27 May 2026

LU7 ACQUIRES BREAKTHROUGH GOLD & COPPER EXTRACTION FROM E-WASTE TECHNOLOGY

Highlights

- Acquired global rights to University of Edinburgh's gold and copper extraction hydro-met technology (Gold Copper Diamide Extraction GCDE process)
- GCDE Technology selectively extracts gold and copper from electronic waste
- Uses simple, recyclable organic compounds to selectively extract gold and copper
- Ability to selectively extract gold and copper with minimal impurities
- Advantages over conventional high temperature smelting
- Devices, phones, laptops and printed circuit boards
- E-waste generation estimated at 93.5 Mt by 2030 of which 80% ends up in landfill
- Approx 200–350 grams of gold in one metric tonne of e-waste
- Amount of gold in e-waste is 100 times higher than in natural gold ore
- Gold content is worth US$46,320 pt e-waste (300g/t @ US$4,800 /oz)
- Copper in e-waste ranges from 50–270 kg per tonne
- Copper content is worth US$2,064 pt e-waste (160 kg/t @ US$12,900 /t)
- Complements LU7's silver extraction technology from PV recycling

Lithium Universe Limited (ASX: LU7) ("Lithium Universe" or "the Company") is pleased to announce that it has secured an exclusive global licence from the University of Edinburgh for a breakthrough process to **recover gold and copper from waste computers, phones, and circuit boards (e-waste)**. E-waste generation is estimated to be about **93.5 Mt by 2030 of which 80%**[1] ends up in landfill.

Developed by the University of Edinburgh's School of Chemistry, supported by Edinburgh Innovations, the patented process exploits a simple, reusable organic diamide to selectively capture and precipitate gold from complex acidic solutions generated from circuit boards and electronic waste.

1. International Renewable Energy Agency & International Energy Agency Photovoltaic Power Systems Programme (2016), End-of-Life Management: Solar Photovoltaic Panels.

Following gold recovery, copper is extracted using a dedicated copper-precipitating agent (pyrazine-2,3-dicarboxylic acid, PDCA), enabling the recovery of high-quality copper from the remaining acidic solution. Together, these two steps allow for the selective recovery of the two most valuable metals in e-waste without the need for high-temperature treatment or energy-intensive processes typically required in conventional smelting or pyrolysis methods. The technology is known as the **Gold Copper Diamide Extraction (GCDE)** process.

While the sustainable recycling of these materials is complex and often uses environmentally unsustainable methods, the development of new hydrometallurgical processes for e-waste recycling has received recent attention because of the potential reduction in environmental impact, suitability for small scale applications, and low capital cost. In this context, highly selective, reusable precipitation methods are becoming popular as they offer advantages over traditional, single-use precipitants and avoid the use of organic solvents required in solvent extraction technologies.

Currently, **93.5 million tonnes of e-waste** are generated globally each year, with waste printed circuit boards (PCBs) accounting for approximately 50 million tonnes. E-waste is a concentrated source of base metals such as iron, nickel, copper, tin, and zinc as well as many high value noble metals that include silver, gold, platinum, and palladium. In particular, the **Cu content of waste PCBs is 20% by weight**, while the **Au content of waste mobile phones is up to 1200 g/t**; these concentrations are far higher than those found in natural Cu- and Au-containing minerals.

Electronic waste represents a high-grade "urban ore". Gold is applied to PCB edge connectors ("gold fingers"), contact pads, switch contacts, thin protective board coatings, and the fine bonding wires linking chips to their packages. Although present in small quantities, gold is essential because of its excellent conductivity, resistance to corrosion, and long-term connection reliability.

Copper, by contrast, forms the backbone of the circuitry. It is used extensively in internal wiring and PCB layers, charging ports and connectors, battery terminals, inductors and small coils, and in some designs as heat spreaders to manage power and thermal loads. Copper content is significant, typically ranging from 50–270 kg per tonne of circuit boards, making e-waste an attractive and valuable source of metal recovery.

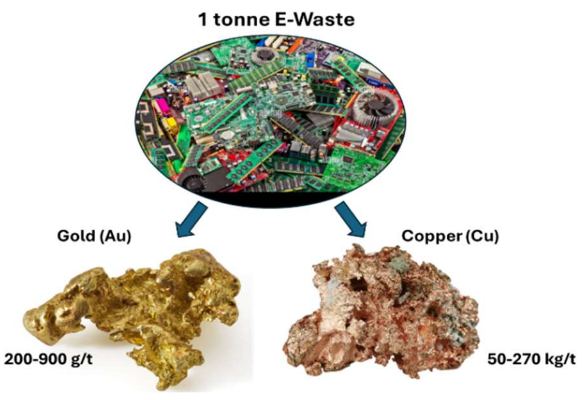

Figure 1 – Typical amounts of Gold and Copper in E-Waste

Figure 2 – Gold Content in E-Waste Compared with Gold Mines

PRICE OF GOLD AND COPPER

The price of gold reached a record high in late 2025 and is currently trading at US$4,800 /oz. There is approximate 200–350 grams of gold in one metric tonne of E-waste. The content of gold in printed circuit boards can be as high as 900 grams per tonne of electronic waste. At the average gold content of 300 grams per tonne and the current trading price the gold content in a single tonne of E-waste is worth US$46,320 per tonne for just the gold content without factoring in recoveries.

Copper in E-waste ranges widely between 50 kg and 270 kg per tonne. The current LME price of copper is trading at around US$12,900 per tonne and assuming at average content of 160 kg /t the copper content is worth US$2,064 per tonne.

THE SCALE OF THE E-WASTE PROBLEM

Driven by rapid technological turnover and consumer demand, e-waste has become the fastest-growing hazardous solid-waste stream globally. E-waste generation is on track to rise from 62 Mt in 2022 to about 82 Mt by 2030 — a ~32 % increase. However, only about 20% of e-waste is formally recycled using environmentally sound practices, while the remainder is dumped or sent to developing countries for crude processing that releases toxic pollutants.

The low recycling rate stems from the complex mixture of metals and polymers in e-waste, which makes separation difficult and costly. The conventional method of extracting gold from e-waste (especially printed circuit boards) is based on high-temperature smelting or chemical leaching, both of which are energy-intensive and chemically aggressive. Shredded e-waste is smelted in a 1,200–1,400°C furnace, where plastics burn off and base metals melt. Copper acts as a collector metal, dissolving gold and other precious metals into a molten alloy. The copper is then electrolytically refined, with gold concentrating in the anode slime, which is subsequently processed to recover pure gold.

GCDE technology which comprises **selective organic ligand extraction** represents a fundamental shift away from bulk smelting and toward **targeted, low-energy molecular chemistry**. GCDE uses a specially designed organic ligand (diamide) that selectively binds gold ions at low (often room) temperature. The process targets gold specifically, leaving base metals such as iron, aluminium and other impurities largely untouched, resulting in high selectivity and minimal co-precipitation of unwanted metals.

GCDE TECHNOLOGY

The University of Edinburgh's innovation centres on a class of organic molecules known as tertiary diamide ligand; small, reusable compounds that act like selective "magnets" for valuable metals such as gold. When electronic waste (for example, old circuit boards) is dissolved in a mild acid, the result is a solution containing many metal ions; gold, copper, tin, iron, and others. Separating these metals has traditionally required multiple chemical steps involving harsh reagents and toxic waste.

STAGE 1 – GOLD EXTRACTION

The electronic circuit board feedstock is produced using conventional, off-the-shelf e-waste recycling equipment, with multiple established suppliers available globally. In a typical process, mixed electronic waste is shredded, ground and mechanically separated into various material streams. One of the key output fractions is a concentrated printed circuit board (PCB) stream, from which plastics, insulated cables, ferrous metals and other non-ferrous materials have been removed. See Figure 3.

Figure 3 – Typical E-Waste recycling plants separating electronic boards

In the **GCDE process**, electronic circuit boards are halide leached at room temperature to dissolve the metals, with gold and copper converting into soluble chloride complexes such as $HAuCl_4$ and $CuCl_2$ in solution.

In the University of Edinburgh process, the specially designed diamide molecule functions as a smart, reusable precipitator for gold dissolved in acidic solutions derived from e-waste. When electronic scrap is leached with HCl acid, gold enters solution as the tetrachloroauric acid, $HAuCl_4$.The diamide ligand contains two amide groups with nitrogen and oxygen donor atoms (See Figures 6,7) that are protonated to selectively recognise the gold ion. When the diamide is added to the leach solution, Au forms a complex with diamide, which is insoluble and rapidly precipitates as a distinct yellow solid, while base metals such as copper, iron and nickel remaining dissolved in solution. The gold complex can then be washed with water to form a pure $HAuCl_4$ solution which is further refined to produce metallic gold, and the diamide reagent recovered for reuse multiple times (See Figure 4 and 5). This high level of selectivity arises from a favourable "soft–soft" bonding interaction between the gold ion and the cationic receptor. Operating under mild conditions and avoiding toxic reagents such as cyanide, mercury, and organic solvent, the process offers an environmentally responsible and energy-efficient method for recovering gold from e-waste.

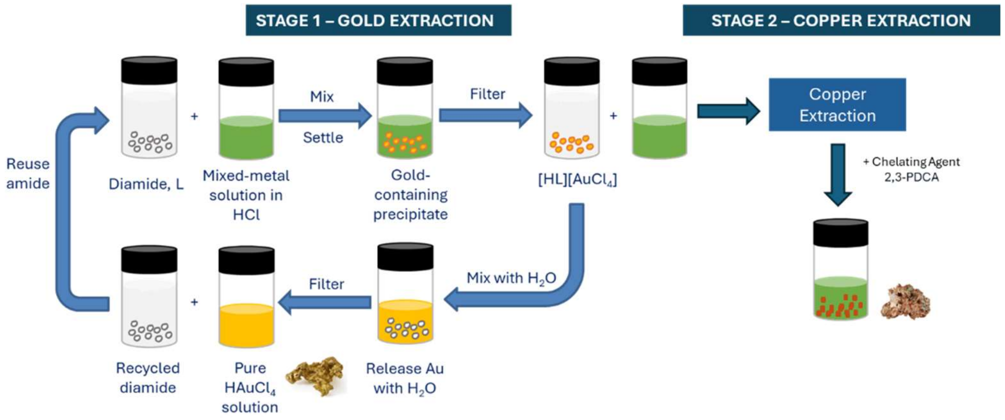

Figure 4 – GCDE Process of selectively extracting gold and copper using amide ligands

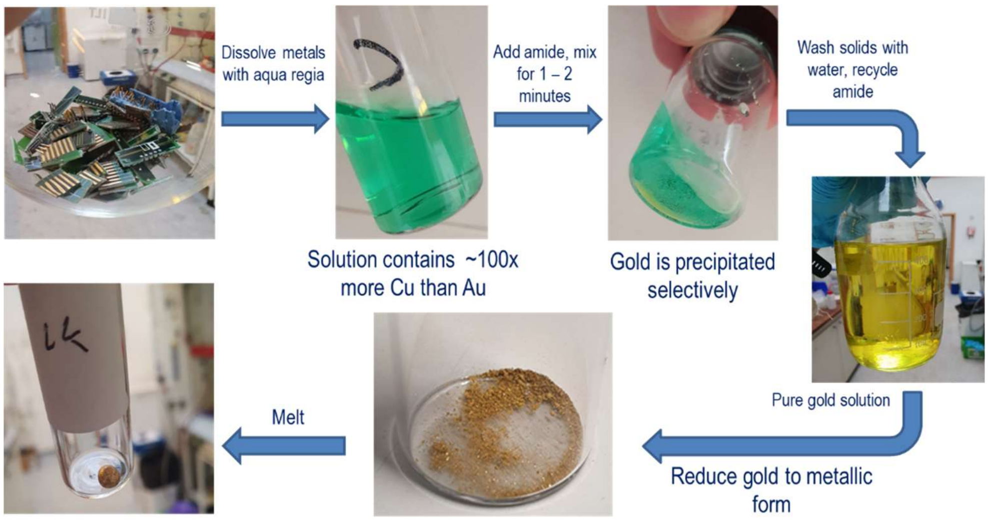

Figure 5 – Photos of Stage 1 Gold Extraction Process

The Edinburgh process uses a diamide compound that selectively interacts to gold ions, while ignoring other impurity metals such as copper, iron, or nickel. This precise molecular recognition causes only the target metals to form insoluble complexes, leaving impurities dissolved in the leach solution. As a result, it enables the direct separation of high-purity gold under mild, environmentally safe conditions without further purification steps.

DIAMIDE LIGAND - HOW DOES IT WORK?

A diamide is a **compound with two amide groups** (see Figure 6) whose oxygen atoms are protonated under the acidic conditions to form a cationic ribbon polymer that interacts preferentially with the tetrachloroaurate anions over other metals (see Figure 7).

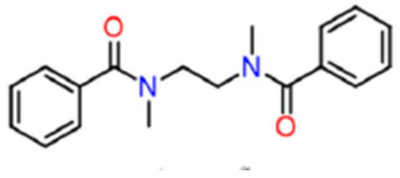

Figure 6 - Chemical structure of Diamide

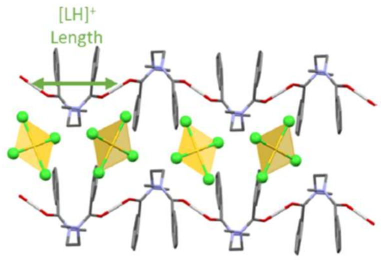

Figure 7 - Diamide extracting gold (yellow) $AuCl_4$

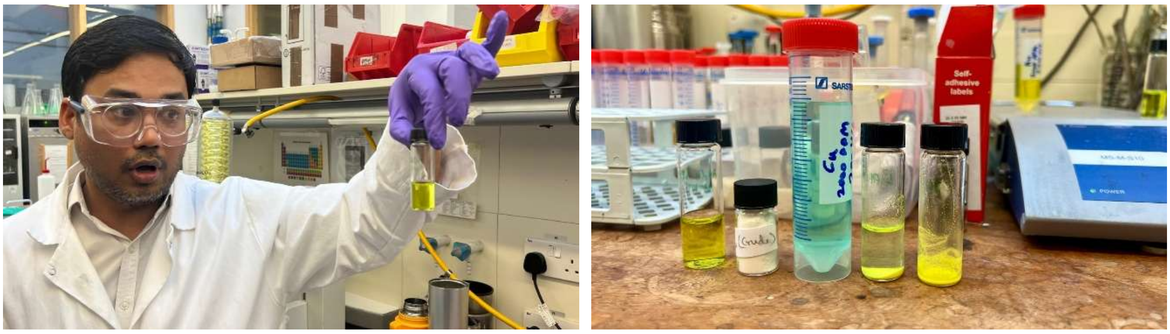

Photo: Edinburgh School of Chemistry Research Team

STAGE 2 – COPPER EXTRACTION

After the gold has been selectively removed from the acidic e-waste leach solution, the remaining liquor typically contains high concentrations of dissolved copper (as Cu^{2+}), along with smaller amounts of iron, aluminium and other base metals. At this stage, **2,3-PDCA (pyrazine-2,3-dicarboxylic acid)** is introduced as a selective copper chelating agent. 2,3-PDCA contains two carboxylic acid groups and a nitrogen-containing aromatic ring. In acidic solution, it coordinates strongly with Cu^{2+} ions, forming a stable copper–ligand complex. The molecular geometry and electron-donating sites of 2,3-PDCA favour copper binding over many competing metal ions, providing useful selectivity in mixed-metal systems typical of PCB leachates.

The ditopic nature of 2,3-PDCA means that its copper complex selectively precipitates from solution, allowing for straightforward isolation. The copper can be released from the ligand electrochemically or through chemical stripping.

Because this step operates at relatively low temperature and moderate acidity, it avoids the high-energy inputs of pyrometallurgical smelting. Importantly, copper is recovered after gold in a staged hydrometallurgical sequence, improving metal purity and reducing cross-contamination. The approach enables production of **high-quality copper** from complex acidic e-waste streams while lowering energy consumption and reagent intensity compared with conventional furnace-based methods.

EDINGBURGH UNIVERSITY TEAM

The inventors of the GCDE technology from the Edinburgh University School of Chemistry are Professor Jason Love and Professor Carole Morrison. The inventors have extensive interest in metal extraction and recycling processes and experience of studying the chemistry that underpins all aspects of metal recovery processes including base and precious metals. Their focus and interest targeted the extraction of precious metals from e-waste and in 2021, published a paper entitled “Gold extraction and recycling by selective precipitation” in the Nature Communications. In 2022, they applied for a patent that covered Europe and USA. Professors Love and Morrison were winners of the Anders Gustav Ekeberg Prize in 2020. Lithium Universe is fortunate to be able to secure the licence and rights to commercialise this unique technology.

Photo: LU7 Management with Inventors and Licensing Team

LICENCE AGREEMENT

Lithium Universe entered into an exclusive worldwide licensing agreement with the University of Edinburgh to commercialise its patented gold/copper extraction technology (GCDE), with patent applications pending in Europe and the United States. Under the agreement, Lithium Universe has the exclusive rights to use, commercialise and sub licence the technology. In return, the University is entitled to a commercial royalty of between 2–3% on revenues generated from the extraction of metals by the technology.

The licence term continues for the shorter of the remaining life of the last patent or 20 years from the Commencement Date. Financial consideration includes an upfront payment of £20,000, reimbursement of approximately £25,000 in patent registration costs (payable 6 months from Commencement Date), and an annual licence fee of £15,000 due on first anniversary of agreement signing.

Lithium Universe will pay a 3% royalty to Edinburgh University on its annual gross revenue derived from metal products produced using the technology. Any approved sublicensees will pay 20% of any royalty fees to the Edinburgh University and 80% to Lithium Universe Limited.

In addition, milestone payments of £100,000 are payable upon Final Investment Decision (FID) for a pilot plant, £100,000 upon commissioning and start-up, and £100,000 upon first commercial sale.

EXECUTIVE CHAIRMAN COMMENT

"Our strategy is built around two complementary divisions, each addressing critical gaps in the global energy transition. The first is our core lithium refining business, where we are focused on closing the lithium conversion gap in North America through the development of merchant lithium carbonate refineries. This remains our primary focus, underpinned by strong market fundamentals and a clear pathway to commercialisation.

Alongside this, we have established a Precious Metals Recovery Division targeting high-value metals from photovoltaic (PV) solar panels and electronic waste. This division is driven by a simple rationale: the energy transition is not only about producing new materials, but also recovering valuable metals already in circulation. With growing volumes of end-of-life solar panels and e-waste, there is a clear opportunity to apply advanced, low-impact technologies to extract silver and other metals efficiently and sustainably. Importantly, this initiative does not detract from our lithium strategy. It is being advanced in parallel using a disciplined, modular approach with limited capital intensity at the early stage. If successful, it provides significant upside optionality—either as an integrated business within the Company or as a standalone entity that could be spun out to unlock shareholder value".

PROFESSOR JASON LOVE COMMENT

"We are delighted to partner with and license our gold and copper extraction technology to Lithium Universe. The Company brings significant experience in scaling innovative processing technologies from laboratory development through to commercial deployment. There are clear synergies with Lithium Universe's existing silver extraction technology and its strong chemical engineering and project delivery expertise.

We will work closely with the Company to advance the development of a pilot plant and accelerate the pathway to commercialisation. We look forward to bringing this technology to market together."

Watch the GCDE Explainer
https://youtu.be/O__fW8jLzLU

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About Lithium Universe Limited (LU7)

Lithium Universe (ASX: LU7) is an emerging lithium development company focused on building a fully integrated lithium supply chain in North America. The company's flagship asset is the Brownsville Lithium Refinery project in Québec, which aims to produce battery-grade lithium carbonate using spodumene feedstock sourced from within Canada. LU7 is led by a world-class team with extensive experience in lithium refining, project delivery, and global supply chain integration.

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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Forward-looking Statements

This announcement contains forward-looking statements which are identified by words such as 'anticipates', 'forecasts', 'may', 'will', 'could', 'believes', 'estimates', 'targets', 'expects', 'plan' or 'intends' and other similar words that involve risks and uncertainties. Indications of, and guidelines or outlook on, future earnings, distributions or financial position or performance and targets, estimates and assumptions in respect of production, prices, operating costs, results, capital expenditures, reserves and are also forward-looking statements. These statements are based on an assessment of present economic and operating conditions, and on a number of assumptions and estimates regarding future events and actions that, while considered reasonable as of the date of this announcement and are expected to take place, are inherently subject to significant technical, business, economic, competitive, political and social uncertainties and contingencies. Such forward-looking statements are not guarantees of future performance and involve known and unknown risks, uncertainties, assumptions and other important factors, many of which are beyond the control of our Company, the Directors, and management. We cannot and do not give any assurance that the results, performance or achievements expressed or implied by the forward-looking statements contained in this announcement will occur and readers are cautioned not to place undue reliance on these forward-looking statements. These forward-looking statements are subject to various risk factors that could cause actual events or results to differ materially from the events or results estimated, expressed, or anticipated in these statements.

ABOUT LITHIUM UNIVERSE LIMITED

Lithium Universe Limited (ASX: LU7) ("Lithium Universe" or "the Company") 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.

SILVER EXTRACTION - PV SOLAR PANEL RECYCLING STRATEGY

As the global demand for solar energy expands, solar panel waste is projected to reach 60–78 million tonnes by 2050, making efficient recycling solutions critical. Silver is essential for solar panels, electronics, and electric vehicles due to its unmatched electrical conductivity. Industrial demand has surged, especially from photovoltaics and AI technologies, creating a global supply deficit. With production lagging, silver prices have soared, reinforcing the economic importance of efficient recycling.

Lithium Universe has responded by acquiring Macquarie University's Microwave Joule Heating Technology (MJHT) and Jet Electrochemical Silver Extraction (JESE) method, a breakthrough in recovering valuable metals from end-of-life PV panels. The first stage, developed by Macquarie University, is Microwave Joule Heating Technology (MJHT), a process that uses microwave energy to selectively heat silicon cells softening the ethylene vinyl acetate (EVA) encapsulant that binds a solar panel's layers. This enables room-temperature delamination of glass, silicon, and metal layers without crushing, furnaces, or toxic chemicals. The result is a clean separation of materials, drastically reducing energy use, emissions, and chemical waste while preserving the integrity of high-value silicon and silver components. Following delamination, Lithium Universe applies its Jet Electrochemical Silver Extraction (JESE) process, a micro-jet electrochemical system that directs a fine stream of dilute nitric electrolyte onto the silver pads of solar cells. This method achieves over 95% silver recovery at 96% purity, while using 83% less acid and no chemical additives. The process operates at just 5 volts, recycles its electrolyte, and produces zero heavy-metal waste, establishing a true closed-loop recycling system. Together, MJHT and JESE form a sustainable, scalable recycling platform that converts discarded solar panels into a renewable source of silver, silicon, and other critical materials, a vital step toward circularity in the global clean-energy supply chain.

LITHIUM DIVISION

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 planning to build 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.

Second Refinery Strategy

Lithium Universe Limited has launched a second lithium refinery strategy in the Port of Brownsville, Texas, complementing its planned flagship Bécancour project in Québec. The initiative creates a binational refining platform to address North America's lithium conversion shortage and strengthen supply chain resilience. Strategically located near the Port of Brownsville, the site offers deep-water access, low labour costs, and streamlined permitting within one of the U.S.'s most business-friendly regions. Leveraging a "copy and paste" design from the proven Bécancour refinery, the Texas project can be rapidly deployed to serve nearby gigafactories, aligning with U.S. policy incentives under the Inflation Reduction Act.