# ASX ANNOUNCEMENT

20 March 2019

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ASX: LIT

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## Domestic Lithium Cathode Production
## The key to renewable energy security

Lithium Australia NL (ASX: LIT) has launched its preliminary feasibility study on the Sadisdorf lithium/tin deposit in Germany. The study will evaluate the direct production of cathode powders, lithium iron phosphate (LFP) in particular, from mica feed material. This mica is usually considered waste from this, and similar, tin mining operations.

Recovery of the mica, and direct production of cathode powders from it, is a strategy that enables the domestic supply of ***cathode materials requiring neither cobalt or nickel***, thus providing supply chain security.

LFP batteries, which have many features superior to other battery chemistries, are ideally suited to applications in the energy storage systems (ESS) that provide backup for renewable energy.

The combination of:

- domestic supply,
- direct production of cathode powders, and
- local manufacture of LFP batteries

provides not only supply chain security but also helps in achieving long-term security for the energy industry.

Lithium Australia has a suite of technologies – all tested at pilot scale – to deliver high-performance LFP cathode materials from domestic sources into such markets, thereby improving energy security.

Recently Lithium Australia initiated the Australian Battery Consortium, in order to pursue similar opportunities in Australia.

Lithium Australia also plans to monetise its control position in the Electra project in Mexico. There, it holds ground both north and south of Bacanora Lithium's giant Sonora lithium clay deposit, and has identified significant mineralisation in that ground.
Lithium Australia's strategic positioning in the ESS supply chain is the subject of a presentation (below) to the Informa Lithium and Battery Metals Conference in Perth, Western Australia on 20 March, 2019.

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## About Lithium Australia NL

Lithium Australia aspires to 'close the loop' on the energy-metal cycle in an ethical and sustainable manner. To that end, it has amassed a portfolio of projects and alliances and developed innovative extraction processes to convert *all* lithium silicates (including mine waste) to lithium chemicals. From these chemicals, the Company plans to produce advanced components for the lithium-ion battery industry. The final step for Lithium Australia involves the recycling of spent batteries and e-waste. By uniting resources and the best available technology, the Company aims to establish a vertically integrated lithium processing business.

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# ENERGY SECURITY

## a solution to supply chain control




**Adrian Griffin**
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***COMPETENT PERSON'S STATEMENT***

*The information in this report that relates to reporting of Exploration Results is based on and fairly represents information and supporting documentation prepared by Adrian Griffin, a member of the Australasian Institute of Mining and Metallurgy. Mr Griffin is a shareholder in, and managing director of, LIT and has sufficient experience relevant to the style of mineralisation and type of deposit under consideration. He is qualified as a Competent Person as defined in the 2012 edition of the* Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves. *Mr Griffin consents to the inclusion in this report of the matters based on information in the form and context in which it appears.*

Lithium Australia


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# Energy management – today's content

1. Lithium Australia (ASX:LIT) business units.
2. Manufacture of lithium chemicals from waste materials.
3. Conversion to cathode materials.
4. The choice of lithium-ion battery (LIB) chemistries.
5. Lithium iron phosphate (LFP) – the rugged LIB.
6. The renewable energy market and energy security.


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# Lithium Australia's business divisions

**Global resource and exploration portfolio (Australia, Mexico, Alaska, Europe, Africa)**

**Processing of lithium from hard-rock sources without roasting – low energy, byproduct credits**




**Recovery of all metals to re-birth battery components and improve sustainability**

**Production of advanced cathode powders with no need for lithium hydroxide or carbonate precursors**



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# Global energy politics






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# Production of lithium chemicals

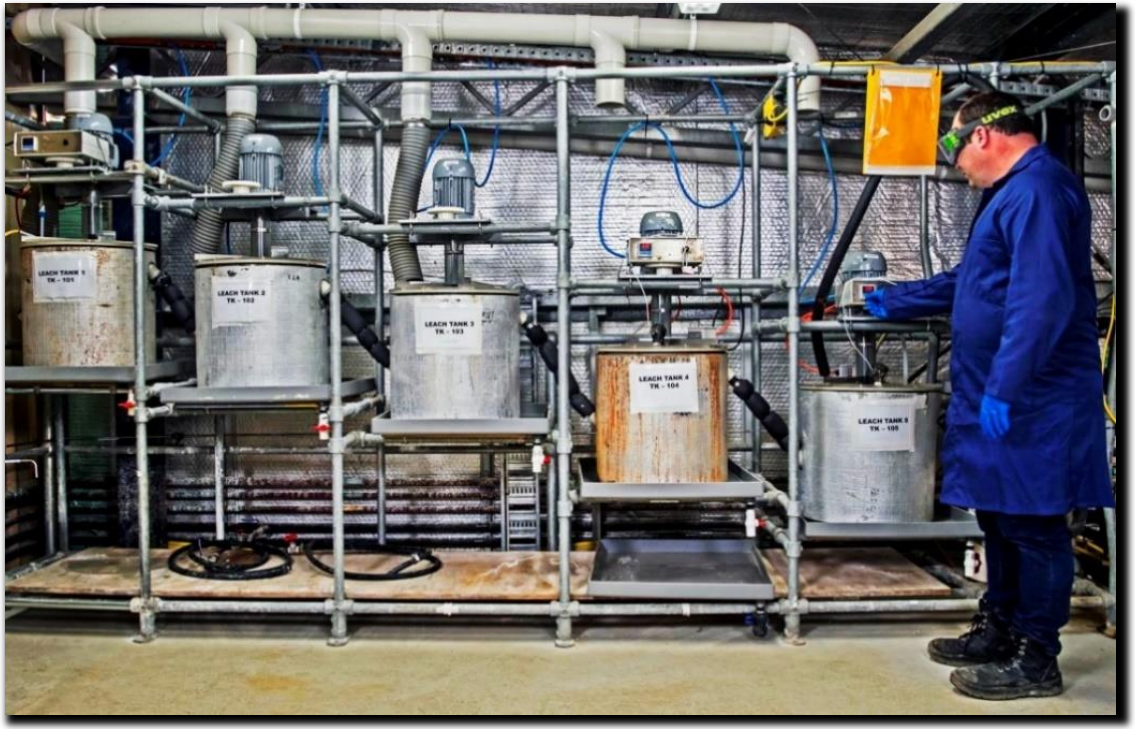
- **LIT's focus is on sustainability** – capitalising on the waste products of others.
- Processing of all lithium minerals with a low energy footprint:
  - SiLeach® for lithium micas and phosphates, and
  - LieNA® for spodumene, petalite
- Better control of water balance.
- Potential for direct extraction from brines.



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# Lithium chemicals – SiLeach®

Generation 1 SiLeach® pilot plant – ANSTO, Sydney.



Generation 3 plant scheduled for construction 2019.

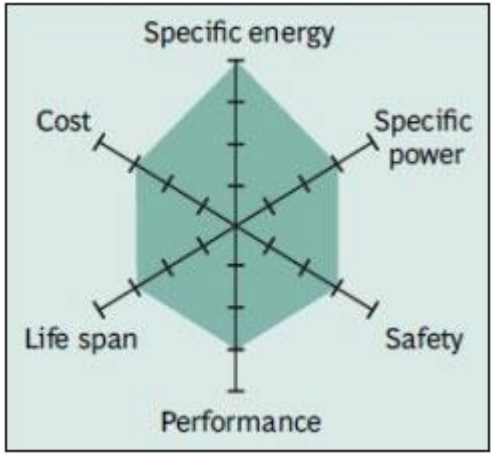

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# Cathode manufacture drivers

- **LIT's focus is on sustainability** – capitalising on the waste products of others:
  - mine waste,
  - co-products,
  - recycled materials.
- Direct cathode powder production.
- Energy security:
  - supply diversity,
  - domestic feed sources.
- Matching cathode type to the end use is an essential element of success:
  - Australia is the leading market for energy storage applications,
  - **lithium iron phosphate (LFP) is the cathode material of choice.**

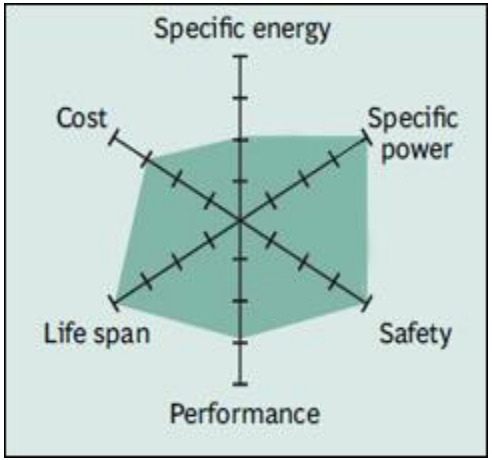

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# LFP – longevity, power, price




(lithium) nickel manganese cobalt

**NMC**




Lithium iron phosphate

**LFP**

Source: https://batteryuniversity.com


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# LFP – the rugged Li-ion battery

- Deep discharge
- High recharge rates
- High power delivery
- 30 year design life
- Low-cost
- Operation without battery management systems
- Wide operational temperature range
- No thermal runaway
- Very safe
- Applicable to transport and energy storage applications


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# LFP – the safe LIB

Where are we headed?


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# LFP – the safe LIB

**Battery material shortage pushes developers to shift li-ion chemistries**

Demand for nickel manganese cobalt batteries is outstripping supply, so some storage developers are turning to the more 'rugged' lithium iron phosphate chemistry.

Peter Maloney@TopFloorPower
Utility Drive https://www.utilitydive.com
Sept. 11, 2018


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# Australian implementation plan

"The current supply tightness for NMC batteries is opening up doors for LFP batteries as they are seeing a growing interest from storage vendors for not just power but also energy applications," Mitalee Gupta, energy storage analyst at Wood Mackenzie Power & Renewables, told Utility Dive via email.

Peter Maloney@TopFloorPower
Utility Drive https://www.utilitydive.com
Sept. 11, 2018


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# LFP – the rugged Li-ion battery

The manufacturing process


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# VSPC Ltd – superior cathodes

Assets include R&D facility – Brisbane, Queensland:

- electrochemical testing laboratory,
- in-house material characterization,
- integrated cell-making and testing and
- IP – three patent families.

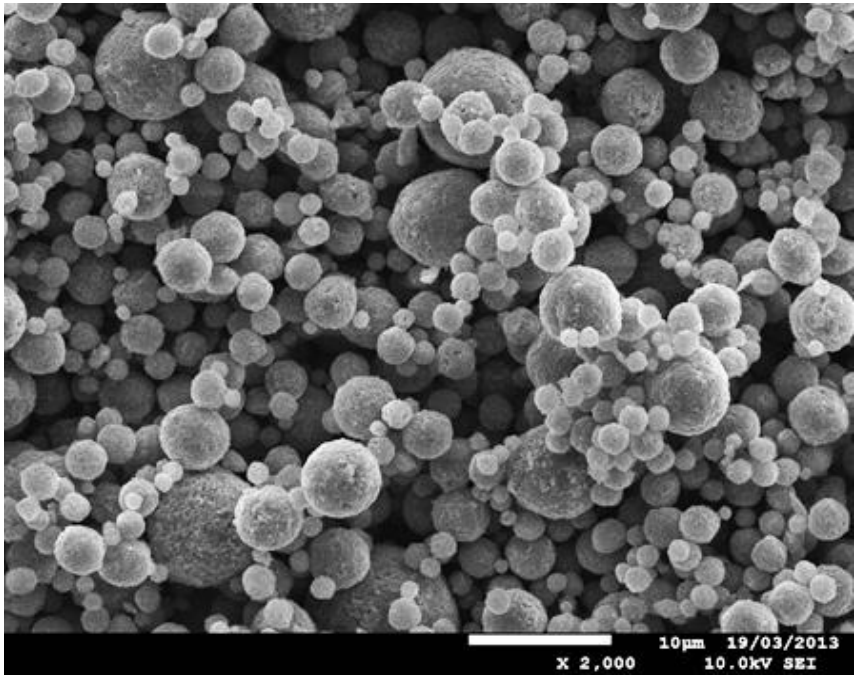





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# VSPC cathode materials

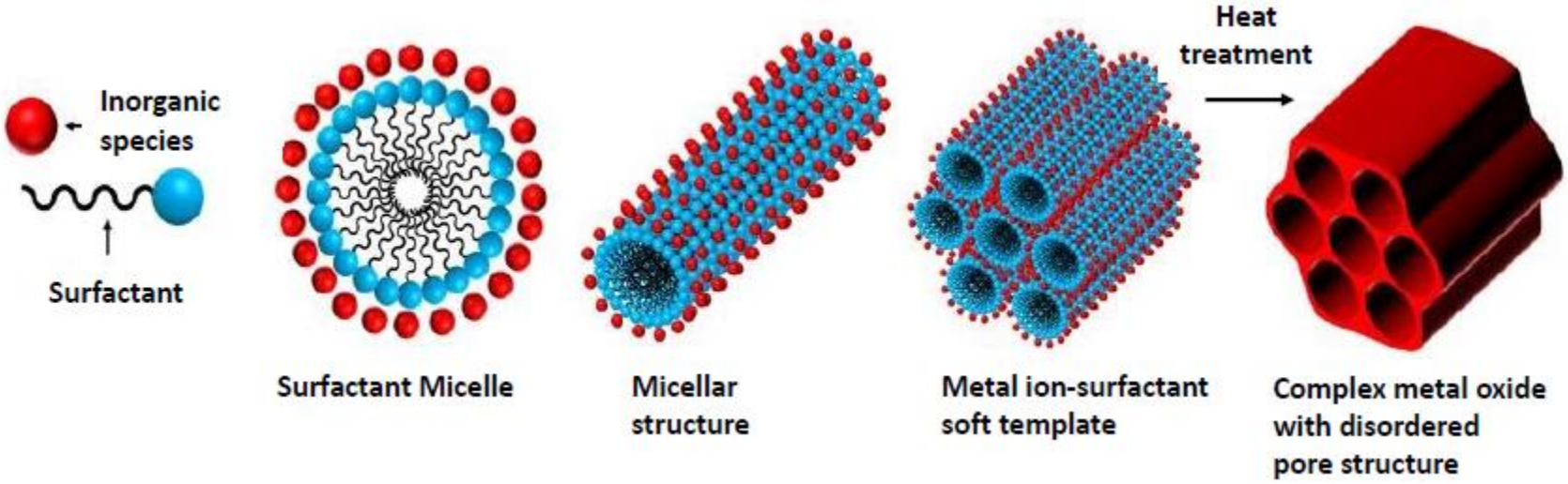
- Simple nanotechnology for superior battery cathodes.
- Precise control of composition and particle size.
- Low-cost production.
- Evaluation by Chinese/Japanese and Indian battery manufacturers.
- LFP is ideally suited to the energy storage market and other applications where energy density is less critical.





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# Sacrificial soft templating





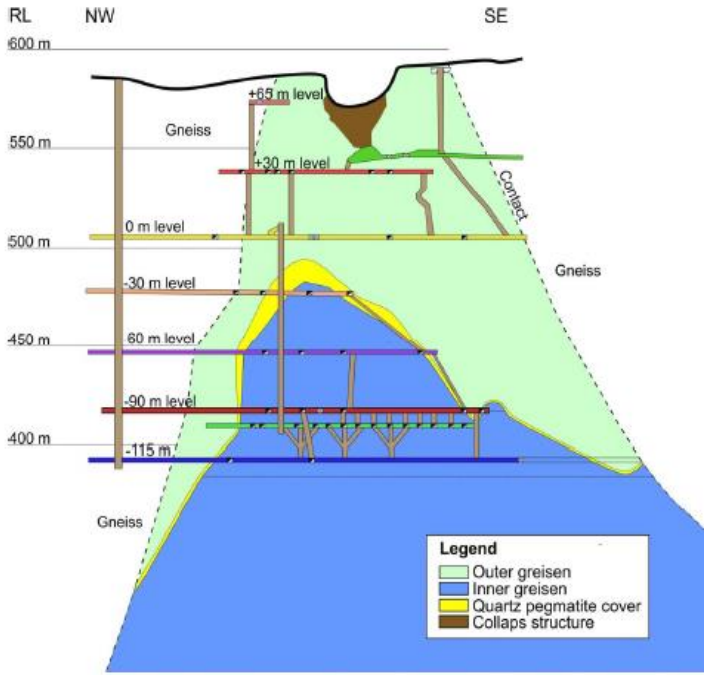

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# Batteries – the European reality

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## Sadisdorf lithium/tin project




## Pre-feasibility commenced



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# SiLeach®/VSPC®
## - a solution for domestic energy security

- Lithium micas processed with SiLeach® – convenient precursor to cathode powder production.
- **SiLeach®/VSPC requires no nickel and no cobalt.**
- No lithium hydroxide or lithium carbonate required.
- Battery recycling liquors as direct feed for VSPC cathode powder production.
- Cobalt and nickel-free cathode compositions minimise supply chain risk.


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# LMax®*

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# European energy security

- Energy security:
  - cannot be provided by renewables alone – storage required,
  - is not achieved by building battery factories,
  - is supply chain security for domestic battery production.
- Europe requires:
  - a domestic lithium feed source and domestic cathode production,
  - Ni and Co free battery chemistry.
- Lithium Australia can provide the elements for energy security.


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# Australian Battery Consortium

Lithium Australia has initiated the Australian Battery Consortium

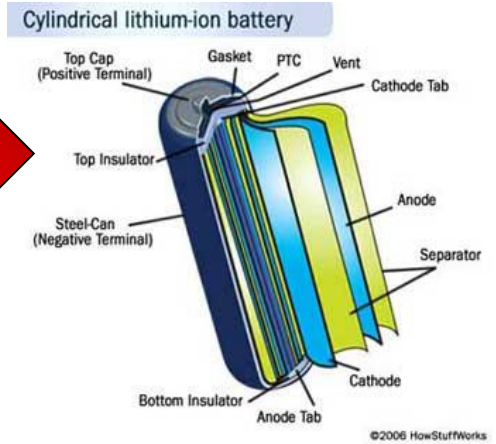
- Flexibility to use locally based raw materials or commercial supply.
- SiLeach® based lithium feed.
- Potential for domestically sourced materials to mitigate supply chain risk.
- Direct cathode production from waste using VSPC technology.
- International expertise from established battery producers.
- Not restricted by jurisdiction


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# Waste ➡ SiLeach® ➡ VSPC ®

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VSPC




- Successfully tested through to lithium-ion batteries.
- Modelled for European cathode powder production.
- Development plans for Australian battery production.



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# Conclusions

- Unconventional lithium sources provide a domestic supply opportunity.
- LFP chemistry is ideally suited to energy storage system (ESS) applications.
- Cathode powders can be directly generated from lithium micas using SiLeach® and VSPC technologies.
- Domestic supply of cathode powders and the use of LFP chemistry **eliminates the reliance on nickel and cobalt** providing ESS and supply chain security.
- Recycling provides additional supply chain flexibility.
- Lithium Australia has a package of proprietary technologies to make supply chain security a reality.


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# Advancing towards the future

- VSPC to:
  - develop the most advanced LFP cathode materials
  - introduce further cathode chemistries.
  - complete commercial cathode powder plant DFS in 2019
- SiLeach® to pilot material from one Australian and two European sources.
- ABC –Australian Battery Consortium initiative underway to provide domestic control of the supply chain and renewable energy security.
- Expansion of resource base:
  - Australia,
  - Europe.
- Monetizing the Electra project (Mexico).


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# An opportunity to secure domestic energy security




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