

23 July 2024

Calix awarded \$15m grant for zero emissions lime & cement CCU demonstration

Sydney, Australia | 23 July 2024 – Australian environmental technology company, Calix Limited (ASX: CXL) (“the Company”) is pleased to announce it has been awarded a \$15 million grant from the Australian Government’s Carbon Capture Technologies Program. The grant will support the construction of a world-first renewably powered carbon capture and use (“CCU”) demonstration plant in South Australia to produce near zero emissions lime and supply captured industrial CO₂ emissions to the HyGATE funded Solar Methanol 1 project (“SM1”)¹.

Highlights:

- Calix has been awarded a \$15 million grant from the Australian Government to reimburse up to 50% of the expenditure to build a commercial demonstration electric calciner for near zero emissions lime and cement in South Australia, subject to achievement of Project milestones.
- The novel, renewably powered CCU project will create two revenue streams via a near zero emissions lime product and the sale of captured CO₂ for use as a chemical feedstock.
- The Leilac technology will be used to capture up to 20,000 tonnes of process CO₂ emissions per annum produced unavoidably in the manufacture of cement and lime.
- Up to 15,000 tonnes of CO₂ per annum will be sold to the SM1 project to produce green methanol. Additional captured CO₂ may be supplied to other users in local industry.
- The SM1 project is being developed by a consortium of partners, including Vast (NAS: VSTE)² and German energy company Mabanaft³, under the Australian-German funded HyGATE initiative.
- Calix will collaborate with its partners on the operation of the electric calciner and sale of its lime products.
- A second phase of the project aims to develop a novel cement making process for near zero emissions cement.

Demonstrating zero emissions lime and cement

Lime is an essential material used in the iron & steel, alumina, paper, pharmaceuticals, food, farming and chemical industries, and demand for lime in Australia is predicted to grow by 57% between 2022 and 2050⁴. Like cement, lime is made from the processing of limestone to form quicklime (calcium oxide). When limestone is heated in this process, carbon dioxide is unavoidably released directly from

¹ Calix ASX Announcement. [Calix part of Australian-German consortium awarded funding to manufacture sustainable fuels from captured CO₂](#), 30 January 2023

² <https://www.vast.energy/>

³ <https://www.mabanaft.com/en/about-us/mabanaft-group/>

⁴ [Decarbonisation Pathways for the Australian Lime Sector](#), VDZ, 2023

the raw material. This ‘process’ CO₂ accounts for ~60-70% of the emissions released during the production of lime^{4,5}. Collectively, lime and cement account for ~8% of global greenhouse gas emissions⁶.

The ‘Zero Emissions Intensity Lime and Cement Technology Built in Australia Project’ (“ZETA Project” or “the Project”) will use an electric and renewably powered version of the Leilac technology to efficiently capture unavoidable process CO₂ emissions and produce near zero emissions lime and cement.

In phase 1 of the Project, the Leilac technology will be used to produce ~15,000 tonnes per annum of near-zero emissions lime and capture of up to 20,000 tonnes per annum of high purity CO₂. Calix will collaborate with its partners on the operation and sale of the zero emissions lime products. Up to 15,000 tonnes of CO₂ per year captured by the Leilac technology will be sold to the SM1 project in Port Augusta, South Australia, with any excess captured CO₂ available to be supplied to local industrial CO₂ users in South Australia. The Project will also train plant operators to support future projects.

In a second phase of the Project, the ZETA program will aim to expand production to include the processing of cement raw meal to a near-zero emissions cement clinker product, with captured CO₂ again supplied for use. By incorporating cement clinkering as an additional process in the Leilac technology, the Project aims to develop a novel route to zero emissions clinker production that reduces cost, energy consumption and footprint.

Demonstrating cost-effective CCUS

The ZETA Project aims to deliver revenue from two streams: a near zero emissions lime product and supply of captured CO₂ for use as a chemical feedstock. Calix’s electric calcination technology also enables fast start-up and shut down, and highly flexible production rates. The ZETA Project aims to leverage this capability to match production to demand and renewable energy costs. Developing this capability is intended to support more cost-effective electric mineral processing and support future grid load-balancing applications.

The ZETA Project’s multiple revenue streams, efficient electric heating and flexible operations, coupled with the support from the Australian Government’s Carbon Capture Technologies Program, aim to deliver a project with positive economics despite being a first-of-a-kind demonstration.

Supporting decarbonisation of multiple hard-to-abate industries

By capturing and using unavoidable process emissions, the ZETA Project aims to demonstrate innovative pathways to decarbonise multiple hard-to-abate industries.

For industries such as cement and lime, where the majority of emissions are unavoidably released directly from the raw material, cost-effective CCUS is an essential part of the sector’s decarbonisation strategy^{7,8}. The use of captured CO₂ eliminates the need for CO₂ transport and storage infrastructure, and potentially provides an additional revenue source to decarbonisation projects. The production of near-zero emissions lime is also an important enabling capability to

⁵ [Decarbonising the lime industry: State-of-the-art](#), Renewable and Sustainable Energy Reviews, [168](#), 1127652022, 2022.

⁶ [Trends in Global CO2 emissions](#), Netherlands Environmental Assessment Agency, The Hague, 2016

⁷ [Decarbonisation Pathways for the Australian Lime Sector](#), VDZ, 2023

⁸ [The GCCA 2050 Cement and Concrete Industry Roadmap for Net Zero Concrete](#)

produce green metals, particularly near-zero emissions steel and aluminium.

Using captured CO₂ as a feedstock to produce low-carbon fuels can also support the decarbonisation of hard-to-abate transport sectors such as aviation and shipping. Green methanol can be synthesised from renewable energy, green hydrogen and captured industrial CO₂. Methanol is a viable low-carbon alternative to diesel for the shipping industry, a pre-cursor for sustainable aviation fuel, and a versatile green hydrogen carrier.

The Solar Methanol 1 project

SM1 aims to develop a world-first methanol production demonstration plant, producing ~7,500 tonnes of methanol per year. SM1 is being developed by a consortium of members, including Vast, Mabanaft and Calix, and has been awarded funding of ~\$40 million as part of the German-Australian Hydrogen Innovation and Technology Incubator (HyGATE) initiative.⁹

The SM1 project has passed numerous milestones since it was announced, including receipt of planning consent¹⁰ and the formation of a Joint Development Agreement between Vast and Mabanaft¹¹.

Next steps and timelines

The ZETA Project aims to develop and demonstrate cost-effective solutions to manufacture sustainable lime, cement and future fuels, and is being developed in parallel to SM1, with the quantity and timing of CO₂ supply targeted to match the demand for methanol production. The material Project milestones for phase 1 are listed below, and Project funding terms under the grant agreement are provided in the Appendix.

Project milestone	Estimated timing
Pre-Front-End Engineering Design (Pre-FEED) completed	End 2024
Front-End Engineering Design (FEED) completed / Final Investment Decision (FID)	Late 2025 / Early 2026
First lime / CO ₂ production	FID + 18 months

Table 1. Material project milestones and estimated timings

Calix CEO and Managing Director, Phil Hodgson said,

“Calix is delighted to have been awarded funding under the Australian Government’s Carbon Capture Technologies Program to produce near-zero emissions lime and cement. This highly innovative

⁹ Calix ASX Announcement. [Calix part of Australian-German consortium awarded funding to manufacture sustainable fuels from captured CO₂](#). 30 January 2023

¹⁰ Vast Press Release: [Vast Receives Planning Consent for CSP-powered Solar Methanol Project in Port Augusta](#). May 30, 2024

¹¹ Vast Press Release: [Vast and Mabanaft advance Port Augusta green methanol project to unlock Australia’s green fuels industry](#). June 13, 2024

Project aims to demonstrate solutions for several national priorities identified in the Australian Government's Future Made in Australia program.

"Calix's renewably powered technology platform can electrify mineral processing and capture unavoidable emissions to enable carbon-intensive industries like cement and lime to reach net zero. Zero emissions lime will also be an important enabling material for the development of an Australian green metals industry for green steel and aluminium."

"Additionally, by combining captured CO₂ with Australian sunshine in collaboration with our partners in the SM1 project, we aim to demonstrate a low-cost decarbonisation pathway for cement and lime and a novel way to make low-carbon transport fuels."

"It is exciting to see Australian technology companies, supported by Australian Government funding, collaborating to take advantage of the unique comparative advantages Australia can have in a decarbonising global economy."

Vast CEO, Craig Wood said,

"We are delighted to be partnering with Calix on SM1, using CO₂ captured from their near zero emissions lime plant to produce green methanol to decarbonise the maritime sector. It is excellent to see the Australian Government supporting companies like Vast and Calix as we develop solutions to decarbonise shipping and aviation globally."

"Coming against the backdrop of the Australian Government's Future Made in Australia program, which aims in part to unlock a domestic renewable liquid fuels manufacturing industry, there is real momentum for Australia to become a world leader in this space."

Mabanaft's Director New Energy, Philipp Kroepels said,

"We believe that government support, such as that provided by Australia and Germany through the HyGATE initiative, is essential to stimulate development of low-carbon, sustainable fuels, including methanol. Our joint project with Calix and VAST will certainly take us forward in developing viable solutions for decarbonisation."

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Appendix: Project funding terms

The grant funding is made to the Company by the Australian Government, acting through the Department of Climate Change, Energy, Environment and Water (DCCEEW), and is subject to the terms of an agreement under the Australian Government's Carbon Capture Technologies Program.

The grant is to assist the engineering, construction, commissioning and operation of the Project. As per a standard Australian Government grant agreement, the grant is payable to the Company as reimbursement of Project expenditures, paid in instalments distributed over the term of the Project ending on 31 March 2031, and subject to the successful completion of Project milestones. The material milestones and their estimated timings are provided in table 1, which may be subject to change. There are no other material items within the standard government agreement that have not been disclosed.

Failure to satisfy the milestones conditions, or a change in Australian Government policy with respect to DCCEEW, or funding provided by DCCEEW, that relates to the Australian Government's obligations under this agreement, may result in the Australian Government by notice terminating this agreement

or changing the scope of the Project, effective from the time specified in the notice. Such provisions are typical in government funding agreements.

Further information about the DCCEEW Carbon Capture Technologies Program is available at:
<https://www.dcceew.gov.au/climate-change/emissions-reduction/carbon-capture-use-storage>

This announcement has been authorised for release to the ASX by:

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About Calix

Calix Limited (ASX: CXL) is an environmental technology company solving urgent global challenges in industrial decarbonisation and sustainability.

Calix's unique patented core platform technology delivers efficient indirect heating of raw materials to enable renewably powered mineral processing and efficient capture of unavoidable industrial emissions.

With strong and increasing demand driven by global commitments to net-zero emissions, Calix is applying its core technology to the decarbonisation of cement, steel and alumina, sustainable processing of critical minerals, direct air capture of atmospheric carbon dioxide, and sustainable environmental products.

Each application of the technology is being deployed through a proven licensing, joint-venture and spin-out model. Subsidiary businesses focused on a specific application and target market accelerate commercialisation and enable a flexible equity funding model to support exponential growth.

Leveraging its core platform technology and a global network of partners, Calix is urgently developing multiple environmental businesses that deliver positive global impact. Because there's only one Earth.

Mars is for quitters.

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