12 August 2025

LU7 ACQUIRES BREAKTHROUGH MACQUARIE UNIVERSITY ELECTRO JET SILVER EXTRACTION TECHNOLOGY FOR PV SOLAR PANEL RECYCLING

Highlights

- LU7 has acquired global rights to Macquarie University's Jet Electrochemical Silver Extraction (JESE) Technology
- JESE uses electrochemical low-voltage jet to selectively extract silver
- Anodic oxidation of silver which dissolves into dilute nitric acid electrolyte
- Leaves aluminium and other impurities
- High purity silver metal recovered from electrolyte via electrochemical deposition
- Process preserves silicon wafers which minimises contamination for silicon recycling
- High-purity silicon is critical for semiconductor manufacturing
- Integrates with Microwave Delamination (MJHT) for full PV recycling solution
- Which separates clean glass and silicon wafer from EVA
- LU7 has acquired license rights to the technology from Macquarie University

Lithium Universe Limited (ASX: LU7, "Lithium Universe" or "the Company") is pleased to announce it has acquired the global rights to Macquarie University's **Jet Electrochemical Silver Extraction (JESE) Technology.** The rights will be secured via an **exclusive licensing agreement (Licensing Agreement) with Macquarie University (MQU)**, held through LU7's holding company, New Age Minerals Pty Ltd (**NAM**). This innovative process utilizes a low-voltage electrochemical jet of dilute nitric acid to selectively dissolve silver from solar cells. By applying a potential of approximately 2V-5V between the silicon wafer contact (anode) and the jet probe (cathode), silver on the wafer surface undergoes anodic oxidation, forming Ag^{+} ions that dissolve into the electrolyte through electrolysis-driven dissolution.

Watch Technology In Action:
https://youtu.be/_0l6lWpwrfE?si=9_5lv-08nHYkNJlp

The jet probe precisely tracks the silver fingers and busbars on the cell surface, enabling highly targeted silver removal without leaching of other impurities or damaging the underlying silicon wafer. The silver-ion electrolyte is continuously recirculated, and high-purity metallic silver is recovered via electrochemical deposition. Importantly, the silicon wafer remains intact and uncontaminated—unlike conventional processes that often introduce iron contamination through mechanical grinding with glass—making it suitable for potential high value silicon recycling. Macquarie's registered patent for this technology has been registered.

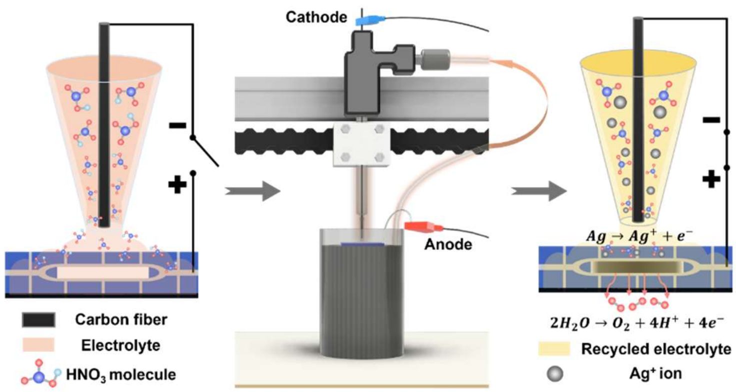


Figure 1 – Electrochemical Jet dissolving silver into Ag^+ ions

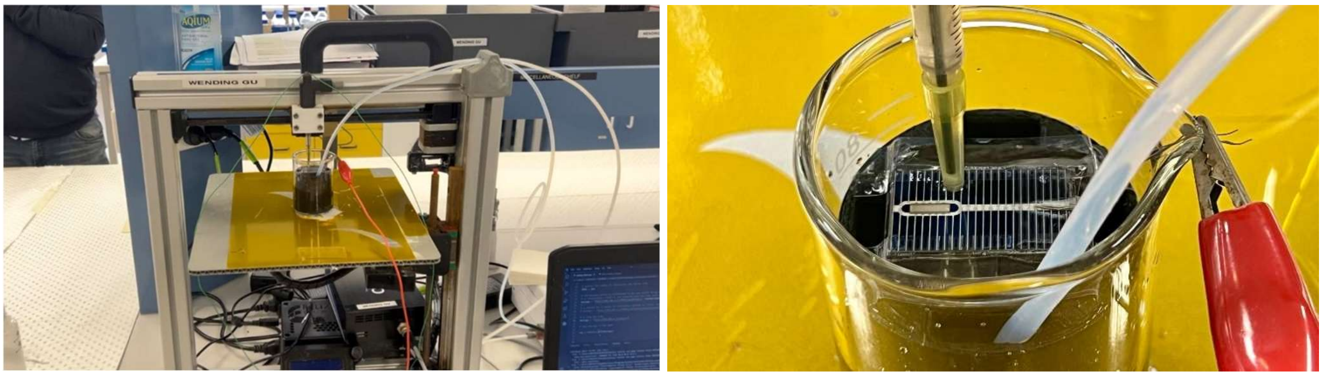


Figure 2 – Jet Electrochemical Silver Extraction Probe

Figure 3 – Lithium Universe Directors and CFO meeting Macquarie University team

IN CONJUNCTION WITH MICROWAVE DELAMINATION

This breakthrough complements LU7's previously licensed Microwave Joule Heating Technology (MJHT), an energy-efficient process that delaminates solar panels without mechanical grinding or high-temperature furnaces. MJHT preserves the integrity of both the glass and the silicon wafer, creating an ideal precursor for the Jet Electrochemical Silver Extraction (JESE) process. A key advantage of MJHT is its ability to recover intact glass free from EVA residue, allowing direct reuse in PV module manufacturing—particularly valuable for reprocessing production rejects from PV factories. Additionally, MJHT maintains the structural integrity of the silicon wafer, enabling seamless integration into the JESE silver extraction process. Together, MJHT and JESE form a comprehensive and sustainable PV recycling platform that positions LU7 at the forefront of critical metal recovery from solar panel waste.

Figure 4 – Dr Binesh Veettil explaining Microwave Delamination Microwave Equipment

Both these innovations mark a significant advancement in photovoltaic (PV) solar panel recycling. Conventional methods rely on destructive processes in which wafers are shredded or ground into powder and then exposed to aggressive leaching with highly concentrated acids. Such approaches are energy-intensive, destroy the wafer, and produce substantial volumes of hazardous chemical waste. In contrast, the Macquarie method overcomes these drawbacks by providing a safer, cleaner, and more sustainable solution that recovers high-value silver while preserving the wafer's integrity for efficient recycling.

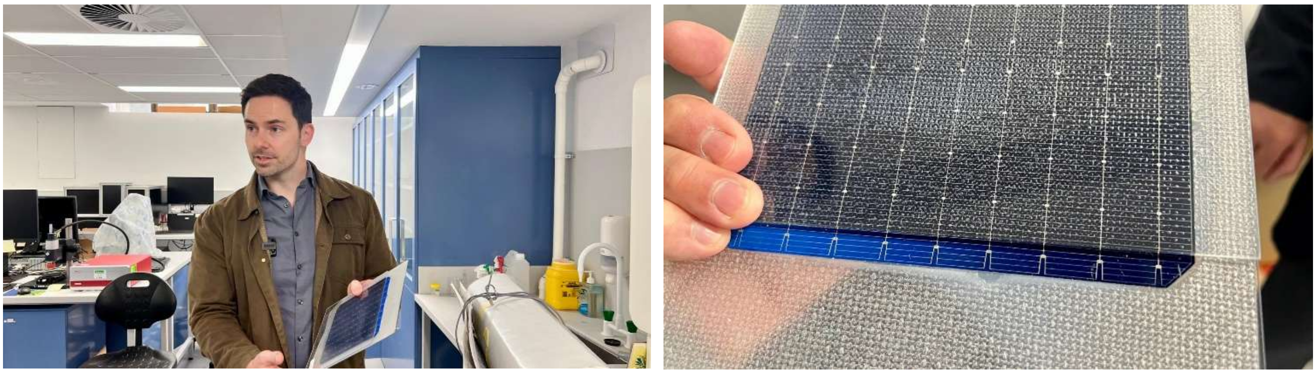


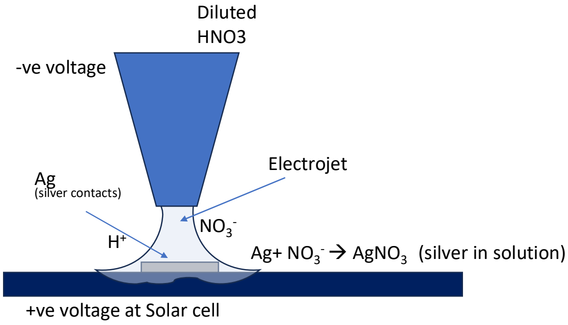
Figure 5 - Dr David Payne, co-lead Macquarie Team showing intact glass sheet and silicon wafer sheet

Cleanly separating silicon wafer from glass is essential for effective silicon module recycling. This approach allows recovery of intact cells that can be refined into metallurgical- or solar-grade silicon, instead of being downgraded to low-value ferro-silicon. If modules are pulverized without prior delamination, ductile metals such as aluminium and silver become trapped within aggregates, making impurity removal inefficient and costly. Pulverization also mixes glass, EVA, metals, and silicon, significantly complicating high-purity recovery and reducing profitability. A recent Korean LIB recycling study found that pre-milling etching after delamination removes over 98% of aluminium and over 99% of silver, whereas milling first leaves residual metal concentrations in the tens of thousands of ppm. Delaminated and purified silicon can also be upgraded for advanced applications, including conversion to nano-silicon for lithium-ion battery anodes, achieving over 99% purity and excellent electrochemical performance with capacity retention above 95.5%.

TECHNOLOGY OVERVIEW

Silver is primarily used in photovoltaic (PV) solar cells as a key material for the electrical contacts that allow the flow of electricity generated by the solar panel. It is blended with other materials to create a conductive paste, which is applied to the cell surface and baked to form silver contacts. These contacts create thin "fingers" and thicker "busbars" that efficiently collect and transport the generated electrical current. By providing minimal resistance and high conductivity, silver ensures efficient power transfer from the solar cell to the external circuit.

The MQU silver extraction process operates by delivering a precise jet of dilute nitric acid onto the silver-coated surface of a solar cell. This jet is applied through a chemically inert nozzle made of PTFE or PEEK, positioned very close to the wafer surface. At an applied potential of approximately 5V across the silicon wafer contact (anode) and jet probe (cathode), (See Figures 6 and 7) silver at the wafer surface undergoes anodic oxidation to form Ag^+ ions. These ions subsequently dissolve into the electrolyte through an electrolysis-driven dissolution process. The low voltage is sufficient to drive the oxidation without damaging the underlying silicon structure, enabling selective silver removal while preserving wafer integrity for potential reuse or further processing in photovoltaic recycling applications. The electrolyte, containing dissolved silver ions, is continuously recirculated and the silver is recovered through an electrochemical deposition process. In this step, the electrolyte containing silver ions is passed through an electrochemical cell where the silver ions are reduced and plated onto a conductive cathode, forming high purity metallic silver that can reach grades suitable for electronics and photovoltaic applications that can be collected and refined for resale. The remaining electrolyte can then be recirculated back into the extraction system, minimising chemical use and waste.



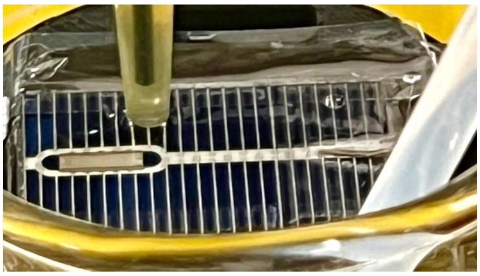


Figure 6 – Operation of the Electrochemical Jet Nozzle with silver dissolution

The inclusion of this deposition process closes the loop of silver recovery. It ensures that the dissolved silver is efficiently converted back into usable metal, while the recirculating electrolyte reduces the consumption of new chemicals and lowers waste disposal requirements. This integrated approach enhances the economic value of the technology by providing both efficient silver extraction and high-purity metal recovery.

The process offers several major advantages. Because it uses dilute nitric acid, chemical hazards are greatly reduced compared to conventional methods that rely on concentrated nitric acid. Energy consumption is also much lower with current efficiency of 77% and the elimination of energy-intensive grinding. Importantly, the wafer remains intact throughout the process, allowing it to be cleaned and reused, which dramatically improves the economic and environmental profile of solar panel recycling.

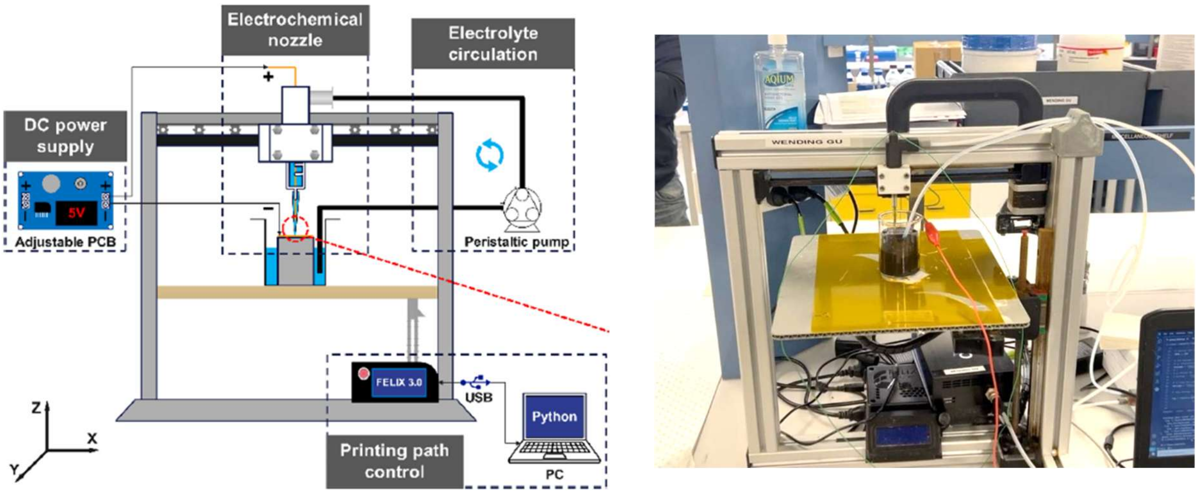


Figure 7 – Electrochemical jet moves along silver fingers and busbars, with precision silver extraction

The electrochemical jet moves with precision (using scanning and AI) along the silver “fingers” and “busbars” on a solar cell’s surface, guided by a pre-programmed scan and sensor feedback that map the metallized grid. The fingers are fine lines that collect current, while busbars are thicker pathways that consolidate it. Using this mapped pattern, the jet tracks and follows only the silver-coated regions.

Figure 8 – Silver fingers and busbars which the electrochemical jet nozzle tracks

A narrow stream of dilute nitric acid is delivered through a chemically inert nozzle positioned close to the wafer. With a low applied voltage of about 5V across the contacts, the silver undergoes anodic oxidation to form soluble Ag^{+} ions, which dissolve into the electrolyte. Tests show this dissolution occurs in less than 6 seconds at the jet position. The jet's movement is synchronized with sensor data, enabling highly selective silver removal while avoiding contact with non-metallic areas and leaving the silicon wafer intact. This approach minimizes material loss and prevents wafer damage, ensuring efficient and uniform silver recovery across different panel designs. After the silver is dissolved, it can be recovered from the electrolyte through electrochemical deposition, producing high-purity metallic silver for reuse in electronics and photovoltaics. The process combines precision tracking, efficient dissolution, and preservation of wafer integrity, offering a sustainable method to recover valuable silver while enabling potential reuse of the silicon substrate.

COMPARISON TO CONVENTIONAL METHODS

Traditional silver extraction involves mechanical comminution, where wafers are shredded or ground into fine powder, followed by chemical leaching using highly concentrated nitric acid. While this method can recover silver, it permanently destroys the wafer, consumes large volumes of strong acid, generates hazardous waste, and requires significant energy. The MQU method directly addresses these issues. By avoiding wafer destruction and operating with dilute acid at low voltage, it achieves efficient silver recovery while reducing chemical hazards, waste, and energy demand. This selective electrochemical process can also be fine-tuned to avoid dissolving other metals, enhancing recovery efficiency and purity.

Table 1 – JESE Comparison with Conventional Method

Feature	Conventional Method	Macquarie JESE Method
Wafer Preservation	Wafer ground into powder – not reusable	Wafer remains intact, potentially reusable
Acid Usage	Highly concentrated nitric acid	Dilute nitric acid (≤ 0.5 M)
Energy Demand	High (mechanical grinding + leaching)	Less Energy
Waste Generation	High, toxic NOx emissions	Low, electrolyte is recirculated

ECONOMIC IMPACT AND MARKET OPPORTUNITY

Each solar panel contains around 20 grams of silver, equating to about A$36 at current silver prices. With approximately 50 panels per tonne of PV modules, one tonne of waste panels contains about one kilogram of silver. Considering that global PV waste is projected to reach 60 to 78 million tonnes by 2050, the total recoverable silver value could exceed A$154 billion. This vast and underutilized resource represents a significant economic opportunity for LU7. Silver demand is being driven by multiple sectors, with photovoltaics representing one of the fastest-growing sources of industrial consumption. In 2025, global silver demand is expected to reach 680 million ounces, with industrial demand growing at 7% CAGR. A market deficit of approximately 117.6 million ounces is forecast, reflecting the inability of mining supply to keep pace with rising demand. Over the past decade, silver prices have risen from US$15 per ounce in 2018 to US$34 per ounce in 2025, an increase of 126%. As industrial demand continues to rise, recycling will play an increasingly important role in bridging the supply gap.

INTEGRATION WITH MICROWAVE JOULE HEATING TECHNOLOGY

LU7's previously acquired MJHT platform enables energy-efficient delamination of PV modules by selectively heating silicon wafers to soften the encapsulant. This process eliminates the need for mechanical grinding or extreme furnace temperatures, preserving wafers for further processing. The jet electrochemical silver extraction technology integrates perfectly with MJHT. After delamination, wafers can undergo precise silver removal without damage, followed by wafer cleaning and reuse. This combined process maximizes material recovery and minimises waste, representing a full circular economy solution for PV panels.

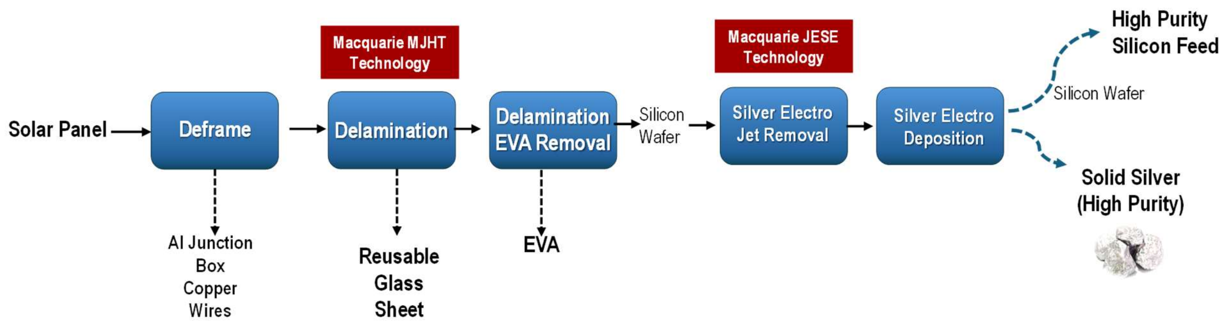


Figure 9 – Incorporation of MQU MJHT and JESE Technology in Silver Extraction Process

ENVIRONMENTAL AND SUSTAINABILITY BENEFITS

The Macquarie University technology supports global sustainability and circular economy goals by enabling both the recovery of high-value silver and the recycling of silicon from silicon wafers. Wafer manufacturing is one of the most energy- and resource-intensive steps in solar panel production, involving polysilicon refining, ingot casting, and wafer slicing. By potentially reusing wafers, the technology reduces demand for virgin silicon, lowers production costs, and significantly decreases carbon emissions. Furthermore, the use of dilute nitric acid and recirculating electrolyte minimises hazardous waste generation and reduces the environmental burden associated with conventional recycling methods.

WHY RECYCLING OF SILVER IS LUCRATIVE

A report from the International Energy Agency (IEA) projects that global waste from PV solar panels will reach up to 8.0 million tonnes by 2030 and 60–78 million tonnes by 2050. By 2035, Australia is expected to accumulate 1 million tonnes of solar panel waste, valued at over A$1 billion (about 50 panels weigh about 1 tonne). Despite the growing challenge, only 15% of used PV cells are currently recycled, with the rest ending up in landfills. This low recycling rate is due to complex processes, high-temperature furnaces, and toxic chemicals, leading to poor recovery yields.

"In Fact, the Silver that's contained inside Solar Modules equates to in its totality, Australia's Biggest Silver Mine" (Australia Smart Energy Council)

Recycling and extracting silver from solar panels presents a lucrative business opportunity for LU7 due to the substantial amount of silver in each panel—approximately 20 grams, equating to around A$36 in value. With the growing volume of solar panel waste, this offers a readily available cheap feedstock for recycling. As the demand for silver increases, especially in industries like electronics and renewable energy, recovering silver from end-of-life panels can become a valuable and sustainable revenue stream. The Company believes that the MQU technology provides a more efficient recycling technology, positioning it to capitalize on this growing market while addressing environmental challenges.

DEMAND FOR SILVER

The average solar panel is often reported to contain around 20 grams (0.7 oz) of silver, with some sources indicating a range of 3.2 to 8 grams per square meter. The value of silver in each panel is in the region of A$36 per panel (USD$34/oz) at today's price. The demand for silver in the solar industry is rising rapidly, driven by the global expansion of solar panel installations. In Australia, the goal of achieving 82% renewable energy by 2030 and a 43% reduction in carbon emissions is fuelling the growth of solar panel installations.

In recent years, photovoltaics have accounted for a significant share of total silver consumption, and this trend is expected to continue. In 2025, silver demand is projected to reach a **record 680 million ounces**, fuelled by a 7% increase in industrial demand, as shown in Figure 10. This growth is largely driven by the increasing use of silver in various industries, with photovoltaics and AI emerging as the fastest-growing sectors.

Silver is both expensive and relatively scarce. Its extraction primarily involves mining ores such as argentite, which are then processed through smelting or chemical methods. As demand for solar energy and electronics continues to rise, silver supply is struggling to keep up. This ongoing imbalance between supply and demand is expected to result in a **market deficit of around 117.6 million** ounces in 2025. Such deficits have been a recurring trend in recent years, contributing to upward pressure on silver prices. This trend has already been reflected in the price of silver, which has risen from **US$15/oz in 2018 to US$34/oz in 2025**, marking a 126% increase over that period, as shown in Figure 11.

The silver market is experiencing a shortfall, which is putting upward pressure on prices, underscoring the increasing importance of silver recovery through recycling. As traditional mining struggles to meet demand, recycling will play an increasingly vital role in securing the supply of this critical metal. The continued expansion of industries reliant on silver, coupled with supply constraints, suggests that silver's value will likely remain high in the coming years.

Lithium Universe LIMITED

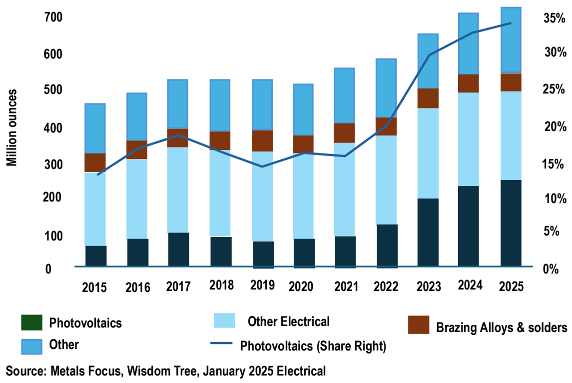


Figure 10 – Silver Demand Driven by PV Cells

Figure 11 – Silver 10-Year Price Trend

EXTRACTION OF OTHER VALUABLE METALS

As part of the second phase, the Company will investigate the recovery of additional valuable metals from discarded PV solar panels, including silicon, gallium, indium, and copper. The JESE technology's versatility enables selective extraction of these metals, enhancing overall resource recovery and further increasing the commercial and environmental value of PV recycling.

Executive Chairman, Iggy Tan stated, *"LU7 has completed its review of the technology and will now proceed to secure the global licence from Macquarie University. Our collaboration with the Macquarie University team has been exceptional. Their scientific expertise and innovative approach have greatly accelerated the development of the Jet Electrochemical Silver Extraction technology. We have built a strong, solutions-focused partnership, combining Macquarie's world-class research with LU7's commercial vision. Together, we are delivering a breakthrough recycling solution that recovers high-purity silver while preserving wafer integrity. This partnership exemplifies how industry and academia can work hand in hand to create technologies that drive both commercial success and sustainability."*

Schedule 1- Key terms of the Licensing Agreement

Territory	Exclusive worldwide right to commercialise the Technology. MQU retains a perpetual, royalty-free, worldwide, non-commercial licence to use the Technology (and any improvements) for research and education purposes.
Term	The longer of: • the date on which the last exclusive rights of MQU in the Technology lapse or expire; or • 20 years after the first commercial sale of any material, product, kit, method or use utilising the Technology, (**Term**).
Payments	The consideration payable by NAM to MQU for the use of Technology is: • A payment of $14,300 as reimbursement for the costs associated with the registration of the Technology (**Reimbursement Registration Cost**); and • an annual payment of $20,000 in cash payable within 30 days of each anniversary of the commencement date of the Licensing Agreement (being, 11 August 2025) (**Commencement Date**), with payment commencing from 2027 and continuing until 2042.
Royalty	NAM will pay a 3% royalty on annual gross sales of products produced from both the Microwave Delaminating IP and the Jet Electrochemical Silver Extraction IP as a combined process and/or services using the Technology achieved by or on behalf of NAM, payable quarterly to MQU, within 30 days of the end of each quarter during the Term (**Royalty**). The Royalty payment will be a minimum of $5,000 per annum commencing from the anniversary of the Commencement Date that falls within 2033.
Milestone Fee	NAM must notify MQU in writing of the achievement of each of the following milestones: • the successful commissioning and initial testing of the pilot plant, as reasonably determined by NAM; and • the commencement of production leading to the first commercial sale of the licensed product or process, (each a **Milestone**). Upon the occurrence of each Milestone, MQU will be entitled to receive either of the following as selected by MQU: • $100,000 cash by direct transfer to the bank account nominated by MQU; or • subject to the receipt of LU7 shareholder approval, fully-paid ordinary shares in NAM equal to the aggregate value of $100,000 based on a deemed issue price equal to 15-day volume-weighted average price preceding the date of issuance (**Milestone Equity**). MQU shall notify LU7 of its selection within 30 days of being notified by NAM of each Milestone achievement. NAM must complete payment of the relevant Milestone Fee within 30 days of the written notice of MQU's selection.
Improvements	All improvements to the Technology (whether made by MQU or NAM) during the Term are owned by MQU and automatically form part of the licensed intellectual property that is licensed to NAM under the Licensing Agreement.

Sublicensing	NAM may sublicense the Technology without MQU's prior consent, subject to conditions including that the sublicensee cannot further sublicense and must agree to novation of the sublicence to MQU if the head licence is terminated.
Impact/ Performance Criteria	NAM must at all times use reasonable and diligent efforts (including through approved sublicences) to pursue the development and commercialisation of the Technology and the development of the Products, including with a view to achieving the following: Phase 1: R&D completed by 2027 Phase 2: Pilot testing and validation completed by 2030 Phase 3: Commercial deployment and first sales by 2032. Within thirty (30) days after the end of each quarter during the Term, NAM must provide MQU with true, accurate and detailed written reports of the following information relating to that quarter: 1. Products and services sales figures achieved, including numbers of Products or service engagements, total billings, calculation of gross sales figures and Royalties due under the Licensing Agreement; and 2. details relating to activities to develop and commercialise the Technology and the development of Products, including work completed, key scientific discoveries and summary of work-in-progress and progress of the above criteria.
Termination	MQU may terminate the licence if the Company ceases to use reasonable and diligent efforts to commercialise the Technology for a continuous period of six months or the Company or its personnel engage in conduct reasonably likely to cause reputational harm to MQU. Either party may immediately terminate the Licensing Agreement by written notice if the other party commits a material breach that is not remedied within 30 days (if capable of remedy), commits a material breach that is incapable of remedy, or is subject to an insolvency event.

Authorised by the Chairman of Lithium Universe Limited

Lithium Universe Interactive Investor Hub
Engage with Lithium Universe directly by asking questions, watching video summaries and seeing what other shareholders have to say about this, as well as past announcements, at our Investor Hub https://investorhub.lithiumuniverse.com/

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Lithium Universe LIMITED

ABOUT LITHIUM UNIVERSE LIMITED

Lithium Universe Limited (ASX: LU7) is a forward-thinking company on a mission to close the "Lithium Conversion Gap" in North America and revolutionize the photovoltaic (PV) solar panel recycling sector. The company is dedicated to securing the future of green energy by addressing two major strategic initiatives: the development of a green, battery-grade lithium carbonate refinery in Québec, Canada, and pioneering the recycling of valuable metals, including silver, from discarded solar panels.

Lithium Strategy: Closing the Lithium Conversion Gap
Lithium Universe is at the forefront of efforts to meet the growing demand for lithium in North America. As electric vehicle (EV) battery manufacturers prepare to deploy an estimated 1,000 GW of battery capacity by 2028, the need for lithium is expected to rise dramatically. However, with only a fraction of the required lithium conversion capacity in North America, LU7 is determined to play a pivotal role in reducing dependence on foreign supply chains. The company is building a green, battery-grade lithium carbonate refinery in Bécancour, Québec, leveraging the proven technology developed at the Jiangsu Lithium Carbonate Plant. This refinery will produce up to 18,270 tonnes per year of lithium carbonate, focusing initially on the production of lithium carbonate for lithium iron phosphate (LFP) batteries. The refinery's smaller, off-the-shelf plant model ensures efficient operations and timely implementation, positioning LU7 as a key player in the emerging North American lithium market. With a strong leadership team, including industry pioneers like Chairman Iggy Tan, LU7 is well-positioned to deliver this transformative project. The company's strategy is counter-cyclical, designed to build through the market downturn and benefit from the inevitable recovery, ensuring sustained exposure to the growing lithium demand.

PV Solar Panel Recycling Strategy: Silver Extraction
As the global demand for solar energy expands, the issue of solar panel waste has grown exponentially. With an estimated 60–78 million tonnes of solar panel waste expected by 2050, the need for efficient recycling solutions is more critical than ever. Lithium Universe has responded by acquiring the Microwave Joule Heating Technology (MJHT) from Macquarie University, a groundbreaking innovation for extracting valuable metals from discarded PV solar panels. The company's first focus is on the recovery of silver, a critical component in solar panel manufacturing. Silver's excellent electrical conductivity makes it indispensable in photovoltaic cells, where it forms the electrical contacts for electricity flow. The technology developed by LU7 enhances the extraction of silver, silicon, gallium, and indium, addressing a major gap in the recycling industry. With the price of silver soaring due to increasing demand in solar and electronics, LU7's efforts in silver recovery are timely and essential for sustaining the global clean energy supply chain. This breakthrough technology significantly reduces the environmental impact of solar panel waste by offering a more efficient, cost-effective, and environmentally friendly recycling solution. As the company progresses, it plans to expand its focus to other critical metals like copper and indium, ultimately contributing to the global circular economy.

Lithium Universe is committed to ensuring that both its lithium and PV solar recycling strategies help meet the world's growing demand for clean energy, while offering a sustainable solution to the challenges of resource scarcity and waste management.