petroleum. She is a Petroleum/Reservoir Engineer holding a Bachelor of Engineering (Hons) from the University of Adelaide.
- Joanne has been directly responsible for managing production operations, exploration drilling and development projects, capital raisings, asset transactions and joint venture interests throughout her career; including as Deputy Managing Director at ASX-listed Nido Petroleum for 7 years.

Mr Trent Spry Executive Director

- Trent brings to the Board significant ASX corporate experience, expertise in geoscience, exploration and project development as well as significant recent experience in the USA.
- Trent has over twenty years of experience in the upstream oil and gas industry in exploration, appraisal and development. He holds a Bachelor of Science (Hons)(National Centre for Petroleum Geology & Geophysics, University of Adelaide) and is a graduate of the Australian Institute of Company Directors.
- He has originated numerous projects from concept or acquisition through to discovery, appraisal, successful development and exit in Australia, SE Asia, the Gulf of Mexico and the US onshore. Trent specializes in new ventures and project execution and has expertise in hydrocarbon and helium systems analysis.

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CONVERSIONS AND TERMINOLOGY

Imperial units have been used in this report.

Imperial Units			Metric Units	
M (10^3)	one thousand	Prefixes	k (10^3)	one thousand
MM (10^6)	million		M (10^6)	million
B (10^9)	one billion		T (10^{12})	one billion E
T (10^{12})	one trillion		(10^{18})	one trillion G
			(10^9)	one milliard
in.	inches	Length	cm	centimetres
ft	feet		m	metres
mi	mile		km	kilometres
ft^2	square feet	Area	m^2	square metres
ac	acres		ha	hectares
cf or ft^3	cubic feet	Volume	m^3	cubic metres
scf	standard cubic feet			
gal	gallons		L	litres
Mcf	thousand cubic feet			
Mcfpd	thousand cubic feet per day			
MMcf	million cubic feet			
MMcfpd	million cubic feet per day			
Bcf	billion cubic feet (10^9)			
bbl	barrels		m^3	cubic metre
Mbbl	thousand barrels			
stb	stock tank barrel		stm^3	stock tank cubic metres
bbl/d	barrels per day		m^3/d	cubic metre per day

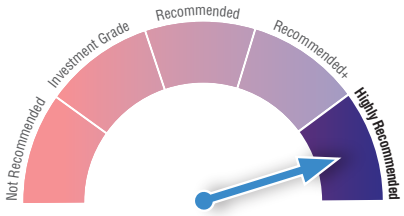
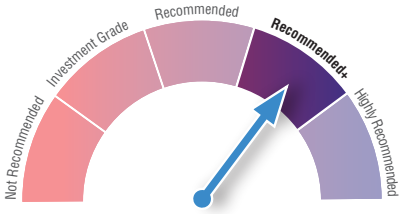
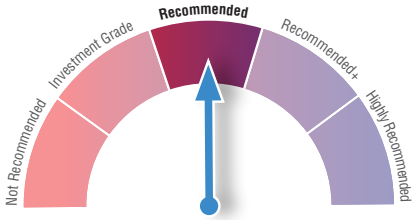
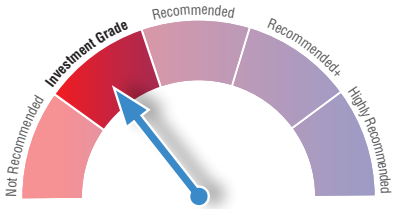
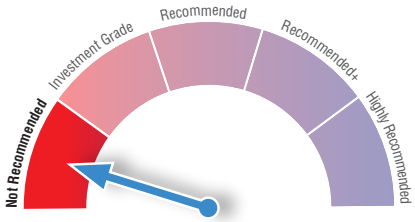
Conversion Factors — Metric to Imperial		
cubic metres (m^3) (@ 15°C)	x 6.29010	= barrels (bbl) (@ 60°F), water
m^3 (@ 15°C)	x 6.3300	= bbl (@ 60°F), Ethane
m^3 (@ 15°C)	x 6.30001	= bbl (@ 60°F), Propane
m^3 (@ 15°C)	x 6.29683	= bbl (@ 60°F), Butanes
m^3 (@ 15°C)	x 6.29287	= bbl (@ 60°F), oil, Pentanes Plus
m^3 (@ 101.325 kPaa, 15°C)	x 0.0354937	= thousands of cubic feet (Mcf) (@ 14.65 psia, 60°F)
1,000 cubic metres (10^3m^3) (@ 101.325 kPaa, 15°C)	x 35.49373	= Mcf (@ 14.65 psia, 60°F)
hectares (ha)	x 2.4710541	= acres
1,000 square metres (10^3m^2)	x 0.2471054	= acres
10,000 cubic metres (ha·m)	x 8.107133	= acre feet (ac-ft)
$m^3/10^3m^3$ (@ 101.325 kPaa, 15° C)	x 0.0437809	= Mcf/Ac.ft. (@ 14.65 psia, 60°F)
joules (j)	x 0.000948213	= Btu
megajoules per cubic metre (MJ/m^3) (@ 101.325 kPaa, 15°C)	x 26.714952	= British thermal units per standard cubic foot (Btu/scf) (@ 14.65 psia, 60°F)
dollars per gigajoule ($/GJ)	x 1.054615	= $/Mcf (1,000 Btu gas)
metres (m)	x 3.28084	= feet (ft)
kilometres (km)	x 0.6213712	= miles (mi)
dollars per 1,000 cubic metres ($/$10^3m^3$)	x 0.0288951	= dollars per thousand cubic feet ($/Mcf) (@ 15.025 psia) B.C.
($/$10^3m^3$)	x 0.02817399	= $/Mcf (@ 14.65 psia) Alta.
dollars per cubic metre ($/$m^3$)	x 0.158910	= dollars per barrel ($/bbl)
gas/oil ratio (GOR) (m^3/m^3)	x 5.640309	= GOR (scf/bbl)
kilowatts (kW)	x 1.341022	= horsepower
kilopascals (kPa)	x 0.145038	= psi
tonnes (t)	x 0.9842064	= long tons (LT)
kilograms (kg)	x 2.204624	= pounds (lb)
litres (L)	x 0.2199692	= gallons (Imperial)
litres (L)	x 0.264172	= gallons (U.S.)
cubic metres per million cubic metres ($m^3/10^6m^3$) (C_3)	x 0.177496	= barrels per million cubic feet (bbl/MMcf) (@ 14.65 psia)
$m^3/10^6m^3$) (C_4)	x 0.1774069	= bbl/MMcf (@ 14.65 psia)
$m^3/10^6m^3$) (C_{5+})	x 0.1772953	= bbl/MMcf (@ 14.65 psia)
tonnes per million cubic metres ($t/10^6m^3$) (sulphur)	x 0.0277290	= LT/MMcf (@ 14.65 psia)
millilitres per cubic meter (mL/m^3) (C_{5+})	x 0.0061974	= gallons (Imperial) per thousand cubic feet (gal (Imp)/Mcf)
(mL/m^3) (C_{5+})	x 0.0074428	= gallons (U.S.) per thousand cubic feet (gal (U.S.)/Mcf)
Kelvin (K)	x 1.8	= degrees Rankine (°R)
millipascal seconds (mPa·s)	x 1.0	= centipoise

Notes:

APPENDIX A – RATINGS PROCESS

Independent Investment Research Pty Ltd "IIR" rating system

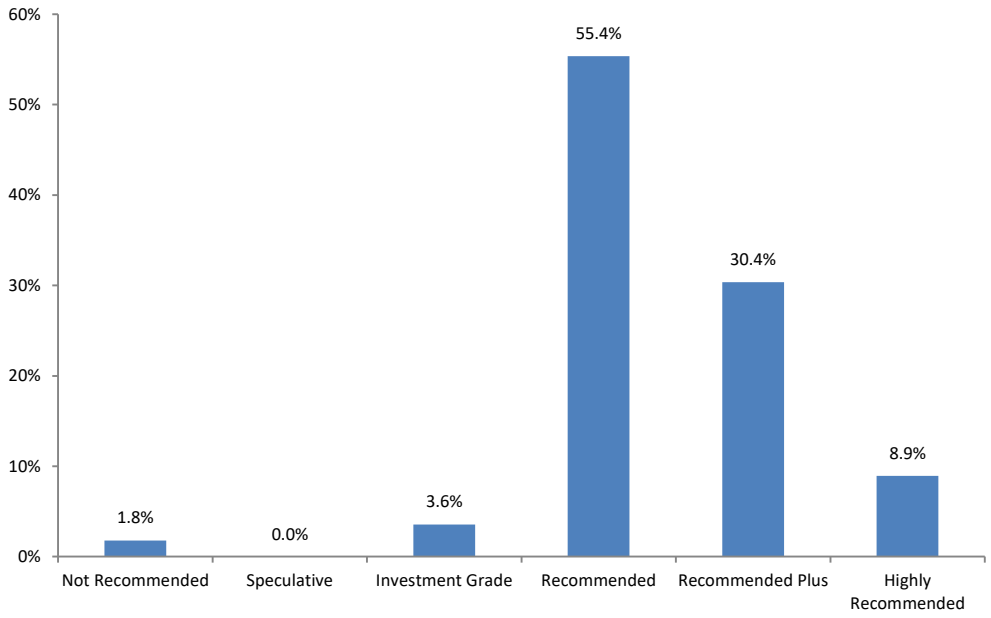
IIR has developed a framework for rating investment product offerings in Australia. Our review process gives consideration to a broad number of qualitative and quantitative factors. Essentially, the evaluation process includes the following key factors: management and underlying portfolio construction; investment management, product structure, risk management, experience and performance; fees, risks and likely outcomes.

LMI Ratings	SCORE
Highly Recommended	**83 and above**
	This is the highest rating provided by IIR, indicating this is a best of breed product that has exceeded the requirements of our review process across a number of key evaluation parameters and achieved exceptionally high scores in a number of categories. The product provides a highly attractive risk/return trade-off. The Fund is likely effectively to apply industry best practice to manage endogenous risk factors, and, to the extent that it can, exogenous risk factors.
Recommended +	**79–83**
	This rating indicates that IIR believes this is a superior grade product that has exceeded the requirements of our review process across a number of key evaluation parameters and achieved high scores in a number of categories. In addition, the product rates highly on one or two attributes in our key criteria. It has an above-average risk/return trade-off and should be able consistently to generate above average risk-adjusted returns in line with stated investment objectives. The Fund should be in a position effectively to manage endogenous risk factors, and, to the extent that it can, exogenous risk factors. This should result in returns that reflect the expected level of risk.
Recommended	**70–79**
	This rating indicates that IIR believes this is an above-average grade product that has exceeded the minimum requirements of our review process across a number of key evaluation parameters. It has an above-average risk/return trade-off and should be able to consistently generate above-average risk adjusted returns in line with stated investment objectives.
Investment Grade	**60-70**
	This rating indicates that IIR believes this is an average grade product that has exceeded the minimum requirements of our review process across a number of key evaluation parameters. It has an average risk/ return trade-off and should be able to consistently generate average risk adjusted returns in line with stated investment objectives.
Not Recommended	**<60**
	This rating indicates that IIR believes that despite the product's merits and attributes, it has failed to meet the minimum aggregate requirements of our review process across a number of key evaluation parameters. While this is a product below the minimum rating to be considered Investment Grade, this does not mean the product is without merit. Funds in this category are considered to be susceptible to high risks that are not reflected by the projected return. Performance volatility, particularly on the down-side, is likely.

APPENDIX B – MANAGED INVESTMENTS COVERAGE

The below graphic details the spread of ratings for managed investments rated by Independent Investment Research (IIR). The managed investments represented below include listed and unlisted managed funds, fund of funds, exchange traded funds and model portfolios.

SPREAD OF MANAGED INVESTMENT RATINGS



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