Graphene Manufacturing Group

ENERGY SAVING AND ENERGY STORAGE SOLUTIONS

www.graphenemg.com | TSXV:GMG

October 2022

Graphene Manufacturing Group

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Graphene Manufacturing Group

BOARD OF DIRECTORS & ADVISORY TEAM

Craig Nicol (Founder, Managing Director & CEO)

Craig Nicol has a career of over 20 years in delivering large scale innovation including leading multi-billion-dollar gas and LNG value chains in Australia and Asia Pacific and managing sales and marketing teams across Asia Pacific working for Shell International. Craig has a Bachelor of Engineering degree in Manufacturing Systems (Honours) and a bachelor's degree in Business Marketing from the Queensland University of Technology. Craig is a member of the Australian Institute of Company Directors (AICD).

Guy Outen (Chair & Director)

Guy Outen has over 35 years of experience with Royal Dutch Shell plc in various roles including EVP Strategy & Portfolio where he worked with the Shell CEO and Board to create amongst other outcomes Shell's New Energies focusing on lower emissions. Guy Outen has a Bachelor of Commerce (Honours) and a Masters of Commerce (Economics) from Melbourne University. Guy Outen is a Senior Advisor to Boston Consulting Group, a Fellow Australian Society of Certified Practicing Accountants (FCPA) and Chartered Governance Institute (FCG); a Member of the Institute of Directors UK and the Australian Institute of Company Directors (AICD).

Frederick Kotzee (CFO & Director)

Frederick Kotzee is a chartered accountant with more than 20 years of public markets company experience leading financial operations and strategic planning for multinational companies. Through his career, Frederick has held various positions in the Anglo American Group, where his roles included General Manager of Corporate Finance, Head of Business Development at Anglo Platinum and then CFO of Kumba Iron Ore. Frederick was the CFO of the Australian-listed Kidman Resources Limited where he successfully secured financing and offtake agreements as well as supporting the company's ultimate acquisition.

Rob Shewchuk (Director)

Rob Shewchuk has over 25 years of experience in executive and director experience. Rob is based in Calgary, Alberta, Canada. Rob is the President & CEO of LithiumBank Resources Corp, Director of GMG, Director of Spectre Capital Corp, and Director of Verses Technologies Inc. Rob began his career as an Equities Trader on the floor of the Alberta Stock Exchange in 1995 for Yorkton Securities Inc. Rob became a licensed broker at Yorkton in 1998 and worked on the Equities desk through 2004. Rob joined Standard Securities Capital Corporation where he became Chairman in 2006. Rob merged Standard Securities with Wolverton Securities Ltd in 2009 and became a Director of Wolverton Securities until 2016 when it was purchased by PI Financial Corp.

Emma FitzGerald (Director)

Emma FitzGerald has 25+ years of leadership experience with global businesses in the Water and Energy Sectors. Most recently she was CEO of Puma Energy focused on delivering affordable and sustainable energy solutions to emerging markets in Africa, Central America and Asia. Prior to this she ran gas, water and waste networks for National Grid and Severn Trent in the UK. She also spent many years running Downstream Retail, Lubricants and LPG businesses for Shell plc. around the world. Over the last ten years she has served on the boards of publicly listed, privately owned and not for profit organizations in both Executive and Non Executive Director capacities.

Will Ollerhead (Director)

Will Ollerhead has over 30 years of experience in the capital markets and corporate finance field. Mr. Ollerhead was the CEO of Cuspis Capital Ltd. and has served on several other boards of both public and private companies, and not-for profit organizations, as chairman, director, and as a member and chair of audit committees. He has operated Ollerhead Capital since its founding in 1997, providing corporate finance advisory services and managing a private investment portfolio.

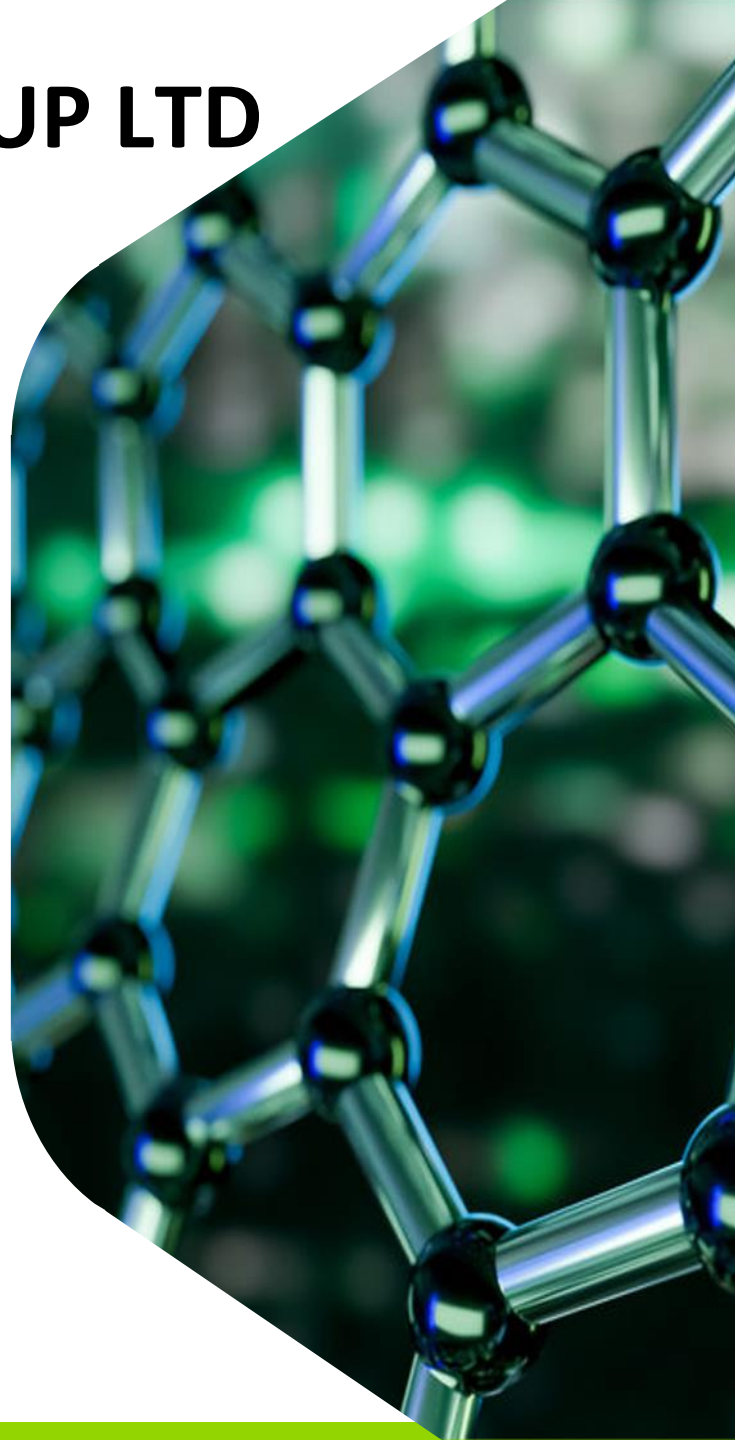
Bob Galyen (Advisor)

Bob is a highly experienced executive in the battery energy storage world and science/engineering-based communities. Bob was previously the Chief Technology Officer (CTO) of Contemporary Amperex Technology Company Limited (CATL). CATL is widely known as the largest lithium ion battery manufacturer in the world – supplying electric vehicles and high efficiency storage systems. He serves on multiple Committees of Directors and Technical Advisory Boards.

Professor Dan Brett (Advisor)

Dan is Professor of Electrochemical Engineering at the University College London (UCL), a top ranked University, where he is a director of the Electrochemical Innovation Lab (EIL) and Advanced Propulsion Lab (APL). He is an academic founder of the Faraday Institution (a UK battery research programme with a consortium of over 20 UK universities and 50 businesses – including 450 researchers) and member of its Expert Panel.

GRAPHENE MANUFACTURING GROUP LTD



- Is a **disruptive clean-technology** company that has recently listed on TSX-V under the symbol GMG.
- Led by former Shell Executives, the Company has developed and proved its own proprietary process to produce graphene from readily available low-cost natural gas feedstock. The final result is **high quality, low cost, scalable, tuneable and low / no contaminant graphene**.
- The proprietary process is held as a trade secret with a number of product patents.
- Targeting globally critical **Energy Savings And Energy Storage Solutions** applications
- Marketing Energy Savings products, developing next-generation Graphene Aluminium-Ion batteries, technical and commercial opportunities

WHAT IS GRAPHENE?

THE CARBON WONDER PRODUCT

Graphene is the first two-dimensional material and is classed as a “super-material” offering many properties.

GMG focuses on its extreme thermal conductivity, enhanced lubrication and ion storage.

GMG Graphene has significant potential to enhance the performance of a wide range of materials and is expected to drive development of disruptive technologies and transform industries. It is classified as a nanomaterial (i.e. its dimension is on the nanoscale between 1-100nm) and looks like black powder.

MELTING POINT

950^0C+ Stability in oxygen free environment

WEIGHT ASPECT RATIO

Light & up to 300m2/gm of surface area

ION STORAGE

High density capacity for ion storage

THERMAL CONDUCTIVITY

Extreme Heat Diffusivity

ENHANCED LUBRICATION

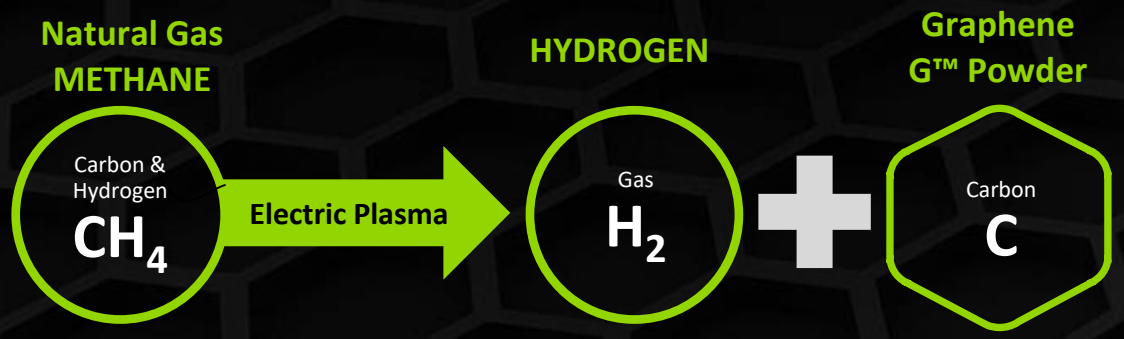
Extreme lubrication and wear reduction

TENSILE STRENGTH

Very strong when integrated into materials

GMG'S COMPETITIVE ADVANTAGE

GMG GRAPHENE PRODUCTION



OTHER GRAPHENE PRODUCTION

- ✔ Instantaneous & Continuous
- ✔ Low-Cost Inputs and Setup
- ✔ Unconstrained Fast Scalability (after validating quality)
- ✔ Controlled Definability
- ✔ High Quality Grade Graphene (University Verified)
- ✔ Cogeneration Capabilities
- ✔ Low environmental footprint

- ✘ Mining Constraints & Gestation
- ✘ Cost Inputs and Setup
- ✘ Constrained Scalability
- ✘ Variable Definability
- ✘ Impurities form Graphene Oxide
- ✘ Environmental Footprint

FROM NATURAL GAS TO FINAL PRODUCT

Competitive Advantage

Product quality is validated for the application, GMG's manufacturing process is scalable, instantaneous and uniform in quality. • Low-Cost Inputs and Setup • Unconstrained Fast Scalability

Natural Gas

We start with low-cost natural gas feedstock that is readily available

Our Proprietary Process

Cracks natural gas (methane) into Graphene and Hydrogen in a continuous process

GMG Graphene

Our process allows (after validating product quality) definable platelet size to produce to specifications enabling our product portfolio

Our Product Lines

- THERMAL-XR®™
- LUBRICANT™
- GRAPHENE ALUMINIUM-ION BATTERY

GMG'S PRODUCT MARKETS

THERMAL-XR®™

HVAC ENERGY SAVING COATINGS

Deployed

Air-Conditioning Efficiency Paint

Commencing revenue with customers in various countries

LUBRICANT™

AUTOMOTIVE FLUIDS

Development

Engine Oil Additives

Engaging prospects in Australia, SE Asia & Middle East.

GRAPHENE ALUMINIUM-ION BATTERY

ENERGY STORAGE BATTERY

Development

Developing Commercial Prototypes

University of Queensland Collaboration. Coin cell and pouch cell prototypes currently in development.

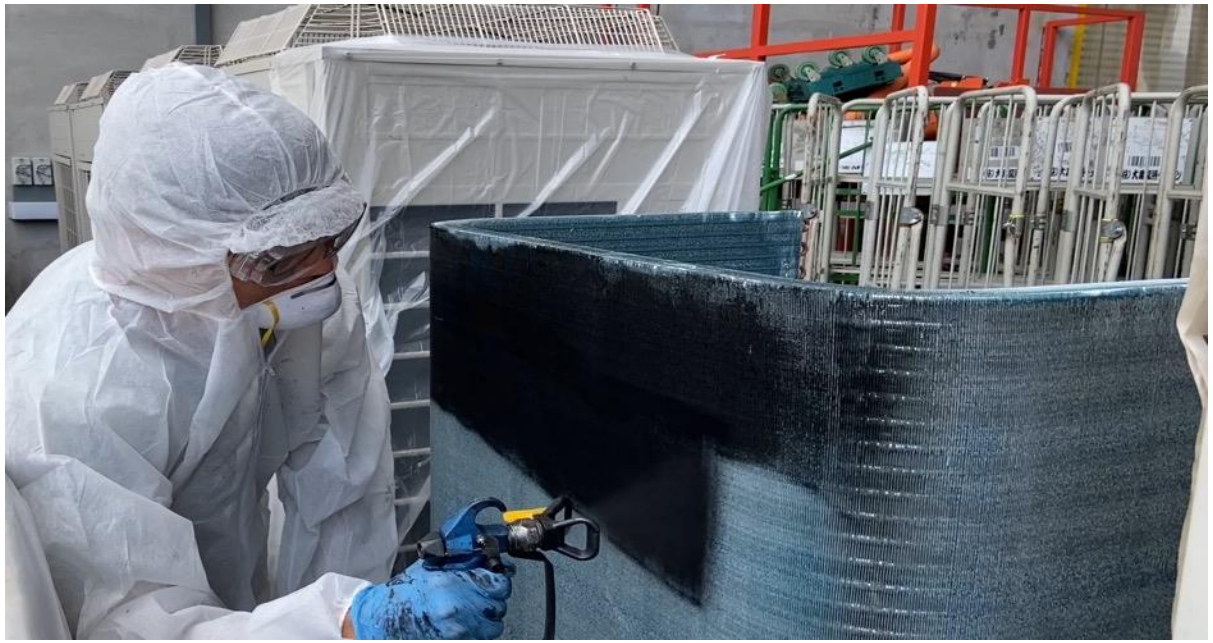
Sources: Publicly available market size data and internal Management estimates.

THERMAL-XR®

THERMAL-XR® A HVAC-R Energy Savings Coating System powered by GMG Graphene has created a unique and novel way of increasing corrosion protection, heat transfer and improving the thermal efficiency of HVAC-R equipment.

It is suitable for applying on aluminium and copper coils used in air-cooled heat exchange equipment, namely air conditioning and refrigeration.

- **Energy Savings**
- **Emission Reductions**
- **Corrosion Protection**
- **Increased Thermal Efficiency**



THERMAL-XR® MILESTONES

08 **Acquisition |** THERMAL-XR® manufacturing IP and brand rights to set the stage for global growth. GMG will buy the base coatings product from OzKem, and will manufacture the THERMAL-XR® products containing GMG graphene.

05 **Stanford University |**GMG Becomes Member Of The Thermal & Fluid Sciences Affiliates Program at Stanford University to understand the thermal transfer properties of GMG Graphene.

2022

10 **+20% Energy Savings|** Measured and verified by an independent third-party certified verification and measurement professional (CVMP).

08 **AICIS|**Awarded Australian Industrial Chemical Introduction Scheme Commercial Evaluation Authorisation By the Australian Government's Department of Health to have its Graphene approved for use as a component within industrial coatings.

2021

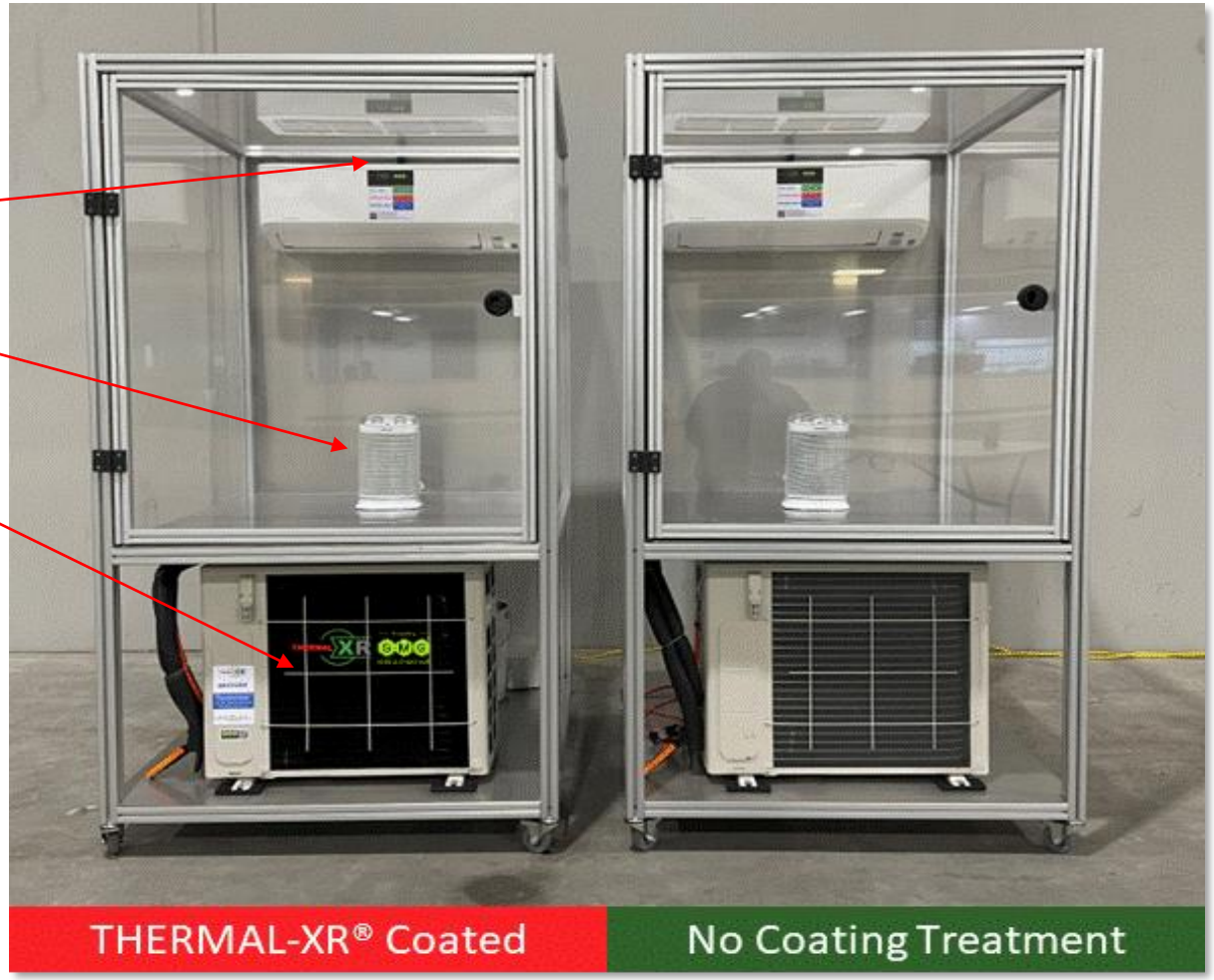
NEW AIRCONDITIONER TEST PROCEDURE

Testo smart probes monitoring and recording.

Heaters turned on to reach 45^{0}C start temperature.

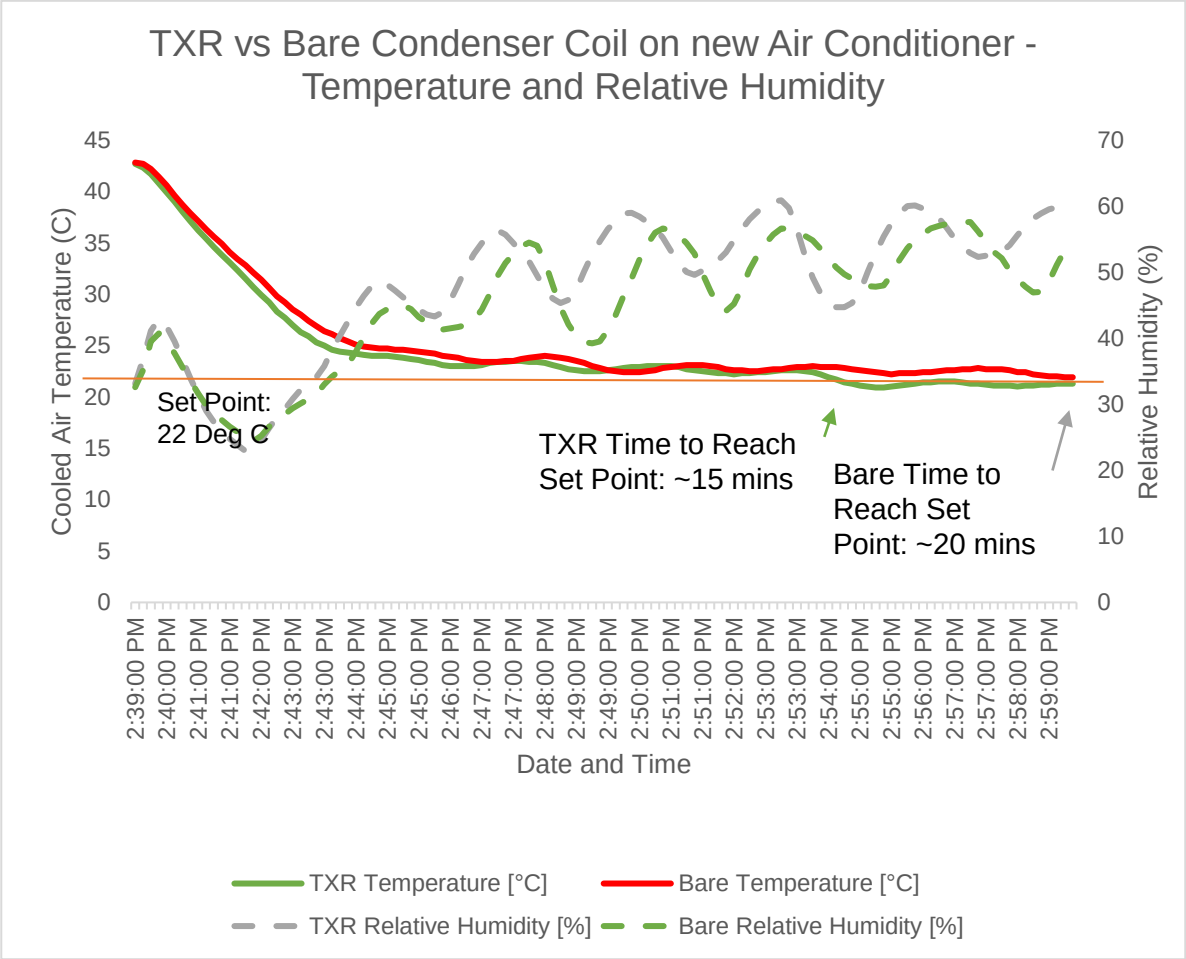
At 45^{0}C air conditioners are turned on, setpoint 22^{0}C.

Time & Energy Consumption comparison between THERMAL-XR® coated air conditioner and Non-Coated to achieve setpoint 22^{0}C.



THERMAL-XR® RESULTS

- Starting internal temperatures of 45^{0}C
- Similar or less power used by THERMAL-XR® coated air conditioner versus non coated air conditioner.
- **Average ~ 20% reduction in time to achieve setpoint 22^{0}C with THERMAL-XR®.**

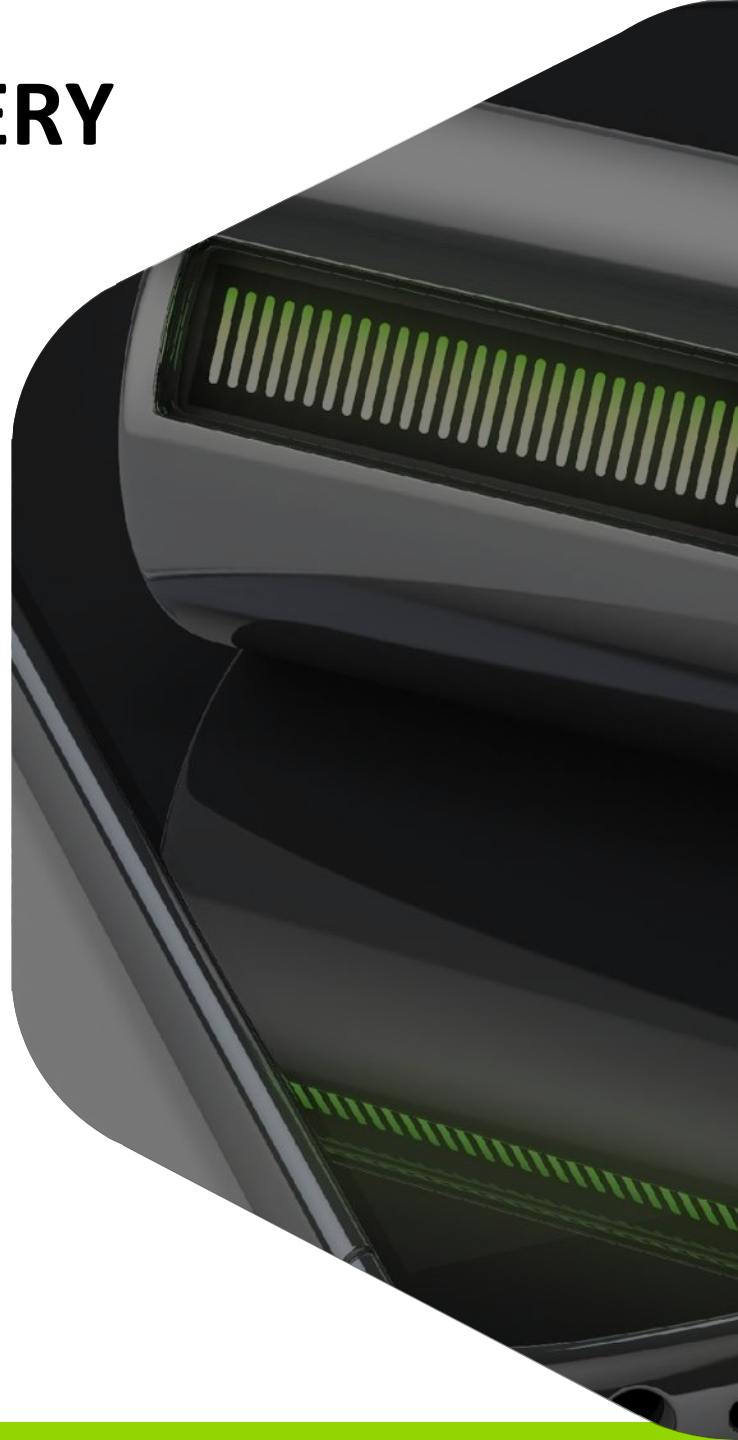


GMG Management Estimates based on multiple tests.

GRAPHENE ALUMINIUM-ION BATTERY

Following earlier collaboration, in 2021 GMG entered into a research agreement with the University of Queensland ("UQ") to develop Graphene Aluminum-Ion batteries.

Graphene Manufacturing Group Ltd was granted an ***exclusive licence of the patent-pending technology for battery cathodes.***

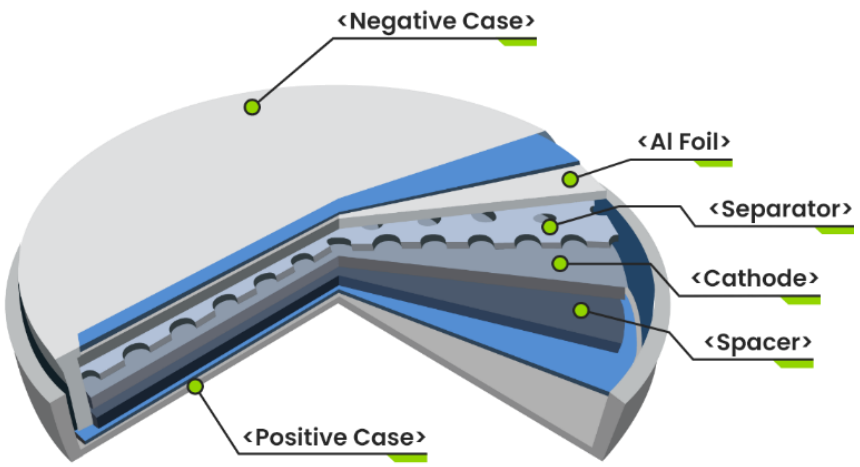


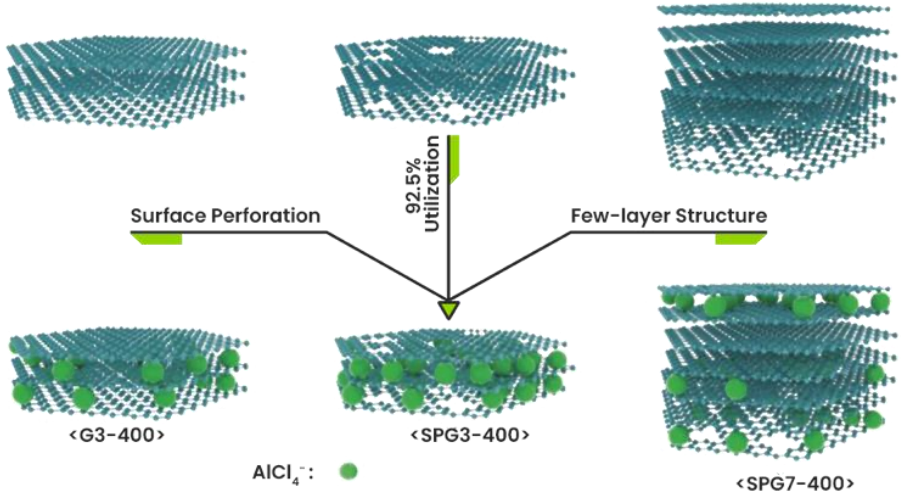
GRAPHENE ALUMINIUM-ION BATTERY – INDICATIONS SO FAR

- Compares favourably with Lithium-Ion Batteries
- Interchangeable (at 3+ volts)
- Rechargeable
- Up to 70 Times Faster-charging
- Up to 3x More Battery Life
- Greener & Safer
- No Lithium, Copper, Cobalt, Manganese or rare earth materials – uncomplicated supply chain
- Ongoing Intellectual Property collaboration between UQ & GMG

UQ NANOTECHNOLOGY

- Aluminium atoms have 3 spare electrons vs Lithium atoms with 1 spare electron.
- Aluminium-Ion batteries have up to 3 times the energy density of Lithium-Ion batteries.
- Graphene is used to store the Aluminium-Ions (atoms without spare electrons).
- Extremely fast charging and discharging – called a hybrid ***supercapacitor battery***.
- Simpler construction than Lithium-Ion batteries – predominantly Graphene and Aluminium.





UQ battery cells use nanotechnology to insert Aluminium-Ions (atoms without some electrons) inside tiny perforations in GMG Graphene platelets.

THE PATENT APPLICATION

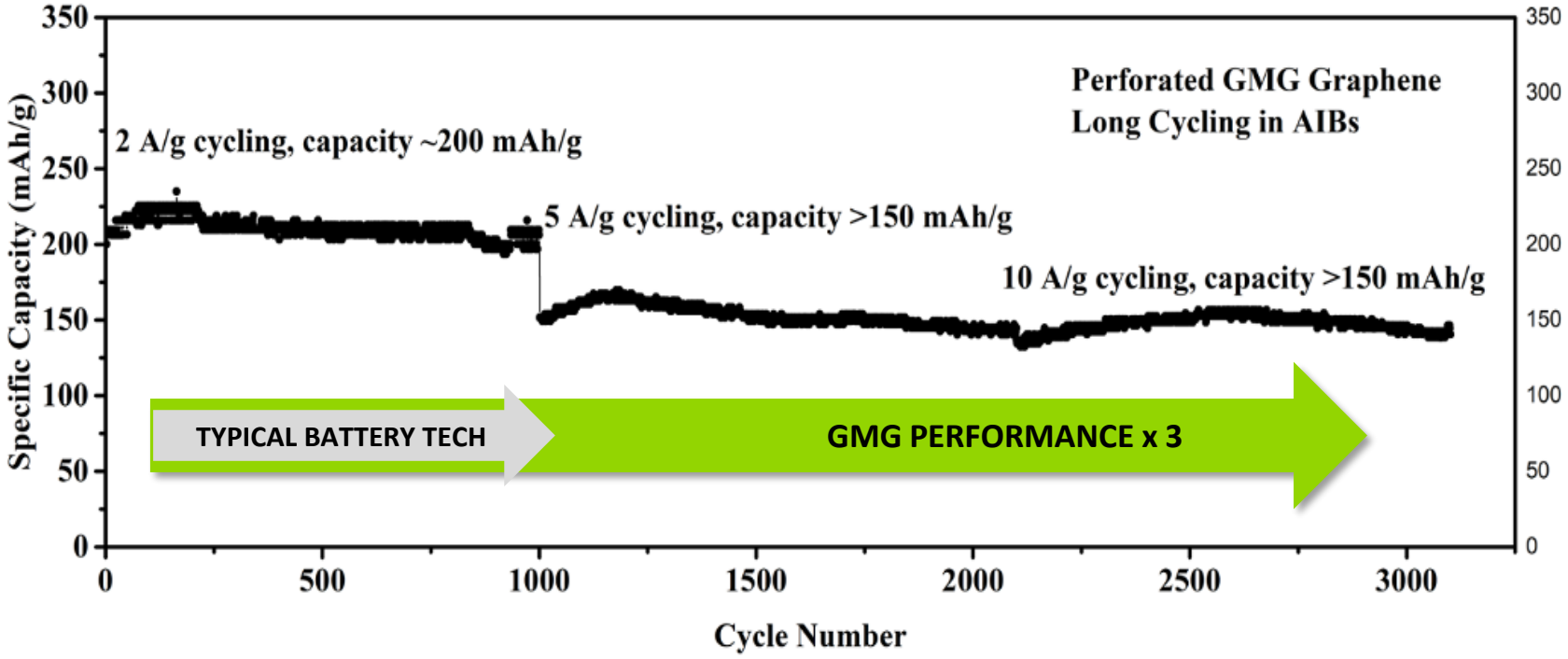
GMG's partner, The University of Queensland, **has filed a global patent application for the G+AI Battery** under the Patent Corporation Treaty.

- 20 year[1] licence agreement, between GMG and UniQuest (the commercialisation arm of UQ).
- GMG to pay Uniquest a royalty on sales of G+AI Batteries.
- This patent application is an important step in securing the intellectual property and global commercialisation rights for the G+AI Battery technology that GMG has rights to develop and deploy.

[1] The licence agreement has a term of 20 years or longer, should patents remain in place in certain countries.

2032 COIN CELL BATTERY PERFORMANCE TEST

June 2021 | The University of Queensland confirmed **a very high cycle rate** for Graphene Aluminium-Ion coin cell batteries.



HIGHLY STABLE OVER THOUSANDS OF CYCLES

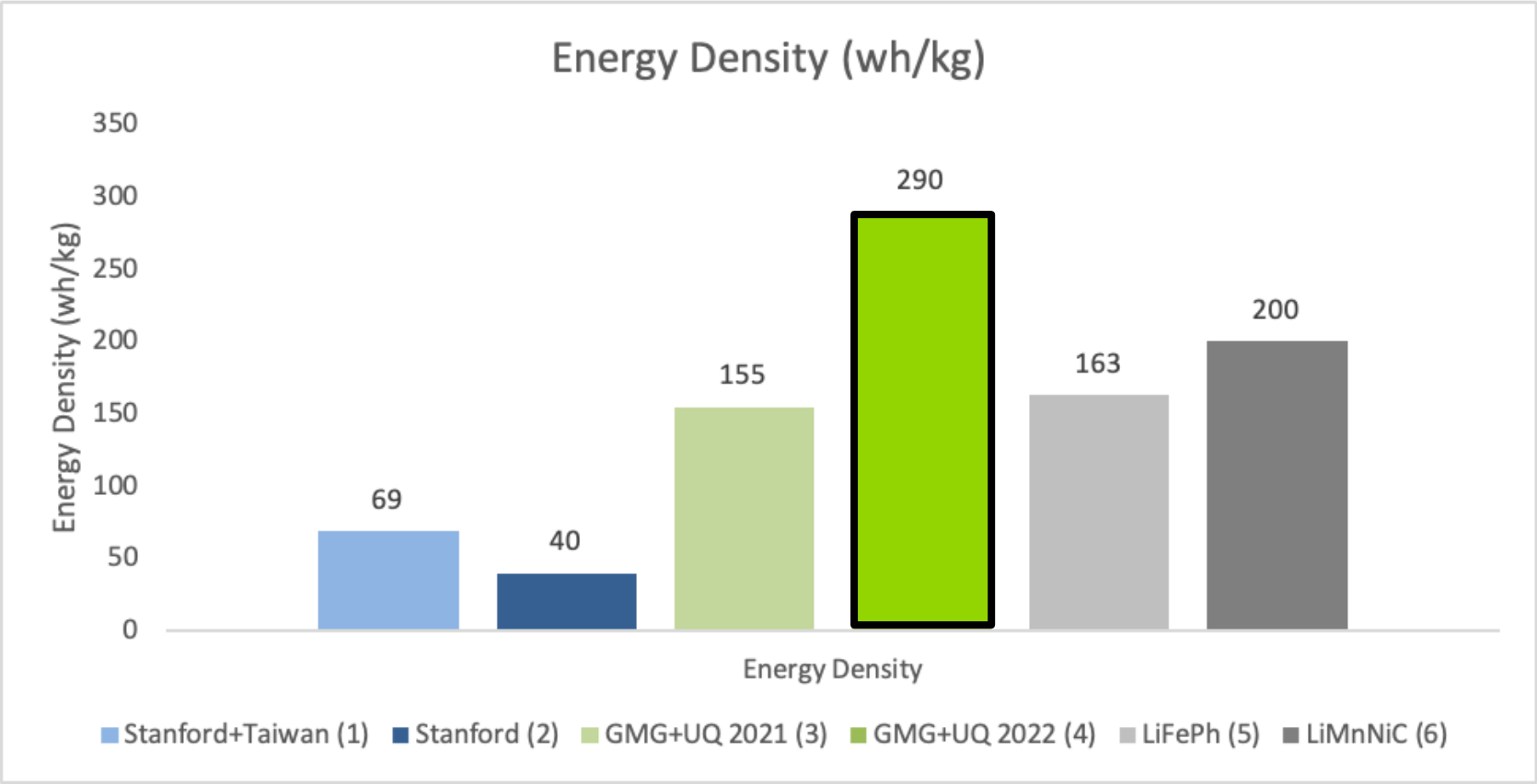
All testing was carried out on coin cells with perforated GMG graphene in aluminium ion battery at ambient temperature cycling from 2.4V to 0.5V, 1000 cycles at 10 Coulomb (2 A/g), 1000 cycles at 30 Coulomb (5 A/g), 1000 cycles at 66 Coulomb (10 A/g).

IMPROVED BATTERY TECHNOLOGY PERFORMANCE

Battery Technology	Electrode Materials	Energy Density (Wh/kg)	Power Density (W/kg)	Calculated Time to Fully Charge Average Phone Battery (minutes)
Graphene Aluminum-Ion Batteries:				
Taiwan/Stanford US[1]	Natural graphite/Al	~68.7	~41.1	60 - 110
Stanford US[2]	CVD graphitic foam/Al	40	~3000	1 - 5
GMG + UQ[3] (June 2021)	**GMG + UQ Graphene/Al**	**150-160***	**~7000**	**1 - 5**
GMG + UQ[4] (October 2022)	**GMG + UQ Graphene/Al**	**290-310***	**~9350 @ 30C**	**3**
Lithium Iron Phosphate (LFP)[5]	Lithium iron phosphate cathode	163	163 @1C	60
Lithium Manganese Nickel Cobalt Ion (NCM)[6]	Lithium Manganese Nickel Cobalt cathode	200	200 @ 1C 1603 @ 8C	60 7.5

Source: (1) Hongjie Dai, Nat. Commun., 2017, 8:14283, (2) Hongjie Dai, Nature, 2015, 520, 325, (3) and (4). University of Queensland validated GMG testing data.* (5). CATL 3.2V 150Ah LiFePO4 Battery Cell - LiFePO4 Battery (lifepo4-battery.com) on 29/09/22 (6). CATL 3.7V 65Ah NCM Lithium Battery Cell - LiFePO4 Battery (lifepo4-battery.com) on 29/09/22 7 *GMG testing data is based on industry standard estimate methodology - using a reducing factor of 2.3.

IMPROVED BATTERY TECHNOLOGY PERFORMANCE



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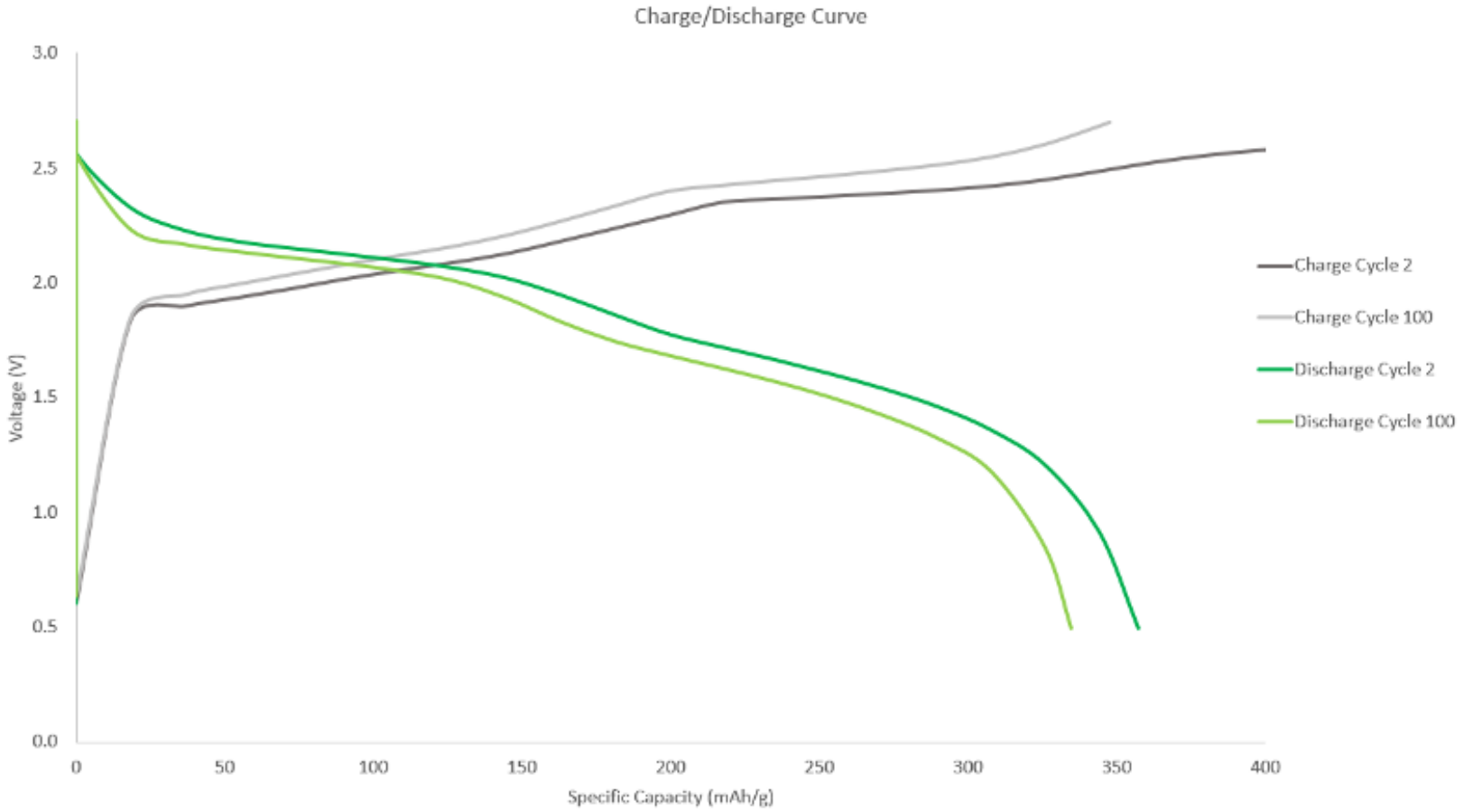
IMPROVED BATTERY TECHNOLOGY PERFORMANCE

This performance increase is from increasing the two main parameters since the Previous Announcement of ~ 61% increase in the battery's specific discharge capacity from 200 to 360mAh/gram and ~ 17% increase in the nominal voltage from 1.7 V to 2.0 V.

GMG now achieves a higher success and pass rate for the cells it makes for development and testing purposes which is a significant step towards commercial production.

The following chart show the 2 volts and specific discharge capacity of 340 - 360 mAh/gram:



Source: GMG testing. All testing was carried out on coin cells with GMG Graphene in Aluminium Ion Battery at ambient temperature cycling from 2.7V to 0.5V, 4.5 Coulomb (2.2 A/g) charge rate

REPEATABLE BATTERY-GRADE GRAPHENE MANUFACTURING & QUALITY

- Confidence is growing our scalable process to make “battery-grade graphene” in a repeatable manner. Further validation testing is underway.
- GMG has tested the battery performance with several different grades of GMG produced graphene over time in a repeatable and reproducible manner.
- GMG has increasing confidence it’s path to scale the graphene process and progress an FID study for the first coin cell battery production.

G+AI COIN CELL DEVELOPMENT

NEXT STEPS

- Further engineering and development to achieve a coin cell capacity for targeted product applications and customers.
- FID assessment for automated coin cell manufacturing and additional graphene production.
- **August 2022** | AU$1.5 M investment for expanding and relocating graphene production and Battery Development Centre.
- **2023** | Planned FID on coin cell plant.
- **2024** | First production target.

G+AI Coin Cell Prototypes

G+AI POUCH CELL DEVELOPMENT

NEXT STEPS

- Finalise the coin cell initial development.
- Update the Technology and Product Road Map and finalise the applications for the initial market/customer and the targeted capacity.
- Continual confidentiality agreements with potential customers.
- Undertake an FID assessment on an integrated gas to graphene, and automated pouch cell manufacturing site and facility.
- Progress pouch cell development.

G+AI Pouch Cell Prototypes

BATTERY MARKET & POTENTIAL APPLICATIONS

- Numerous customers including major global brands have shown interest in purchasing batteries for use in their products.
- The types of applications are broad; well-suited to the battery's potentially wide and varied performance.
- These applications can potentially utilise the battery in either Coin Cell & Pouch Cell formats.

REMOTES / IOT DEVICES

PERSONAL ELECTRONICS

SMART DEVICES/TOOLS

HOUSEHOLD & GRID STORAGE

ELECTRIC VEHICLES / AVIATION

BATTERY DEVELOPMENT MILESTONES

06 2022

Pouch Cell Development Equipment Operational. *G+AI Batteries in pouch cell format and the first pouch cells were been manufactured.*

12

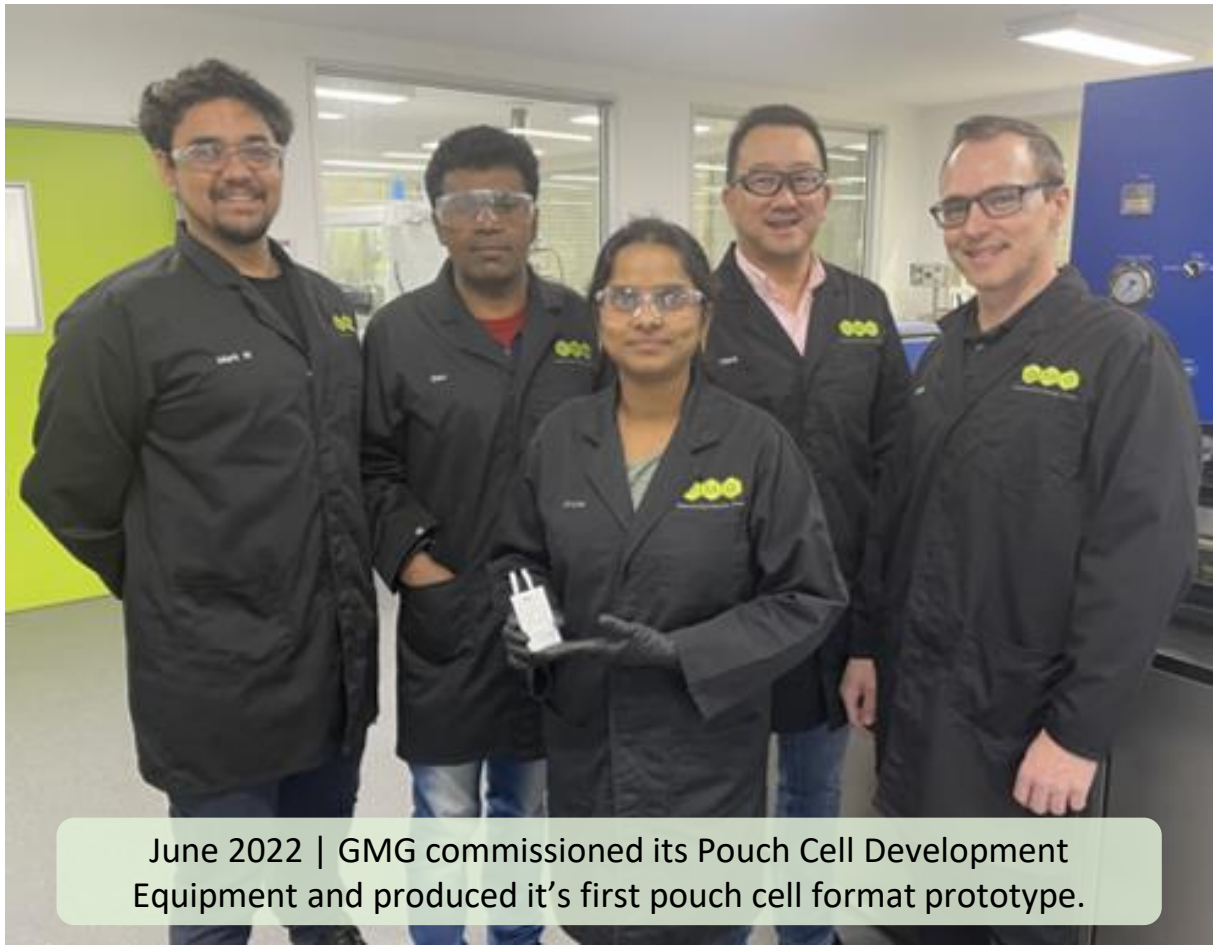
2032 Coin Cell Prototypes. *Ongoing testing and evaluation.*

12

Battery Development Centre Commissioned. *In-house development, testing, commercialisation acceleration and customer collaboration with prototypes.*

09 2021

Battery Development Centre Investment Decision.



June 2022 | GMG commissioned its Pouch Cell Development Equipment and produced it's first pouch cell format prototype.

BATTERY VALUE CHAIN PARTNERS

R&D

Graphene Aluminium-Ion Battery Development

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

Key Input Materials Aluminium Products

RioTinto

Scaling and automating of our proprietary Graphene Manufacturing Process

wood.

G+AI Battery Manufacturing at Scale

BOSCH Invented for life

Product Development & Global Sales

Ongoing Discussions with Major Global Brands

GMG SHARE STRUCTURE

- **Ticker: TSXV - GMG**
- **Shares Outstanding** *(23/9/22)*: **79,078,586**
- **Market Capitalization** *(6/10/22)* **~C$238M**
- **Options** *(23/9/22)*: **4,498,559**
- **Warrants** *(23/9/22)*: **2,781,887**
- **Cash at Bank** *(30/6/22)*: **~A$12.3M**

Graphene Manufacturing Group

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