

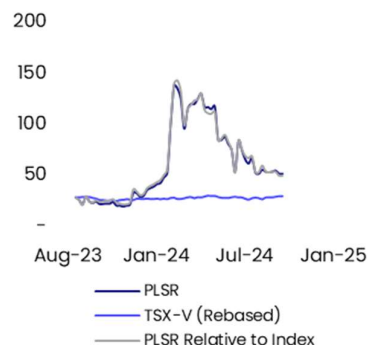
**Imminent work on Topaz**

23 October 2024

<b>NAV:</b>	<b>\$mm</b>
Core (cash)	7.5
Dev. & Appraisal	64.9
Exploration	32.5
<b>Total</b>	<b>104.9</b>
Per Share	63.3
From Current Price	134.4%

**Stock Data**

Market Cap:	£34.2mm
EV:	\$36.9mm
Shares in Issue	126.6mm
Change: 1m	-1.9%
3m	-32.9%
12m	130.4%



**Pulsar Helium has raised £5m gross from its fund raise and subsequent listing on London’s AIM. This gives management sufficient funds to deepen the Jetstream-1 well and drill the Jetstream-2 appraisal well on the Topaz prospect. These wells have the ability to add significant additional resources and increase the certainty over this exciting helium discovery. This programme could add significant shareholder value. With this note we are initiating coverage with a target price of 63.3p.**

**Quality Helium play**

Pulsar Helium is a helium explorer with two assets – Minnesota and Eastern Greenland. Attention will focus on the work programme on the Topaz discovery in Minnesota which is the most advanced of its projects. This found one of the highest concentrations of helium in the USA. The Jetstream-1 well that was drilled in 2024 had helium concentrations of 8.7% - 14.5%. On top of this, there is significant quantities of carbon dioxide where there is a ready market, making it a valuable bi-product.

**Topaz work programme**

Pulsar is about to start a work programme on the Topaz discovery and has contracted a rig ahead of work in Q4 2024. The first step will be to deepen the Jetstream-1 well, which intercepted the top 100 metres of a helium charged reservoir. This will be deepened by a further 500 metres with the desire to prove up additional reservoir. This will have a material impact on potential resources. After this, management will drill the Jetstream-2 appraisal well which will help identify the extent of the structure and give better confidence in the resources.

**Valuation**

We derive a target price through the use of a RENAV (Risky Exploration Net Asset Value) using a very conservative helium price of US\$450/mcf and recoverable resources of 0.7 BCF. We have only valued Topaz. We have assumed a 50% chance of success at Topaz. On top of this we assumed that there are other prospects of similar magnitude and where there is a chance of success of 25%. Using these and adjusting for the net cash, we achieve a target price of 63.3p/share. As we mentioned above, the work programme could have a significant impact on resources and chances of success allowing further upside in this valuation.

**Finances**

The group has raised gross proceeds of GBP 5 million through its share issue and listing on London’s AIM market. This, with existing cash balances, should be more than sufficient for its anticipated work programme.

**Corporate Broking**

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**Initiating coverage**

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**NOTE:** “m” denotes thousands & “mm” millions

## Summary & Conclusion

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Pulsar Helium has two major assets located in Minnesota, USA and Greenland. The acreage in Minnesota boasts the Topaz discovery which has one of the highest concentrations of helium found in recent years and is the main focus of the company in the short term. In Greenland, Pulsar has the Tunu exploration licence which is still at very early stages. The recent fundraise has allowed the group to start moving ahead with the development of its asset base with drilling at Topaz expected in Q4 2024.

### Topaz

Pulsar has acquired a significant portfolio of acreage over the Bald Eagle formation in Minnesota where a well was drilled in 2011 by Duluth Metals (in the search for platinum and palladium) discovered gas which was found to contain a mixture of carbon dioxide, nitrogen and helium. Duluth plugged and abandoned this well leaving the way for Pulsar to acquire the licences. Management drilled a further well in 2024 (Jetstream-1) which flowed at 821 mcf/day of gas. Excitingly, this had concentrations of helium of 8.7% -14.5%, which is the second highest concentrations found in the USA. The well also had significant levels of carbon dioxide (at over 70% by volume). At these levels, this becomes a valuable bi-product with significant demand from areas such as the carbonated drinks industry.

Pulsar is about to start on a work programme that will significantly increase the resources. The first operation will be to deepen the Jetstream-1 well. The initial well intercepted the top 100 metres of a helium charged reservoir. Through deepening this well, it is hoped to prove up an additional 500 metres of reservoir which would provide a major fillip to resources. Pulsar also wants to drill an appraisal well (Jetstream-2) which will provide better certainty to the resources. Management has signed a rig contract and work can start once site improvements have been made. Pulsar has also secured additional acreage in this area where it is hoped that additional prospects can be identified. (For more details please see page 5)

### Tunu

Pulsar has a 100% working interest in the Tunu exploration licence on the Eastern coast of Greenland. The geology is perfect for the generation of helium and samplings of nearby hotspots has seen concentrations up to 0.8%. This exploration licence is at early stages and management is looking to start initial exploration work with the hope that it can mature drillable prospects. (For more details please see page 7)

### Valuation

We derive the valuation of Pulsar through a RENAV (Risky Exploration Net Asset Value). For the Topaz discovery we are assuming 0.7 BCF of helium at a conservative price of US\$450/mcf which is below the price of some recent offtake deals. We have assumed a 50% chance of success. For the other prospects we have taken a similar stance on pricing and volumetrics but assumed a 25% chance of success. This gives

a target price of 63.3 p/share. We believe that this is conservative and the drilling programme could significantly increase the resource base and chances of success. We also believe that our assumption on the helium price is conservative compared to current market pricings. We provide a sensitivity analysis for investors. (For more details please see page 13).

### Finances

At the end of Q2 2024 (ending 31 March 2024), the group had net cash of US\$2.3 million. This has been augmented by the recent fundraise has seen gross proceeds of GBP5.0 million from its share raise (and admission to London's AIM). We estimate that that the group currently has net cash of approximately US\$7.5 million. This should be more than sufficient to meet the costs of the drill programme and subsequent testing. Although the subsequent potential development will require significant funding, much of this could be funded through debt on the back of any offtake agreements. (For more details please see page 12)

# Operations

## Overview

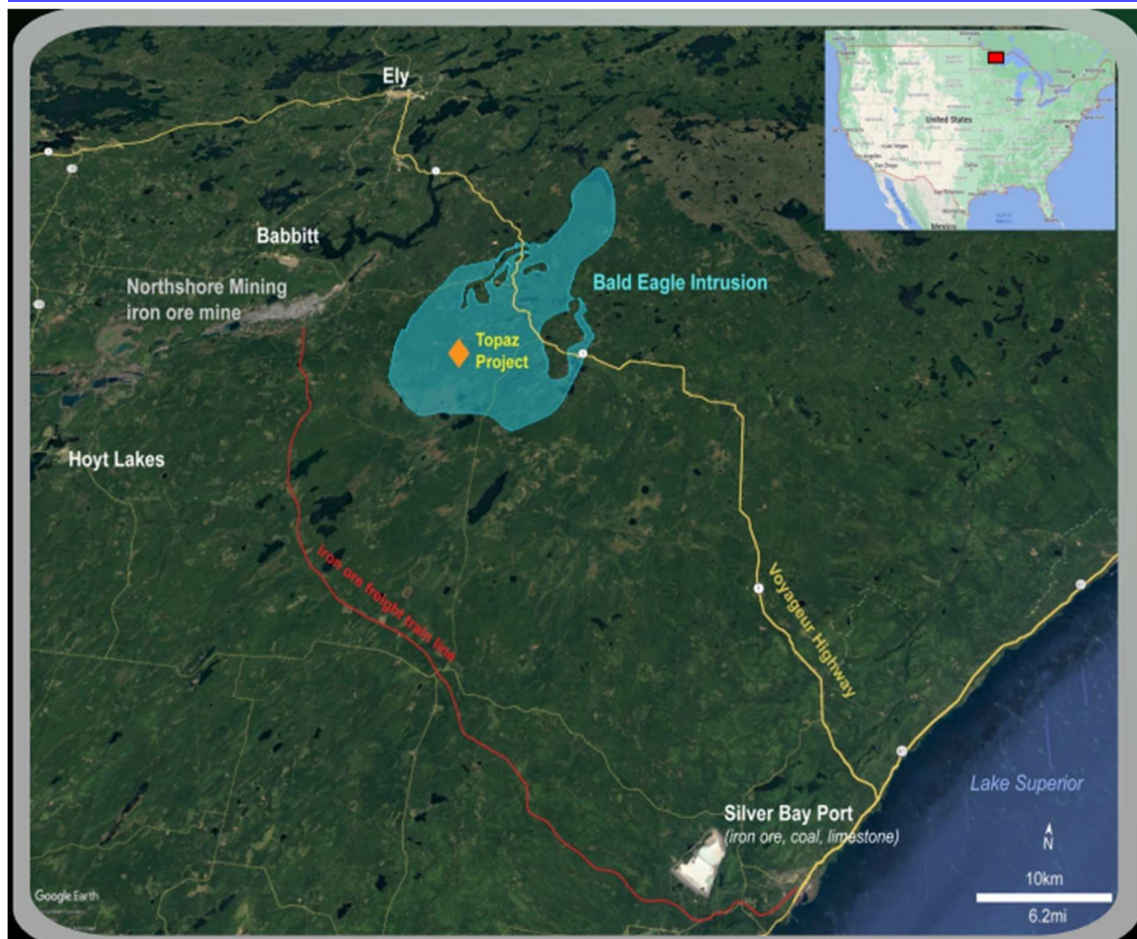
Pulsar Helium has concentrated its helium exploration operations in two areas – East Greenland and Minnesota (USA). The acreage in Minnesota boasts the Topaz discovery which has one of the highest concentrations of helium found in recent years and is the main focus of the company in the short term. In Greenland, Pulsar has the Tunu exploration licence which is still at very early stages.

## Topaz

Pulsar Helium has acquired a portfolio of acreage over the Bald Eagle Intrusion in Minnesota. A well was initially drilled in 2011 by Duluth Metals, which had been exploring for platinum and palladium, but discovered gas. On analysis, this gas was found to be a mixture of nitrogen, carbon dioxide and helium. Duluth plugged the well and walked away which opened that way for Pulsar to acquire the portfolio of licences.

**Figure 1** Topaz project

Location map

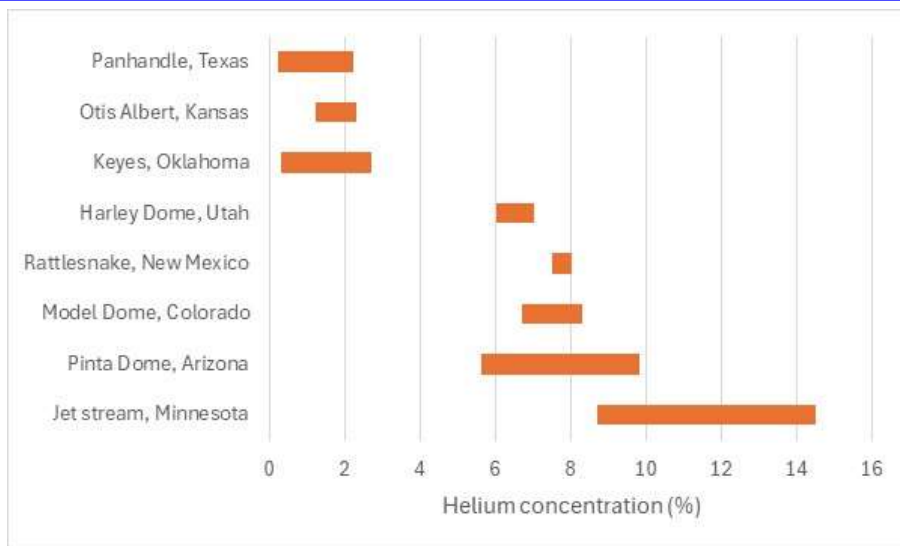


Source: Pulsar Helium

In 2024, Pulsar drilled the Jetstream-1 well approximately 15 foot away from the original Duluth well. This proved to be one of the most exciting wells drilled for several decades. The well flowed gas naturally to surface at a maximum rate of 821 mcf/day and had helium concentrations 8.7% - 14.5% by volume with aggregate concentrations of 10% - 11%. This discovery has the second highest level of helium concentration found in the US. There are other wells that were drilled in the vicinity which also found gas but were not tested, due to the apparent lack of value, and could well prove to be helium containing.

**Figure 2 Helium concentrations**

**Highest concentrations by state**



Source: USGS

### Carbon dioxide

Another significant factor was that much of the gas was carbon dioxide (at over 70% by volume). Although carbon dioxide might be widely perceived as a problem (global warming et al.), in these concentrations we believe that this will be an important asset for Pulsar. In the USA, there is significant industrial demand from areas – such as the carbonated drinks and food packaging industries. Recent shortages have led to prices rising sharply and has been seen over US\$30/mcf. No water was found at the well which removes the environmental problems and cost of disposal.

### Forward plan

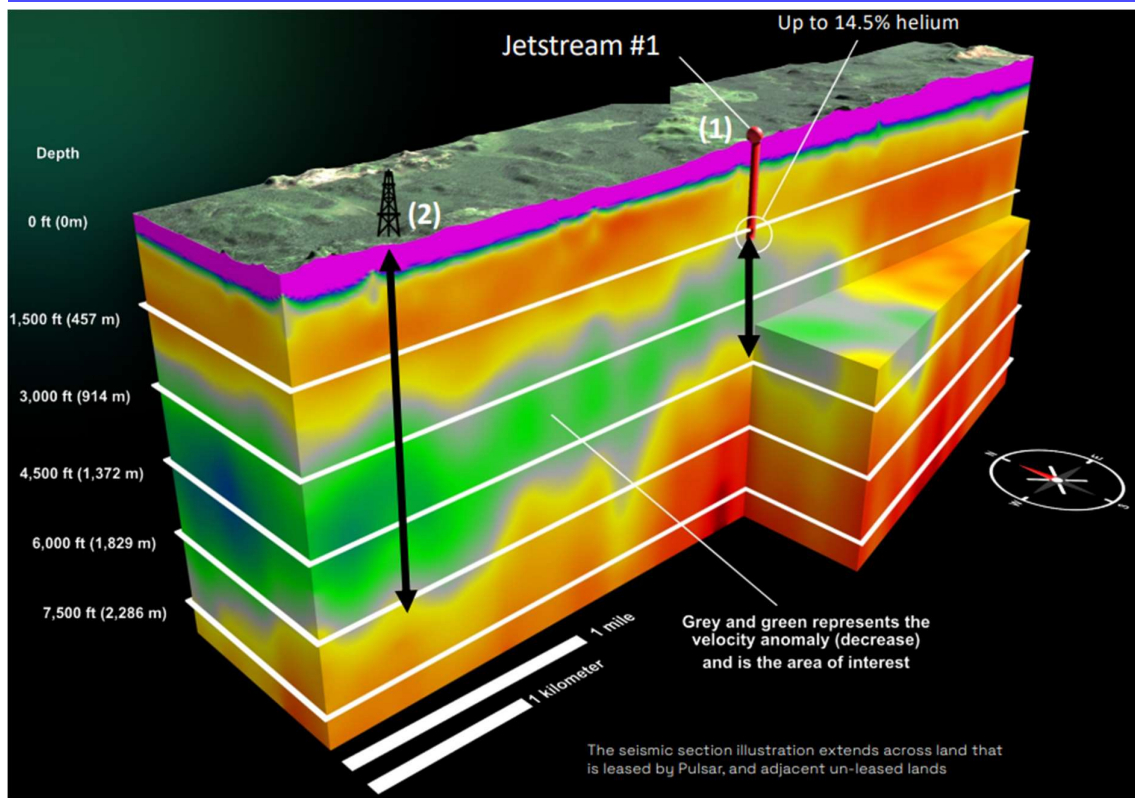
Management is now looking at drilling a follow-up wells on the Jetstream discovery. The first operation will be to deepen the original well. The first well (Jetstream-1) intercepted the top 100 metres of the reservoir. The new operation will deepen this well and it is hoped that the company can find up to 500 metres of additional helium charged reservoir. Management hopes that the gas charged fractured reservoir could increase with depth. Pulsar has now signed a rig contract with Caspar Drilling and all the relevant permits have been received and it is hoped, after completing site improvements, to drill this well in the current quarter.



Interpretation of a line of 2D seismic data has shown that the shown that the reflective package at the helium-bearing interval extends 1.5 km to the east and 2.0 km to the west. Pulsar would look to drill an appraisal well (Jetstream-2) on this discovery to increase the extent of this discovery.

**Figure 3 Topaz discovery**

**Schematic of forthcoming work programme**



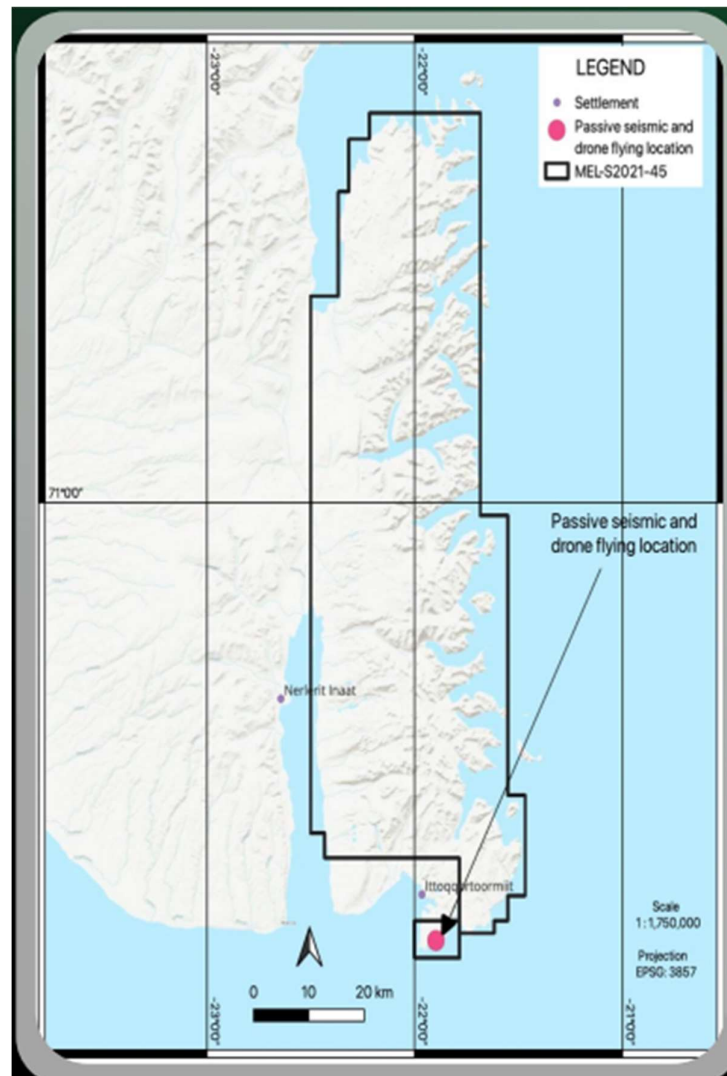
Source: Pulsar Helium

### Increased acreage

Pulsar has also announced that in October 2024 it had significantly added to its exploration acreage in the area. The company has increased its land holding from 2,089 to 4,181 net acres. Management would look to acquire further acreage securing its leading position in this play. Pulsar is also in talks with the State of Minnesota about leasing the helium rights in its land.

### Tunu

Pulsar Helium has a 100% working interest in the Tunu exploration licence (MEL-S 2021/45) which is located on Liverpool Land in the Eastern coast of Greenland. This is a significant area of land covering approximately 2,800 square kilometres – equivalent to 11 UK North Sea blocks and so will give the management significant running room if it able to find commercial quantities of helium. On the licence, Pulsar Helium has the exclusive rights to all mineral resources (with the exception of hydrocarbons and radioactive elements).

**Figure 4 Tunu licence****Location map**

Source: USGS

Greenland is potentially perfect for the generation of Helium. It has some of the oldest rocks on earth (up to 3 billion years old). These Precambrian rocks are high in radioactive elements which is one of the pre-cursors to generating helium. The country also has sedimentary strata which could prove to be an ideal trap for the gas. Pulsar has found evidence of Helium with concentrations of 0.2% - 0.8% from recent hot spring sampling. Although this is low it should increase to higher levels on drilling should a suitable trap be identified. It should be noted that gas samples to the south have had helium concentrations of up to 2.3%.

The licence is also located close to a mantle plume that generates significant heat (hence the hot springs) and it is believed that this could have generated some hydrogen which would be a valuable bi-product. This also opens up the potential of having some geothermal power. Pulsar is in talks with Icelandic partners about tapping into this potential. This has two advantages in that it gives the potential of a



green source of power but also gives Pulsar access to the Icelandic drilling technology and expertise.

Through being an autonomous part of Denmark, this makes the licence to be effectively located within Europe. This will give Puslar the potential of gaining some funding for this potential project from the EU given that helium is on the critical raw material list. Although this is located close to Canada, it is expected that shipping to Aarhus in Denmark will be a mere 4 days. Success could allow Pulsar to be the only major helium producer in Europe.

This licence is at early stages and management would look to mature prospects to drill. The first stage will be an ANT (Ambient Noise Tomography) passive seismic survey. The company is also looking at geothermal and aeromagnetic surveys. This will help to further assess the licence and, hopefully, find an ideal location to drill.

### **Fiscal regime**

Greenland has a relatively benign fiscal regime. There is a state royalty on sales of 2.5%. And at the corporate level there is a corporation tax of 25% and dividend tax (on dividends back to the parent company) of 36%. Dividends can be deducted from corporation tax giving a marginal top rate of tax of 36%.

## Resources

Pulsar Helium commissioned Sproule International Ltd to carry out a CPR (Competent Persons Report) on the assets of the group in August 2024. The headline number might not look too exciting. Sproule believes that net 2C recoverable helium resources of a mere 5.9 mmcf on its leased acreage with an additional 10.5 mmcf on application acreage. On the carbon dioxide there are 2C recoverable reserves of 44.6 mmcf on its leased acreage and 78.8 mmcf on its application acreage. This represents a 44% increase in helium resources on the report that was published in 2022.

**Figure 5 Sproule estimates for net helium & carbon dioxide resources at Topaz (mmcf)**

	Contingent (mmcf)	Prospective (mmcf)	Combined (mmcf)
<b>Helium</b>			
Low	1.6	11.5	13.1
Best	5.9	40.3	46.2
High	34.9	205.9	240.8
<b>Carbon dioxide</b>			
Low	11.9	88.0	99.9
Best	44.6	303.7	348.3
High	266.7	1570.7	1837.4

Source: Sproule International Ltd

We can see significant upside to the resources that Sproule has estimated. These do not take into account a thicker reservoir, more prospects and a larger acreage portfolio.

### Increasing the payzone

We believe that these numbers are too conservative. The resources relate to the Jetstream discovery where the well tagged the first 100 metres of the prospect and Pulsar believes that this prospect has a pay of approximately 600 metres. Management believes that at deeper levels there will be more porosity and fracturing and hopefully the flow rates will increase. The deepening of the Jetstream-1 well should confirm the greater pay and allow the recoverable resources to be increased. The drilling of the Jetstream-2 well should also allow company to convert more prospective resources into contingent resources.

### Other prospects

The resources only relate to the Jetstream discovery. Management is in the process of identifying other prospects across its portfolio of acreage. These are all thought to be similar to Jetstream. There have been other wells drilled in the area which found non-combustible gas but was never tested. We believe that the

interpretation of the recently acquired seismic should add more prospects to be drilled.

### **Increasing acreage**

As we mentioned earlier, Pulsar is in the process of adding to its portfolio. The company announced that in October 2024, it had doubled its acreage portfolio and was in the process of applying for mineral rights on State owned land. This is likely to open up further prospects. The Sproule report covers a mere 13% of Pulsar's gross land position under lease and option.

### **Drainage of federal land**

Sproule has not been able to include any resources that are located on adjacent federal land which are not leased out. It is doubtful that the company will be able to gain the mineral rights on this acreage. However, management has been given the belief that this would not be contested if it drained this land and hence would be available for Pulsar to extract these resources.

## Finances

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At the end of Q2 2024 (ending 31 March 2024), the group had net cash of US\$2.3 million. This has been augmented by the recent fundraise (and listing on London's AIM market) has seen gross proceeds of GBP5.0 million. We estimate that after the cost of the issue and with the use of cash in running the business that the group currently has net cash of US\$7.5 million. This should be more than sufficient to meet the costs of the drill programme and subsequent testing.

We believe that the development of the Topaz will US\$15 million which would cover a plant to produce gross gas of 5 mmcf/day. On top of this we are assuming drilling costs of US\$10 million. We believe that once a development is sanctioned that it would look to sign offtake agreements and on the back of these it should be able to get debt financing for some (if not all) of the development costs.

# Valuation

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## Asset Valuation Methodology

For valuing Pulsar Helium, we take the traditional approach of asset valuation which is widely used by the industry. This valuation is derived through using a DCF (discounted cash flow) methodology to the known fields and discoveries of the company. The field production profiles, capital expenditure and operating costs are modelled under the appropriate fiscal regime to give a cash flow profile, which is discounted to provide a net present value for each asset. We usually add an element of value for the risked exploration upside to give an indication of how this asset value may change over the next 12 months. The risk factor that we take is the GCS (Geological Chance of Success), which is based on the play chances (reservoir, source and seal) coupled with the local chances (seal, migration and trap). We also adjust for the net cash

## Costings

At present the costings of the operations are uncertain. However, Pulsar is currently getting a third party economic evaluation which should be released in Q4 2024 and will allow us to fine tune our valuations. However, we are using the economic assumptions that the economics of operations will be similar to Blue Star Helium which is based in the US and has high concentrations of Helium (about 8.8%) and hence should be similar.

We are therefore assuming that the cost of the equipment is US\$15m for a plant that can process 5 mmcf/day of gross gas. We have assumed that the helium concentration is 10% and 72% carbon dioxide – giving 500 mcf/day of helium and 3,600 mcf/day of carbon dioxide. We have assumed that the cost of processing the gross gas is US\$10/mcf. This might prove to be conservative given that Pulsar expects there to be no water to deal with (which can be costly to dispose and environmentally problematic) and the concentrations of helium and carbon dioxide are greater than at Blue Star Helium. We believe that this is a modular operation and can be easily expanded as more reserves and resources are located. We are assuming that Pulsar will be selling 98% pure helium and not going through the process of producing very pure grade 6 (99.9999%) helium which would require the costly process of liquefaction (although this will lead to a significantly higher sales price).

## Helium and carbon dioxide prices

Helium prices have proved to be strong over the last few years as the market becomes tighter. By example in May 2023, Royal Helium sold half of the capacity of its Steepleville plant in Alberta to a private North American corporation at a price of US\$625/mcf. The price of liquefied helium is higher – in 2022 Air Products signed a 5-year supply contract with NASA for US\$1,100/mcf.

For our valuation, we have assumed a flat helium and carbon dioxide prices which, we believe, are conservative and below the current prices achieved by the industry. In our base case, we have assumed a helium price of US\$450/mcf whilst the carbon dioxide price is estimated at US\$25.00/mcf. Investors will have differing views on prices and we will provide sensitivities later in the note.

### Discount rate & exchange rates

The discount rate that we use in the valuation is the standard 10%. Although it could be argued that this should be adjusted to reflect the company's WACC (weighted average cost of capital), this is the standard rate that is widely used by the industry in making acquisitions. Investors may have differing views of the discount rate, and like the helium price, we provide sensitivities later in this note

The helium industry very much works in US dollars, with the revenue and most of the costs priced in dollars. Therefore, we have modelled the assets in US dollars and will translate this through at the current exchange rate to allow UK investors to see a sterling-based valuation. Sterling is currently trading at a USD/GBP level of approximately 1.31. A strengthening US Dollar would prove beneficial for UK shareholders.

## RENAV

For the asset valuation, we have taken the value of the risked exploration in the Topaz discovery, other areas and added the net cash. For Topaz, we have assumed helium resources of 0.7 BCF and a 50% chance of success. For other prospects (and upside on Topaz) we have assumed a similar resource base but with a 25% chance of success. We are assuming that net cash is US\$7.5m.

We have not included any value at this stage for the Tunu licence in Greenland as there is much work that is required to identify a prospect and to get this to a drill-ready stage. There is also significant uncertainty over the helium levels once drilled.

Overall, using the above assumption we achieve a RENAV of 63.3p/share. Investors should be aware that the riskings are likely to change with the well programme which will see a deepening of the Jetstream-1 well and the drilling of the Jetstream-2 appraisal well.

**Figure 6 Pulsar Helium RENAV**

	<b>Gross</b>	<b>CoS</b>	<b>Risked</b>		
	<b>US\$m</b>	<b>%</b>	<b>US\$m</b>	<b>£m</b>	<b>p/share</b>
<b>Topaz</b>	129.9	50%	64.9	49.6	39.2
<b>Other</b>	129.9	25%	32.5	24.8	19.6
<b>Cash</b>	7.54	100%	7.5	5.8	4.5
<b>Total</b>	<b>267.3</b>		<b>104.9</b>	<b>80.1</b>	<b>63.3</b>

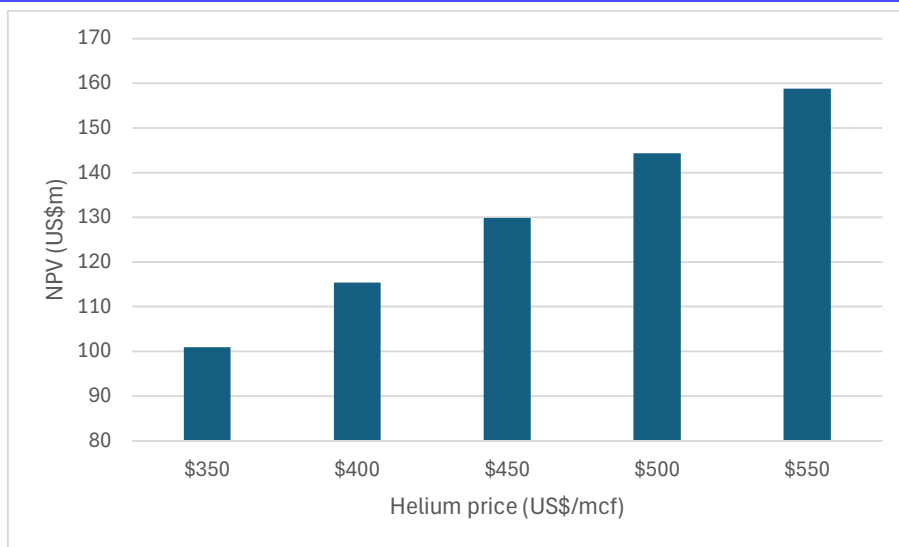
Source: Oak Securities estimates



## Sensitivity

As we mentioned earlier, we have provided investors with a sensitivity analysis. The following chart shows how the value would change for US\$50/mcf changes in the helium price from our main conservative scenario of US\$450/mcf.

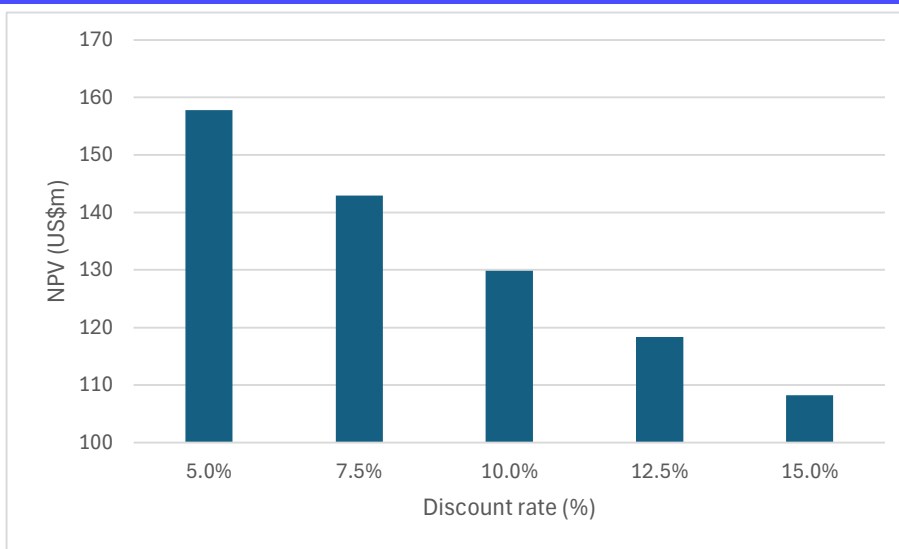
**Figure 7** Changes in Topaz valuation with differing helium prices



Source: USGS

We have also shown investors the changes that could occur to this valuation should they want to base the valuation at a different level to our main discount rate of 10%.

**Figure 8** Changes in Topaz valuation with differing discount rates



Source: USGS

## Pulsar Helium management

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Pulsar Helium has a very experienced management team and is ably led by the co-founders Thomas Abraham-James (CEO) and Neil Herbert (Executive chairman). Dan O'Brien has recently been appointed CFO. The executive directors are well supported by four non-executive directors.

### Tom Abraham-Jones (CEO)

Tom is a seasoned geologist, with over 17 years experience, and has recently specialised in the discovery and development of helium plays. Prior to founding Pulsar Helium, he was co-founder and CEO of Helium One.

### Neil Herbert (Chairman)

Neil has over 30 years of running companies from start-up and building them up through IPO and M & A. He joined the natural resources segment in the 1990s when he joined Antofagasta and helped with the transformation of this company into one of the world's largest copper miners.

### Dan O'Brien (CFO)

Dan has recently been appointed to the board ahead of the listing on London's AIM market. He is an accountant with over 20 years experience in resource companies. He has significant experience as CFO of other quoted exploration companies.

## Shareholding

Management has a significant vested interest in the company. The three main founders have 27.4% of the issued share capital. ABCrescent BV, part of AB Capital, has a 12.2% shareholding and locked in for approximately 12 months. The free float is 52%. The shares were listed on the TSX Venture Exchange in August 2023 and was accepted on the US OTCQB in March 2024 and were listed on London's AIM market in October 2024.

## Appendix 1: Helium – The Rare Element

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### Overview

Helium is the second element and first noble gas in the periodic table. It is the second lightest of elements (after hydrogen) and has the smallest atomic radii. Although helium is believed to be the most abundant element in the Universe, it is a very rare commodity on Earth since, due to its lightness and small radius, allows most of the free helium molecules to escape the Earth's atmosphere and go to outer space. Helium was first identified in 1868 during a solar eclipse – hence the reason it was named after the sun (Helios in Greek). On Earth, the gas is generated deep underground through the radioactive decay of nuclear elements such as Uranium-238. One of the first discoveries of the gas underground was made in 1903 in Kansas, US with a well discovering gas (called a "howling gasser"). Despite much excitement, the gas failed to ignite due to large levels of nitrogen and some helium being present in the gas.

### Properties

Helium is a unique gas with many key properties. Through being a noble gas, Helium is colourless, odourless, non-toxic and totally inert. The gas has the lowest liquefaction point (just above absolute zero) and the element is the only one to remain in liquid form down to absolute zero. In a liquid form Helium, becomes a quantum fluid with properties that include superfluidity, superconductivity and possesses negligible viscosity. With its Houdini-like qualities, it is very difficult to recycle helium.

### Demand

With its unique properties, helium has many valuable uses. Historically, this was used in inflatable blimps and airships (and party balloons) given that it is light and not flammable like hydrogen. This led to the US, under the Helium Act of 1925, to set up a helium reserve to have an advantage over other countries. This was the primary use of the gas prior to the end of the second world war. Although there is currently little military use, there is increased industrial interest in resurrecting the airship. However, its other properties give the gas a string of additional industrial uses.

### Cryogenics

Cryogenics is currently the major use of helium accounting for approximately 32% of total demand. Due to the ability to cool helium to low levels, it has become a valuable commodity with perhaps the most well-known being the cooling of magnets in MRI (Magnetic Resonance Imaging) with the average scanner requiring approximately 700 litres/year of liquid helium. Another major use is in space craft where helium is used in cooling and pressurising of the hydrogen fuel ahead of launch.

## Leak detection

With its small size, helium is used in leak detection. This ranges from checking of space craft through to the air conditioning in a car. This amply demonstrated with the recent Being Starliner space launch where helium leaks at the thrusters suggested problems, and led to the astronauts being left on the International Space Station.

## Computing

Helium has major demand from the electronics industry where it is used in many aspects from the manufacturing of fibre optics through to semi-conductors. For example, helium filled hard drives are expected to produce a 50% increase in storage capacity with 23% less power required compared to a more normal drive.

## Welding

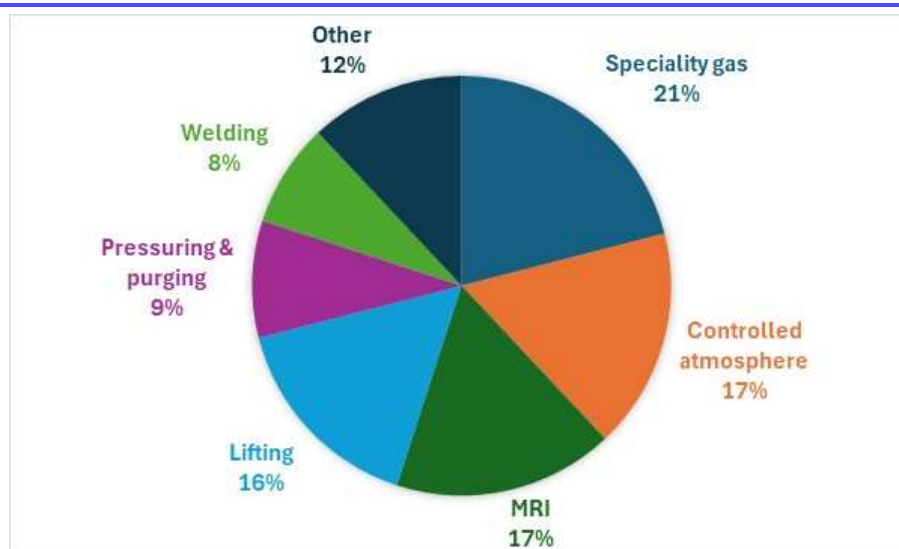
Helium has major use in arc welding as it is non-reactive (providing a barrier) and allows for a higher rate of heat transfer. In most welding, helium is mixed with argon. However with seam-welding, there is usually the need to use pure helium.

## Breathing

Another major use is in breathing mixture where helium replaces nitrogen. Perhaps the best known is with Heliox which has a similar viscosity but lower density to normal air and is used in medical and diving operations. This is typically 80% helium and 20% oxygen – although mixtures vary as required.

**Figure 9 Helium demand**

Breakdown helium demand by use (%)



Source: USGS

## Demand Growth

It is believed that 2023 global demand for helium is standing at approximately 6 BCF. This is expected to grow at a rate of 4% – 6% per annum. This would lead to demand in 2030 of 8 – 9 BCF meaning the global market would have to find

approximately 2 – 3 BCF of annual production to meet the demand. With recent advances in chip technology and the increase usage of space vehicles we believe that this could prove conservative.

## Supply

As we mentioned previously, helium is formed from the decay of radioactive elements such as Uranium and thorium. This involves long timelines for its generation – Uranium-238 has a half-life of 4.5 billion years and Thorium 232 of 14 billion years. This would lead to the practical assumption that this is a non-renewable resource. Helium is predominantly formed deep within the Earth's crust and, given its small light size, tends to move upwards through the geological strata. Similar to hydrocarbons, the gas is sometimes caught in geological traps where there is an effective seal to stop the gas escaping into the atmosphere. Helium tends to be found in small trace concentrations (usually of less than 0.1% by volume) and it is widely thought that the commercial threshold for commercial extraction is above 0.3%. The gas is usually found in natural gas although sometimes it is found with other gases such as nitrogen, hydrogen and carbon dioxide. Although with increased efforts to find this valuable gas this could become an increasingly common occurrence. It is impractical to extract helium for the atmosphere where (due to its ability to escape to space) is only found in quantities of 4 – 5 ppm (parts per million).

As we alluded to above, most helium is mainly extracted from major natural gas deposits. The US has always proved to be the main producer of helium from its onshore gas fields which have high global concentrations of the gas. However, where there are major accumulations of natural gas, there is the potential of producing commercial quantities of helium. This has been seen in Algeria, Qatar and Russia which have emerged as new major producers.

### Algeria

Algeria is a major producer of helium gas from its Hassi R'Mel which is a giant onshore natural gas field with gas reserves of 85 TCF of gas. The helium concentration is low at 0.19%, but this is commercial given the economics of the large natural gas reserves. The problem for Algerian supply is Hassi R'Mel is a mature field (which started production in 1961) and is now in decline leading to a potential decline in helium production.

### Qatar

Qatar has huge gas reserves in the North field (which is believed to contain over 800 TCF of natural gas) and accounts (according to BP) for 20% of global LNG exports. Although the percentage of helium in the natural gas stream is very low, at 0.04%, the huge volumes of natural gas gives the country the largest global helium reserves – although this has never been officially quantified. With the anticipated increase in LNG production, Qatar is expected to increase helium production from a current level of 2 BCF/day up to 4 BCF/day by 2030.

## Russia

Russia has the largest gas reserves in the world. Although most of the fields have negligible helium, the volume of gas reserves leaves Russia with the fourth largest reserves of helium. Its helium gas production will be given a significant boost when it brings on stream the giant Amur gas processing plant. All six trains are expected to be on stream in 2025 and the facility will have helium production of 60mmcm/day (2.1 BCF/day). This, however, remains subject to the current sanctions and it is unsure how much this plant will produce in the short to medium term.

## US

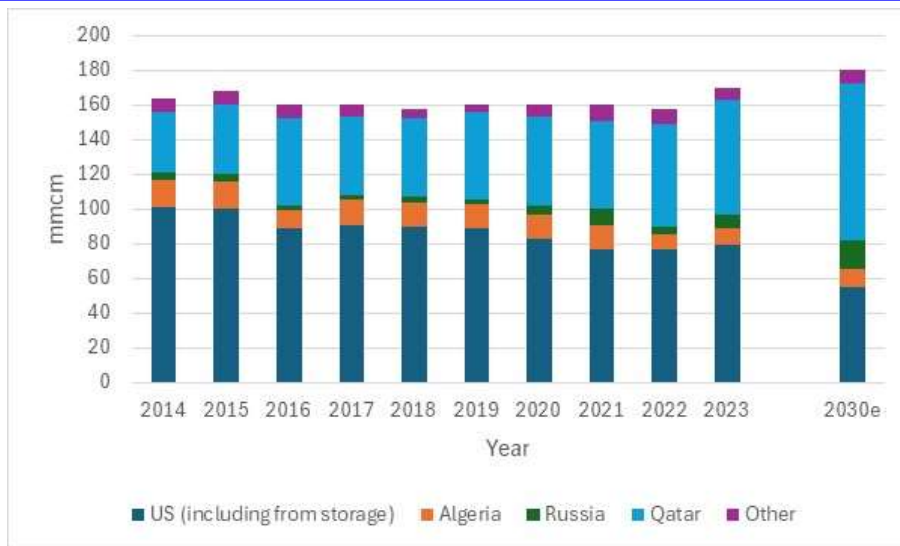
The US is the largest supplier of helium from its many gas fields with approximately 46% of global production. The country has been stable in its production but the fields are becoming increasingly mature and starting to decline. The other major issue with the country has been the sell-off of its strategic reserve of helium. Stocks of helium stored underground were 18,400 tonnes in 2022 compared to 161,000 tonnes in 2000.

## Australia

Australia used to be one of the larger producers of Helium. This was supplied from the Conoco Phillips operated Bayu Undan field in the Timor Sea. This supplied helium which was extracted at the Darwin LNG plant. This field reached the end of its life in 2023 leaving Australia with, currently, no commercial helium production.

**Figure 10 Helium supply**

Breakdown annual helium production by country (mmcm)



Source: USGS

## Supply Growth

As we mentioned earlier, the growth in the supply of helium will be driven by Qatar and Russia. These have the potential of adding up to 4 BCF/day which will be able to fill the gap between rising demand and falling production and leave the market



balanced. However, there is increasing risk associated with this new production. As we have seen after Russia's invasion of Ukraine and the current unrest in the Middle East, this leaves the future supply coming from countries with higher political risks.

**Table 1 2023 Global helium production and reserves (BCM)**

Country	Production	Reserves
USA	79	8552
Algeria	10	1800
Russia	8	1700
Qatar	66	n/a
Other	7	24
<b>Total</b>	<b>170</b>	

Source: USGS

## Extraction

Extracting concentrated helium from gas found underground has three distinct parts to the process and will very much depend on the associated gases and the level of purity required.

### Membrane separation

This uses a high pressure membrane. Given that the molecules of helium are small they are able to pass through this membrane whilst many larger molecules will be held back. This is a relatively new technology

### Adsorption

This technique uses changes in temperature or pressure to cause the adsorption of gases into a large surface area consisting of uniformed pores sizes. PSA is pressure swing absorption and TSA is temperature swing absorption.

### Cryogenic

This uses low temperatures which causes other gases to liquefy in the fractionation unit. This leaves purer helium given that it has the lowest condensation point of all the gases.

## Research Analyst Disclosures

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### **Peter Hitchens Bsc Eng (Hons.)**

Peter has in excess of 35 years' experience in oil & gas equity research with a bias towards the Exploration & Production companies. Having trained as a chemical engineer, Peter was lured by the glamour of the city in 1986. He has worked for many firms including Lehman Brother, Williams de Broe, Panmure Gordon and HSBC. He has been rate on many occasions by Extel and Starmine. Peter Has witnessed many cycles in oil prices and investors sentiment through his long career.

Although his main focus has been equity research, he has also worked with corporate finance and been the broker for many companies such as Enterprise Oil, Faroe Petroleum and Broders & Southern.

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