 Australia Battery Recycling & Reuse Value Chain Gap Analysis Survey Questionnaire

This study is funded by Future Battery Industries Cooperative Research Centre (FBICRC) and conducted by The Commonwealth Scientific and Industrial Research Organisation (CSIRO).

#### About Future Battery Industries Co-operative Research Centre (FBICRC)

The FBI CRC was setup to support Australian industry to solve critical issues, develop new technologies, products and services and compete on the world stage. It is jointly funded by the Federal Government, industry participants and research organisations. The FBI CRC aims to help Australia battery recycling and reuse industry and all their relevant stakeholders to make the most of the upcoming opportunities and help to develop a competitive circular battery value chain in Australia.

#### About CSIRO:

CSIRO is Australia’s national science agency responsible for scientific research. CSIRO solves the Australia greatest challenges using innovative science and technology and works with leading organisations globally.

#### Survey Aims and Scope

The aim of this survey is to identify:

* Challenges and gaps in all aspects of the value chain, including, but not limited to, technical, processing, infrastructure, policy, economics, business tools etc.
* Current industrial initiatives & requirements
* Methods to improve current processes & identify new opportunities

#### Stakeholder groups invited to participate in this survey

* Recycling companies
* Government waste management regulators
* Battery chemical manufacturers/suppliers
* Researchorganisations/universities
* Battery manufacturers/retailers and importers
* Industry Bodies and not-for-profit organisations

# Section A - About Your Organisation

1. **Your name or name of organisation (optional)** *- note this information will not be shared or made publically available.*

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1. **Which best describes your organisation?**

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| --- |
| [ ]  Recycling Industry |
| [ ]  Policy maker/Regulatory Stakeholder |
| [ ]  Battery Chemical Manufacturer/Component supplier |
| [ ]  Battery cell and/or System Manufacturer /Supplier/Retailer |
| [ ]  Battery importer |
| [ ]  Research Organisation/ University |
| [ ]  Industry Body |
| [ ]  Not-for-profit organisation |

[ ] Other, please specify:

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1. **Where are you operating your business or located?**

[ ]  Western Australia

[ ]  Northern Territory

[ ]  Queensland

[ ]  New South Wales

[ ]  Victoria

[ ]  South Australia

[ ]  Tasmania

[ ]  All of Australia

[ ]  Not in Australia, please specify:

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1. **Are there schemes or processes in your location to recycle batteries?**

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| --- | --- | --- |
| Lithium and lithium-ion batteries |  [ ] Yes |  [ ] No |
| Other battery chemistries |  [ ] Yes |  [ ] No |

1. **What type of activities best describes your business? (select all that apply)**

 [ ] Collection

 [ ] Sorting

 [ ] Crushing

 [ ] Separating crushed batteries materials

 [ ] Battery metals separation

 [ ] Importing waste batteries/cathode & anode materials

 [ ] Exporting waste batteries/cathode & anode materials

 [ ] Battery system or battery cell manufacturing

 [ ] Battery system retail

[ ]  Battery importer

 [ ] Battery refurbishment/repurposing

 [ ] Refurbished batteries retail

 [ ] Retail of recovered battery materials from recycling

 [ ] Research and development on battery materials or systems

 [ ] Research and development on battery recycling &/or reuse

 [ ] Regulatory or Industry Body

 [ ] Other, please specify:

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# Section B - General Views

1. **How would you rate public awareness for lithium ion battery (LIB) recycling and reuse in Australia now?**

 [ ] Low

 [ ] Medium

 [ ] High

Comments on your choice:

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1. **What is your understanding of putting lithium-ion batteries into general landfill? (choose all that apply)**

[ ] They are non-hazardous material and is acceptable to put them into landfill.

[ ] They are hazardous material and harmful to our environment and this waste stream should be managed outside of landfill sites.

[ ] The economic value of the waste lithium ion battery is low but the environmental impacts, if placed in landfill, is high.

[ ] They contain valuable critical materials which should be recovered through recycling.

[ ] Recycling of waste lithium-ion batteries presents an economic opportunity/business opportunity.

[ ] The amount of waste LIBs is low now; disposal to landfill has nearly no impact. Management solutions should be considered when the quantity has increased.

[ ] Other views:

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1. **In your opinion, how likely is it for Australia to have its own battery value chain from mining of critical materials, battery manufacture, reuse to recycling and remanufacturing in the future?**

|  |  |
| --- | --- |
| The likelihood in 10 years: | The likelihood in 20 years: |
| [ ]  Very Low (0-4%) | [ ]  Very Low (0-4%) |
| [ ]  Low (5-20%) | [ ]  Low (5-20%) |
| [ ]  Moderate (21-79%) | [ ]  Moderate (21-79%) |
| [ ]  High (80-90%) | [ ]  High (80-90%) |
| [ ]  Very high (96-100%) | [ ]  Very high (96-100%) |
| What do you think the greatest hurdle/barrier is in the next 10 years? (e.g. mining, manufacturing, reuse, recycling, regulatory etc.)

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 | What do you think the greatest hurdle/barrier is in the next 20 years? (e.g. mining, manufacturing, reuse, recycling, regulatory etc.)

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1. **In your opinion, which areas are current opportunities and future opportunity areas for Australia? (choose all that apply)**

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| --- | --- |
| Current opportunities | Future Opportunities |
| [ ]  Mining of battery materials[ ]  Battery materials manufacture[ ]  Battery cell manufacture[ ]  Battery system/device manufacture[ ]  Battery retail[ ]  Battery reuse after first use[ ]  Battery recycling and materials recovery[ ]  Battery refurbishment or remanufacture with recycled materials[ ]  None of the above | [ ]  Mining of battery materials[ ]  Battery materials manufacture[ ]  Battery cell manufacture[ ]  Battery system/device manufacture[ ]  Battery retail[ ]  Battery reuse after first use[ ]  Battery recycling and materials recovery[ ]  Battery refurbishment or remanufacture with recycled materials [ ]  None of the above |
| Other (please specify): | **Other (please specify):** |
|  |  |

1. **Do you think Australian battery materials and recycling industry should only focus on current activities of mining resources and waste export or expand deeper into the value chain through new industry creation in addition to the existing industry?**

 [ ]  Keep existing role only

 [ ]  Keep existing role and expand into new industries

 [ ]  Other comments

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**Keeping existing role:**

What are the advantages of doing this?

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What are the disadvantages of doing this?

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**Creating new industries:**

What are the advantages of doing this?

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What are the disadvantages of doing this?

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# Section C - Questions for all Industry Sectors

1. **In your opinion, what are the technological barriers to recycling/reusing Li-ion batteries in Australia?**

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1. **In your opinion, what is the biggest business/policy barriers to reuse and recycling of Li-ion batteries in Australia?**

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1. **In your opinion, what are the key challenges to keep battery materials recovered through recycling within the battery value chain (for example remanufacture of new Li-ion or alternative battery chemistries)?**

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1. **In your opinion, should recovered battery materials from recycling be used in alternative industries (for example additives for cements etc.)?**

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1. **In your opinion, what sort of assistance should the FBI CRC provide to create more value in the Australia battery industry?**

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1. **In your opinion, what can the FBI CRC do to keep recovered (from recycling) battery materials within the Australian battery value chain?**

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1. **What are the major technical challenges in your business due to battery recycling?**

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1. **What are the major commercial challenges in your business due to battery recycling?**

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1. **In your opinion, what are the current problems in the battery recycling industry?**
2. Waste battery collection and transportation

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1. Waste battery storage

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1. Waste battery recycling process, for example sorting, safety, materials separation, markets for recovered materials etc.

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1. What actions would help alleviate the above problems

Government/regulatory/policy

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Technical solutions

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Consumer awareness/collection

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1. **What is your opinion, of the current waste battery collection infrastructure? (choose all that apply)**

[ ]  Sufficient to deal with current volume and future volumes

[ ]  Sufficient to deal current volume but insufficient for the future volume

[ ]  Improvement/change is needed to meet current needs

[ ]  Improvement/change is needed to meet future needs

1. **What improvements (if any) can be made to make the collection system work better for your business, please describe:**

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|  |

1. **In your opinion, what can be done to increase waste battery collection rates?**

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1. **As for increasing collection rate, which do you think are more important than others, such as incentive (I), public awareness(PA), collection infrastructure (CI), regulation (R).**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Not important** | **Somewhat important** | **Neither important or unimportant** | **Very important** | **Extremely important** |
| **Incentives** |[ ] [ ] [ ] [ ] [ ]
| **Public Awareness** |[ ] [ ] [ ] [ ] [ ]
| **Collection Infrastructure** |[ ] [ ] [ ] [ ] [ ]
| **Regulation or policies** |[ ] [ ] [ ] [ ] [ ]

1. **In your opinion, are there any technical difficulties if Australia was to use an automated collection facility similar to glass/can/plastic bottle collection programs?**

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1. **Under the current collection and transportation practices, who pays for the waste batteries delivery to recycling companies?**

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1. **Do the current transportation regulations assist or hinder in waste battery transport across different jurisdictions?**

[ ]  Assist

[ ]  Hinder

Why?

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1. **Would a unified Australian transportation regulatory framework assist or hinder the collection and transportation of waste batteries?**

[ ]  Assist

[ ]  Hinder

1. **What information technology, facility/equipment could be helpful to improve the transportation process?**

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# Section D - Recycling Industry Specific Questions

1. **What type of battery chemistry do you recycle? (choose all that apply)**

[ ]  Lead acid battery (LAB)

[ ]  Nickle cadmium (NiCd)

[ ]  Nickle metal hydride (NiMH)

[ ]  Lithium metal battery / primary lithium battery

[ ]  Rechargeable lithium-ion batteries (LIB)

[ ]  Alkaline batteries

[ ]  Other, please specify:

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**If you recycle mixed battery chemistries (mentioned above), do you sort and separate them before any subsequent processing (crushing, anode/cathode separation etc.)?**

[ ]  Yes

[ ]  No

[ ]  Not applicable

1. **In your opinion how important are the following factors for the recycling industry:**

|  |  |  |
| --- | --- | --- |
|  | **In 2020/2021** | **In 2030/2031** |
|  | **Not important** | **Somewhat important** | **Neither important or unimportant** | **Very important** | **Extremely important** | **Not important** | **Somewhat important** | **Neither important or unimportant** | **Very important** | **Extremely important** |
| **Availability of end of life batteries i.e. supply** | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   |
| **Processing technology** | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   |
| **Market for recovered materials**  | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   |
| **Processing costs** | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   |
| **Social licence to operate** | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   |
| **Business insurance** | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   |
| **Regulation** | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   | [ ]   |

1. **In your opinion/experience how easy is it for recycling companies to get insurance for battery recycling activities?**

[ ]  Not a problem

[ ]  Easy to get

[ ]  Fair Price

[ ]  Hard to get

[ ]  Expensive

[ ]  In line with other insurance products

[ ]  Do not know

[ ]  Other

Your comments:

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1. **If in the future Australia were to ban battery waste export, how would it affect your business?**

[ ]  It would have no effect on my business

[ ]  My business will be negatively affected:

[ ]  Negligible impacts

[ ]  Minimal impacts

[ ]  Significant impacts

[ ]  My business will positively affected:

 [ ]  negligible impacts

[ ]  minimal impacts

[ ]  Significant impacts

Comments on impact:

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[ ]  My business would have to stop or reduce operations in battery recycling

[ ]  Stop [ ]  Reduce

[ ]  My business would be able to identify new/other opportunities in the battery recycling value chain as a consequence of an export limitation/ban, such as:

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1. **If Australia banned waste battery import, how it would affect the battery industry in Australia?**

[ ]  It would have no effect on my business

[ ]  My business will be negatively affected:

[ ]  Negligible impacts

[ ]  Minimal impacts

[ ]  Significant impacts

[ ]  My business will positively affected:

 [ ]  negligible impacts

[ ]  minimal impacts

[ ]  Significant impacts

Comments on impact:

|  |
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[ ]  My business would have to stop or reduce operations in battery recycling

[ ]  Stop [ ]  Reduce

[ ]  My business would be able to identify new/other opportunities in the battery recycling value chain as a consequence of an import limitation/ban, such as:

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1. **How do you feel about the current Australian battery recycling permit system?**

[ ]  Good and does not require changing

[ ]  Can be improved but is useable

[ ]  Needs significant changes

[ ]  Bad and needs overhaul or a new system

Comments

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1. **In your opinion what are the key policy or regulatory barriers for battery recycling industry?**

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1. **What policy or regulatory changes/additions would help battery recycling industry grow and/or make battery recycling industry more competitive (nationally and globally)?**

**Nationally:**

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1. **Are you aware of any economic modelling tools that could help your business?**

[ ]  No

[ ]  Yes. Please specify:

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1. **If an economic modelling tool was available would you utilise it for your business?**

[ ]  Yes

[ ]  No

[ ]  maybe

1. **What sort of technoeconomic modelling tool features would help your business or future investments in the battery value chain?**

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1. **Under the current industry landscape, is it economically viable to transfer waste LIB across multiple Australian jurisdictions to a centralised processing point?**

[ ]  Yes

[ ]  No

[ ]  It depends on State or Territory jurisdiction

[ ]  Better to have multiple processing points in different jurisdictions

Comments:

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1. **In your opinion, under the current battery recycling industry landscape is it economically viable to have a centralised processing point for Li-ion battery recycling or have a decentralised Li-ion battery recycling processing points?**

[ ]  Centralised processing and recycling

[ ]  Decentralised processing and recycling

[ ]  Mixed system - centralised for some jurisdictions and decentralised for others

 Comments:

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1. **In your opinion, what technologies would be needed for you to consider battery materials separation and recovery on-shore in Australia for reuse in battery manufacturing or for other market sectors**

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# Section E - Questions for Battery Materials Manufacturers or Suppliers

1. **How would growth in the Australian battery recycling and materials industry affect your business?**

[ ]  No negative impact/negligible impact

[ ]  Some negative impacts

[ ]  Major negative impacts

[ ]  Significant negative impacts

[ ]  Some positive impacts

[ ]  Major positive impacts

[ ]  Significant positive impacts

[ ]  Do not know

1. **Can your industry currently utilise recovered materials from recycled batteries?**

[ ]  Yes

[ ]  No

1. **Can your industry transition to utilise recovered materials from recycled batteries**

[ ]  Yes

[ ]  No

1. **What are the important characteristics of recovered/recycled materials for your business? (choose all that apply)**

[ ]  Costs

[ ]  Material quality and purity

[ ]  Recovered materials market

[ ]  Transportation and supply chains

[ ]  Characteristics of recycled/recovered materials are unimportant for my business

[ ]  Not applicable to my business

[ ]  Other (please specify)

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# Section F - Questions for Policy Makers or Regulatory Stakeholders

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1. **What are the key characteristics for an effective recycling system?**
2. **In your opinion is the battery recycling system in your jurisdiction fit for purpose now (2020/2021) and for the immediate future (up to 2030)?**

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1. **In your opinion, are there any key barriers at present which prevent effective battery recycling in your jurisdiction?**

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1. **Are you aware of any changes to current import/export policies for battery waste coming into effect?**

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1. **How do you manage battery waste streams in your jurisdiction, including stockpiling of wastes waiting for export or processing?**

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1. **If in the future Australia was to ban battery waste export how would your jurisdiction manage waste streams?**

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1. **Are you aware of any policy changes to promote adoption of electric vehicle, residential/commercial renewable energy (e.g. PV panel) storage or grid support infrastructure utilising batteries in your jurisdiction?**

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1. **In your opinion, what methods can be used to develop battery recycling industry or grow existing battery recycling industry within your jurisdiction?**

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1. **Are there any impediments to second life battery use for stationary power in your jurisdiction? If YES, please describe…**

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# Section G - Questions for Battery Retailers /Suppliers

1. **In your opinion, what are the key factors which will entice consumers to purchase refurbished/second life batteries?**

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1. **In your opinion, what can be done by Australia to increase battery recycling rates?**

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1. **What are the major barriers for customers to purchase new batteries in States and Territories where your organisation operates?**

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1. **What mechanisms does your organisation employ to recycle end of life batteries?**

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1. **What mechanisms does your organisation employ to encourage your customers to recycle end-of-life batteries which they have purchased from you?**

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1. **How will the battery stewardship scheme affect your business?**

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# Section H - Questions for Battery Recycling Researchers

1. **In your opinion, what are the key technical issues in recovering all battery materials?**

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1. **In your opinion, what are the issues with the processing of recovered material from waste batteries when compared with virgin materials?**

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1. **In your opinion, are there any technical difficulties to utilise an automated collection and sorting facilities such as those used in glass/can/plastic bottle collection program?**

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1. **What sort of research does your organisation do in the battery value chain field?**

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1. **In your opinion, what are the key technology barriers in battery recycling and reuse?**

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1. **Which research areas do you think would make the most impact in the Australian battery recycling industry?**

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1. **What can be done by the Future Battery Industries CRC to advance battery reuse and keep battery materials in the value chain at the end of battery life?**

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1. **In your opinion, are there any areas of the regulatory landscape which need to be changed to encourage recycling/re-use in Australia?**

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1. **In your opinion, are there any areas of consumer and public awareness which need to be changed to encourage recycling/re-use in Australia?**

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# Section I - Emerging industry of Battery Reuse and Remanufacture

1. **What do you think are the main factors that affects customer acceptance of reusing refurbished batteries?**

[ ]  Price

[ ]  Suitability for application

[ ]  Incentives

[ ]  Brand reputation

[ ]  Societal and climate impacts

[ ]  Other

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1. **Do you have plans to refurbish batteries?**

[ ]  Yes

[ ]  No

[ ]  Don’t know

[ ]  Not applicable

1. **What are the key barriers preventing you from entering this type of business?**

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1. **In your opinion what sorts of incentive or support do you need to transition into this emerging area?**

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1. **In your opinion what are the key requirements needed to setup a viable Australian battery manufacturing and battery recycling industry?**

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