

ASX Announcement

11th May, 2021

Pilbara Minerals Limited and Calix Limited execute MOU for Joint Venture Demonstration Project to develop “midstream” lithium chemicals refinery

Highlights:

- Calix and Pilbara Minerals have executed an MOU covering the co-development of “midstream” lithium chemicals refinery utilising Calix’s core technology
- The MOU commits the parties to a scoping study on the project, at Pilbara Minerals’ cost, covering lithium salt production of up to several thousand tonnes from Pilbara Minerals’ spodumene concentrate facility at Pilgangoora
- Following success in the scoping study, Pilbara Minerals and Calix propose to jointly develop a demonstration plant at Pilgangoora, with a view to further commercialising the technology developed
- The project represents a world-first development of a commercial-demonstration-scale, low-emissions lithium salt production facility

Sydney, Australia | 11th May, 2021 – Multi-award-winning Australian technology company Calix Limited (ASX: CXL, ‘Calix’ or ‘the Company’), is pleased to announce it has executed an MOU covering the development of a Joint Venture project to develop a “midstream” lithium chemicals refinery with Pilbara Minerals Limited (ASX:PLS).

Pilbara Minerals (ASX:PLS) and Calix Limited (ASX:CXL) will undertake a scoping study to assess a new refining process incorporating Calix’s unique calcination technology and subsequent production of a concentrated lithium salt “midstream product” for lithium batteries.

Pilbara Minerals owns and operates the Pilgangoora deposit, one of the world’s largest lithium resources. Ore is currently processed to produce a spodumene concentrate which is then shipped to customers overseas for conversion into lithium carbonate or lithium hydroxide, for use in lithium ion batteries.

Calix’s core technology involves a new type of kiln that is highly versatile and able to be electrically heated, and thus renewable-energy-powered.

The proposed demonstration process will take fine, lower-grade spodumene concentrate and further process it on site utilising renewable energy to create a low carbon, concentrated lithium salt, which can be further refined by others into lithium battery materials, or may potentially be used as direct feedstock for Lithium Iron Phosphate (LFP) cathode manufacture – LFP batteries being a key subset of China’s lithium ion battery supply and the battery of choice for the Tesla Model 3 in China.



The Calix calcination process is particularly well suited to fine spodumene feeds and provides excellent temperature control, allowing lower grade concentrates to be successfully treated, and can be renewably powered.

The scoping study will run until late 2021. If positive, Pilbara Minerals and Calix intend to form a Joint Venture to build a demonstration facility, starting with a Definitive Feasibility Study (DFS). The contemplated facility will be capable of up to several thousand tonnes of lithium salt annual production capacity, and the JV will also market and export the product from the facility, “on-shoring” significant value into Australia and avoiding the international shipment of thousands of tonnes of waste material (>90% of current spodumene exports) overseas.

The development could cornerstone a full battery production supply chain in Australia. To achieve this, Pilbara Minerals and Calix have agreed that once the demonstration facility has established the process and the market, the process will be marketed by the JV to Pilbara Minerals and other spodumene producers under licensing arrangements. The project is in strong alignment with Government strategies to on-shore processing and manufacturing, more sustainable mining and processing, and critical minerals strategies for battery materials. Spodumene-derived lithium salts from Australian producers could hit 500kT by 2030, and with current lithium carbonate prices well in excess of US\$10,000 per tonne – this represents a considerable licensing opportunity for the JV and multi-billion-dollar export value opportunity for Australia.

Pilbara Minerals and Calix commenced work on the project after being brought together under the Future Battery Industries Co-operative Research Centre (“FBI-CRC”).

The overall benefits of developing the process include:

- A higher recovery is obtained from the ore body = less mine wastage
- A higher value product is produced in Australia = more value kept on-shore
- Significant waste is not shipped overseas, by shipping a much higher lithium concentrate = far less transportation cost / wastage
- By using an electric calciner, the project can connect to renewable power = materially lower CO₂ footprint in the envisaged novel lithium raw materials supply chain, becoming very important for Australian exports

Ken Brinsden, Managing Director of Pilbara Minerals said there are several significant problems experienced with existing rotary kiln technology when treating fine concentrates.

“Firstly, the conventional calcination of fine ore incurs increased losses via dust. Secondly, legacy calcination techniques are very energy and carbon intensive, using fossil fuels in an environment of significant heat losses. And lastly, the lack of uniform temperature control can lead to either incomplete phase change or partial melting of the concentrate impurities, both of which hinder the recovery of lithium in subsequent extraction processes.”

“Calix and Pilbara Minerals have conducted calcination trials of Pilgangoora spodumene in its electrically fired BATMn reactor, at Calix’s Bacchus Marsh facility, and it successfully demonstrated high conversion rates, zero dust emissions and avoided any partial melting concerns.”

“With these promising results, we will now move to a scoping study phase to investigate installing a calciner and downstream demonstration processing plant at Pilgangoora to allow the processing of fine, low grade ore to produce lithium salt material for export overseas.”



Phil Hodgson, Managing Director of Calix, said the successful trials over the course of the past nine months had tested spodumene concentrates of different grades and particle sizes.

“This proof-of-concept work demonstrated that the Calix technology was able to achieve >95% conversion of the spodumene ore to an extractable lithium, which is comparable to the conventional rotary kiln process, but with fine, and lower grade, material. Additionally, we carried out these runs on our “BATMn” electric kiln, providing additional proof-of-concept for the technology to be run off renewable electricity, such as a solar and/or wind farm.

“We look forward to working with Pilbara Minerals on this exciting project for the hard-rock lithium industry, and also other mining and processing companies in other minerals to improve their industrial processes, reduce costs and increase their sustainability,” Hodgson said.

Lithium-ion batteries are the dominant rechargeable battery storage technology of choice, particularly for electric vehicles, consumer electronics and renewable grid storage, and is growing rapidly as these sectors boom. This announcement has been authorised for release to the ASX by:-

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About Calix

Calix is a team of dedicated people developing a unique, patented technology to provide industrial solutions that address global sustainability challenges.

The core technology is being used to develop more environmentally friendly solutions for advanced batteries, crop protection, aquaculture, wastewater and carbon reduction.

Calix develops its technology via a global network of research and development collaborations, including governments, research institutes and universities, some of world's largest companies, and a growing customer base and distributor network for its commercialised products and processes.

Because there's only one Earth – Mars is for Quitters.

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