# CRITICAL RESOURCES ADVANCES BATTERY TECHNOLOGY PROGRAM WITH THERMAL MANAGEMENT PORTFOLIO

Critical Resources completes worldwide exclusive licence over NTU's thermal management portfolio, extending the Company's solid-state battery development program.

- **Licence Executed** with NTUitive Pte Ltd, the innovation and enterprise company of Nanyang Technological University (NTU), Singapore, covering two-phase cooling of lithium-ion batteries, GPUs and CPUs within high-density electronics and data centre infrastructure.

- **Integrated thermal management:** The worldwide licence covers thermal management for lithium-ion batteries, GPUs and CPUs extending the Company's solid-state battery evaluation program for high-temperature environments.

- **Designed for warm operating environments:** The technologies seek to eliminate the requirement for refrigeration chiller plants by operating at ambient temperature, with greatest advantage in high-density, high-ambient-temperature infrastructure where cooling costs are the highest.

- **Dynamic Control:** The thermal management portfolio includes 'Model Predictive Control' (MPC) that adjusts energy use in real time, optimising GPUs and CPUs performance and energy consumption — an approach directly applicable to battery management in high-temperature environments.

- **Peer-Reviewed Performance Validation** report a 25.8% reduction in total facility energy consumption, Power Usage Effectiveness (PUE) of 1.08 versus approximately 1.69 for conventional air-cooled systems, and a 7°C reduction in chip-level temperature at full load (*Applied Energy (2022)*[1] *and Energy (2023)*[2]).

- **Mine-to-market downstream strategy:** Integration of the solid-state lithium-ion battery program with the licenced thermal management technology extends Critical Resources' downstream exposure to high-temperature environments such as data centre and high-density electronics infrastructure.

**Critical Resources Limited** ('**Critical Resources**' or the '**Company**', **ASX:CRR**) is pleased to announce the completion of the binding exclusive worldwide commercial licence with NTUitive Pte Ltd (**NTUitive**), the innovation and enterprise company of Nanyang Technological University, Singapore (**NTU**), covering four technology disclosures, including one granted US patent, relating to two-phase cooling of lithium-ion batteries and Central Processing Units (**CPU**) and Graphics Processing Units (**GPU**) within high-density electronics and data centre infrastructure.

Execution of the binding exclusive commercial licence follows the Company's 30 April 2026 announcement in which Critical Resources was nominated to hold the full commercial licence on exercise of the option held under an evaluation licence arrangement with NTU.

## ABOUT THE THERMAL MANAGEMENT TECHNOLOGY PORTFOLIO

Operating temperature directly affects ionic conductivity, interface stability, and the rate of performance degradation over time in advanced battery architectures. For solid-state battery architectures operating at elevated temperature environments, controlled thermal conditions are a prerequisite for repeatable, reliable performance.

CRR's solid-state battery evaluation program is generating datasets on electrolyte conductivity, interface stability and cathode/electrolyte construction. As that program progresses toward prototype configurations, thermal management becomes a practical development consideration. The NTU commercial licence covers thermal management of lithium-ion batteries alongside GPUs and CPUs. This connects CRR's lithium-ion value chain — from lithium supply at Mavis Lake through to potential downstream battery development.

The NTU portfolio of thermal management technologies covers a two-phase spray cooling approach to remove heat from electronic components and battery systems. A dielectric fluid — electrically non-conductive and commercially available — is sprayed directly onto the surface of the heat-generating component such as GPU and CPU units. The fluid evaporates on contact (**two-phase**), removing heat far more efficiently than any approach that keeps the coolant in liquid form. The vapour is captured in a sealed enclosure, condensed back to liquid using near-ambient-temperature fluid, and recirculated in a closed loop. The system operates with ambient-temperature fluid at approximately 30°C with no refrigeration or mechanical chiller required.

The NTU thermal management technologies are supported by peer-reviewed publications in *Applied Energy* (2022)[1] and *Energy* (2023)[2]. Validated performance data from those studies includes a 25.8% reduction in total data centre facility energy consumption, a Power Usage Effectiveness (PUE) of 1.08 compared to approximately 1.69 for conventional air-cooled systems, and a 7°C reduction in GPUs and CPUs temperature at full load performance.

The licenced portfolio includes a thermal model of the two-phase spray-cooled system — a physics-grounded predictive model characterising dynamic thermal responses to varying ambient-temperature and load conditions. This provides the foundation for Model Predictive Control (MPC) of cooling loads and, by extension, of battery operating temperatures within an integrated system.

> **Critical Resources Managing Director, Tim Wither, commented:** '*This licence completes the option pathway flagged in our 30 April update. The NTU portfolio connects to our existing solid-state battery development work in the US, where heat is a primary determinant of battery cycle life and safety. Our development approach remains capital-light and milestone-gated, and we look forward to updating the market as we progress.*'

## TRANSACTION TERMS

The commercial licence grants the Company an exclusive worldwide rights to develop licenced portfolio within the Field of Application, being thermal management of lithium-ion batteries, CPUs, GPUs and other heat-generating components within high-density electronic and data centre infrastructure. The total consideration over the ten (10) year licence period is SGD$220,000, exclusive of patent cost recovery obligations. There are no royalty payments on product sales.

The licence includes a performance milestone requiring first commercial sale of a licenced product within three (3) years of completion of the planned Research Collaboration Agreement(s) with NTU. If that milestone

is not met, NTUitive may elect to convert the exclusive licence to non-exclusive, or the Company may negotiate with NTUitive to maintain exclusivity for a mutually agreed annual fee.

The Company will undertake a structured evaluation of the thermal management technology portfolio after a Research Collaboration Agreement (RCA) with NTU is finalised, which remains under discussion. The Company's approach is capital-light and milestone-based, with each stage of development gated by independent technical and commercial validation. The evaluation program may be increased subject to successful completion of defined technical and commercial milestones. The evaluation is designed to assess technical performance and integration potential with the Company's existing battery programs.

**This announcement has been approved for release by the Board of Directors of Critical Resources.**

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## ABOUT CRITICAL RESOURCES LIMITED

Critical Resources Limited (ASX:CRR) is an Australian mining and technology company with a primary focus on the discovery and development of critical metals and next-generation lithium-ion battery technologies essential to a sustainable future. The Company holds a diversified portfolio including the Mavis Lake Lithium Project in Ontario, Canada, the Halls Peak Base Metals Project in New South Wales, and a growing gold portfolio in New Zealand.

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This announcement may contain certain forward-looking statements and projections. This announcement also contains forward-looking statements regarding technology development, commercial licencing, pilot deployment, and integration of the NTU cooling portfolio with CRR's battery programs. These statements are subject to technology, development, regulatory, and commercial risks and actual outcomes may differ materially from those described. Statements regarding CRR's plans with respect to its mineral properties and programs are forward-looking statements. Such forward-looking statements/projections are estimates for discussion purposes only and should not be relied upon. Forward-looking statements/projections are inherently uncertain and may therefore differ materially from results ultimately achieved. There can be no assurance that CRR's plans for development of its mineral properties will proceed as currently expected. There can also be no assurance that CRR will be able to confirm the presence of additional mineral resources, that any mineralisation will prove to be economic or that a mine will successfully be developed on any of CRR's mineral properties. Critical Resources Limited does not make any representations and provides no warranties concerning the accuracy of the projections and disclaims any obligation to update or revise any forward-looking statements/projections based on new information, future events or otherwise, except to the extent required by applicable laws. While the information contained in this report has been prepared in good faith, neither Critical Resources Limited nor any of its directors, officers, agents, employees or advisors give any representation or warranty, express or implied, as to the fairness, accuracy, completeness or correctness of the information, opinions and conclusions contained in this announcement.

## REFERENCES


1. Kandasamy, R., Ho, J.Y., Liu, P., Wong, T.N., Toh, K.C., Chua Jr, S. (2022). Two-phase spray cooling for high ambient temperature data centers: Evaluation of system performance. *Applied Energy*, 305, 117816. https://doi.org/10.1016/j.apenergy.2021.117816
2. Liu, P., Kandasamy, R., Ho, J.Y., Wong, T.N., Toh, K.C. (2023). Dynamic performance analysis and thermal modelling of a novel two-phase spray cooled rack system for data center cooling. *Energy*, 269, 126835. https://doi.org/10.1016/j.energy.2023.126835