New Energy Industry Cooperative Research Centre

Ore to energy systems – Smart conversion of Australia's energy materials

February 2018

Cooperative Research Centres (CRCs) Explained

The Australian Government CRC program is a proven model that supports industry-led collaborations between industry, researchers and the community within Australia and internationally to develop new technologies, products and services.

It aims to:

- Boost the commercial returns from research while providing the flexibility required to respond to emerging economic challenges and opportunities.
- Link researchers with industry to focus on research and development that is geared towards end use and commercialisation
- Allow participants to share IP and partake in commercialisation
- Improve the competitiveness, productivity and sustainability of Australian industries, especially those with a competitive strength

CRC background:

CRCs are funded (50/50 Industry/Government) for up to 10 years.

210 CRCs have been funded since inception in 1991.

CRCs have undergone several independent reviews, all concluding the program has delivered significant economic, environmental and social impacts.

31 active CRCs including:

CRC for Optimising Resource Extraction (International Collaborations in Bolivia, Canada, Chile, France, USA, UK, PNG, South Africa)

Deep Exploration Technologies CRC (International Collaborations in Bulgaria, Canada, China, Finland, France, Germany)

Energy Pipelines CRC (International Collaborations in Canada, China, Japan, UK, USA)

PHRONIS CONSULTING

The Case for New Energy Industry Capacity Building

Why Now?

- Rapidly increasing demand (and prices) for Energy Materials for the New Energy Industry
- Australia is positioned to become a global leader

Why Australia?

- Australia is abundantly rich in Energy Materials that underpin the New Energy Industry
- Strong skills in exploring, mining and production
- Increase value-add into refining and efficient production of finished (customised) products
- Established technology and infrastructure base
- Alternative supply chain for geographic markets/customers (e.g. ASEAN countries)

What's the Value Proposition?

- Connecting material producers, METS and end users (building the ecosystem and critical mass)
- Connecting companies with world class research and development
- Growing existing companies and new opportunities for commerce

Defining New Energy Materials for the New Energy Industry:

Minerals, compounds, materials, devices and technologies that are mined, refined, produced or manufactured for the production, storage, transmission and utilisation of energy

PHRONIS CONSULTING

New Energy Industry CRC

aims to transform Australia's Energy Materials delivering industry leadership in advanced knowledge, process and business models to meaningfully contribute to the full energy value chain

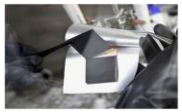
Value Chain

- Exploration and Resource Definition
- Mining Ore
- Beneficiation
- Manufacture
- Integration, operation and service
- Reuse Recycle

Growth by Cooperative Research

- Technological and Process Innovation
- Government Policy
- Knowledge/Skills/Services Development
- Commercialisation/Investment Capital
- Social License

Example Value Add – Revenue $ per unit of Lithium

$1	$3	$44	$500
			
Spodumene Production	**Lithium Carbonate Production**	**Lithium Cathode Production**	**Lithium Battery Production**

Source Black Rock Mining

PHRONIS CONSULTING

Value Chain Research Opportunities CRC

- Manufacturing next generation energy materials that bolster efficiency, reliability and security of globally transforming energy systems
- Energy storage systems for domestic, industrial and defence applications
- Designing and manufacturing next generation products, including integration and control technologies
- Developing comprehensive re-cycling capacity for high value energy materials
- Establishing government policies and regulations to spring board New Energy industry domestic and export growth
- Securing public trust and social licence for new industries and technologies
- Selling high-value energy industry materials, technologies and services to global markets.

PHRONIS CONSULTING

CRC Program Design

The New Energy Industry CRC programs would enable full value chain participation. Programs will have industry input and assessments of projects to guide commercialisation strategies.

Program 1
Industry Development

R&D: Policy, Regulation, Skills, Social Licence, Technology Adoption, Investment

Program 2
Resources and Processing

- Resource Identification
- Concentration
- By Product Recovery
- Purification

Program 3
Component and Product Solutions

- Material synthesis
- Cell development
- Product evaluation

Program 4
Integration and Delivery

- Fabrication
- Testing and Evaluation
- Scale Up
- Integration

Program 5
Reuse and Recycle

- Collection
- Reuse evaluation
- Recycle flowsheet

PHRONIS CONSULTING

Potential Research Projects

	Program 1 Industry Development	Program 2 Resources and Processing	Program 3 Component and Product Solutions	Program 4 Integration and Delivery	Program 5 Reuse and Recycle
Value Proposition	**• Grid stability • Lower energy prices • Manufacturing industry investment**	**• Low cost delivery of feed materials into Global Energy Storage supply chains**	**• Fit for Purpose Storage Systems (capacity, cost, charge/discharge rate, lifetime)**	**• Fully functioning Applications - e.g. Grid Frequency Control Load Following Spin Response / Voltage Support / Black Start**	**• Circular economy outcomes - lower costs due to material recycle**
Potential Research Projects	• Policy to enhance recycling of batteries	• Low cost pathways to produce Lithium Carbonate from Lithium Silicates and other sources	• Next generation storage solutions: Synthesis pathways for Li-Ni-Mn-Al batteries • Fabrication of high surface area material structures to allow high charge transfer lower costs	• Modelling reduced congestion charges with Energy Storage • Modelling increases in capacity for variable renewable resources	• Integrated processing and recycling of raw and recycled materials streams
	• Investment attraction for battery manufacturing	• Low cost pathways to produce metal sulphates for batteries from processing stages	• Alternative low cost electrode materials: Use of graphene and carbon nanostructures to increase electrochemical activity	• Modelling reduced power network infrastructure needs and costs with Energy Storage	• Policy settings to encourage collection and recycle
	• Techno – Economic optimisation of market rules for new energy system	• Low cost pathways to recover by-products from smelter streams (e.g. Se/Te in Copper streams, In/Ge in Zinc Stems)	• Improves in service: In-Situ Sensors for Cell nano-Structural changes with charge /discharge cycle	• Modelling of multiple interacting micro-grids with Energy Storage and modelling time of use bill management and increased solar PV use	• By-Product recovery from other e-waste integrated into battery materials supply chains

PHRONIS CONSULTING

Next Steps

- Continue to define scope for CRC with stakeholder input
- Extend consultation with industry and government to confirm priority needs
- Identify existing knowledge, capabilities, gaps and opportunities
- Define research programs and projects
- Formalise governance structure
- Submit CRC EOI June 2018

PHRONIS CONSULTING