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SUBMISSION TO  
QUEENSLAND  
GOVERNMENT  
RESOURCES INDUSTRY  
DEVELOPMENT PLAN  
FEBRUARY 11, 2022

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**Advanced Materials and Battery Council<sup>1</sup>**

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<sup>1</sup> The Advanced Materials and Battery Council is not yet incorporated but is in process to be established through the Ai Group.

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## Introduction

Global investment in batteries is projected by the IEA to average US\$450 billion per annum over the next decade if the world is to keep carbon dioxide emissions to levels that avoid destructive levels of climate change. The IEA warns that supply of metals and battery precursor materials will have to increase by around 30% per annum to meet these targets [1]. Consequently, countries from Europe to the Americas and the Asia Pacific have recognised the economic opportunities associated with batteries and are actively supporting investment to benefit from the ensuing economic development.

Unlike other countries attempting to benefit from this opportunity, Queensland currently hosts a fledgling but impressive, multi-chemistry battery industry value chain. However, the sector will struggle to grow into a comprehensive ecosystem without being identified in the Queensland Government's advanced manufacturing roadmap, as a priority industry, or prioritised for assistance from the Queensland Jobs Fund. The battery industry value chain comprises prospective miners for critical minerals, start-ups spun out from university laboratories seeking to commercialise novel critical mineral processing technology, electro-chemical and cell manufacturing, battery management and pack development to meet the global demand for environmental, social and governance (ESG) compliant battery componentry, in addition to companies supplying energy storage and management systems for Australian domestic installations. Companies in the value chain operate largely in isolation from each other but want to benefit from downstream collaboration between miners, processors and electro-chemical manufacturers as well as upstream between those operating at the retail end who currently import and assemble lithium cells, packs and/or battery management systems for sale but would prefer to source locally. A list of the industry proponents is included in Attachment A.

Most of the industry proponents within the Queensland battery industry value chain seek the benefits of a comprehensive battery industry ecosystem to foster a vibrant and robust sector to grow and compete in the emergent global battery market. Prospective members are in process to establish the Advanced Materials and Battery Council (AMBC) to represent their interests to all levels of government, participate in the development of effective policy frameworks and facilitate collaboration between members. Queensland research institutions and the Queensland Department of Energy and Public Works also indicate an interest in Council membership.

Prospective members of the AMBC recognise the importance of the Queensland Government's Resources Industry Development Plan (RIDP) because of the RIDP's vision and objectives. Equally, they support the vision of a resilient, responsible and sustainable Queensland resources industry that grows as it transforms, and the AMBC supports the

stated objectives of the RIDP to grow and diversify the resources industry, strengthen Queensland's ESG credentials and improve regulatory efficiency. Not all 'downstream' industry proponents in the AMBC are currently coupled with a Queensland-based resource, because some technologies are not reliant on specific deposits, but this should not lessen the importance of their contribution to the resource industry development plan, a global battery value chain and their contribution to Queensland's economic future.

The embryonic nature of both the AMBC and the industry proponents who plan to be members of the Council, limits the resources available for the Council, and the institutional capacity of the Council, to engage with the Queensland Government, the Commonwealth Government, Local Governments, international corporations, industry consortia, investors and financiers, and grow the battery industry ecosystem in Queensland. For this reason this submission discusses those aspects of the RIDP that are critical for the sector's success/survival and is primarily focused on action item 4 of the RIDP to develop a battery industry strategy, although some commentary is provided on related action items.

The submission that follows addresses each of the RIDP Key Focus Areas by commenting on the proposed actions for those focus areas.

## Key focus area 1: Grow and diversify the industry

### Action 3: Investigate promotion strategies for Queensland's new economy minerals

There has been excellent international promotion of the extractive industries by the Commonwealth and Queensland governments but there is less attention to international promotion of Queensland's downstream companies associated with the 'new economy'. To demonstrate the depth of available technology, research and government support, it would be particularly useful if promotion activities were co-ordinated across all Queensland Government departments associated with new economy minerals, new economy advanced materials and new economy technologies.

### Action 4: Develop a Queensland Battery Industry Strategy

Research over recent decades points to the important role of proactive government intervention for building successful development of critical industry sectors, whether in minerals, advanced manufacturing, health sciences and biotechnologies, informatics and so on. This submission outlines the key success factors for sector development, evidence of industry policy applied around the world, and how battery hubs have developed elsewhere. The response on action item #4 further discusses how other states in Australia are

approaching the opportunity for development of a downstream critical minerals industry and concludes with recommendations for a battery industry strategy for Queensland.

### Key success factors for sector development

Proactive government intervention has been found to be the key element of successful sector development through:

- **support for small producers to grow and be globally competitive** including co-ordinating actors for sector innovation (including entrepreneurial hubs), acquiring core technologies through subsidies for R&D and technology transfers from other sectors & countries, demand creation through local sourcing and local workforce requirements [2] [3, 4];
- **risk and uncertainty management** through assisting with commitments to irreversible investment decisions, linking macroeconomic management and industry, and managing conflict between competing interests [5];
- reaching understanding with **business elites to pursue state objectives** [6], and good governance to enforce strategic vision and influence investment and industry to Make Winners rather than Pick Winners (or Losers) [7, 8];
- creating government-business-research **collaborations** targeted at forging a local ecosystem by strengthening connection between global firms, local entrepreneurs, investors, research community and domestic labour force to learn about constraints faced by firms, leverage local academic/scientific and research base, make education part of the initiative, experiment to establish best ways to remove constraints, monitor to evaluate policy success, and adapt policy to incorporate learnings into ongoing policy framework [3, 9]; and
- formulating **policy linked to regional capacities and opportunities**, but ensuring that the actions and instruments used are cohesive and consistent with the state and federal levels by interlinking aligned policies such as innovation policy (R&D subsidies, technology transfers), social and skills policy (labour force participation, training, education) and energy policy (access to affordable energy) [10].

### Evidence of application and success of industry policy

Professor Ha-Joon Chang, Dr Antonio Andreoni & Ming Leong Kuan from Cambridge University were commissioned by the UK Government's Foresight Future of Manufacturing Project to assess the nature of successful industry policy around the world and gain insights for UK industry policy to support and grow manufacturing [2].

Chang et al find that China, Japan, Korea, Germany and the United States of America all have industry policy frameworks to promote national industries detailed in the **Key Success Factors for Sector Development** above. In summary, governments that have successfully developed new industries pursue a variety of policy tools, including: well-articulated

strategies to support targeted sectors; access to cheap finance; facilitation of international competition; integration between suppliers, producers and customers including regional clusters; promotion for innovation through public funds and tax breaks for R&D [2]. A “Hidden developmental state” [11] has emerged in the United States of America to conduct industry policy under the names of defence, health and agricultural policy. The clandestine nature of this form of industry policy results in unstable funding, lack of co-ordination across policy areas and excessive commoditisation of knowledge [2].

### **Evidence of success of battery hubs**

A recent report produced by the Future Battery Industry Co-operative Research Centre (FBICRC) [12] notes that if Australian governments wish to move Australian industry to downstream processing and manufacturing within the highly-competitive, fast-emerging global battery supply chain, policy makers need a coordinated and strategic approach to accelerate hub development. While natural resource endowments in battery minerals provide a once-in-a-generation opportunity to develop future downstream industries, successful companies will have to compete with those in countries that have already invested heavily (both government and industry). The FBICRC report examined international battery hub sites: 1) Leipzig-Dresden-Berlin (LDB) Triangle, Germany; 2) the Gigafactory in Nevada, USA; and, 3) Osaka, Japan for success factors. The study did not provide evidence for a perfect ‘hub’ location or model. Each hub evolved with different complementary industries, small-to medium businesses, multinationals, government services, training facilities, R&D institutes, universities, infrastructure, and policy frameworks. Australia’s distance from battery consumer markets and the scale of investment by governments in the Northern Hemisphere on industry hub development will require determination to participate in this global opportunity. The projected growth in the global industry does however provide a robust rationale for Australian participation in the global supply chains.

According to the FBICRC report, hub proponents must specify the clear strategic advantages and benefits of regional ‘assets’ and collaborative commitments. The recommendations to facilitate battery hub development include:

- Leveraging current Australian assets to grow advanced battery industry, and support hub development.
- Identifying and working with champions for change.
- Aggregating production efficiencies through site strategic selection and design.
- Working with relevant stakeholders to optimise and streamline hub governance and regulations.
- Increasing industry innovation capacity and global competitiveness.
- Advocating for and progressing agendas to decarbonise production.

- Facilitating industry accreditation and the introduction of resource traceability technologies.
- Capacity building across industry.
- Implementing circular economy and industrial symbiosis principles and practices.

**“The key lessons from the international case studies was they did not offer the cheapest labour, nor provide a perfect hub location in all aspects, but that industry and government collaborated to identify and leverage competitive advantages to strengthen regional development” [12, P37].**

### Potential to grow battery related circular economy

Currently, more than 90% of spent li-ion batteries (LiB) in Australia will end up in landfill. Of LiBs that are recycled, only small sized batteries can be recycled, and almost none can be recycled efficiently in Queensland. Envirostream, based in Victoria, recycles small sized LiBs but anything oversized is shipped overseas. With the accelerated uptake of electric vehicles comes bigger LiBs that will need to be recycled, similar to the current successful program to recycle lead-acid batteries. Recycling LiB facilities will enable the extraction of valuable metals from spent batteries to be fed back into battery value chains, at the same time as reducing landfill.

Recycling technologies can be developed to suit the unique Australian industrial ecosystem and be adaptable to the evolving types of battery technologies being used. Australia is already a leader in the primary production of battery metals (Ni, Co, Cu, Li, Al, Pb, Zn) and this position can be leveraged in that primary production facilities can be adapted to recycle battery materials concentrates or intermediate products. Queensland would be a logical location for a recycling facility being on the North side of the East Coast in line with transportation infrastructure from the major cities but closer to international trade partners. In Queensland, a first stage LiB recycling facility could conceivably segregate copper and aluminium foils and send them to the Townsville copper refinery and Boyne Island Aluminium Smelter, respectively. Ni/Co and Li concentrates could be sent to refineries in Western Australia. In the future, new Ni/Co refineries being proposed in Queensland could take in the materials (QPM / Australian Mines / Pure Battery Technologies) and make custom compounds for local battery manufacturers. Other components of the batteries such as the conductive graphite and possibly even the electrolyte could be considered in recycling approaches.

Recycling technologies pioneered in Queensland could also themselves be exported to other countries with larger markets but lower expertise in metal processing.

Recycling LiBs offers Queensland the opportunity to develop a new industry integrated into a larger battery industry ecosystem to provide intermediate inputs to battery manufacturing. In terms of a global market for recycling, a longer strategy should address

the opportunity to import first stage intermediate recycled product from neighbours (including Indonesia, forecast to be the fourth largest economy in the world by 2050) for advanced processing and refining as input to battery manufacturing in Queensland.

## Summary of strategies related to batteries in other states in Australia and selected other countries

### *Western Australia*

Western Australia announced a **Future Battery Industry Strategy** in 2019 [13] with the aim of growing WA's future battery industry as a significant source of economic development, diversification, jobs and skills. As part of the strategy the WA government committed to strengthen relationships with global investors and manufacturers in battery and EV supply chains and fast-track new battery projects in the state.

In November 2020, the WA Government announced a Future Battery taskforce [14]. The WA Government also announced that it is actively seeking to attract global cathode active materials manufacturers to the state allocating \$13.2 million to attract global precursor or cathode active materials manufacturers to WA. The WA government has also developed Kwinana as a Strategic Industrial Area (SIA) to foster specialist chemical and resource-based processing. Kwinana SIA is already home to Alcoa (alumina), CSBP (chemicals / fertilisers), Wesfarmers (LPG), Tianqi Lithium Australia (lithium hydroxide), Avertas Kwinana (Waste to Energy) and Covalent Lithium (Lithium hydroxide). BHP's Nickel West has recently opened a nickel sulphate plant in Kwinana powered by 50% solar energy.

There is evidence that WA's policy framework, including the support for the Kwinana Strategic Industrial Area, is leading to significant investment in critical minerals downstream manufacturing capacity [15].

### *New South Wales*

The NSW **Critical Minerals and High-Tech Minerals Strategy** was announced on 29 November 2021 [16]. It is a vision to build on existing potential and position NSW as a major global supplier of critical minerals and high-tech materials. Actions include: proactive development of critical minerals battery supply chains; the establishment of a Critical Minerals Hub near Parkes to leverage renewable energy from the Central West Orana REZ and support advanced manufacturing; and attract investment for downstream processing through collaboration with Japan, India, South Korea, the EU, US, UK, Austrade and DFAT. NSW commitments include investment of \$350m to secure jobs, \$185m for infrastructure in Parkes, and \$750m for the Net Zero Industry and Innovation program to drive demand in technology requiring critical minerals.



### *South Australia*

South Australia's **Thinking Critical South Australia** is a global crowd sourcing program to attract innovators and entrepreneurs in the critical minerals value chain to unlock the state's critical mineral deposits [17]. In the first of 2 rounds, the 5 best proposals announced on 28 February 2022 will be given \$50k and other incentives like support to establish in SA, marketing, introductions to customers, business networks and the critical minerals ecosystem, and access to research facilities. The second round will open from 1 March 2022 to 30 April 2022.

### *Northern Territory*

The **Territory Critical Minerals Plan** was announced in 2019 and is a vision for producing, processing and manufacturing critical minerals through accelerating exploration, supporting projects to commence production and growing refining, processing and manufacturing of the minerals [18]. A local jobs fund of \$89m seeks to attract investors in lithium, vanadium, copper and rare-earths. The NT Government has also invested \$0.5m with the FBICRC to research downstream opportunities.

### *Canada*

Invest in Canada, the investment attraction agency for the Canadian Government is spruiking its credentials to become a battery supply chain hub [19].

### *United Kingdom*

UK Innovation and Research has launched the Faraday Challenge [20] to drive battery manufacturing in Britain. Included in this initiative is establishment of the UKP108million Faraday Institution to be the UK's independent institute for electrochemical energy storage research, skills development, market analysis, and early-stage commercialisation [21]. In addition, UKP120m has been invested in a UK Battery Industrialisation Centre to support companies quickly develop manufacturing capacity to meet global demand.

### *South Korea*

The K-battery strategy will invest US\$35bn in research by 2030 and create a public-private plan to secure technologies and establish a battery ecosystem to gain dominance in the battery market [22]. Batteries are designated as a national strategic technology and tax cuts are offered to encourage research and investment in infrastructure.

### **A battery industry strategy within Queensland's industry policy framework**

There are two overarching rationales for Queensland to develop a robust battery industry strategy:

1. Diversify Queensland's economy to prepare for the global energy transition. The IEA predicts that global coal demand will decrease by 2030, the extent of which will depend on how ambitious global climate goals will be, through reduced coal-fired generation and new methods for the production of steel [1]. Announced plans for automation in the mining industry [23, 24] highlight the potential for employment loss in Central Queensland [25, 26] in addition to that associated with global demand decline. Thus, new opportunities for regional economic development need to be pursued. Manufacturing is a rich source of employment for persons, not only in the manufacturing sector, but also the sectors integrated with manufacturing from mining through to professional services and research. Although globally employment-density in manufacturing is reducing as automation improves productivity, skills required for higher-level manufacturing (i.e. manufacturing requiring cutting edge technology destined for global markets) include high levels of tertiary educated innovators, entrepreneurs, researchers, engineers and associated professionals.
2. Benefit from the global energy transition. Global investment in electrification of transport to achieve climate goals is predicted to reach US\$370 billion per annum by 2030 [1]. Both the European Commission and the US Government have identified the need for preferential partnerships to secure battery supply chains for electric vehicles [27, 28]. European auto manufacturers are particularly vulnerable to strategic risk associated with access to new economy minerals because of their lack of domestic strategic mineral deposits. Queensland has economically viable deposits of all minerals (except lithium<sup>2</sup>) required for battery supply chains and the potential to partner with auto and battery manufacturers to secure access to feedstocks for batteries. The Queensland Government owns a significant proportion of Queensland electricity supply assets which gives it the levers to pursue a careful strategy to transition electricity supply to meet Net Zero Emission targets and ESG credentials for customers, through investment in battery storage to secure supply from renewable sources, including onsite supply to manufacturing sites, and requisite tariff and pricing arrangements to keep down energy costs for manufacturers. There is a further advantage to processing and manufacturing in Queensland – namely the opportunity for low cost, low emission, solar energy. If this opportunity can be exploited, product manufactured in Queensland will not only secure access to required resources for manufacturers but will avoid carbon border adjustments to account for CO<sub>2</sub> emitted during manufacture on entry into Europe or North America.

## Recommendations for a Queensland Battery Industry Strategy

1. **Industry policy framework.** Developing a new sector and manufacturing ecosystem from fledgling tech start-ups is challenging, and policies to support a battery industry

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<sup>2</sup> It has been reported that several locations in Queensland are prospective for lithium mineralisation and are under exploration..

strategy will need to be integrated into Queensland's existing industry policy framework and plans for the 2032 Olympics. This will require:

- a. a comprehensive review of the existing industry policy framework;
  - b. research on how the existing framework should be amended/redeveloped to meet a battery industry strategy as well as meet the commitment to a carbon neutral 2032 Olympic Games; and
  - c. the commissioning of a report to identify the medium to long term potential for the advanced materials and battery sector in Queensland in terms of employment, value add and exports, if the sector is accorded government assistance through a supportive industry policy framework.
2. **Battery industry strategy timeframe.** Governments in Western Australia, Canada, South Korea and Singapore are already seeking relationships with critical minerals suppliers to attract investment to build downstream processing and manufacturing hubs in their countries. If Queensland is to benefit from its critical minerals deposits and green-tech start-ups that are currently seeking a foothold on the global stage, its battery industry strategy needs to be rolled out urgently to avoid losing the investment in downstream processing and manufacturing to those countries that have further advanced plans to develop their sectors.
3. **Support for Advanced Materials and Battery Council.** Limited institutional knowledge and capacity of industry proponents in the Queensland battery industry, makes a well-resourced Council critical to the success of each of the member companies and the establishment of a robust battery industry ecosystem in Queensland. Council members are prepared to fund acquisition of institutional capacity to support the sector development, but they are, as yet, too small to create the depth of capacity required for success. The Queensland Government should seek to support the AMBC with financial, professional and technical resources to facilitate collaboration between industry proponents and Government on policy frameworks but also to support industry proponents navigate the complexities of commercialisation of novel technologies for a new and fast-evolving global supply chain. For budgeting purposes, the Queensland Government might seek to:
- a. fund a full-time general manager for the AMBC for 2 years, with the requisite engineering and commercialisation expertise, to be the primary representative of the AMBC and the battery industry when advocating for the sector to governments, customers, financiers and partners; and
  - b. second key Queensland Government officer(s) to the AMBC to facilitate access to the appropriate decision-makers and policy makers within the Queensland Departments of State Development, Regional Development and Manufacturing, Energy and Public Works, Resources, Treasury, Trade and Investment Queensland, and Townsville City Council.
4. **Priority Industry Status for Advanced Materials and Battery sector.** The large opportunity emerging from global electrification of transportation (estimated to be

an annual average of US\$370 billion over the next decade [1]), is evidence of the potential for the Advanced Materials and Battery sector in Queensland to become a significant industry, employer and exporter of Queensland resources, ingenuity and technology. Despite the global opportunity, the Advanced Materials and Battery sector is not included as a Queensland Priority Industry reducing industry proponents' eligibility for state assistance. Priority Industry Status should be awarded to the Advanced Materials and Battery sector urgently.

5. **Queensland Jobs Fund.** Significant funds from the Queensland Government are earmarked for renewable energy, hydrogen projects and investment in Queensland businesses, but there is no prioritising of either grants, loans or investment for the Advanced Materials and Battery industry proponents. Industry proponents not backed by the Queensland Government are vulnerable to relocate because of attractive proposals from other countries, or states in Australia, investing to meet projected global demand. Funds should be earmarked for financing commercialisation and scale-up of Queensland companies participating in the Advanced Materials and Battery value chain.
6. **Townsville Battery Hub.** Townsville is attractive for critical minerals processing/refining because of its pre-existing port facilities and access to the North-West Minerals Province critical mineral deposits. A battery/manufacturing hub in Townsville is supported by AMBC members, in particular those members that have plans to operate from Townsville. As a matter of priority, the Queensland Government should take responsibility for the development of the Townsville industrial precincts to be fit-for-purpose for critical minerals processing and refining (irrespective of who owns the precincts).
7. **National Battery Testing Centre (NBTC).** The FBICRC has funded the establishment of the NBTC in Brisbane until 2024. The NBTC strategically underpins the advanced materials and battery sector in Queensland and will play a pivotal role in testing and standards of locally produced and imported batteries and components. The NBTC is already strongly integrated with industry proponents who highlight the importance of the technical expertise, infrastructure, and ability to demonstrate integration of large-scale energy storage into micro-grids that the NBTC brings to the sector in Queensland. The existence of this facility in Brisbane will attract new companies in the battery value chain to Queensland. The Queensland Battery Industry Strategy should seek to secure the long-term future of the NBTC in Brisbane subject to guidance from the NBTC and industry proponents.
8. **Circular economy.** Invest in research to develop efficient LiB recycling processes for multiple battery chemistries and the feasibility of integrating recycled product into existing processing streams. Research should seek to encourage partnerships with primary industry proponents to facilitate integration of recycled metals from LiBs into existing processes. In addition, recycled metals should be credentialled to ensure that they meet ESG and the EU Battery passport requirements.

9. **Queensland Government Technical capacity.** The Queensland Government already boasts a Chief Health Officer, Chief Scientist, Chief Entrepreneur, Chief Justice, Chief Geologist, Chief Economist and Chief Statistician but no one individual with the technical and executive responsibility to guide policy relating to a complex, dynamically evolving, global battery value chain. Research points to the importance of policy makers being learning directors [8] or engineers [29] to close the knowledge gap [4] and direct acquisition of missing technologies through research, purchase or collaboration. A Chief Battery Engineer would facilitate the development of an eco-system from uncoordinated piecemeal technologies rather than the existing industry proponents playing a minor role in other nations' sector development.

### Action 5: Continue to implement the Queensland Government's Advanced Manufacturing 10-Year Roadmap and Action Plan

Members of the AMBC are of the view that Advanced Manufacturing 10-Year Roadmap does not advance the case for the battery industry, even though it should. The Roadmap points to the importance of the Fourth Industrial Revolution, in particular the key industries of: aerospace; biofutures; biomedical; defence industries; food, beverage and beef processing; mining equipment, technology and services; precision agriculture; rail manufacturing; renewables and hydrogen; and resource recovery. However, this scope excludes the very large opportunity identified by the International Energy Agency for the electrification of transport. It also excludes the opportunity presented by the global shift to renewable energy which requires stationary battery storage to secure supply and stabilise the grid. Electrification of transport and transition to renewable sources of energy will be defined by batteries of a multitude of chemistries not mentioned in the Roadmap and not usually associated with the Fourth Industrial Revolution.

Members of the AMBC request that the battery industry strategy be integrated into Queensland's industry policy framework, to be visible as an important and potential growth sector, including pragmatic support for the battery industry in the way of assistance with capital and debt raising, international marketing, world class research into emerging technologies and access to policy and decision makers within all levels of government.

### Action 6: Continue to support regional manufacturing hubs

The mayor of Townsville has the stated objective of establishing Townsville as a regional battery hub. Townsville is attractive for critical minerals processing/refining because of its pre-existing port facilities and access to the North-West Minerals Province critical mineral deposits. A battery/manufacturing hub in Townsville is supported by AMBC members, in particular those members that have plans to operate from Townsville.

Kwinana, in Western Australia, is already recognised as a battery hub within the Kwinana Strategic Industrial Area [15]. Unlike Kwinana, Queensland’s regional manufacturing hub in Townsville has no adequate industrial precincts suitable to support a battery hub. One precinct is owned by the Townsville Council whilst another is owned by the Queensland Government. Neither of these facilities is adequately developed for industry proponents to commence construction. The lack of suitably developed industry precincts has already caused delays to progress on members’ project plans. Without urgent attention to the development of the industrial precincts, the industry proponents may be forced to relocate to developed industrial precincts in other states or countries, and Townsville may never become a battery hub.

As a matter of priority, the Queensland Government should declare Townsville a manufacturing/battery hub, take responsibility for the development of the industrial precincts to be fit-for-purpose for critical minerals processing and refining (irrespective of who owns the precincts), and seek commitment from the Commonwealth Government to invest in development of the manufacturing/battery hub in Townsville as part of the Commonwealth Government’s Low Emissions Technology Roadmap, the Modern Manufacturing Initiative or any federal program to facilitate Queensland’s, Australia’s and the global transition to a low-emissions economy.

### Action 7: Review of rent for new economy minerals projects

Council members with mining operations request rent moratoriums on new economy minerals to provide support for enhancing competitiveness against low-cost, poor ESG credentialled countries to get established and develop strong networks with customers.

### Action 8: Facilitate and investigate common user infrastructure

Council members request attention to the following common user infrastructure:

- Industry precincts, particularly in Townsville
- Port upgrades, particularly in Townsville
- Rail network expansion, particularly out to the North West Minerals Province
- Road networks, particularly from remote deposits to existing transport networks
- Water infrastructure for projects west of the divide
- Support for renewable energy systems to provide power to all mining, processing and manufacturing projects
- Copperstring 2.0, powering Northern Qld, 1,000KM high voltage network line – Townsville to Mt Isa

### Action 13: Refresh Queensland's approach to innovation

Innovation doesn't stop when a university lab has a scientific breakthrough, or a start-up moves into an innovation precinct. New technologies need to be supported through early commercialisation with novel financing schemes, mentoring for technology executives, formulation of tertiary education to reflect emerging industry requirements and thick networks of collaboration to improve knowledge dissemination, problem solving and a supportive policy framework. Queensland's approach to innovation needs to integrate into industry policy through support for entrepreneurial start-ups to avoid the 'valley of death' or the relocation of promising start-ups to countries prepared to invest in early stage commercialisation.

## Key focus area 2: Strengthen our ESG credentials and protect the environment

### Action 14: Establish a government–industry working group to determine appropriate government action

Queensland has the potential to become the Green-Metals State. The Advanced Materials and Battery sector recognises the importance of a government-industry working group to advance the appropriate action for ESG credentialing and the members are committed to engaging with a working group. However, the AMBC represents a small industry, and it is essential that engagement does not overburden industry proponents.

### Action 16: Investigate research and development support options, particularly for mineral traceability technology

The AMBC recommends ongoing government investment in research to develop tangible technology solutions that can support traceability and transparency across supply chains. The EU battery passport and other regulatory requirements will define the competitiveness of product produced by AMBC members in Queensland. In addition, the AMBC recommends that the Queensland Government invest in the commercialisation of solutions such as that being developed by Everledger to ensure that solutions developed become standardised frameworks to be applied across all jurisdictions participating in the manufacture of batteries. Everledger, which is currently working on a pilot to start to address some of these needs, with the support of the Critical Minerals Facilitation Office, is a proud founding member of the AMBC.

## Focus area 6: Improve regulatory efficiency

### Action 36: Improve resource project assessment processes

- Consider short term royalty relief until new economy minerals projects are fully commercialised

## Conclusion

AMBC members are excited about the very large opportunity for the Queensland resources industry from a global transition to Net Zero emissions. Equally the members are committed to commercialising innovative technology for the global battery market. It is not possible for small, innovative mining and tech companies to compete globally without significant government support as alluded to in this submission. AMBC members request that the Queensland Government partner with the AMBC to develop the collaborative environment required to establish a new advanced materials and battery sector that beats competitors in other countries because of its nimbleness, cohesiveness, world class technology and supportive policy framework.



## Appendix A: Queensland Battery Industry Eco-system

AMBC Segment	Company name	Project Description	AMBC Member
Critical mineral mining	<b>Aeon Metals</b>	Walford Creek, copper-cobalt project, 350 km north west of Mt Isa, owned by Aeon Metals, reports a cobalt sulphide deposit with an estimated reserve of 35 Mt at 0.12% cobalt and mineralisation including copper, zinc and gold.	Yes
	<b>AlumTek Minerals</b>	Bauxite mining tailings processing for rare earth oxides and other critical minerals	Yes
	<b>Australian Mines</b>	The Sconi project spans three mining license areas in Greenvale, Lucknow and Kokomo in north Queensland. The deposits of nickel, cobalt and scandium are hosted in laterites that are economically viable.	Yes
	<b>Lava Blue</b>	Lava Blue acquired a portfolio of exploration and mining permits though the purchase of the Mt Rosey Mining Company Pty Ltd, and more recently Cloncurry Industrial Minerals Pty Ltd. Permits currently held are prospective for manganese, cobalt and a range of other critical minerals.	Yes
	<b>Multicom Resources</b>	Saint Elmo Project, owned by Multicom Resources, is situated east of Julia Creek and boasts a significant vanadium deposit.	Yes
	<b>QEM Ltd</b>	Julia Creek Project, owned by QEM Ltd, includes a large vanadium deposit and shale oil in Julia Creek.	Yes
	<b>Vecco Group</b>	Debella Vanadium Project, owned by the Vecco Group, is located in NW Queensland and contains a large, high grade, shallow Vanadium and Alumina resource.	Yes
	<b>Lithium Energy Limited</b>	Burke Graphite Project, owned by Lithium Energy Limited, now listed on the ASX (LEL), located in the Cloncurry region, 122km from Mt Isa and 783km from Townsville, comprises a natural graphite deposit, with potential for low cost open-pit mining.	No
	<b>Novonix</b>	Mt Dromedary Graphite Project, owned by Novonix, located in the Cloncurry region, comprises an extensive, high-grade graphite deposit. Novonix have made no announcements on this project since 2018.	No
	<b>Eclipse Metals</b>	Mary Valley Manganese, owned by Eclipse Metals, 16 km south west of Gympie, is a previously mined manganese deposit, with possible mineable potential.	No
	<b>Strategic Metals Australia</b>	Strategic Metals Australia claimed to have discovered lithium lepidolite deposit in Georgetown, 400km south west of Cairns (Gluyas, 2019). Nothing further has been reported on this deposit.	No
<b>QNI Resources</b>	QNI Resources tailings, are claimed to hold more than 69,000t of contained metal by the owner Clive Palmer (Creagh, 2018).	No	
Metal processing / refining	<b>Alpha HPA</b>	Alpha HPA plans to process High Purity Aluminium (HPA) from the Collerina Ni-Co-Sc Project in NSW for speciality coatings for LEDs, Li-ion battery electrodes and cathodes (in particular NCA and NCMA) at a Precursor Production Facility in Gladstone with a capacity of 10kt of HPA equivalent per year by 2023.	Yes
	<b>Australian Mines</b>	Sconi project plans to produce nickel sulphate and cobalt sulphate from deposits near Greenvale, 250km north west of Townsville	Yes

	<b>Lava Blue</b>	Lava Blue plans to produce HPA products from kaolin clays – a pilot plant is underway with QUT to establish commercialisation potential with plans for a processing site at Charters Towers on the Mt Isa-Townsville rail line and highway.	Yes
<b>Electro-chemical</b>	<b>Multicom Resources</b>	The St Elmo Project includes processing of high purity vanadium and HPA.	Yes
	<b>Pure Battery Technologies (PBT)</b>	PBT is already processing Mixed Hydroxide Precipitate (MHP) into battery ready nickel and cobalt in Germany but has plans for a plant in Townsville and recently concluded a research relationship with the University of Queensland (UQ).	Yes
	<b>QEM</b>	The Julia Creek Project plans to produce green hydrogen onsite. Around 2027-28, the project plans to produce 10kt of vanadium pentoxide (V <sub>2</sub> O <sub>5</sub> ), the principal precursor for vanadium redox batteries.	Yes
	<b>Queensland Pacific Metals (QPM)</b>	The Townsville Energy Chemical Hub (TECH) project plans to import laterite ore from New Caledonia, process to nickel sulfate (16ktpa), cobalt sulfate (1.8ktpa), high purity alumina (4ktpa), has off-take agreements with LG Energy Solutions and POSCO, with production planned to commence in late 2023. QPM plans to employ 300 people.	Yes
	<b>Vecco Group</b>	The Debella Project plans to refine the resource to high purity vanadium and high purity alumina.	Yes
	<b>Feline</b>	Feline has a small plant for manufacturing advanced high-performance LiBs for niche applications that value high performance and safety. It supplies into the defence sector, both B2B and B2G	Yes
	<b>Graphene Manufacturing Group (GMG)</b>	GMG is a clean-technology company that has developed and proved its own proprietary production process to manufacture Graphene powder from readily available low-cost feedstock. This process produces high quality, low cost, scalable, 'tuneable' and contaminant-free graphene.	Yes
	<b>Li-S Energy</b>	Li-S recently listed on the ASX from a joint-venture between Brisbane-based mine equipment technology company PPK (ASX) and Deakin University, which recently announced that the use of nanomaterial, Boron Nitride Nanotubes to facilitate the functional relationship between lithium and sulphur, resolving cycle life problems of Li-Sulphur batteries.	Yes
	<b>QEM</b>	QEM is part of the Queensland Vanadium Consortium (QVC) which is working to establish a multi-user scale demonstration plant in Townsville to process vanadium for batteries.	Yes
	<b>Redflow</b>	Brisbane based zinc-bromine flow battery company that manufactures flow batteries in Thailand.	Yes
	<b>Vecco Group</b>	Vecco is developing the first commercial scale electrolyte facility for large scale vanadium batteries.	Yes
	<b>Very Small Particle Company (VSPC)</b>	VSPC has an electrochemistry laboratory and pilot plant for the efficient design, manufacture and supply of complex high-purity, high-performance metal oxides and other cathode materials with a relationship with UQ and CSIRO.	Yes

Battery cell manufacturing	<b>AnteoTech (ADO)</b>	ADO is a listed battery chemistry company seeking to improve the energy storage capacity of LiB anodes (AnteoTech, 2021). It is possibly better known for its EuGeni Covid-19 Rapid Test (Queensland Cabinet and Ministerial Directory, 2021) which is now being distributed in the UK and South East Asia (Smith, 2021).	No
	<b>Novonix</b>	Novonix is headquartered in Brisbane but is listed in the OTCQX exchange in Canada, with a battery technology facility in Canada and an anode materials business in Tennessee (SA). They have developed a proprietary manufacturing process to eliminate waste and significantly lower the cost of cathode production. NOVONIX has filed patent applications for materials and processes in advanced anodes, cathodes and electrolytes	No
	<b>Feline</b>	Feline has a fabrication and prototyping facility to produce large format lithium-ion cells and batteries at small scale	Yes
	<b>Graphene Manufacturing Group (GMG)</b>	GMG is working with UQ to progress research and explore commercialization of GMG graphene aluminium-ion batteries	Yes
	<b>Magnis Energy Technologies</b>	Imperium 3 Townsville Gigafactory (IM3T) project plans to manufacture lithium cells and li-ion batteries at a 16GWh factory in Townsville, with research collaborations with University of Newcastle in NSW and Bingham University in NY, USA. Graphite sourced from the Nachu project in Tanzania will allow high quality graphite extraction through mechanical processes for milling and flotation, without resorting to chemical or thermal purification. The project proponents are currently seeking off-take agreements for supply of batteries packed at Townsville from cells imported from New York to secure finance for the Gigafactory project.	Yes
	<b>Li-S Energy</b>	Li-S's technology has the potential to make manufacturing of Li-S batteries commercially viable. Patents for the chemistry have been lodged.	Yes
Battery management	<b>Century Yuasa</b>	Century Yuasa manufactures and supplies Australian automotive industry with 1.5 million lead-acid batteries every year.	No
	<b>Prohelion</b>	Prohelion, a specialist mobile vehicle power company, packs silicon solar cells with lithium batteries, and an energy management system for solar modules and batteries.	Yes
	<b>Vaulta</b>	Vaulta uses advanced composite materials and smart, streamlined design for lighter and smaller battery cases with fewer parts.	Yes
Import, assemble, implement	<b>Planet Ark Power</b>	Planet Ark Power, a privately held solar power, battery storage and microgrid solution provider for commercial and industrial sites, utilising a proprietary energy management platform, eleXsys, to balance network and system consumption (Planet Ark Power, 2021)	Yes
	<b>Redback Technologies</b>	Redback Technologies, a privately held energy management company for residential solar, inverter and LiBs which imports its componentry from China, with a focus on products engineered for residential energy management	Yes

Cross-sector	<b>Redearth</b>	Redearth Energy Storage, a privately held, LIB battery pack company, which imports lithium cells from China, with a focus on products engineered for Australian conditions	Yes
	<b>Redflow</b>	Imports flow batteries from Thailand for sale in Australia	Yes
	<b>Century Yuasa</b>	CYB imports DC power electronics, industrial uninterruptible power systems, off-grid power, commercial energy storage systems and lithium-ion rechargeable batteries across multiple applications for sale in Australia.	No
	<b>Lithium Battery Systems (LBS)</b>	LBS designs, engineers and makes lithium batteries tailored for off-grid, mobile applications	No
	<b>National Battery Testing Centre</b>	QUT's National Battery Testing Centre at Banyo in Brisbane, provides a test facility for multiple types and sizes of battery systems in real-world conditions for Australian applications. NBTC also has unique capabilities to fabricate and test pilot quantities of custom Li-ion cells. The centre is a part of the Future Battery Industries CRC, and currently employs 8 core staff members (excluding students and partners running experiments) with plans to increase to 15 in the near future	Yes
	<b>Everledger</b>	Everledger is a technology company that uses blockchain, Artificial Intelligence and Internet of Things to provide meta-data for supply chains where transparency is a strategic imperative for both manufacturers and customers. The founder and CEO, Leanne Kemp, co-chairs the World Economic Forum's Global Future Council on the Future of Manufacturing and takes part in the Global Future Council on Blockchain. This technology platform will be critical to establish ESG credentials of LiB supply chains, and thus establish eligibility for EU involvement in projects and investment vehicles (Everledger, 2021)	Yes

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