Introduction

Western Australia (WA) is a world renowned minerals and energy province. Producing over 50 different commodities, the state embraces over 1000 operating mine sites and over 60 operating oil and gas fields.

WA is establishing itself as a centre of excellence for mining and petroleum services and related research.

Emerging from this resource rich landscape are significant lithium and rare earth industries. Across Australia, numerous projects are either under development or in production. In a number of cases these companies are forging vertically integrated supply chain relationships with manufacturers of cutting edge technologies across the world.

Australian institutions are undertaking world leading research in product development and minerals processing.

Developed by the Chamber of Minerals and Energy of Western Australia (CME), this prospectus consolidates information about lithium and rare earths companies and related research institutions, highlighting WA’s significant trade, investment and collaboration potential.

We invite you to consider the importance of this industry, and to look at building relationships with these organisations in Australia. Each featured profile includes contact details, allowing you to make direct contact with those potential business partners.
Australian Rare Earth Element and Lithium deposits owners

**Lithium**

**Western Australia**
- Greenbushes: Talison Lithium Ltd (operating)
- Mt Cattlin: Galaxy Resources Ltd (operating)

**Rare Earth Elements**

**Western Australia**
- Mt Weld: Lynas Corporation Ltd (operating)
- Cummins Range: Kimberley Rare Earths Ltd (exploration)
- Hastings Brockman: Hastings Rare Metals Ltd (exploration)
- John Galt: Northern Metals Ltd (exploration)
- Yangibana: Artemis Resources Ltd/Hastings Rare Metals Ltd (exploration)
- Perth Basin: Iluka Resources Ltd, BeMaX Resources Ltd, Doral Pty Ltd (operating but REE not produced)
- Cooljarloo: Tixwest JV (operating but REE not produced)
- Cyclone: Diatreme Resources Ltd (exploration)
- Mulga Rock: Energy and Minerals Australia (proposed)
- Pilangoora: Altura Mining Ltd (exploration)
- Mt Marion: Reed resources/Mineral Resources Ltd (Under development)

**South Australia**
- Jacinth-Ambrosia: Iluka Resources Ltd (operating but REE not produced)
- Olympic Dam: BHP Billiton Ltd (operating but REE not produced)

**New South Wales**
- Dubbo: Alkane Resources Ltd (proposed)
- Murray Basin: BeMaX Resources Ltd, Iluka Resources, Astron Ltd, International

**Northern Territory**
- Nolans Bore: Arafura Resources Ltd (proposed)

**Queensland**
- Korella: Krucible Metals Ltd (proposed)
- Mary Kathleen: Chinalco Yunnan Copper Resources Ltd/Gold search Ltd
Alkane Resources Ltd - Developing a Major Zirconium, Niobium and Rare Earth Resource

Alkane Resources Ltd is a multi commodity mining and exploration company headquartered in Perth Western Australia, which has a very tight geographical operational focus in the Central West Region of New South Wales.

Over many years since the development of the Peak Hill Gold Mine in 1996, the Company has built up resources in several commodities and is currently advancing the Tomingley Gold Project and the Dubbo Zirconia Project towards development.

The Dubbo Zirconia Project (DZP) is Alkane’s flagship development and a feasibility study is nearing completion (July 2011). This project is based upon a very large in-ground resource of zirconium, niobium, tantalum, yttrium and rare earth elements, about 30 kilometres south of the regional city of Dubbo (population 42,000).

An operating flow sheet has been developed to recover a suite of zirconium, niobium and rare earth products which has been trialled at demonstration pilot plant (DPP) stage. The DPP was designed to prove the chemistry of the flow sheet at a large scale, generate capital and operating costs for the feasibility study, and provide products for customer evaluation.

The current development concept is 1 million tonne per annum ore processing to produce:

- Zirconium products (ZBS, ZOH, ZBC, ZrO2) 15,700 tpa (ZrO2 units)
- Niobium concentrate (Nb2O5, FeNb) 3,005 tpa (Nb2O5 units)
- Light rare earth concentrate 3,050 tpa (LREO)
- Heavy rare earth concentrate 1,120 tpa (HREO)

Three Memorandum of Understanding (MoU) have been signed covering all the zirconium output. Several other MoUs are in progress to secure off-take for the niobium and rare earth outputs from the project.

The feasibility study was completed in September demonstrating a very robust project with substantial financial returns and an A$1.2 billion NPV for the initial 20 year project life. Assuming project financing and development consent from the State Government, the project should be in commercial production in 2014.

The DZP will be a strategically significant long term supplier to the zirconium and heavy rare earth businesses, and an important contributor for niobium and light rare earths.

Contact: Ian Chalmers
Managing Director
ichalmers@alkane.com.au
Arafura Resources Limited

Arafura Resources Limited is an emerging rare earths producer that listed on the Australian Securities Exchange in November 2003, and was admitted to the S&P/ASX 300 Index in March 2009. The Company’s vision is to be the recognised leading producer of rare earths for users worldwide by developing the Nolans Rare Earths Project, and pursuing long term growth opportunities through exploration and strategic partnerships.

Rare earths provide environmentally friendly solutions through an array of applications aimed at achieving energy efficiency, and in developing green technologies. They are also in increasing demand worldwide for use in high technology devices that are central to our modern lifestyle.

The Nolans Project plans for operations at two sites in Australia: the Nolans Bore Mine in the Northern Territory and the Whyalla Rare Earths Complex in South Australia. Nolans is underpinned by a world-class rare earths deposit which has sufficient resources to support mining and chemical processing operations for at least 20 years. Annual production of 20,000 tonnes of Rare Earth Oxides (REO), equivalent to about 10 percent of the world’s supply, will be produced from the Whyalla Rare Earths Complex, along with co-products of uranium oxide, phosphate, and a gypsum by-product.

The project has a desirable mix of rare earths, currently worth approximately US$150 per kilogram (October 2011), with an elevated proportion of rare earths that feed high growth markets in magnets and phosphors when compared to most other rare earth deposits.

Arafura is undertaking a Bankable Feasibility Study (BFS) on the Nolans Project. It is planned to have the BFS completed and project financing in place by the end of 2012.

The production of rare earths from the Nolans Project is a new and important industry for Australia. Nolans is a long-term resource development, and is one of the very few new production sources of rare earths that will emerge this decade. Arafura is well placed to meet growing demand for rare earths in an environment of curtailed supply by the industry’s current major producer, China. Arafura has recently announced a Letter of Intent with major German company Thyssen Krupp. This will cover commercial arrangements for sales of Arafura’s products into Germany and account for 15% of Arafura’s future products.

For more information on Arafura and the Nolans Rare Earths Project, contact Arafura’s Managing Director & CEO, Dr Steve Ward, on the below-listed Perth details.
Galaxy Resources Ltd is an integrated lithium mining, chemicals and battery company listed on the Australian Securities Exchange (Code: GXY)

Lithium Resources:
- Galaxy wholly owns the Mt Cattlin project in Western Australia
- It mines pegmatite ore and processes it on site to produce spodumene concentrate
- Full capacity production of 137,000 tpa spodumene concentrate
- Galaxy also produces a tantalum by-product of 56,000 lbs pa of contained tantalum
- The latest Mt Cattlin resource update indicates an 18.2 mt resource at 1.08% Li₂O
- Drilling and exploration work is continuing
- The company also owns the Ponton rare earth deposit in Western Australia

Lithium Chemicals:
- Galaxy ships spodumene to its wholly owned lithium carbonate plant in China's Jiangsu province
- The Jiangsu plant will be the first fully automated lithium carbonate plant in China
- Plant has a design capacity of 17,000 tpa of battery grade lithium carbonate
- Galaxy's spodumene is converted into lithium carbonate
- Lithium carbonate is a key ingredient in lithium ion batteries
- The plant is expected to be commissioned by end of 2011
- Galaxy has secured Oiflute Agreements for 100% of its capacity
  - 13 major Chinese lithium cathode makers
  - Mitsubishi Corp, Japan (5,000 tpa)

Lithium Batteries:
- Galaxy plans to build a lithium-ion battery project in China
- Batteries to be used mainly for electric bikes
- Initial production of 350,000 battery packs a year
- Fully automated line equipment to be utilised under turnkey contract with Korean consortium KUBT
- Technology licence agreement signed with lithium ion battery producer, K2 Energy Solutions Inc for expertise, licensing and commercial support
- Letter of Intent signed for the battery plant site, commissioning expected 2013
- Ofiflute framework agreements signed with 13 Chinese e-bike manufacturers for 100% of battery production
THE COMPANY

Kimberley Rare Earths listed on the Australian Securities Exchange (ASX:KRE) in May 2011 having raised approximately AUD$18.2 million under an oversubscribed IPO, and is focused on developing rare earth projects from exploration through to production.

The Company is governed by an experienced non-executive board of directors, lead by Managing Director Tim Dobson, a metallurgist with 23 years experience in complex mining operations and project development.

CUMMINS RANGE RARE EARTHS DEPOSIT

Located in the East Kimberley region of Western Australia, Cummins Range is a shallow, latertic carbonatite hosted rare earths deposit with a JORC compliant Inferred Resource of 4.17MT at an average grade of 1.72% TREO together with advanced exploration targets.

The Company owns 25% of the Cummins Range rare earths project and has the right to earn up to 80% of the project through advanced exploration and the production of a bankable feasibility study.

KRE has commenced an aggressive $10m exploration and development program in order to increase its equity in the project to 55%, and will then earn 80% of the project by delivering a bankable feasibility study for developing the project into production.

Cummins Range has a rare earth oxide composition similar to that found in Lynas Corporation’s Central Lanthanide Deposit at Mt Weld in Western Australia. Further, the rare earth elements are largely hosted in monazite, one of only three rare earth minerals historically processed for rare earths, the others being bastnasite and xenotime.

MALILONGUE EXPLORATION PROJECT

Located in north western Mozambique, Malilongue is a pegmatite-hosted rare earth project with significant exploration potential, including for xenotime-hosted yttrium, dysprosium and erbium.

KRE has entered a Joint Venture farm-in agreement to earn up to 90% of the non-gemstone rights in the project over 5 years.

Historical project data includes rock chip samples assaying over 20% total rare earth oxides (TREO), and concentrates from 38 separate pits located throughout the pegmatite field sampled by current owner averaged over 1000ppm TREO with 55% being light (LREO), 25% heavy (HREO) and 20% yttrium oxide.

OPPORTUNITY

Cummins Range is one of only a handful of advanced stage rare earths projects in Australia with the key advantages of location, mineralogy and ease of mining. The Company has an experienced and committed team that is focused on developing the project towards production.

For more information on Kimberley Rare Earths:
Contact: Tim Dobson, Managing Director
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Office: Suite 1, 83 Havelock Street, West Perth, Western Australia
**LITHIUM**

- **Product:** Spodumene concentrate (6% Li₂O)
- **Resource:** >10Mt @ 1.4% Li₂O
- **Contained Li:** ~140,000t of LCE
- **Production:** 200,000tpa @ 6.0% Li₂O
- **Name:** Mt Marion Lithium Project
- **Location:** Kalgoorlie, Western Australia
- **Status:** Production anticipated to commence in 2012.
- **Ownership:** Reed Resources - 70%
  Mineral Resources - 30%
- **Website:** [www.reedresources.com/lithium.php](http://www.reedresources.com/lithium.php)

**VANADIUM**

- **Product:** FeV, V₂O₅
- **Resource:** 65Mt @ 0.82% V₂O₅
- **Contained V:** ~300,000t of V
- **Production:** 7,700tpa FeV or 11,200tpa V₂O₅
- **Name:** Barrambie Vanadium Project
- **Location:** Meekatharra, Western Australia
- **Status:** Finance and construction negotiations currently underway.
- **Ownership:** Reed Resources - 100%
- **Website:** [www.reedresources.com/vanadium.php](http://www.reedresources.com/vanadium.php)

REED RESOURCES LTD is a diversified miner and explorer. The Company’s projects are located in Western Australia. In addition to lithium and vanadium, Reed owns the Meekatharra Gold Project with resources exceeding 2.7million ounces.
Salares Exploration Project, Chile
- Five prospective lithium brine lakes
- Located in the Atacama Region – world’s lithium brine production hub
- Outstanding results for both lithium and potassium from initial drilling

Greenbushes Lithium Operations, Western Australia
- World’s largest lithium mine, located close to a major port and key infrastructure
- World’s highest grade lithium Mineral Resource with a 22 year mine life
- Lithium Proven & Probable Mineral Reserves, 31.4 million tonnes at a grade of 3.1% Li₂O
- 50,000 tonnes lithium carbonate equivalent sold in 2011
- Doubling of production capacity underway to meet expected future lithium market growth
- Plant to convert lithium mineral concentrate to lithium carbonate proposed to be developed in Western Australia

www.talisonlithium.com  |  Contact: emma.hall@talisonlithium.com
Enhancing the collaborative research between WA and Germany

The following pages detail some of the research initiatives being undertaken in Western Australia. There is a strong interest in the collaboration of research programs between WA and Germany.
Specialising in Rare Earth Process Development

ANSTO Minerals teams undertake innovative process development, from evaluation of drill hole samples through to pilot plant demonstrations. These capabilities are provided at our own facilities, as well as for on-site problem solving.

We have considerable expertise in hydrometallurgical unit operations such as leaching, solvent extraction, ion exchange, precipitation and process water treatment.

We provide specialised knowledge in the processing of ores containing rare earths, including:

- Extensive experience in the processing of rare earths from primary sources such as monazite or from secondary sources such as apatites, complex zirconium/nioibium ores and other non traditional secondary sources.

- Laboratory and pilot plant studies of the following specific processes:
  - Caustic conversion of rare earth phosphate type minerals
  - Sulphuric acid bake/water leach processes
  - Recovery and purification of rare earths by precipitation techniques such as of rare earth double sulphates or rare earth oxalates
  - Impurity control in rare earth flowsheets
  - Radioactivity deportment in rare earth flowsheets including recovery of uranium as a by-product
  - Precipitation of rare earth carbonate
  - Purification of rare earths by solvent extraction techniques for recovery of rare earth concentrates or higher purity individual rare earth products

- Conceptual studies for flowsheet development of greenfield mineral processing sites
- Conceptual studies for introduction of new technology into existing mineral processing flowsheets

Examples of ANSTO Minerals major rare earth projects include:

- Extensive laboratory testwork carried out for the recovery of rare earths from the Mt Weld deposit in Western Australia, including operation of caustic conversion at pilot plant scale and mini-pilot plant operation of continuous solvent extraction processes for the purification of targeted rare earth products

- Development of a process for the recovery of rare earths from the Nolans deposit in Northern Territory, including pilot plant testing.

- Development of a process to recover rare earths from the Toogi Deposit in Dubbo, NSW, integrated with the recovery of Zr and Nb. A demonstration plant of the process has been constructed and operated at the ANSTO Lucas Heights site.

Contact Dr Karin Soldenhoff
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CSIRO Initiatives

Exploration for and mining of Li and rare earths

**CSIRO Minerals Down Under Flagship**

CSIRO has developed considerable capabilities in the processing of rare earths and other strategic metals, mainly through undertaking research for emerging industry players. CSIRO has also developed capabilities in exploration research, delivered through the Minerals Down Under Flagship, that can be applied to rare earths and lithium.


Li processing

**CSIRO Future Manufacturing Flagship**

CSIRO has considered producing Li metal strip using existing equipment for the processing of light metals. A preliminary study was conducted that determined that the proposed process was feasible in theory, however; there are OHSE issues to be addressed. The next stage would be to conduct a full feasibility study followed by laboratory scale trials.

Further information: www.csiro.au/org/CPSE

Li batteries

**CSIRO Energy Transformed Flagship and Energy Technology Division**

CSIRO has significant capability in the development and characterisation of materials for both lithium ion and lithium metal batteries. Our core expertise is in the characterisation and understanding of how lithium metal can be effectively plated in two-dimensions; the formation of three-dimensional or dendritic growths can cause short-circuit and fire in a battery.

Further information: www.csiro.au/science/Lithium-Metal-Battery-Research

Control technologies

**CSIRO Future Manufacturing Flagship**

CSIRO has significant expertise centred on drive-train technologies for hybrid and fuel cell ready electric vehicles with a proven track record in the development of hybrid vehicles, having developed the ECOmmodore, a parallel hybrid, in partnership with Holden, and a series hybrid electric vehicle, the aXcess vehicle with the aXcess consortium of Australian companies.

Further information: www.csiro.au/org/FutureManufacturingFlagship

Electric motors

**CSIRO Future Manufacturing Flagship**

CSIRO has expertise in the design of electric motors, with an emphasis on rare-earth permanent magnet and switched reluctance electric machines, using 2D and 3D finite-element software (ANSYS) with optimisation capability.

Electric machines have been developed for a wide range of applications, including automotive, appliance, and renewable energy industries. Facilities are available for producing prototype machines and integration of the machine into different applications.

Further information: www.csiro.au/org/FutureManufacturingFlagship

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Research at the University of Wollongong

The University of Wollongong has created a research environment that facilitates multidisciplinary approaches to research focussed on outcomes to real problems. Our researchers have global reach, working with industry and other R&D organisations on projects that make a difference to our world and to people’s lives.

Internationally renowned research and researchers

The Institute for Superconducting and Electronic Materials (ISEM) is a world class cooperative research team in energy, superconducting and electronic materials science and technology. ISEM has been instrumental in the development of this research field in Australia. Led by Professor Shi Xue Dou, an internationally renowned expert in the field of superconductivity and energy storage, ISEM has assembled a team of more than 100 researchers and postgraduate students with a track record of research breakthroughs and strong national and international partnerships.

World-class facilities

The Australian Institute of Innovative Materials (AIIM) Research Facility, which houses ISEM and other research groups, is located at the university’s Innovation Campus, established to provide a unique opportunity for commercial organisations to work with world-class researchers. The AIIM Research Facility contains facilities for processing electrode and electrolyte materials and a state-of-the-art industrial battery laboratory specially designed for electric and hybrid electric vehicle battery testing. It also features Australia’s first multifunctional materials processing and devices facility to help transform lab-based discoveries into reality.

Advanced battery technologies

ISEM is conducting industry relevant research advanced battery technologies, in particular lithium-ion batteries, with a focus on the development of low cost, high power rechargeable batteries for automotive applications. ISEM’s research program is driving breakthroughs to increase energy capacity and power density, enhance battery lifecycle; improve operational safety; and develop on-board charging mechanisms.

For more information on the Institute for Superconducting and Electronic Materials, visit isem.uow.edu.au or contact Professor Shi Xue Dou on +61 2 4221 5730 or via email at shi@uow.edu.au
The Chamber of Minerals and Energy of Western Australia (CME) is the peak resource sector representative body in Western Australia.

CME exists to champion the Western Australian resources sector and assist it in achieving its vision to lead the world in sustainable practice, through innovation, and to underpin Australia’s position in the global economy.
Further Information

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