

SA's first onshore helium and



On May 4, 2016, The Linde Group, its African subsidiary Afrox and alternative energy company Renergen Limited – through its subsidiary TETRA 4 – signed an historic agreement for the commercialisation of the Free State Helium and Natural Gas field. *African Fusion* attends and talks to Nazmi Adams (left) Afrox general manager of sales and marketing.

In Virginia near Welkom, about 160 km from the impact centre, now the site of the Vredefort Dome World Heritage Centre, a 187 000 hectare natural gas/helium field has been discovered with proven reserves of 25-billion cubic feet of natural gas and helium. The helium present today was created by the natural radioactive decay of heavy radioactive elements (thorium and uranium) formed as a direct result of the Vredefort impact event. This radiogenic helium is trapped with natural gas in concentrations averaging 4.0% by volume.

This field is the first and only onshore and natural gas resource in South Africa with commercially viable percentages of helium.

Under the agreement signed on May 4, TETRA 4 has contracted the helium under an offtake agreement with the Linde Group – via its global helium business – and assigned the distribution rights for these substantial reserves. JSE listed Afrox, a member of The Linde Group, will operate the plant and market the helium locally.

“The discovery and commercialisation of the Free State onshore helium source is great news for industry, healthcare and the South African economy as a whole,” said Afrox managing direc-

tor, Schalk Venter. “The signing of this agreement marks an historic moment in bolstering South Africa’s self-sufficiency in terms of helium production.”

Helium, although the second most abundant gas in the universe, is relatively scarce on earth and tends to be found trapped with natural gas in relatively low concentrations, typically up to 1.0% by volume of the gas released. The Free State Helium and Natural Gas field, however, enjoys much higher concentrations.

Linde’s high-tech extraction technology will be used to separate helium from natural gas through a single system based on patented processing plant technology, which purifies, compresses, liquefies and stores the helium ready for distribution to customers. The helium plant will be designed and delivered by Linde Engineering and is expected to commence operations in 2018/19.

Linde helium plants reduce energy consumption and cut CO₂ emissions compared to traditional helium from natural gas extraction processes and incorporate the latest in engineering technology advances. The plant will be of modular design and will be precision manufactured in Europe before being shipped to the Free State for fast and efficient construction.

Nick Haines, head of The Linde Group’s Global Source Development, Global Helium & Rare Gases, said: “Linde has worked diligently to commercialise this unique helium resource together with TETRA 4 and looks forward to receiving helium upon commencement of plant operations.”

Utilising the latest in land preservation techniques, TETRA 4 has drilled wells to tap the gas source dome, while ensuring minimal visual and environmental impact on the gas field’s landscape. The wells and wellheads are being interconnected underground via an intricate network of pipes. These pipes will feed directly into the Linde-

Eons ago, an asteroid about 15 to 20 km across slammed into the Earth in what is now Vredefort, in the Free State province of South Africa. This, the largest verified impact of its kind in the history of our planet, formed a crater 300 km in diameter.

Today, partial concentric rings of rocks can still be seen on satellite images, with the oldest being the Witwatersrand rocks, which form an interrupted arc of outcrops, the most famous being the Johannesburg group where gold was discovered in 1886. Had it not been for the Vredefort impact, gold may never have been discovered on the Witwatersrand and our economy and industry would have been considerably different today.



Photographed at the signing of a commercialisation agreement for the Free State Helium and Natural Gas field are, from left: Alexander Brandl, senior process engineer, Linde; Renergen CEO, Stefano Marani; Schalk Venter, Afrox CEO; Nick Haines, head of The Linde Group’s global helium source development; and Nick Mitchell, COO and executive director, Renergen.

natural gas field



Helium is one of the most important noble gases and is used in a variety of industrial applications. As a result, global demand is rising by around 5.0% per year.

engineered, Afrox-run helium processing plant.

As part of TETRA 4's commitment to social regeneration, the company has created a number of bursaries for local students in the Virginia/Welkom area and has refitted the local Stilte Primary School with classrooms, furniture, a solar borehole pump, and upgraded the children's play area. TETRA 4 also plans to supply the local operations of Mega-Bus with compressed natural gas, (CNG) as 'green' fuel for its local bus services.

Renegen chief executive officer, Stefano Marani, said: "Today is indeed an important milestone as we embark on the beneficiation of this important helium deposit for the benefit of all our stakeholders."

The helium market and welding

According to Afrox's Nazmi Adams, helium is an inert gas that can be used as a replacement for argon in shielding gas mixtures for welding applications. "Helium tends to be used in more complex mixtures, where a better quality weld is preferred," he says. "For aluminium welding, for example, we offer the Alushield® brand; an argon-helium mixture where the helium is added to give higher arc energy. The helium combats the high thermal conductivity associated with aluminium alloys, increasing penetration and reducing the need for preheating," he explains, adding that the same principles apply to the welding of copper, for which the argon-helium Coppashield® gas mix is recommended.

These mixtures are best for auto-

mated welding processes where faster welding speeds and lower defect rates can significantly reduce fabrication costs.

Helium is also used in steel and stainless steel shielding gas mixtures, such as Stainshield Heavy and Stainshield TIG Plus, where smaller quantities of helium are added to better meet fusion and bead surface quality requirements and to increase welding speeds, especially for thicker materials. "These gas mixtures are used for high-value items where the quality is paramount," Adams tells *African Fusion*.

"A local source of helium, which will be more competitive simply because it is not having to be imported, will make the use of helium more attractive to a wider range of fabricators," he continues. "It will allow our local industry to move up the fabrication technology ladder in terms of added value and weld quality," he says.

Currently, Adams believes, the welding market is dominated by repair and maintenance activity. "We are very competent at finding ways to fix things that get broken. If you look at the costs of fabricating simple structures, the material costs dominate. This limits the value the industry can add through technology.

"In the European fabrication market, however, high-value components are being manufactured where the costs of the components are significantly higher than the cost of the material used. The value added during the manufacture of a Rolls-Royce engine,



Above: Utilising the latest in land preservation techniques, TETRA 4 has drilled wells to tap the gas source dome, while ensuring minimal visual and environmental impact on the gas field's landscape.

for example, far outweighs the R/kg cost of the material used."

Adams believes the local helium source will create value-adding advantages for local fabricators. "South Africa is striving towards better beneficiation of local natural resources. With our helium plant, we are taking gas out of the ground, purifying it to process the higher value helium 'impurity', and then using it to create even higher value three- and four-part shielding gas mixtures for local fabricators," Adams argues. "Compare the cost/kg of helium and the cost/kg of coal. Helium gives a much higher process return ratio. Then by using the helium in three and four part gas mixtures, we create an even higher value shielding gas product," he says.

In addition, helium gas can help to better process local steel, chromium (in stainless steel) platinum and titanium resources. "If readily available and competitively priced helium makes it more competitive for a fabricator to use more exotic materials to make higher value fabrications, then we will have generated an additional value multiplier," he suggests.

The Virginia gas field is predicted to have a helium capacity of 650 000 m³ p/a. "We also suspect more helium-rich natural gas fields will be found as geologists continue to map the resource patterns around the Vredefort Dome," Adams concludes. ■