AUSTRALIAN
RESEARCH
INDEPENDENT INVESTMENT RESEARCH

# Latrobe Magnesium Limited

# (ASX: LMG)

Initiating Coverage

December 2016

INDEPENDENT
INVESTMENT RESEARCH

## WHO IS IIR?

Independent Investment Research, "IIR", is an independent investment research house based in Australia and the United States. IIR specialises in the analysis of high quality commissioned research for Brokers, Family Offices and Fund Managers. IIR distributes its research in Asia, United States and the Americas. IIR does not participate in any corporate or capital raising activity and therefore it does not have any inherent bias that may result from research that is linked to any corporate/ capital raising activity.

IIR was established in 2004 under Aegis Equities Research Group of companies to provide investment research to a select group of retail and wholesale clients. Since March 2010, IIR (the Aegis Equities business was sold to Morningstar) has operated independently from Aegis by former Aegis senior executives/shareholders to provide clients with unparalleled research that covers listed and unlisted managed investments, listed companies, structured products, and IPOs.

IIR takes great pride in the quality and independence of our analysis, underpinned by high caliber staff and a transparent, proven and rigorous research methodology.

**INDEPENDENCE OF RESEARCH ANALYSTS**

Research analysts are not directly supervised by personnel from other areas of the Firm whose interests or functions may conflict with those of the research analysts. The evaluation and appraisal of research analysts for purposes of career advancement, remuneration and promotion is structured so that non-research personnel do not exert inappropriate influence over analysts.

Supervision and reporting lines: Analysts who publish research reports are supervised by, and report to, Research Management. Research analysts do not report to, and are not supervised by, any sales personnel nor do they have dealings with Sales personnel

Evaluation and remuneration: The remuneration of research analysts is determined on the basis of a number of factors, including quality, accuracy and value of research, productivity, experience, individual reputation, and evaluations by investor clients.

**INDEPENDENCE – ACTIVITIES OF ANALYSTS**

IIR restricts research analysts from performing roles that could prejudice, or appear to prejudice, the independence of their research.

Pitches: Research analysts are not permitted to participate in sales pitches for corporate mandates on behalf of a Broker and are not permitted to prepare or review materials for those pitches. Pitch materials by investor clients may not contain the promise of research coverage by IIR.

No promotion of issuers' transactions: Research analysts may not be involved in promotional or marketing activities of an issuer of a relevant investment that would reasonably be construed as representing the issuer. For this reason, analysts are not permitted to attend "road show" presentations by issuers that are corporate clients of the Firm relating to offerings of securities or any other investment banking transaction from that our clients may undertake from time to time. Analysts may, however, observe road shows remotely, without asking questions, by video link or telephone in order to help ensure that they have access to the same information as their investor clients.

Widely-attended conferences: Analysts are permitted to attend and speak at widely-attended conferences at which our firm has been invited to present our views. These widely-attended conferences may include investor presentations by corporate clients of the Firm.

Other permitted activities: Analysts may be consulted by Firm sales personnel on matters such as market and industry trends, conditions and developments and the structuring, pricing and expected market reception of securities offerings or other market operations. Analysts may also carry out preliminary due diligence and vetting of issuers that may be prospective research clients of ours.

**INDUCEMENTS AND INAPPROPRIATE INFLUENCES**

IIR prohibits research analysts from soliciting or receiving any inducement in respect of their publication of research and restricts certain communications between research analysts and personnel from other business areas within the Firm including management, which might be perceived to result in inappropriate influence on analysts' views.

Remuneration and other benefits: IIR procedures prohibit analysts from accepting any remuneration or other benefit from an issuer or any other party in respect of the publication of research and from offering or accepting any inducement (including the selective disclosure by an issuer of material information not generally available) for the publication of favourable research. These restrictions do not preclude the acceptance of reasonable hospitality in accordance with the Firm's general policies on entertainment, gifts and corporate hospitality.

**DISCLAIMER**

This publication has been prepared by Independent Investment Research (Aust) Pty Limited trading as Independent Investment Research ("IIR") (ABN 11 152 172 079), an corporate authorised representative of Australian Financial Services Licensee (AFSL no. 410381. IIR has been commissioned to prepare this independent research report (the "Report") and will receive fees for its preparation. Each company specified in the Report (the "Participants") has provided IIR with information about its current activities. While the information contained in this publication has been prepared with all reasonable care from sources that IIR believes are reliable, no responsibility or liability is accepted by IIR for any errors, omissions or misstatements however caused. In the event that updated or additional information is issued by the "Participants", subsequent to this publication, IIR is under no obligation to provide further research unless commissioned to do so. Any opinions, forecasts or recommendations reflects the judgment and assumptions of IIR as at the date of publication and may change without notice. IIR and each Participant in the Report, their officers, agents and employees exclude all liability whatsoever, in negligence or otherwise, for any loss or damage relating to this document to the full extent permitted by law. This publication is not and should not be construed as, an offer to sell or the solicitation of an offer to purchase or subscribe for any investment. Any opinion contained in the Report is unsolicited general information only. Neither IIR nor the Participants are aware that any recipient intends to rely on this Report or of the manner in which a recipient intends to use it. In preparing our information, it is not possible to take into consideration the investment objectives, financial situation or particular needs of any individual recipient. Investors should obtain individual financial advice from their investment advisor to determine whether opinions or recommendations (if any) contained in this publication are appropriate to their investment objectives, financial situation or particular needs before acting on such opinions or recommendations. This report is intended for the residents of Australia. It is not intended for any person(s) who is resident of any other country. This document does not constitute an offer of services in jurisdictions where IIR or its affiliates do not have the necessary licenses. IIR and/or the Participant, their officers, employees or its related bodies corporate may, from time to time hold positions in any securities included in this Report and may buy or sell such securities or engage in other transactions involving such securities. IIR and the Participant, their directors and associates declare that from time to time they may hold interests in and/or earn brokerage, fees or other benefits from the securities mentioned in this publication.

IIR, its officers, employees and its related bodies corporate have not and will not receive, whether directly or indirectly, any commission, fee, benefit or advantage, whether pecuniary or otherwise in connection with making any statements and/or recommendation (if any), contained in this Report. IIR discloses that from time to time it or its officers, employees and related bodies corporate may have an interest in the securities, directly or indirectly, which are the subject of these statements and/or recommendations (if any) and may buy or sell securities in the companies mentioned in this publication; may affect transactions which may not be consistent with the statements and/or recommendations (if any) in this publication; may have directorships in the companies mentioned in this publication; and/or may perform paid services for the companies that are the subject of such statements and/or recommendations (if any).

However, under no circumstances has IIR been influenced, either directly or indirectly, in making any statements and/or recommendations (if any) contained in this Report. The information contained in this publication must be read in conjunction with the Legal Notice that can be located at http://www.independentresearch.com.au/Public/Disclaimer.aspx.

**THIS IS A COMMISSIONED RESEARCH REPORT.**

The research process includes the following protocols to ensure independence is maintained at all times:

1) The research process has complete editorial independence from the company and this included in the contract with the company;
2) Our analyst has independence from the firm's management, as in, management/ sales team cannot influence the research in any way;
3) Our research does not provide a recommendation, in that, we do not provide a "Buy, Sell or Hold" on any stocks. This is left to the Adviser who knows their client and the individual portfolio of the client.
4) Our research process for valuation is usually more conservative than what is adopted in Broking firms in general sense. Our firm has a conservative bias on assumptions provided by management as compared to Broking firms.
5) All research mandates are settled upfront so as to remove any influence on ultimate report conclusion;
6) All staff are not allowed to trade in any stock or accept stock options before, during and after (for a period of 6 weeks) the research process.

For more information regarding our services please refer to our website www.independentresearch.com.au.

# Contents

Turning Waste Into Magnesium ..... 1
Key Points ..... 1
Swot Analysis ..... 2
Company Overview ..... 3
Financial Position ..... 4
Process Technology ..... 4
Latrobe Valley Magnesium Plant ..... 7
Magnesium Market ..... 9
Investment Case ..... 12
Capital Structure ..... 12
Risks ..... 13
Board and Management ..... 13

INDEPENDENT INVESTMENT RESEARCH

# Latrobe Magnesium Limited (ASX: LMG)

Initiating Coverage

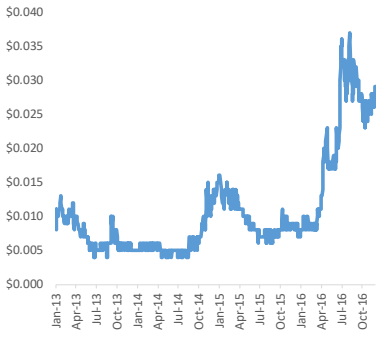
| Investment Profile | |
|---|---|
| Share price ($) as at 6 December 2016 | 0.028 |
| Issued capital: | |
| Ordinary shares (M) | 1,251.6 |
| Options (M) | 5.0 |
| Fully Diluted (M) | 1,256.6 |
| Market capitalisation ($M) | 35.0 |
| 12-month Low/High ($) | 0.007/0.038 |

**Board and Management**

Jock Murray: Non-Executive Chairman
David Paterson: Chief Executive Officer
Kevin Torpey: Executive Director
Philip Bruce: No-Executive Director
John Lee: Non-Executive Director

| Major Shareholders | % |
|---|---|
| David Paterson | 8.0 |
| Kevin Torpey | 8.0 |
| Csh Engineering Pty Ltd | 3.7 |
| Gibbs Plumbing Services Pty Ltd | 3.2 |
| S A Short Pty Ltd | 2.4 |
| **Top 20 Shareholders** | **39.2** |

**Share Price**




## TURNING WASTE INTO MAGNESIUM

Latrobe Magnesium Limited (ASX: LMG) is progressing towards the construction of a magnesium plant which will use the proprietary Hydromet process technology to extract magnesium and supplementary cementitious material (SCM) from fly ash (waste) produced from brown coal power plants. LMG will be the first and only magnesium producer in Australia and the extraction of magnesium from brown coal fly ash will be a world first. Magnesium is known as the 'green' metal given its superior strength-to-weight ratio compared to other metals. Demand for magnesium is expected to grow with car manufacturers looking to increase the amount of magnesium used in vehicles to reduce the weight of vehicles to comply with emission targets.

## KEY POINTS

**Hydromet Process:** In July 2016, LMG acquired the remaining 50% of the patented Hydromet process from Ecoengineers Pty Ltd for 30m LMG ordinary shares. The Hydromet process uses standard industrial reagents and equipment to remove impurities from the fly ash - sulphur, iron and silicon. The beneficiated fly ash can then be used as a suitable feedstock for the proven Thermal Reduction process. LMG has developed an automated vertical retort system instead of the standard horizontal retorts The process is to be used at the Latrobe Valley magnesium plant and is currently being tested with the fly ash produced by the RWE Power AG, Hambach mine in Germany. The process has been granted patents in Australia, US, China, and Indonesia, with patents pending in Europe and India. All the countries for which the company has a patent have large brown coal deposits.

**Latrobe Valley Magnesium Plant:** The company expects to complete a BFS in December 2016 for the construction of an initial magnesium plant to produce 5,000 tonnes of magnesium per annum. With the successful operation of the plant, LMG intends to expand the production of the plant to 40,000 tonnes per annum. Testwork has proven magnesium recovery rates of up to 94%. The company has announced construction of the plant is expected to cost between $46m and $51m. Operating and detailed capital costs are expected to be released upon completion of the BFS. In addition to the production of magnesium, the company will produce supplementary cementitious material (SCM). The company expects to produce 8 tonnes of SCM for every tonne of magnesium. 95% of the of the fly ash is expected to be converted into usable materials.

**Offtake Agreements:** LMG has signed MOU's with company's in Japan and the US for the purchase of the magnesium produced at the Latrobe Valley plant. These two companies have committed to purchase all of the annual output from the initial plant. Given the limited magnesium supply from outside of China, LMG is in a strong position for the offtake of the additional capacity when built.

**Capital Position & Requirements:** LMG had $2.15m in cash at September-end after raising $2.83m through a share placement to sophisticated investors and a Share Purchase Plan (SPP) in the September quarter. In October, the company received a $560k R&D tax incentive from the government. Given the capital required for construction of the initial plant, the company will be required to secure funding. LMG have secured R&D funding from the Federal Government, whereby the company is entitled to receive a cash rebate of 43.5% of all eligible expenditure (current testwork, capital costs of initial plant and operating costs for first 12-months of operation). In addition, LMG has requested $10m from the Victorian Government. If approved, government funding would represent 59%-65% of the required capital for the initial plant. Given the expanded plant of 40,000 tonnes of magnesium per annum is expected to be commence 12-months after the initial plant, additional capital will be required to be raised to fund the expanded plant. LMG expects the expansion to be largely funded by borrowing and an equity raising.

**Automotive Industry Expected to Drive Magnesium Demand:** Demand for magnesium is expected to be driven primarily by the automotive industry. The tightening of global automotive emission targets has resulted in car manufacturers prioritising the light weighting of vehicles to improve fuel efficiency and comply with the targets. With magnesium having a superior strength-to-weight ratio compared to all other metals, the major automotive companies have indicated they are seeking to increase the amount of magnesium in vehicles. LMG is in a unique position to take advantage of the expected growth in demand from the automotive industry with companies keen on sourcing magnesium from outside of China.

## SWOT ANALYSIS

### STRENGTHS

- A Bankable Feasibility Study is set to be released in the near-term. This study is expected to result in the company being able to finalise the Ash Supply Term Sheet and commence construction of the production plant in 1Q'CY17.
- The company has 100% interest in the proprietary extraction process which is patented in the US, China, Indonesia and Australia, with patents pending in Europe and India.
- The company has MOU's with parties in Japan and the US for the offtake of the magnesium produced by the initial plant.
- LMG has secured R&D funding from the Federal Government for the initial magnesium plant. LMG are entitled to receive a cash rebate of 43.5% of all eligible expenditure, which includes current testwork, capital costs and operating costs for the first 12-months of operation. This funding provides significant assistance with the construction of the plant and reduces the debt and equity raising requirements.
- The company has signed a term sheet for the supply of fly ash from the Hazelwood power plant, with the agreement expected to be executed after the completion of the Bankable Feasibility Study (BFS). The company has advised that the term sheet includes the supply of the existing fly ash in the tailing dams, of which there is up to 10m tonnes. The announced closure of the Hazelwood power plant is not expected to impact the magnesium plant with the existing fly ash in the dams expected to supply the plant for up to 25 years.
- High magnesium recovery rates of up to 94%.
- The Latrobe Valley plant will have a low carbon footprint with minimal carbon dioxide produced during processing due to the feedstock containing the magnesium in mineral oxide form. Carbon dioxide will also be consumed in the proprietary Hydromet process.

### WEAKNESSES

- The company has a significant number of shares on issue with 1.25b fully paid ordinary shares on issue, which means improvements in earnings will be heavily diluted for shareholders. More shares are expected to be issued through a capital raising to assist with the funding for construction of the Latrobe Valley magnesium plant.

### OPPORTUNITIES

- The company has the opportunity to participate in the growing global demand for magnesium and will be the only magnesium producer in Australia.
- Over 80% of global magnesium is produced by China. With China violating international trade obligations, countries are seeking to reduce their reliance on China for the supply of magnesium.
- The recent announcement of the closure of the Hazelwood power plant is expected to garner local government support for the magnesium plant, with the magnesium plant providing rehabilitation options for the land in addition to bringing jobs to an area which is experiencing a high unemployment rate.
- The company is currently undertaking testwork with the fly ash produced by the Yallourn power plant to determine whether the impurities can be extracted from the fly ash to produce magnesium from this source.

### THREATS

- The company has signed a term sheet for the supply of spent fly ash from Hazelwood. This term sheet does not have any legally binding obligations at this stage and therefore the agreement may be altered or dismissed.
- The announcement of the closure of the Hazelwood power plant in March 2017 will have an impact on the long-term supply of fly ash. The supply will now be reduced to the existing fly ash in the tailing dams. While the supply longevity will be reduced, we note that there is still enough fly ash to supply the Latrobe Valley magnesium plant for up to 25 years.
- There has already been substantial delays associated with the project, with the construction of the plant initially expected to commence in 2013. Further delays may eventuate, which may impact the capital requirements of the company.

## COMPANY OVERVIEW

- Latrobe Magnesium Limited (ASX: LMG) is progressing towards the construction of a magnesium plant in the Latrobe Valley, Victoria. Construction of the initial plant is expected to commence in 1Q'CY17 with production expected to commence within 12-months of the commencement of construction.
- The initial plant will produce 5,000 tonnes of magnesium per annum. Once this plant is operating successfully, the plant capacity is expected to be expanded to 40,000 tonnes of magnesium per annum.
- The company has been working to get the magnesium plant up and running for some years, with the company having a fly ash supply agreement with the Hazelwood power plant in place since 2000, although we note the terms of the agreement have changed over time.
- The company has signed a term sheet with the operators of the Hazelwood power plant (GDF SUEZ Hazelwood) for the supply of the fly ash from the power plant, including the operating and tailing dam fly ash. Fly ash is a by-product of the production of power from coal. There is up to 10m tonnes of fly ash in Hazelwood's tailing dams.
- The plant will use the proprietary Hydromet process in combination with its Thermal Reduction process to extract magnesium and supplementary cementitious material (SCM) from the fly ash. The Hydromet process has been patented in the US, China, Indonesia and Australia, with patents pending in Europe and India.
- A Pre-Feasibility Study and an Adjustment Study have been completed for the Latrobe Valley plant with the Bankable Feasibility Study expected to be completed in December 2016.
- The location of the plant will provide the plant direct access to the feedstock. The location combined with the proprietary process technology and efficient materials handling is expected to enable the company to operate the plant at a globally competitive cost.
- LMG will be seeking to sell the refined product under long-term contracts to Australia, Japan and throughout the Americas, with the company already having MOU's for the offtake of the initial annual magnesium production.
- The proprietary process technology provides the company with opportunities to develop magnesium plants around the world where there is substantial brown coal power plant capacity. The company has signed an MOU with RWE Power RG to develop a magnesium plant using the feedstock from their Hambach mine in Germany to produce 30,000 tonnes of magnesium per annum.

### A BRIEF HISTORY

- The Latrobe Magnesium Project was acquired by Rambora Technologies (RBT) in August 2002, and the company's name was subsequently changed to Latrobe Magnesium Limited (LMG). At the time of the acquisition, Latrobe Magnesium had completed its first Pre-Feasibility Study for a magnesium plant in the Latrobe Valley.
- Throughout the years, the company has had supply agreements with all three power plants in the Latrobe Valley - Hazelwood, Loy Yang and Yallourn. The supply agreements with Loy Yang have been not been renewed as a result of the magnesium content not being sufficient, while the fly ash from the Yallourn power plant has a high iron content. However, LMG is currently undertaking testwork with the fly ash produced from the Yallourn power plant to determine if the Hydromet process can be adapted to reduce the iron content to a sufficiently low level.
- The company has tested a number of process technology's over the years in search of the best process to extract magnesium from the fly ash before coming across the Hydromet process in 2009. LMG acquired a 50% interest in the Hydromet process from the developer, Ecoengineers Pty Ltd in 2011, before acquiring the remaining 50% interest in July 2016.

### MOU WITH RWE POWER AG

- In June 2016, LMG signed a MOU with RWE Power AG to develop a magnesium plant using the Hydromet process to produce 30,000 tonnes of magnesium per annum using feedstock from its Hambach mine near Cologne, Germany.
- The MOU has been signed after the completion of a concept study in March 2014 to determine the commercial viability of the Hydromet process with the company's feedstock.
- The project involves four stages to achieve production: (1) Conduct process testwork on the fly ash from the mine; (2) Complete a Feasibility Study; (3) Complete engineering, procurement and permitting; and (4) Construction and commissioning.

## FINANCIAL POSITION

- At 30 September 2016, LMG had $2.15m in cash and no debt.
- The company will be required to raise funding for the commencement of construction of the initial Latrobe Valley magnesium plant. The company has announced the initial plant is expected to cost between $46m and $51m.
- The company has identified the sources of funding for the plant. The sources for both the initial plant and the expanded plant are tabled below. The company has been granted R&D funding from the Federal Government which entitles the company to a 43.5% cash rebate on eligible expenditure. The company has also applied for a grant from the Victorian Government which is yet to be approved. The recent announcement by the state government of the funding programs totalling $266m to support the Latrobe Valley post the announcement of the closure of the Hazelwood power plant is expected to support this request.
- Based on the current share price, the company will need to issue 344.8m new shares to raise $10m. With 1.25b ordinary shares already on issue, the issue of additional shares will dilute any earnings upside.
- The below figures were announced in the company's AGM presentation in November 2016. This suggests that the cost of the expansion of the plant will be $305m.

| Funding | | |
|---|---|---|
| **Source** | **5,000 tonne plant (AUD$)** | **40,000 tonne plant (AUD$)** |
| Federal Government | 20m | 25m |
| Victorian Government | 10m | 10m |
| Bank of China Export-import Bank | 10m | 200m |
| Equity Raising | 10m | 70m |
| **Total** | **50m** | **305m** |

## PROCESS TECHNOLOGY

- The company will be using a combination of the proprietary Hydromet process and a Thermal Reduction process to produce magnesium and SCM from the fly ash.
- Fly ash is a by-product of coal combustion. It is the lightweight particles captured in exhaust gas from coal-fired power plants. The fly ash from brown coal has a high magnesium content of up to 12%.

### Hydromet Process

- The company owns the Hydromet process after acquiring the remaining 50% interest in the process technology from the developers, Ecoengineers Pty Ltd. The company acquired all the shares of Ecoengineers through the issue of 30m ordinary shares in LMG. Given the share price at the time, the company paid the equivalent of $0.99m for the remaining interest.
- The company has retained the services of Dr. Steve Short on a consulting basis. Dr. Short is responsible for the development of the Hydromet process. Dr. Short will be advising on how to adapt the current process to process brown coal fly ash from other power stations, both in Australia and overseas.

- The Hydromet process is designed to reduce the three main elements in the Hazelwood fly ash (sulphur, iron and silica) to produce a suitable source of material for the production of magnesium metal using the Thermal Reduction process. The Hydromet process uses complexing agents under alkaline conditions to form water-soluble complexes to enable the leaching of the impurities from the fly ash.

**Thermal Reduction Process**

- The Thermal Reduction process will use the beneficiated fly ash to produce magnesium and other commodities.
- The Thermal Reduction process is a simple and proven process which was invented in the 1940's by Dr. Lloyd Montgomery Pidgeon. The first plant was built in 1941 in Ontario, Canada. The Pidgeon process has come to dominate world magnesium production, with the primary magnesium producer, China, almost exclusively relying on this method.
- LMG's Thermal Reduction process involves the following:
  - **Calcination:** a calciner is used to dry the beneficiated fly ash received from the Hazelwood Hydromet process. Then the finely crushed dolomite carbonate is fed to rotary kilns where it is calcinated to remove the carbon dioxide from the carbonate, leaving dolime.
  - **Mixing:** the beneficiated fly ash and dolime is then mixed with finely ground ferrosilicon and fluorspar. The fine dolime, ferrosilicon and fluorspar are weighted in batch lots.
  - **Briquetting:** the mixture is then compressed into briquettes. Briquettes are then conveyed to the reduction furnaces for deoxidisation.
  - **Retorting:** the briquettes are loaded into the retorts for reduction. Reduction is a batch process releasing magnesium in vapour form, which condenses in the water cooled section of the retort outside furnace wall to form 'crowns' of magnesium crystals. The residue from the reduction charge is removed from the retort and will be used as its SCM.

    LMG will be using automated vertical retorts instead of the normal horizontal retorts. The company is using the automated vertical retorts as it results in lower capital and operating costs as a result of: (a) lower gas usage; (b) better magnesium recovery; (c) reduced labour requirements; (d) reduced infrastructure requirements.
  - **Casting:** after removal from the furnace, the magnesium crowns are pressed from the sleeve in a hydraulic process and sent to be refined.
- The company chose the Thermal Reduction process over an electrolytic process for the following reasons: (a) it's a simple proven technology and the most commonly used process in global magnesium production; (b) it can produce small quantities of magnesium economically; (c) production is capable of being expanded on a modular basis; (d) the construction period for a plant is fast, only taking 12-months; (e) the scalability derisks the project; and (f) production can be tailored to meet the requirements of different brown coal fly ash.
- The Thermal Reduction process does not require complex solutions in the production process and does not consume as much electricity when compare to an electrolytic process.
- Through the use of the Hydromet process and the introduction of various additives into the retort feedstock, the company has been able to create a new product which has been determined to be suitable for use in cement production.

## TESTWORK

- The company has conducted a significant amount of testwork to determine and refine the efficacy of the process on the fly ash produced from the Hazelwood power plant. Testwork performed in 2010 and 2011 confirmed that progressive reductions in sulphur and iron in the fly ash resulted in increased metallic magnesium recoveries.
- Magnesium metal recovery rates of up to 94% have been achieved, which are high compared to commercial recovery rates typically achieved by the Thermal Reduction process.
- Some of the retort testwork during 2011 was conducted without using Calcium Fluoride as a flux in the retort. Results from this work proved that the magnesium recovery rate was not affected by the removal of the flux, which represents a significant cost saving in production.
- The company has also undertaken testwork on the SCM in recent times. The tests have shown the LMG material outperforms fly ash, which is typically used in cement. At present, Victoria imports 100% of its fly ash requirements form other states. Recent testing by TSE in Sydney determined that the strength of material using LMG residues were significantly higher than those using fly ash but slightly lower than the control mix using cement. Further testwork is required.

## PATENTS

- The Hydromet process has been granted patents in the Australia, US, China and Indonesia. Patents are pending in Europe and India.

| Hydromet Process Patents | | |
|---|---|---|
| **Country/Region** | **Status** | **Date of Grant/Expected Date of Grant** |
| Australia | Granted | September 2013 |
| China | Granted | September 2015 |
| Europe | Response filed to search opinion | By end of 2016 |
| India | Patent request | By end of 2016 |
| Indonesia | Patent request | October 2016 |
| US | Granted | September 2015 |

- The countries in which the process has been granted patents or has patents pending all have significant brown coal deposits and numerous brown coal power plants providing opportunities for additional magnesium plants to be constructed.
- The below table details the brown coal power production capacity in these countries/ regions. Germany produces the most power from brown coal with a total production capacity of 25,167MWe. This is followed by the US and Russia.

| Brown Coal Power Station Capacity | |
|---|---|
| **Country** | **Design Capacity (MWe)** |
| Australia | 6,565 |
| China | Undisclosed |
| Europe: | |
| Germany | 25,167 |
| Greece | 5,125 |
| Poland | 9,550 |
| Russia | 10,236 |
| Serbia | 4,196 |
| Slovakia | 518 |
| Slovenia | 820 |
| Spain | 1,753 |
| Turkey | 8,479 |
| India | 5,245 |
| US | 13,884 |

Source: Global Energy Observatory

## LATROBE VALLEY MAGNESIUM PLANT

- The company is progressing towards the construction of the magnesium production plant in the Latrobe Valley, Victoria.
- The company is in the final stages of completing a Bankable Feasibility Study (BFS) for the initial plant which is expected to produce 5,000 tonnes of magnesium per annum. The BFS is expected to be completed in December 2016.
- The cost of the initial plant is expected to cost between $46m and $51m, with details regarding the operating expenses to be released with the BFS.
- The company expects construction of the initial plant to commence in the 1Q'CY17 with production expected to commence in late 2017.
- Once the plant is successfully operational, the company will be seeking to expand the production capacity of the plant to 40,000 tonnes per annum.
- The plant is expected to have a low carbon footprint. With the feedstock containing the magnesium in the mineral oxide form, minimal carbon dioxide is produced during processing. Further to this, carbon dioxide is consumed in the Hydromet process.
- The amount of existing fly ash in the tailing dams guarantees supply to the production facility for up to 25 years at full production.
- The plant is expected to produce limited noise given no mining is associated with the project. Most of the consumables in the process are soft materials and do not require significant grinding. The plant will contain a ball mill, however the company has advised that this will operate within the World Health Organisation noise requirements.
- The products produced from the initial plant will be transported by truck. The company will be seeking build rail infrastructure for the transportation of the expanded production.
- Power and water will be accessed directly from the existing power generators.
- The process is expected to produce minimal waste, with 95% of the fly ash being turned into usable products. Any remaining waste will be deposited in an industrial waste dump. Residual waste is expected to be inactive.
- Water received from the feedstock and excess water recovered will be cooled and discarded through the existing waste lines.

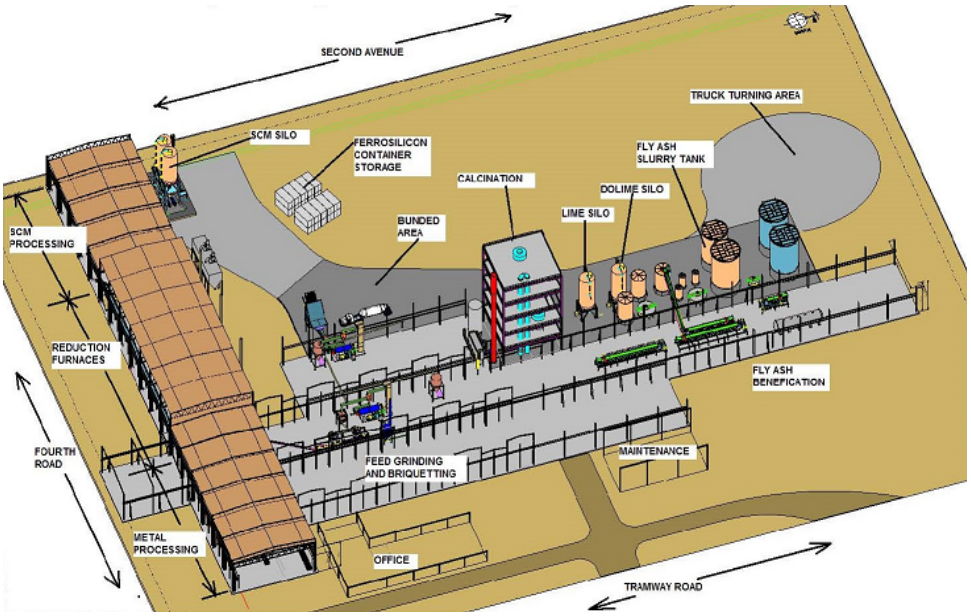
| Current Timetable | |
|---|---|
| December 2016 | Completion of BFS |
| March 2017 | Commence plant installation |
| December 2017 | Completion of plant construction and commencement of magnesium production. |
| December 2018 | Expansion of plant to 40,000 tonnes per anum. |

- The plant is expected to directly employ 55 people for the operation of the initial plant, with up to 150 people directly employed for the expanded plant. Up to 200 people are expected to be employed for the construction phases and up to 450 people employed indirectly.

### PLANT LAYOUT

- The plant will be located in Morwell, Victoria, in close proximity to the Latrobe Valley power production facilities.
- The location of the plant means the plant will have direct access to the feedstock, meaning there is feedstock transportation requirements are minimised. The location will assist with minimising energy costs, with the plant close to existing power stations and gas pipelines.
- The region has the heavy industrial zoning suitable for smelter use.

**Plant Layout**




Source: LMG

## OUTPUTS

- 95% of the fly ash is expected to be converted into usable products with the primary outputs from the plant will be magnesium and SCM.
- As detailed above, the magnesium output will be 5,000 tonnes per annum initially before being expanded to 40,000 tonnes per annum.
- LMG will produce over 8 tonnes of SCM for every tonne of magnesium. The material sells for between $100 and $150 per tonne.

| Outputs | |
|---|---|
| **Product** | **Tonnes per annum** |
| Magnesium | 5,000 initial plant & 40,000 expanded plant |
| SCM | 40,000 from initial plant & 320,000 from expanded plant |
| Char & Silicon | 4,000 initial plant/18,000 expanded plant |

## OFFTAKE AGREEMENTS

The company has signed MOU's with trading houses in both Japan and the US, with the companies committing to consume the magnesium output from the initial plant.

- **Japan** - In March 2016, LMG signed a MOU with Advanced Material Corporation of Japan (AMCJ) for the purchase of 4,000 tonnes per annum of magnesium from the planned LMG magnesium plant in the Latrobe Valley. AMCJ is the largest titanium and magnesium trading house in Tokyo.

  AMCJ's commitment equates to 10% of the annual magnesium used in Japan. With the Japanese Magnesium Association having a stated objective to diversify their supply from China, there are opportunities for greater amounts of magnesium to be sold to Japanese customers when the plant capacity is extended.

- **USA** - In June 2016, LMG signed a MOU with Metal Exchange Corporation (MEC), a US distributor to sell magnesium throughout the Americas. MEC has committed to purchase 2,000 tonnes per annum of magnesium from the magnesium plant.

  North and Central America consume 160,000 tonnes of magnesium per annum, and are the second largest consumer of magnesium behind China. LMG will seek to sell at least 50% of the magnesium produced to the US given the favourable conditions. The sales price of magnesium in the US is inflated as a result of the 141.9% anti-dumping tax imposed on magnesium imported from China.

## MAGNESIUM MARKET

Magnesium is known as the 'green' metal given it's superior strength-to-weight ratio to all common structural metals. Magnesium is 33% lighter than aluminium and titanium and 75% lighter than steel. Magnesium is increasingly being used in the manufacture of car parts, laptops, mobile phones and power tools.

China is the largest producer of magnesium producing 82% of global magnesium (excluding US production) in 2015. Global production (excluding US) increased 30.2% from 2010 to 2015.

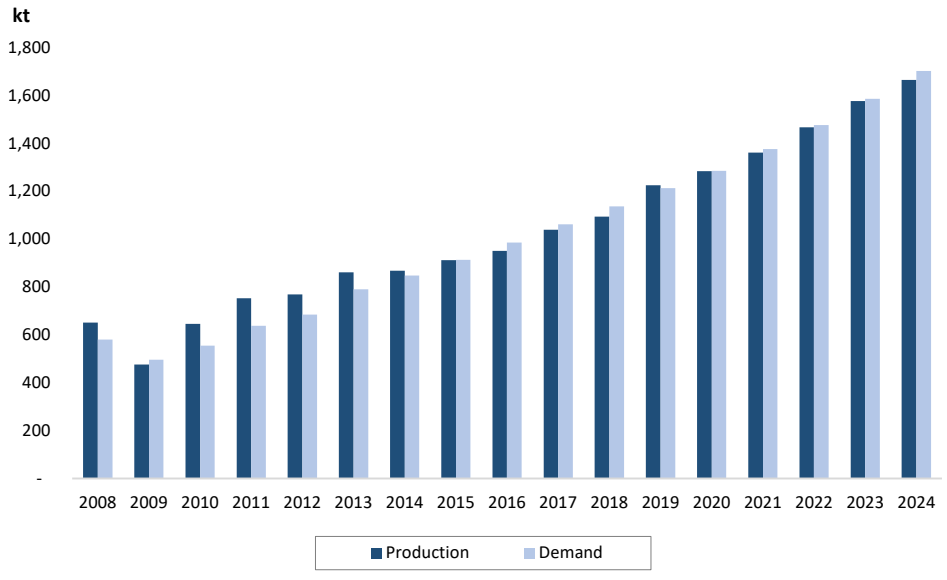
| World Magnesium Production (kt) | | | | | | |
|---|---|---|---|---|---|---|
| **Country** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015 (estimated)** |
| Brazil | 16 | 16 | 16 | 16 | 16 | 16 |
| China | 654 | 661 | 698 | 770 | 874 | 800 |
| Israel | 23.3 | 26.3 | 27 | 28 | 26 | 25 |
| Kazakhstan | 21 | 21 | 21 | 23 | 20 | 20 |
| Malaysia | na | 0.2 | 5 | 1 | 0 | 0 |
| Republic of Korea | na | na | 3 | 8 | 10 | 10 |
| Russia | 29 | 29 | 29 | 32 | 18 | 30 |
| Serbia | na | na | 2 | na | 2 | 2 |
| Ukraine | 2 | 2 | 2 | na | 7 | 9 |
| US* | na | na | na | na | na | na |
| **Total** | **745** | **755** | **802** | **878** | **973** | **970** |
| China Production (%) | 87.8% | 87.5% | 87.0% | 87.7% | 89.8% | 82.5% |

*Witheld to avoid disclosing company proprietary data.
Source: US Geological Survey

CM Group is forecasting magnesium supply to increase to 1.66m tonnes by 2024. That is a 72% increase in the supply of magnesium estimated to be produced in 2015 by the US Geological Survey. The below chart provides the supply and demand forecasts for magnesium by CM Group to 2024. CM Group is predicting that from 2016 the demand for magnesium will greater than the supply. If this is the case, this will provide a positive impetus for the magnesium price.

China is expected to continue to be the primary producer of magnesium, however other countries are bringing on supply to meet global demand and take advantage of the opportunity offered by anti-dumping tariffs in the US and the desire for countries to reduce their reliance of supply from China.

**Global Supply and Demand Forecast (kt)**




Source: CM Group

The most prominent use of magnesium is in Aluminium Alloys with 33.1% of total consumption allocated to this use in 2014 according to the CM Group. This has consistently been the greatest use for magnesium. Diecasting in the automotive industry was the second largest use of magnesium and has consistently been so. Magnesium has been increasingly used as a reducing agent in other metals from 2010 to 2014. The use as a reduction agent has been boosted by the growth in the titanium industry, particularly in China.

| Magnesium Use | | | | | |
|---|---|---|---|---|---|
| **Country** | **2010** | **2011** | **2012** | **2013** | **2014** |
| Aluminium Alloy | 36.8% | 35.4% | 34.7% | 33.6% | 33.1% |
| Iron & Steel | 17.3% | 15.9% | 15.2% | 14.7% | 13.8% |
| Metal Reduction | 6.1% | 9.8% | 10.5% | 12.0% | 12.6% |
| Diecasting - Automotive | 26.2% | 26.2% | 26.9% | 27.0% | 28.0% |
| Diecasting - Other | 7.4% | 5.8% | 5.8% | 5.9% | 5.9% |
| Other | 6.1% | 7.0% | 6.9% | 6.8% | 6.6% |

Source: CM Group

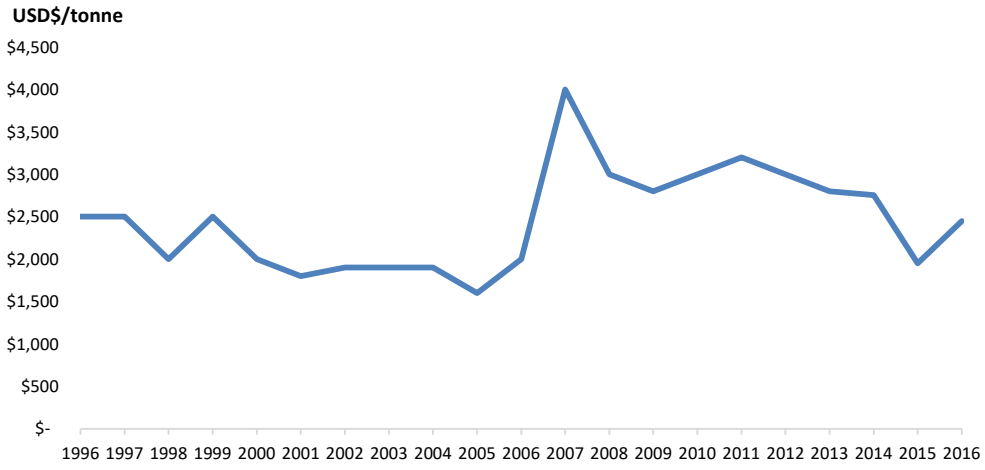
## MAGNESIUM PRICE

At November-end 2016, Magnesium (FOB China) was selling for US$2,450 per tonne. The price differs worldwide as a result of tariffs imposed. The US has imposed an anti-dumping tariff of 141.9% on metals originating from China, which results in magnesium selling at a much higher price in the US. Given LMG would not incur the anti-dumping tariff for magnesium sold into the US, this provides an attractive market with the company receiving a significant premium compared to product sold to the rest of the world.

The 2008 Olympics in China resulted in a significant increase in the price of magnesium with supply restricted due to the imposed restrictions in China on mining and industrial energy usage to ensure there was sufficient power supplies to the regions around where the Olympics were being held. This resulted in a significant drop in production which resulted in the price spike.

Since this time, an abundance of overcapacity and the cancellation of China's 10% export tariff has adversely impacted the magnesium price with the price of magnesium falling 18.3% from the end of 2008 to November-end 2016. After falling 29.2% over the 2015 year, the price has recovered with the price up 25.6% to date in 2016.

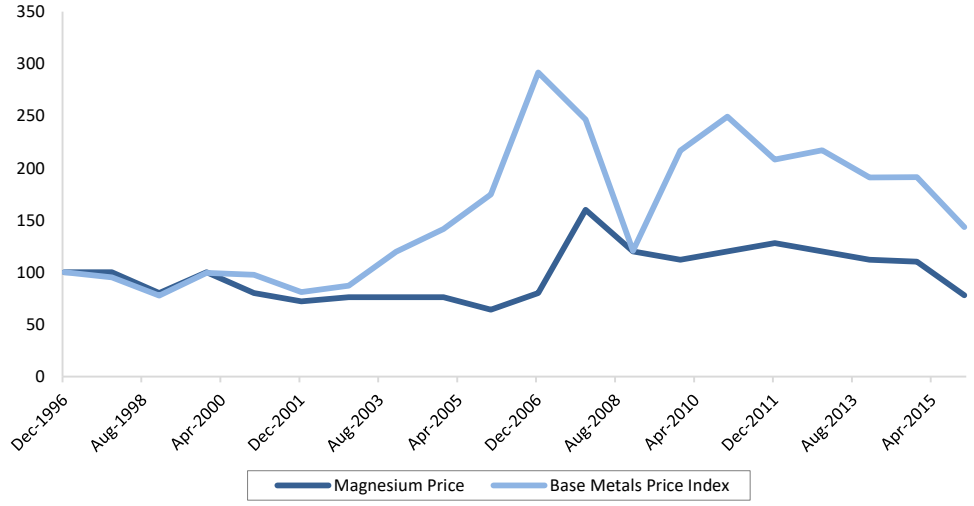
**Historical Magnesium Price (FOB China) - Year-end**




Source: LMG

When compared to the Base Metals Price Index magnesium has underperformed, as shown on the below chart. The Base Metals Price Index is published by the RBA and tracks the price of aluminium, lead, copper, zinc and nickel. When compared to the index, the price of magnesium has a very low positive correlation at 0.17. We note, that the correlation is based on infrequent periods with the comparison based on year-end prices of both magnesium and the Base Metal Price Index. An analysis over more frequent periods may show a different result.

**Magnesium Price vs. Base Metals Price Index (Indexed Performance)**




Source: LMG/RBA/IIR

There are a number of things that could impact the magnesium price moving forward. Lower or higher than forecast demand for magnesium could either put downward or upward pressure on price. Demand is expected to be driven primarily by the automotive industry, however new technologies or alternatives may potentially dampen this demand. Demand in the automotive industry will be largely driven by climate change policies. Changes to these policies will impact demand either positively or negatively. Furthermore, anti-dumping duties distort prices. The removal of these tariffs would reduce prices and may reduce the incentive for further capacity to be built, although we note the US has committed to imposing the anti-dumping tariff on magnesium sourced from China for a further five years.

## MAGNESIUM & THE AUTOMOTIVE INDUSTRY

While magnesium is used in a number of products, including electronic, aviation and medical products, demand for the metal is expected to primarily be driven by the automotive industry.

Magnesium has been used in the automotive industry since the 1920's, initially being used in racing cars to reduce the weight of the cars to add to their competitive advantage. Reducing the weight of cars and its superior strength-to-weight ratio is the reason for the increasing use in vehicles. Magnesium has replaced steel and aluminium in various car parts with magnesium currently used in the gearbox, steering column, air bag housing, steering wheel, seat frames and fuel tank covers.

There has been some reluctance for the automotive industry to implement magnesium on a large scale in vehicles for a number of reasons, including: (i) uncompetitive total component cost; (ii) supply and quality risks with a large majority of product produced by a single country; (iii) lack of technical support; (iv) competition from alternative materials; (v) perceived price instability. Technological improvements in equipment and alloys over the last two years has alleviated some of these concerns and the tightening of fuel efficiency regulations has made the light-weighting of vehicles a priority.

The below table outlines the global automotive emission targets. Those companies that do not comply with the targets will incur financial penalties, the extent of which could be significant.

**Global Automotive Emission Targets**

| Country/Region | Target Year | Standard Type | Fleet Target/Measure |
|---|---|---|---|
| EU | 2021 | $CO_2$ | 95g$CO_2$/km |
| China | 2020 | Fuel Consumption | 5L/100km |
| US | 2025 | Fuel Economy/GHG | 56.2mpg or 143g$CO_2$/mi |
| Canada | 2016 | GHG | 217g$CO_2$/mi |
| Japan | 2020 | Fuel Economy | 20.3km/L |
| Brazil | 2017 | Fuel Economy | 1.82MJ/km |
| India | 2021 | $CO_2$ | 113g/km |
| South Korea | 2015 | Fuel Economy | 17km/L or 140g$CO_2$/km |
| Mexico | 2016 | Fuel Economy | 39.3mpg or 140g/km |

Source: CM Group

Major automotive companies are seeking to increase the amount of magnesium in their vehicles. Ford is currently leading companies in light weighting vehicles. Ford's F150 pickup truck currently has 15kg of magnesium in its components. Ford's medium-term plan is to increase the amount of magnesium in it's F150 truck to 20kg. After cancelling a number of magnesium intense vehicles due to the price spike in 2008, Chrysler have now indicated that they are seeking to increase the use of magnesium as a part of its strategy to meet the Corporate Average Fuel Economy (CAFE) standards. There are a number of other car manufacturers that are heading down the same path.

## INVESTMENT CASE

- An investment in LMG provides exposure to the magnesium industry. LMG will be the only magnesium producer in Australia. LMG has the opportunity to take advantage of companies seeking to source magnesium outside of China.
- The company is well advanced in its progress towards the construction of the initial plant with construction expected to commence in 1Q'CY17.
- The company has secured funding from the Federal Government and we expect the Victorian Government to agree to the funding request given the recent funding package announced for the Latrobe Valley region.
- There is expected to be an increase in the demand for magnesium given the tightening of global automotive emission regulations. These targets have pushed the light-weighting of vehicles to the top of the priority list for automotive companies. This is highlighted by a number of major automotive companies seeking to increase the amount of magnesium in their vehicles.
- The company owns the patented Hydromet process and has the opportunity to build more magnesium plants using feedstock from brown coal power plants around the world and the ability to receive royalty revenue from those that use the process technology.
- We do not expect the announcement of the closure of the Hazelwood plant in March 2017 to impact the fly ash supply agreement, given there is sufficient existing fly ash in the tailing dams to supply the fully operational plant for up to 25 years.
- While the company is progressing towards the construction of its initial plant, an investment in the company is not without risk. Existing shareholder positions will likely be diluted as a result of the required capital raising to fund the project. As with all new projects, there is construction and commissioning risk, in particular the time to build. Delays in construction will impact the funding position of the company and could impact the off-take agreements.

## CAPITAL STRUCTURE

- LMG has 1.25b fully paid ordinary shares and 5m unlisted options on issue. The options have an exercise price of 1.5 cents and a maturity date of 16 December 2016. If all these options are exercised, the company will receive a capital injection of $75,000.

| Top Five Shareholders | | |
|---|---|---|
| **Shareholder** | **Number of Shares (M)** | **Percentage of Shares on Issue (%)** |
| David Paterson | 100.4 | 8.0% |
| Kevin Torpey | 100.1 | 8.0% |
| Csh Engineering Pty Ltd | 46.2 | 3.7% |
| Gibbs Plumbing Services Pty Ltd | 40.1 | 3.2% |
| S A Short Pty Ltd | 30.0 | 2.4 |
| **Total** | **316.8** | **25.3%** |

## RISKS

**Construction Risk**: As with all new projects there is risk with the construction and commissioning of the plant. In particular any delays during construction can impact the funding requirements for the project.

**Supply Agreement Risk**: LMG and Hazelwood have signed a letter of intent to sign the term sheet regarding the supply of fly ash after the completion of the BFS. The term sheet is not contractually binding at this time and may not be executed. While we do not expect this to happen, this would have a significantly negative impact on the viability of the project.

**Capital Risk**: The company has secured some funding for the construction of the initial plant, however, there remains risk with securing the remaining funding. We expect the completion of the BFS to provide greater certainty regarding funding.

**Dilution Risk**: The company will be seeking to raise $10m through an equity raising. At the current share price, the company would have to issue 344.8m new shares to raise $10m. Further dilution is likely with the additional equity raising required for the expansion of the plant.

## BOARD AND MANAGEMENT

**Jock Murray - Non-Executive Chairman:** Mr. Murray was appointed to the LMG board in May 2015. Mr. Murray is currently the strategic advisor for King & Wood Mallesons (law firm) in the government infrastructure sector and a consultant for the engineering company, GHD. Mr. Murray previously worked with the NSW Department for Transport, where he managed a number of projects, including the production of a 10-year development plan for the states transport infrastructure and was the chairman of the Parramatta Rail Link project. Mr. Murray also acted as an adviser for operational planning and infrastructure for the Sydney, Beijing and London Olympic Games. Mr. Murray has held positions on a number of boards, including being Chairman for The Hills Motorway (M2) Limited, Chairman for Country Pipelines and a member of the board of Terminals Australia before it was acquired by Asciano in 2008.

**David Paterson - Chief Executive Officer (CEO):** Mr. Paterson has been an executive with the company since Latrobe Magnesium was acquired in 2002. Mr. Paterson founded Europacific Corporate Advisory Pty Ltd in 1990. Prior to forming Europacific, Mr. Paterson was a Group Manager of the Corporate Services Division of Tricontinental Corporation Limited.

**Kevin Torpey - Executive Director:** Mr. Torpey is an engineer with significant experience with a range of major metal projects. Mr. Torpey was previously Managing Director of Denison Mines and Devex Limited. Mr. Torpey is currently a Director of Empire Energy Group Limited.

**Philip Bruce - Non-Executive Director:** Mr. Bruce has 30 years experience in the resource industry both in Australian and abroad. Mr. Bruce is currently a Director at PF Bruce and Associates and the Managing Director of Hill End Gold Limited. Mr. Bruce is also a Director on the board of Bassari Resources Limited. Throughout his career, Mr. Bruce has worked at Ausmelt Limited, Buka Minerals Limited, Plutonic Resources Limited and was the CEO of PT BHP Indonesia and Managing Director of Triako Resources Limited.

**John Lee - Non-Executive Director:** Mr. Lee has held senior management roles in the Federal Department of Employment and Industrial Relations. Mr. Lee was also a senior private secretary and principal advisor to Tony Street, a federal cabinet minister. Mr. Lee has held a number of senior management positions in the private sector, including with Henry Jones IXL, Elders Building Supplies and Woolworths Limited. Mr. Lee is currently a serving on a number of listed company boards.

# DISCLAIMER

## (a) Disclaimer

The information, reports, financial models, forecasts, strategies, audio broadcasts and other media (referred to as "Content" throughout this Legal Notice), provided on this web site has been prepared and issued by Altavista Research Pty Ltd trading as Independent Investment Research "IIR", Independent Investment Research Holdings Pty Ltd (ACN 155 226 074), as authorised to publish research under an Australian Financial Securities Licence (AFSL No 420170) which allows Independent Investment Research to offer financial service advice to retail and wholesale clients. Users of this web site should not act on any Content without first seeking professional advice. Whilst the Content contained on this web site has been prepared with all reasonable care from sources which we believe are reliable, no responsibility or liability is accepted by Independent Investment Research, for any errors or omissions or misstatements however caused. Any opinions, forecasts or recommendations reflect our judgement and assumptions at the date of publication or broadcast and may change without notice. Content on this web site is not and should not be construed as an offer to sell or the solicitation of an offer to purchase or subscribe for any investment. We are not aware that any user intends to rely on the Content provided or of the manner in which a user intends to use it. In preparing our Content it is not possible to take into consideration the investment objectives, financial situation or particular needs of any individual user.

Access by any user to this website does not create a client relationship between Independent Investment Research and the user. Users seeking to invest must obtain individual financial advice to determine whether recommendations are appropriate to their investment objectives, personal financial situation or particular needs, before acting on any recommendations. Any Content is not for public circulation or reproduction, whether in whole or in part and is not to be disclosed to any person other than the intended user, without the prior written consent of Independent Investment Research.

## (b) Disclosure of Interest

### General

Independent Investment Research, its officers, employees, consultants and its related bodies corporate have not and will not receive, whether directly or indirectly: any commission; fee; benefit; or advantage, whether pecuniary or otherwise, in connection with making any recommendation contained on this web site. Independent Investment Research, discloses that from time to time, it or its officers, employees and its related bodies corporate: may have an interest in the securities, directly or indirectly, which are the subject of these recommendations; may buy or sell securities in the companies mentioned in the Content; may effect transactions which may not be consistent with the recommendations in the Content; may have directorships in the companies mentioned in the Content; and/or perform paid services for the companies that are the subject of such recommendations.

However, under no circumstances, has Independent Investment Research been influenced, either directly or indirectly, in making any recommendations contained on this web site.

### Corporate Research

Independent Investment Research has or may have, received a fee either directly by a company itself or by a third party, to provide coverage and/or corporate research (the "Fee"). Where a Fee has been received, Independent Investment Research does not publish:

Buy / Hold / Sell recommendations for the security or managed investment schemes.

## (c) Copyright Protection

All Content at this web site is protected by copyright. Apart from any use permitted under the Copyright Act (Cth) 1968, you must not copy, frame, modify, transmit or distribute the material at this web site, without seeking the prior written consent of the copyright owner. Content on this web site is owned by the business Independent Investment Research. Users are prohibited from copying, distributing, transmitting, displaying, publishing, selling, licensing, creating derivative works or using any content on the web site for commercial or public purposes



## (d) Trade Marks

The trade marks and logos displayed on this web site belong to Independent Investment Research or other parties. Such trade marks include registered trade marks and trade marks pending registration. Users are prohibited from using any of these trade marks, without seeking the prior written consent of IIR or such third party, which may own the trade mark content on this web site.

## (e) Limitation of Liability

To the fullest extent permitted by the law, Independent Investment Research and any of its officers, employees, agents, consultants or related bodies corporate disclaim any liability, whether based in contract, tort, strict liability or otherwise, for any direct, indirect, incidental, consequential or special damages arising out of or in any way connected with the use of any Content made available on this web site by any person or entity.

## (f) No Warranties

Independent Investment Research does not make any claims, promises, guarantees, representations or warranties regarding the accuracy, completeness or fitness for purpose of the Content made available on this web site. All information on this web site is provided to you on an as is basis, without warranty of any kind either express or implied. To the extent that research can be provided by third parties, Independent Investment Research makes no warranty or representation as to the accuracy or completeness of such information displayed on this site, and accepts no liability for errors or omissions arising from such third party information. To the fullest extent permitted by law, under no circumstances will Independent Investment Research be liable for any loss or damage caused by users reliance upon information obtained through this web site. It is the responsibility of the user to evaluate the accuracy, completeness or usefulness of any information, opinion, general advice or other content made available through this web site. Furthermore, Independent Investment Research does not warrant or represent that this web site is error free or free from viruses or defects. A user must do all that is necessary (including using virus checking software) to satisfy itself that accessing this website will not adversely affect its system.

For further information, please contact IIR at: client.services@independentresearch.com.au

INDEPENDENT
INVESTMENT RESEARCH

**Independent Investment Research (Aust.) Pty Limited**

SYDNEY OFFICE
Level 1, 350 George Street
Sydney NSW 2000
Phone: +61 2 8001 6693
Main Fax: +61 2 8072 2170
ABN 11 152 172 079

MELBOURNE OFFICE
Level 7, 20–22 Albert Road
South Melbourne VIC 3205
Phone: +61 3 8678 1766
Main Fax: +61 3 8678 1826

HONG KONG OFFICE
1303 COFCO Tower
262 Gloucester Road
Causeway Bay, Hong Kong

DENVER OFFICE
200 Quebec Street
300-111, Denver Colorado USA
Phone: +1 161 412 444 724

MAILING ADDRESS
PO Box H297 Australia Square
NSW 1215