



## FUNDING AND COLLABORATION

- In February we submitted our executed agreements and our initial quarterly reports to the Commonwealth. This will unlock funding from the Commonwealth and Participants to support the ramp-up of our research and other activities.
- Australian based technology company, Calix Limited (Calix), has joined the CRC as a Key Participant – contributing important technologies and access to its existing thermal manufacturing pilot plant. This grows our number of participants to 48 across the value chain (details on back page).
- We expect to finalise some remaining agreements this quarter, which will lift the CRC's pool of cash and in kind commitments to circa \$120M. We are also in the final stages of agreements with other companies. We will continue to seek to expand our community of participants and funding base in order to support the various projects under development.
- Market conditions in the battery minerals sector have impacted some Participants resulting in reduced commitments for the time being. Most have remained as Associates for the time being, which allows them to maintain engagement in the CRC and increase contributions when market conditions change.



## RESEARCH PROGRAM

Contracts are being progressed for the CRC's initial five flagship research projects. There are 14 other projects across the battery value in various stages of development.

### CATHODE PRECURSOR PILOT PLANT

#### **Project Leader: Erin Ireland, Curtin University**

This downstream processing-focused flagship project aims to develop a Cathode Precursor Production Pilot Plant in Western Australia.

A staged project approach will be implemented as a pathway to commercialisation and highlight the key benefits and risks associated with precursor production.

There is a ready-made, existing market opportunity to increase the value retention for industry partners by assisting them with technology to move further along the battery value chain. The FBICRC and industry participants have identified cost-effective, sustainable production of superior quality battery precursors for cathodes as a research priority, while minimising waste from this process.

The cathode accounts for about one-third of the total cost of a lithium-ion battery, with high nickel content cathodes being able to deliver high energy density, with less capacity fade, while replacing the need for most of the scarcer cobalt and the risks associated with countries which may have less ethical supply chains and labour practices). The Cathode Precursor Production Pilot Plant will leverage and seek to refine existing infrastructure and technology established in partnership between the CSIRO and BHP for a similar scale battery grade nickel sulphate pilot processing plant, with the aim of enhancing technical and processing capabilities in Australia to manufacture nickel- rich hydroxide precursors.

The project has three standout objectives:

1. to demonstrate the feasibility of manufacturing mixed hydroxide NMC precursor in WA,
2. to demonstrate that this MHP precursor can be converted into lithiated and calcined cathode active (CAM) material, and;
3. that waste products can be converted into useful by-products.

This project will deliver the design, construction and operation of a batch pilot plant for manufacturing various cathode precursors. The verification and qualification of the final precursor's electrochemical and materials quality standards performance and QAQC evaluation

of CAM will be delivered through battery production and testing. Process modelling and scale-up verification of the final process design will form part of the research and be completed along with capital and operating costs for commercialisation at scoping study level.

## NATIONAL BATTERY TESTING FACILITY

**Project Leader: Professor Peter Talbot,  
Queensland University of Technology**

The National Battery Testing Facility will test battery systems against international standards for reliable and safe operation when deployed in main grids, micro- grids, and other large-scale uses such as electric vehicles, defence applications and mining. The project leverages the Queensland University of Technology's existing infrastructure which combines the University's battery materials and cell production pilot plant with a new renewable hydrogen pilot facility. Importantly, the project seeks to develop testing and safety standards for vanadium redox-flow batteries intended for domestic and grid energy storage, in addition to large scale lithium ion batteries and zinc-bromine flow batteries to facilitate national uptake.

The combined facility will feature "plug-and-play" capability to combine up to 250kW of solar PV, battery storage systems, H2 electrolyzers, fuel cells and hydrogen storage systems. It will include both DC/DC and DC/AC microgrids. The AC grid will be mains connected which will enable real time (residential) battery testing.

This flagship project, like the Cathode Precursor Production Pilot Plant, represents a major long-term investment for the FBI CRC. Its 4-year project timeline will establish equipment and associated infrastructure as well as establish testing regimes and standards for a range of battery chemistries and sizes, with a significant parallel objective being the formation of an east coast research and training hub to support advanced research, HDR and honours projects as well as practical TAFE course applications.

## INNOVATIVE NICKEL & COBALT EXTRACTION TECHNOLOGY

**Project Leader: Dr Elsayed Oraby,  
Curtin University**

With conventional mineral processing, losses of Nickel and Cobalt to tailings or smelter slags are significant. The Innovative Nickel & Cobalt Extraction Technology Project seeks to explore techniques to recover these crucial metals from waste streams. Conservative estimates from the project suggest \$20 billion worth of nickel and cobalt could be recovered from tailings and other waste materials at the sponsors' sites using these processes. Extending these technologies to the main product streams (i.e. those currently being processed through smelting) would allow further significant upside.

## ENHANCING LITHIUM RECOVERY

**Project Leader: Professor Aleks Nikoloski,  
Murdoch University**

The Enhancing Lithium Recovery Project will address key industry research questions to improve lithium production and meet the rising demand for lithium-ion batteries. The project will test new and improved processes for lithium extraction, recovery and purification as well as processes to manage waste streams that generate by products. From this research, the project aims to deliver integrated processing solutions that will allow lower cost production of battery-grade lithium, while reducing environmental impacts. The most significant opportunities are associated with the pilot plant development of flash calcination technologies for spodumene concentrates and improving concentrator recovery. Further research and development will address sodium sulphate reprocessing for reagent recovery and energy efficient lithium recovery.

## PROCESS LEGACY (WASTE REDUCTION)

**Project Leader: Professor Arie van Riessen,  
Curtin University**

The social licence to operate in mining and minerals processing is moving away from secure waste disposal towards sustainable solutions for a circular economy. The Process Legacy Project will investigate options to maximise economically viable co-products, minimise repository use and realise potential by-product uses, all within a regulatory acceptable framework. The project also aims to develop and implement new risk-based tools to better inform mine site operation and closure planning.



## STRATEGIC UPDATES

**Christina Lampe-Onnerud**

was appointed a special adviser to the Board in January 2020. Christina is a world recognised expert on battery innovation in supporting the world's unprecedented adoption of clean energy. Her company,



Cadenza Innovation, licenses next-generation lithium-ion (Li-ion) battery architecture representing industry-best benchmarks in safety, low cost and high-performance.

Christina will speak at an FBICRC Participants' Forum on 11 March in Perth to provide an international perspective on knowledge and lessons learned from battery innovation to date.



## OTHER INITIATIVES

- In February, the Federal Government announced \$11 million in new CRC-P project funding for six critical minerals projects focused on unlocking new ways to produce materials for advanced batteries.
- In late February, Western Australia's Energy, Mines and Petroleum Minister Bill Johnston released the Future Battery Industry Strategy – Implementation Progress Report. The Report provides an industry-wide snapshot into the significant developments across the state, including the creation of 2,349 additional jobs in regional WA.
- In March, the Federal Government announced a \$68.5 million Reliable Affordable Clean Energy for 2030 CRC. It aims to drive clean energy solutions.
- FBICRC will work in collaboration with these projects and initiatives where synergies or overlaps exist.



## 2020 KEY DATES

### 11 March

#### The Future Batteries CRC Participants' Summit, Perth

The March summit with a keynote welcome from Hon Bill Johnston MLA, Minister for Mines & Petroleum; Energy; Industrial Relations.

### 12 March

#### Meeting of the FBICRC Board, Perth

### 13 March

#### Official FBICRC Federal Ministerial launch,

Hon Karen Andrews MP, Minister for Industry, Science & Technology.



## PARTICIPATION LIST

Category	Organisation	Location	Type
Core	<b>BASF</b>	USA	Industry
Core	<b>BHP</b>	WA	Industry
Core	<b>Curtin University</b>	WA	Research
Core	<b>HEC Group</b>	NSW	Industry
Core	<b>IGO</b>	WA	Industry
Core	<b>MRIWA/DJTSI</b>	WA	Government
Core	<b>Multicom Resources</b>	QLD	Industry
Core	<b>Murdoch University</b>	WA	Research
Core	<b>Queensland University of Technology</b>	QLD	Research
Core	<b>University of Melbourne</b>	VIC	Research
Core	<b>University of Western Australia</b>	WA	Research
Key	<b>Blackstone Minerals</b>	WA	Industry
Key	<b>Calix</b>	NSW	Industry
Key	<b>Deakin University</b>	VIC	Research
Key	<b>Source Certain</b>	WA	Industry
Key	<b>Ultra Power Systems</b>	UK	Industry
Key	<b>University of Technology, Sydney</b>	NSW	Research
Associate	<b>Australian Vanadium</b>	WA	Industry
Associate	<b>BOC Limited</b>	NSW	Industry
Associate	<b>Chemistry Centre</b>	WA	Government
Associate	<b>City of Kwinana</b>	WA	Government
Associate	<b>Climate KIC</b>	NSW	Other
Associate	<b>Cobalt Blue</b>	NSW	Industry
Associate	<b>Covalent Lithium</b>	WA	Industry
Associate	<b>CSIR-IMMT</b>	IND	Industry
Associate	<b>CSIRO</b>	WA	Industry
Associate	<b>Department of Energy and Mining</b>	SA	Government
Associate	<b>Department of Natural Resources Mines and Energy</b>	QLD	Government
Associate	<b>Department of Defence (DST Group)</b>	ACT	Government
Associate	<b>Energetics</b>	WA	Industry
Associate	<b>Envirostream</b>	WA	Industry
Associate	<b>Everledger</b>	UK	Other
Associate	<b>FYI Resources</b>	WA	Industry
Associate	<b>Galaxy Resources</b>	WA	Industry
Associate	<b>Gemtek Automation</b>	WA	Other
Associate	<b>Goldfields-Esperance Development Commission</b>	WA	Government
Associate	<b>Josh Byrne &amp; Associates</b>	WA	Industry
Associate	<b>Kibaran Resources</b>	WA	Industry
Associate	<b>Lava Blue Limited</b>	QLD	Industry
Associate	<b>Lynas Corporation</b>	WA	Industry
Associate	<b>Magellan</b>	WA	Industry
Associate	<b>Mining and Process Solutions</b>	WA	Industry
Associate	<b>MRI (Aust) Pty Ltd</b>	VIC	Industry
Associate	<b>Pilbara Metals Group</b>	WA	Industry
Associate	<b>Proxa Australia</b>	SA	Industry
Associate	<b>RaptorTech</b>	WA	Industry
Associate	<b>South Metropolitan TAFE</b>	WA	Other
Associate	<b>Synergy</b>	WA	Industry
Associate	<b>Syrah Resources</b>	VIC	Industry
Associate	<b>Tianqi Lithium</b>	WA	Industry
Associate	<b>Total Green Recycling</b>	WA	Industry
Associate	<b>University of Adelaide</b>	SA	Research
Affiliate	<b>The Chamber of Minerals and Energy Western Australia</b>	WA	Other



