



AUSTRALIAN BATTERY SOCIETY  
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Please see below the responses from the not-for-profit Australian Battery Society (<https://australianbatterysociety.org/>) for the National Battery Strategy: Issues Paper. Details about the society can be found at the end of the submission, feel free to contact us if you require further information - [admin@australianbatterysociety.org](mailto:admin@australianbatterysociety.org).

### **Theme 1: Moving up the value chain**

**Q1.1: What are Australia's existing advantages? How can Australia capitalise on its existing advantages? And how can Australia expand these advantages?**

Considering lithium-ion batteries, Australia is currently world leading in minerals extraction and integration of batteries into the grid. Australia does well at the "ends" of the battery value chain. There are numerous SMEs and larger companies engaged in mineral extraction which is mostly exported for processing. A few companies are moving up the value chain to process minerals and possibly make electrode active materials or electrodes. At the other end, Australian companies are importing cells and making batteries for a range of applications, there is strength in battery management systems and integration into the grid for various battery technologies. There is activity in lithium-ion battery recycling locally, and plans for circularity in the battery value chain, but there will be a lag before sufficient volume of used batteries becomes available for this to become economical at a large scale. Many of the companies here are focused on collection and separation and the separated components are then shipped overseas for processing, re-use and production.

Australia clearly needs to develop the middle sections of the value chain. Australia is developing well in low Technology Readiness Levels, we need to boost our performance in the intermediate levels (~4-7). Australia can expand on these advantages by understanding client requirements to provide better quality products and services. We can compete on quality by leveraging our expert knowledge (from core R&D).

There should be opportunities for firms to develop processing, electrode and cell manufacture onshore. This can be in the form of incentives or preferences for government contracts and easy access to locally produced, refined raw materials. Sovereign capability is essential in this space. Supporting industries moving along the value chain is key to developing a vibrant and attractive lithium-ion battery industry in Australia. This should include the integrated development of precursor chemicals at battery grade for Li-ion battery chemistries such as nickel manganese oxide (NMC), lithium iron phosphate (LFP) and graphite or next generation materials. A method to do this would be to provide incentives or even quotas for downstream processing and supply of input chemicals to local industry before export, e.g., incentivise supply of LiOH or Li<sub>2</sub>CO<sub>3</sub> to local battery component manufacturers.

Australia is a safe, secure country with stable governance and good ESG standards. These considerations would, in many cases, make Australia a preferred supplier of battery chemicals and components and aid in the geographical diversification of supply of these materials.

A challenge is the lack of an electric vehicle manufacturer for the mass market. Bus and specialised e-bike manufacturers exist and they are embracing lithium-ion batteries and they are actively looking for Australian made batteries and are willing in most cases to invest in Australia if the technology and capability is right for them. Industries like this can add value by having a reliable in-country supply chain and controls on mining can be placed to preferentially serve the Australian community first. Attracting an electric vehicle manufacturer or establishing an Australian electric vehicle company would be a brilliant use for batteries made in Australia. That said, the market is still strong with buses, bikes, households, etc...

Recycling is where Australia can help the global industry, can we recycle our lithium-ion batteries and that of the local region in a sustainable and environmentally friendly manner? This solves a major future problem as larger numbers of batteries come to the end of their lives. We have an opportunity to innovate here and further develop on-shore recycling and processing.

Lithium-ion batteries have a large market share but there are other batteries that will find specialised use. Australia is strong in redox flow batteries (RFB), and other solution-based batteries with manufacturers based in Australia and for example using Australian mined vanadium and developing markets here and abroad. Examples of chemistries developed and manufactured in Australia include vanadium, iron and zinc-bromine flow batteries. A number of next generation battery systems have start-ups focusing on their commercialisation. For incumbent lead-acid, manufacturing and recycling takes place in Australia.

An opportunity for Australia might be the development of a vibrant retro-fitting industry that is supported with made in Australia cells and batteries. This could be pertinent for vehicles, where internal combustion engines are removed from vehicles and battery + electric engines are added – this removes vehicles from the waste stream and allows use of cells/batteries that can be made to suit the Australian climate. A few recent examples of this exist.

Research is excellent in Australia but developing these outcomes into products or options for firms is a struggle. With the explosion of research on batteries and battery materials, finding the right technology for firms and investors can be quite challenging. Being able to bridge that gap by having researchers translate their technology would generate growth in industry and is an opportunity for Australia.

**Q1.2: What areas of the global battery supply chain should Australia focus on, and where are the potential barriers and vulnerabilities for Australian industries in the global supply chain?**

Australia really should be producing all types of batteries and recycling on-shore, much like lead-acid and redox flow batteries. We have all the minerals, the environmental safeguards and security of a stable nation. Australia should focus on manufacturing advanced battery packs and systems that offer competitive advantages in safety, cycle life, ESG and ROI.

Unfortunately, we are at the start of the supply chain for many battery technologies and we don't move up so we rely on our international counterparts to produce the batteries. We have all the minerals needed to produce batteries in Australia – our vulnerability to the supply chain is the manufactured products, cells and batteries and the applied products, e.g., electric vehicles, storage systems. Australians need to wait in line for our supply for most of these or pay higher prices to have them come to us. Why not have the industry set up here to make for the local market... We can use the supply chain to our benefit.

It is worthwhile to re-iterate that an incentive or local content requirement for local cell production may be very impactful to the industry. This may accelerate the redox-flow and lead-acid batteries already produced in Australia and generate benefits for companies wishing to produce lithium-ion and next generation technologies here in Australia.

It is worthwhile to note some barriers and perceived barriers, for example:

- Investments required to produce batteries in Australia, including capex, input costs, running costs.
- Technical and specific training of employees to work (especially in cell manufacturing)
- High capital cost to qualify materials for 1<sup>st</sup> tier companies (large quantities needed) and secure off-take agreements
- Precursor materials at high purity and large scale are not yet available locally, for example, for LFP cathode production. Integrated development of the precursors and cathode materials is required to benefit from the location of component manufacturers in Australia. The focus seems to be on precursors for NMC cathode production but LFP battery volumes are increasing and Australia is well placed to contribute to this sector with lithium, iron and phosphorus reserves.
- For Li-ion battery, no local large EV manufacturer

Some vulnerabilities:

- Competition from government incentives in other jurisdictions, e.g. China, US, Japan, Korea
- Distance from major Li-ion battery producers, an opportunity to attract to Australia, much like lead-acid and redox flow manufacturers
- Losing potential battery manufacturers to overseas markets, e.g., starting up in Australia but producing in the USA
- An opportunity would be to offer co-location opportunities and incentives

### **Q1.3: How should government, industry, and researchers support Australia's battery industries to grow and compete?**

#### Government

Finance opportunities and co-investing in the industry. Some companies will fail but others will succeed. If the government is willing to support private sector investment, a value for such industries will be provided but the government needs to come to terms that not all their investments will succeed. Designating zones for battery growth, providing infrastructure and support, making it easier for made in Australia batteries to happen. Using policy and tax to make it a simple decision to invest in Australian made batteries – companies that don't do a proportion of the value chain in Australia lose many benefits. Support local industry wanting to develop their technology – having an integrated federal, state and local government approach. Providing incentives for local content manufacturing. Reducing the red tape and making it easy to setup a battery manufacturing site – one point of government for this sector. That point in government can then liaise with the rest of government.

Some other ideas:

Provide support for IP generation and translation. Provide support for pre-qualification capital costs, soft loans, site access and rent etc... Provide support for industries to come together to vertically integrate, generate the network to make this happen. Recognise that other governments are also playing in this field, so develop Australian-advantage options, work with regional partners, etc...

#### Industry

Recognise the government ambition and be willing to setup multiple facilities, in Australia and elsewhere. For example, with the US incentives setup a presence for manufacturing in the US and replicate that here in Australia. Government could consider co-funding this – for every company setting up else, provide incentives to duplicate here in Australia. Alternatively, government can provide benefits for having an Australian piloting or manufacturing arm in the future, lure the firms back to Australia. Industry does recognise the benefits of Australia – but funding is difficult compared to US, so convince US investors to do both, invest in Australia access to minerals and in US.

Use Australian content in Australia. Industry should be encouraged to do more processing in Australia – infrastructure should be designed to do this rather than lead to ports.

Researchers

Work with industry to solve their problems. Drive their institutions to make working with industry easier, affordable and with less legislation. Simplify the legal framework for this to happen. Have students work in industries, provide training for students and allow industry to evaluate students.

Researchers should be encouraged to take their ideas and technology to the market, have industry and entrepreneurs available to work on their projects. Provide benefits for researchers to take their technology to market, financial and company support and possibly a forum for the local and international battery industry to see Australian research with an emphasis to making in Australia. Government could use their connections via Austrade and similar to have battery working groups made up of the battery industry that get access to Australian research if they are willing to invest in Australia. An all of Australia approach.

## **Theme 2: Turning our innovative ideas into opportunity**

### **Q2.1: How should Australia build on its strengths in R&D and innovation to commercialise more battery related research?**

There are already great examples of the companies that have done this and are actively doing this. We need to do more by providing adequate support and opportunities, e.g., IP support. Often at a research institution, an inventor needs to have a company or investor lined up to lodge a patent due to the cost. Consider having a body that can do this for researchers.

Providing research institutions or company-based researchers links to investors and industry, developing a battery network, much like the Australian Battery Society but more directed to discovery to market. Minimising administrative cost for start ups in the battery space, loans etc... Providing incentives to researchers to market their research rather than publish.

Directed support for the up and coming battery industry through collaborative industry – research organisation projects such as CRC-P programs. This acts to match R&D to client requirements. External review of new battery technologies and research areas to evaluate their potential for commercial application could help to focus investment on technologies close to technical readiness with demonstrated practical outcomes.

Energy storage clients are concerned about safety, cost, recycling, country of origin, warranty and risk. Many clients are not the end-use-client, hence they need to manage their risk profile, which is challenging for new battery products. R&D has an opportunity to provide the knowledge and data required to properly quantify risk. Possibly a government body tasked to commercialise Australian R&D – much like ARENA but specifically for battery R&D.

### **Q2.2: How could Australia best promote its strengths in R&D to grow domestic battery industries?**

Require investment in local battery industry or local content for importers of end products or for exporters of minerals. Showcase Australian research and development via international missions (Austrade) and work with companies to grow Australian content/manufacturing. Provide massive discounts to Australian consumers who buy Australian made batteries – end product subsidies.

A register of R&D capabilities and staff that are experts in their application for universities and CSIRO would be useful to enable industry to access the required equipment and skills when needed. This would also reveal gaps in capability which could then be addressed. The Australian Battery Society is beginning to develop this.

Industry needs timely technical support for it to be useful for commercial development. Universities are constrained by the availability of staff and equipment and cannot always provide the testing on the short timescales needed by industry which is driven by short-term customer supply requirements and trouble-shooting. Providing an avenue for this to occur may be a solution.

Promotion could be more sector specific, e.g., space, medicine. For instance, a particular product in a particular industry where the major domestic clients are few in number. Promoted R&D should show how it benefits industry in some way. In some cases, industry has not realised this yet. Looking at batteries in sectors that are not conventional and that have untapped opportunity.

Here again a central battery funding stream, much like ARENA acts not only to fund research and development but showcases Australia's opportunities here. Bodies like the Australian Battery Society (not for profit and not an industry group) can support these activities.

Using government to demonstrate Australian batteries and technology – for storage projects or government purchases show preference for Australian made batteries. This could be additional "points" for Australian made batteries and thus they may compete with overseas manufactured batteries or even battery content made in Australia. Such large contracts may encourage further growth of an Australian industry and investment from multinationals in Australia.

### **Q2.3: What steps should governments, or a Growth Centre-like entity, take to support growth of domestic battery industries?**

A number of factors are mentioned above, ranging from an Australian content requirement, to financial benefits of going further up/down the value chain for industry, to integrated centres of battery research and development, single point of contact in government for battery matters, minimising administration cost for start ups, a battery based ARENA funding stream and discounts for Australian made batteries.

Other options may be an integrated location for the full construction of batteries or testing facility. Allowing researchers and industry to bring their inventions to the centre to integrate into the device. An open access prototyping (at various scales), testing and demonstration facility – with adjacent space for industry. A national A-Z centre for battery development.

Furthermore, considering Australia's landmass, a centralised growth centre may not be the best model. A virtual growth centre with locations for various components would be the best way forward. In other words, development of a growth centre should not be confined to a single geographical area given that research and development in Australia is widely distributed in the country. A virtual hub to co-ordinate activities may be more feasible.

The growth centre(s) could leverage existing industrial locations for redox flow and lead-acid space. All steps in the supply chain need to be supported for growth of a domestic battery industry in consultation with industry that is already currently active. There needs to be incentivisation for local development all along the supply chain to ensure that local downstream development is financially and chemically practical – a “local” first approach. There needs to be promotion of Australian battery components at all stages in the supply chain emphasizing the advantages of Australian products.

### **Theme 3: Encouraging investment to grow our battery industries**

**Q3.1: What are the barriers to investing in Australia’s battery industries, and how can they be mitigated? How can governments encourage more investment?**

Redox flow and lead acid battery manufacturers exist in Australia. They should be supported to take their technologies for use in Australia – government projects should consider these technologies, this may encourage further investment. For Li-ion systems and next generation systems there are distinct opportunities.

The stimulus and its conditions provided by the US recently is a big factor in many Australian industries looking to take the next step in the US. How do investors compete with this? How do investors invest in Australian made batteries when companies are likely to be looking to go to the US because of the incentives. Provide incentives to co-make batteries in Australia, demonstrate the opportunities for Australian batteries near raw materials. Leverage the AUKUS relationship.

Government could provide a co-investment for Australian ventures that move to new areas of the value chain currently not in Australia. Government could provide support for dual operations overseas and in Australia (like the US example above). Governments could highlight the ESG and security benefits of Australia + access to international markets.

The government can ask themselves whether they want to have a major battery company in Australia or whether they want to invest in an Australian company becoming a major battery company – this especially true for Li-ion batteries. Some companies and markets are mature and therefore attracting these companies can be difficult. Does Australia want investment in the form of a multi-national starting a plant or developing a local to start a plant in Australia?

**Q3.2 What areas could Australian-made batteries have a competitive advantage for use in Australia and for export?**

Australian made batteries exist in the lead acid and redox flow space. They provide for Australia’s needs and regional needs. They also provide recycling in order to minimise environment impact, e.g. lead recycling. Made in Australia batteries will have ESG, non-child-labour, minimal environmental impact standards that are some of the best in the world. For the local market they would be made for use, higher temperatures, longer distances, etc...

We may have advantages in sectors such as space, defence, IoT (information of things) and medicine where the larger players in the battery sector are not dominant. These areas are opening up to battery technology and often require high-end batteries where quality outweighs quantity. Recycling is a place where Australia can ensure its place in the global market.

Australia provides a secure supply chain that can be used for essentially all battery raw materials and precursors and we are sought after internationally. We could alleviate supply chain disruptions

although from a non-Australian perspective the world might be putting all their eggs in an Australian basket. If we do recycling, we could do materials-devices-recycling all in country.

**Q3.3: What functions or forms of help should the Powering Australia Industry Growth Centre deliver to support Australian battery industries?**

The growth centre should be able to bring researchers, industry and government together under one roof. Allowing the ability to take to market ideas and cut across various levels of government – a place where the industry can innovate and deliver. A one stop shop to work with government for funding, planning, building, EPA approvals etc... This would streamline idea to product. Furthermore, it would provide expertise, access to funds both government and private. With success stories this could attract further funding and become self-sustaining.

The centre could also provide technical support towards prototyping or characterisation or link in with institutes with such facilities. Having a virtual centre has distinct advantages for some of these aspects. The technical support could work on short time scales.

The centre could facilitate legal frameworks for fast IP protection, use between partners and application. This might make it easier for industry, government and university to coordinate and act. A dynamic centre that works fast and effectively. It would also contain battery component testing in commercially relevant cell and battery architectures. One could envision this at various scales from milligram or coin cells to tonne or large format pouch cell or large flow batteries. This would support R&D and product development and needs to be done confidentially with the IP agreements discussed above.

**Q3.4: How can the additional advantages of a precinct model and collaborative vertical integration be achieved for our battery industries?**

As stated earlier geographically confined precincts could be problematic but a virtual centre with resources pooled may work well. Centres of expertise could be generated with existing and additional infrastructure. A distributed model could leverage regional expertise and bring it together with a virtual hub. This would inherently link regions (universities) and industry/government. This would also avoid unnecessary duplication.

A one stop shop for batteries allowing industry to take from material to device to recycling by having a series of centres that provide the relevant skills, expertise and infrastructure and are covered by a global IP and legal framework. The centre can also fast track and coordinate interaction with government. It could also actively scout for investment, a hub for investors to interact with. Investors are actively seeking such opportunities.

Consultation with industry and academia about gaps both in capabilities and potential opportunities should be undertaken and with this various projects can get underway. A competitive battery specific funding scheme could showcase gaps and instruct on opportunities.

Overall all elements in the supply chain and capabilities to go from material to device to recycling need to be available to enhance local production and make it cost effective and globally competitive. It should be noted that such developments will likely result in other end users, e.g., EV manufacturers setting up in Australia. Batteries investment will lead to further opportunities.

**Theme 4: Creating the enabling environment for industry growth**

**Q4.1: What can be done to develop the workforce necessary for domestic battery industries?**

Universities encouraged to develop Bachelors or Masters level courses in battery research and development. This trains battery scientists and engineers in the longer term. Universities work with industry to arrange work placements, coupled with Masters courses – potentially funded in part by government. This trains or up-skills the current workforce. Much like the National Industry PhD program. Secondment of university staff to industry can expose the students to the work environment and build their skills.

There are opportunities for short courses to up-skill trained engineers and scientists. This could be in-person or on-line with specific focus on battery industry skills and the scientific background needed would be useful to build a trained workforce. This could be integrated with industry work experience. From a government level, increase the number of Commonwealth supported positions in the sciences and engineering – this can be specifically targeted to battery-based degrees.

**Q4.2: How can Australia best maintain a world leading environmental, social and governance reputation for products?**

Ensuring all steps follow the high level of environment controls/steps and ensuring viable recycling routes are in place. Having a strong governance structure for best practice and routinely asking industry to self-evaluate or visit industry to evaluate their performance. Emphasize these advantages to the local industry and the world via Austrade and external advertising. Develop high standards for new industry developments but guard against setting the bar so high that local industry cannot compete internationally.

Safety is key in batteries, continuous testing and having a national testing and failure facility, funding research into safer batteries.

**Q4.3: What can be done to give confidence that Australian product safety risks are effectively understood, mitigated and managed?**

For lead acid and redox flow batteries we have great products and standards, keeping this standard is critical and continuously improving them. This concept is trickier with lithium-ion batteries, but having a national testing centre and standardised series of testing requirements – for local market and for export will provide a great confidence boost – can Australian batteries be made the safest in the world? Funding research into safer batteries and mitigation strategies.

Another idea would be a battery passport, showing the materials used, the production location, the amount of greenhouse gases produce and the place to recycle. This can be integrated at a cell or better still device level.

Controlling the import of batteries and devices containing batteries and ensuring certain standards are met. This can be important as batteries are coming in all shapes and sizes and not necessary monitored or controlled.

**Q4.4: How can governments and industry ensure circular economy principles are incorporated into the life cycles of batteries made and used in Australia?**

Lead-acid batteries have a high rate of recycling. Mandating a recycling imperative and a responsibility of the battery manufacturer to work with a recycler to collect and recycle their batteries. The batteries at a certain level would fall into this category, e.g. 12+ cells or a certain Ah. Making it easy to recycle such batteries – collection points, financial reward for recycling (like bottles).



Support local industries involved in recycling via incentives or creating recycling centres with environmental bodies on site for assistance. Promote “design for recycling” in battery manufacture, this could be a feature of Australian made batteries.

Provide local collection points for used batteries across all chemistries. Incentivise the use of inputs from recycling even if there is a cost increase. Encourage R&D into the circularity of battery chemicals use. Support local collectors for such batteries and battery waste.

### ***About the Australian Battery Society***

*The not-for-profit Australian Battery Society (ABS) was founded in 2018. The ABS aims to bring together battery scientists, engineers, industry, government and the community so that we can push forward our adoption of battery technologies. Secondly, we want to increase our understanding of batteries and battery systems, across all battery chemistries. This will enable us to engage in the current and next generation of devices and applications.*

*The ABS’s vision is to build a strong, vibrant battery community, interconnected across the full battery value chain, and encompassing industry, academia, policy makers and members of the public, to support a globally competitive battery industry sector.*