

ASX Announcement

July 30, 2019

Calix successfully demonstrates CO₂ separation at Project LEILAC in Belgium

Highlights:

- Calix's world leading CO₂ capture technology for lime and cement, Project LEILAC (Low Emissions Intensity Lime And Cement), has been commissioned with the consortium announcing the technology concept is operating successfully at Heidelberg Cement's plant at Lixhe in Belgium.
- Project LEILAC has successfully demonstrated separation of CO₂ with more than 95% purity, with full design capacity to be tested in the future following rectification of some commissioning issues, normal for a project of this type.
- Project LEILAC forms an integral part of the European Union's target of reducing CO₂ emissions by 80% below 1990 levels by 2050. To meet the target, the European cement industry will need to deploy carbon capture across 60% of its cement plants.
- Calix is the core technology provider for Project LEILAC with its patented Direct Separation technology aiming to enable the efficient capture of the unavoidable process emissions from lime and cement production
- Project LEILAC consortium consists of the largest lime and cement companies in the world, including Heidelberg Cement, Lhoist, Cemex, and Tarmac (a CRH company). Calix is the core technology provider and project leader.

Sydney, Australia | July 30, 2019 – Multi-award-winning Australian technology company Calix Limited (ASX: CXL) ("Calix" or "the Company"), is pleased to provide an activities update covering the first results from the LEILAC Project.

The LEILAC Project, based at Heidelberg Cement's operations in Lixhe, Belgium is a European Union Horizon 2020 (H2020) research and innovation project. The €21m project (~A\$33m) has received €12m (~A\$19m) of funding from the European Union's Horizon 2020 research and innovation programme. LEILAC is piloting Calix's breakthrough carbon capture technology, called Direct Separation, that would enable both Europe's cement and lime industries to reduce their carbon dioxide (CO₂) emissions dramatically without significant energy or capital penalty.

Project LEILAC releases first public update from commissioning and fingerprinting runs

The LEILAC consortium is pleased to provide an update on the project since completion of construction in early May.

Preliminary test runs have been completed on the LEILAC pilot at Heidelberg Cement's Lixhe plant in Belgium. The technology concept has been shown to work on both lime and cement meal, with calcination near to target levels and high purity CO₂ successfully separated at the top of the reactor, albeit not yet at full design capacity.

Commissioning issues, common to engineering projects of this scale and ambition, continue to be streamlined. The initial progress on the commissioning phase will now be followed by test runs until the end of 2020 to de-risk potential longer term issues, such as tube health and process robustness. In parallel, planning has commenced on the next scale-up of the technology, including conceptual design and engaging funding consortia.

Commissioning activities over the past two months have achieved:

Core process:

- Proven operations with limestone and cement raw meal;
- Separation of CO₂ (>95% purity);
- Heat transfer from the furnace to the powder in the tube to achieve extents of calcination of more than 85% (although not yet at target design capacity for lime of 95%);
- Pre-heating of the raw material with hot CO₂ gas;
- Good performance of the reactor and bellows, including rapid ramping between ambient conditions and 1000°C;
- Demonstration of the benefits of ceramic fibre insulation for lower weight, cost and reduced temperature ramp times.

Supporting Functions:

- Heat generation in the furnace using high-efficiency, low-NO_x burners - maximum duties are still to be achieved but operability and efficiency are as expected;
- Transport of hot product back to the host plant needs some modifications to reach design capacity;
- Feeding of raw material to reactor (dosing) – correction of dosing accuracy and pulsing frequency was required.

General operation: The pilot is safe and easy to operate, with no safety incidents.



Phil Hodgson (Calix CEO, second from left) hosting a LEILAC Project visit from senior HeidelbergCement Executives, including Executive Board Chairman Dr Bernd Scheifele (4th from right), along with Executive Board Members Dr Albert Scheuer (4th from left) and Ernest Jelito (2nd from right).



The LEILAC consortium is very satisfied with the successful initial test runs and performance of the core technology under non-optimum conditions in a first-of-a-kind plant. The next steps for LEILAC will include further testing and reaching full design throughput. Calix will continue to provide material progress updates from LEILAC.

Calix's founder, Chief Scientist and Executive Director, Mark Sceats, said it was very gratifying to see the successful demonstration of the Company's patented Direct Separation concept at Heidelberg Cement's operations in Belgium.

"Whilst there are still challenges ahead to achieving full design capacity, we have achieved many breakthroughs in many key areas of the technology.

"The carbon capture piece of our technology represents a unique approach to mitigating CO₂ emissions from lime and cement manufacturing and has the potential to leap frog other technologies in terms of both timing and cost."

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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.