New Zealand Battery Product Stewardship Research

Milestone Two: Detailed Research

Report for the Ministry for the Environment

Prepared on behalf of the Battery Industry Group (B.I.G.)

29 January 2021

Report for the Ministry for the Environment as part of the B.I.G. New Zealand Battery Product Stewardship Research Project

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Acknowledgements

Our thanks to all those who provided feedback and input into this report.

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Executive Summary

E.1.0 Introduction

This project is working to develop a proposal for a 'circular' product stewardship scheme for large batteries. The intention is to identify the most appropriate integrated solution for New Zealand, for our current state of play and different future scenarios that will support a circular economy.

As per the project plan, this Milestone Two report covers:

- Battery value chain detail
- Potential scheme costs
- Options for recovery of costs
- Consumer research.

E.1.1 Previous work

There is a range of background and research work that sits behind the current project. This is formally presented in the Vector New Energy Futures Paper: Batteries and the Circular Economy.[1] The paper and its Technical Addendum cover a range of issues that lay the groundwork and context for the design of a large battery product stewardship scheme. The Milestone One report should also be referred to, which covers the background including NZ context and legislation, product stewardship scheme elements, international research, and overview of NZ value chains.

E.1.2 Battery Industry Group

The development of the Product Stewardship Scheme for large batteries is being overseen by the Battery Industry Group (B.I.G.). B.I.G. is a stakeholder group that has been assembled to provide input and oversight for this project. Eunomia is part of the B.I.G. Core Delivery Team, with the role of Lead Researcher.

E.2.0 Battery Value Chain Detail

The focus in the research was on the key aspects of the value chain that would directly interact with the operation of a product stewardship scheme. These were identified in

[1] Vector (2019) New Energy Futures Paper: Batteries and the Circular Economy. Available from: https://www.vector.co.nz/articles/vector-s-new-energy-futures-paper-on-batteries-and

the Milestone One report and further refined through the stakeholder engagement process. Interactions at the key stages will shape what is likely to be workable in terms of scheme design. The research focussed on the key actions that are likely to take place at each stage such as:

- Battery identification
- Data recording and tracking
- Fees and payment.

The elements that were explored in the research included the following:

The definition of a 'large battery'. This is crucial for determining which products are obligated under the scheme, and for being able to minimise boundary issues with the e-waste product stewardship scheme, which is also under development. A range of options for definition were examined including weight, dimensions, capacity, intended use, and end of life handling. The assessment suggests that a multi-layered definition is likely to be required with the first layer of definition being intended use and the second being end of life handling and/or weight.

Processes following import. This is the point at which it is determined whether a battery is obligated under the scheme or not, and when fees are calculated and levied on obligated parties. The research indicated that voluntary declarations by obligated parties supported by Government audits matching to Customs or other data is likely to be the most workable. Formal discussions with NZ Customs have not been undertaken and will be required. Billing of obligated parties should be undertaken by the Scheme Manager based on market share. There are a number of options for how market share could be calculated, but the most workable is likely to be based on the kWh of batteries imported, as this figure is readily obtainable and is a reasonable proxy for quantity and size.

Processes at end of use. End of use is where a battery ceases being used for its original purpose and is given a second life – for example, an EV battery may be removed and either installed in another vehicle or used in a stationary storage application. The research found that voluntary declarations by accredited operators is likely to be most practical. There are a number of possible options for effecting payments for eligible services (such as battery removal and assessment), but further investigation will be required to finalise the processes.

Processes at end of life. This is when a battery has no further use as a battery and is then recycled or otherwise disposed of. It is recommended that regulations under S23(1)(c) of the WMA be introduced to require end-of-life batteries to be removed and managed by accredited providers. This would provide control over the end-of-life processes and help ensure consumer confidence. To balance this, it will be important to ensure that accreditation processes do not unduly exclude operators and enable good geographic coverage. Options for achieving this are to manage suppliers through simple contract or supplier agreements and/or requiring adherence to a code of conduct. As with the end of use processes, there are a number of possible options for effecting

payments for eligible services, but further investigation will be required to finalise the preferred processes.

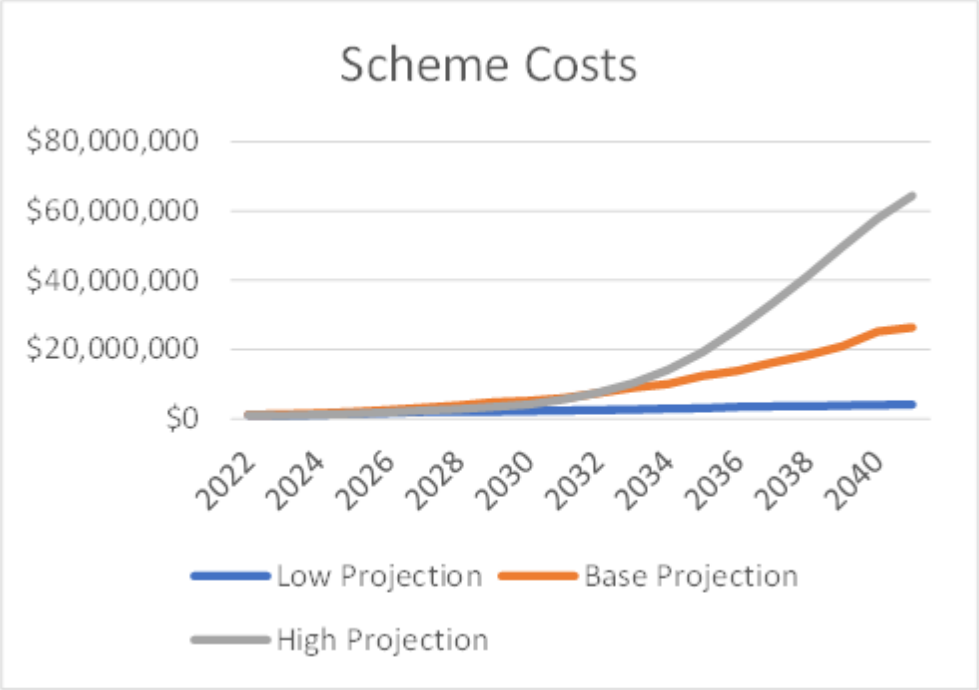
E.3.0 Potential Scheme Costs

Potential scheme costs were developed using a financial model. The model includes fixed costs such as administration costs, governance, data management, communications and education, and research and market development, as well as variable costs associated with the collection and recovery of end-of-life batteries.

Three scenarios were developed around how scheme costs could evolve over a 20-year period (nominally 2022 – 2041). The scenarios considered variations around how many large batteries are placed on the market and come to end of life in that period.

The total scheme costs under each scenario are shown in the chart below.

Figure E. 1: Total Scheme Costs Over Time



Total scheme costs are similar for all schemes in the first 8 years or so. This is driven by the numbers of batteries coming to end of life which, in these early years, mainly reflects historical numbers of batteries placed on the market. Total scheme costs over this period are between $1 million per annum in the first year up to around $5 million by 2030 in the central case projection. By 2041 the total costs have diverged substantially. The low projection costs grow to around $4 million per annum, while the central case costs are estimated at $26 million and the high projection costs at approximately $64 million.

The model also looked at the potential distribution of these costs if they were to be covered by some form of advanced recycling fee. The amount that would need to be charged varies significantly over time due to the fact that the numbers of batteries coming to end of life (the main driver of cost) and the numbers of batteries placed on the market (the number of units the cost is divided up amongst – i.e. the denominator) grow at different rates. If the costs are divided up on a per kWh battery capacity basis, the charges per kWh reach a low point of $0.24 per kWh under the central scenario around 2025 and a high of $4.95 in 2034 under the low growth scenario. By way of illustration, for a 100 kWh battery pack this would be equivalent to fees of around $24 and $495 respectively. This shows the potential variation, not only between scenarios, but how fees may change over time.

The financial modelling shows that there is a high degree of potential variability in terms of both the total costs of the scheme and the level of fees that may be applied to batteries placed on the market under the scheme. There are a number of points that can be made however:

- The large potential growth in the number of large batteries placed on the market combined with the substantial time lag between a battery being placed on the market and reaching end of life means that, under all scenarios, only a fraction of the full end of life cost for batteries placed on the market will need to be levied to cover the total cost of the scheme for a given year within the modelled period (i.e. the next 20 years).
- This means that, in the early years of the scheme, the costs levied are unlikely to be high enough to provide substantial disincentive to the purchase of EVs or large batteries.
- Even over the first 20 years of the scheme, the full cost of recovering a battery under the scheme will not need to be levied to pay for the full scheme costs.
- In the modelling, some set up costs are accounted for in the first year, and this raises the costs in the first year of the scheme.
- Except in the low growth scenario, the vast majority of scheme costs are directly associated with the recovery of batteries, with only a small proportion of costs associated with scheme administration (1.4% in the high growth, 3.3% in the central case, and 16% of costs in the low growth scenario by 2041).
- The modelling bases the costs of recovery on current costs. However, the current costs are not yet well understood and are still being worked out by those involved in the industry. The costs of recovery – across all aspects of the value chain – from collection to assessment, pre-processing, transport, storage and actual recycling, are highly likely to come down over time as new more efficient systems and processes are developed and economies of scale come into play. To this extent at least, future costs may be over-estimated.

E.4.0 Options for Recovery of Costs

In this section the options for recovery of costs all assume that there is a single product stewardship scheme for large batteries.

The product stewardship scheme guidance (S4(1)) limits the options for how costs can be recovered as it requires that the full net costs are met by product or producer fees 'proportional to the producers' market share' and adjusted for the degree to which the product is reusable or recyclable.

The options for recovery of costs considered included:

- **Advance disposal/recycling fee.** This could be applied at point of sale or charged to manufacturers or importers based on market share. The latter is the only approach that puts the full responsibility on producers and allows meaningful incentives around fee modulation.
- **Deposit refund.** This is a method of ensuring that there is sufficient value in the product at the end of its life to encourage its return into the system. The research did not provide a clear case that a deposit refund should be paid to consumers, and end of life costs incurred by those processing batteries may be able to be more appropriately compensated through well designed payment structures.
- **Membership fees.** These could be used to recoup some of the costs of the scheme – such as administration costs. To meet the market share requirement in the guidelines this could be modulated by some form of busines size metric (e.g. turnover, number of employees). A membership fee would be relatively simple to administer, would vary less over time, and be able to be easily charged in advance, which could help in budgeting and cashflow.
- **Other charges.** Because the guidelines specify that scheme costs should be met directly by producers or product fees there is limited ability to levy other charges. However, there may be some scope for recovery of costs for activities that may fall outside of direct scheme costs. For example, professional training courses, or recouping costs of compliance where there has been a breach of standards.[2] The ability to levy these types of charges would need to be clarified with the Ministry for the Environment.
- **Grant funding.** Similarly, grant funding could not be used for paying for core scheme operations. However, there may be opportunity for the Scheme Manager and/or scheme participants to seek grant funding for projects that could enhance scheme outcomes – such as the development of new technology.

[2] In the EU the costs charged through the scheme are restricted to 'Necessary Costs' which are defined.

E.5.0 Consumer Research

This aspect of the research aimed to develop an understanding of the needs of consumers so that these can be taken account of in design of the scheme. To meet these aims the Battery User Group (B.U.G.) was formed. The B.U.G. is a sub-group of the B.I.G. that is focussed on the end-of-life consumer and user experience. The B.U.G. has utilised two main research methods to date: A stakeholder workshop and a consumer survey.

The consumer research has highlighted a number of key factors that will need to be incorporated in the product stewardship scheme design. These include:

- The need for a clear and obvious pathway for how large batteries are dealt with at the end of their life. There should be a network of easily accessible, trusted professionals that consumers can take their batteries to (or vehicles with end of life/end of use batteries in them).
- How to access this pathway needs to be communicated clearly and through trusted information channels. Official sources are likely to be important as they are perceived to be independent and unbiased.
- There needs to be (at least) no financial disadvantage for doing the right thing. Although it was seen as potentially important by some, the need for a payment to consumers was not clear from the research.

Further consumer research is planned for Milestone 3 as part of the stakeholder engagement process.

E.6.0 Conclusions

The Milestone Two research has investigated the key in formulating a preferred scheme design and has provided a framework for evaluating these. The evaluation, alongside adherence to the Ministry for the Environment's product stewardship guidelines, effectively narrows down the options that will likely be workable in practice across the key design parameters considered. This provides a strong basis for identification of a preferred scheme design in Milestone Three.

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Glossary

Advanced recycling fee / advance disposal fee	A charge levied on products (usually when they are placed on the market) that covers the cost of end-of-life management including recycling/disposal. The charge can be applied directly to a product at the point of sale or can be calculated based on product sold and charged back to the producer/importer.
Battery upgrader	Term used in this document to refer to organisations that repair/refurbish batteries, modify or aggregate them for second life applications or similar.
End of life	This is when a battery has no further use as a battery and is then recycled or otherwise disposed of.
End of use	This term refers to where a battery comes to the end of the use for which it was first intended. For example, a battery may be used initially in a vehicle but then bet taken out of that vehicle and find further life either in another vehicle or in a different application such as stationary storage.
PRO/ PSO	Producer Responsibility Organisation / Product Stewardship Organisation. These are not legally defined terms under the WMA but are commonly used to refer to an organisation carrying out duties associated with the administration of the scheme. A scheme may have more than one organisation responsible for its operation. For example, there may be one organisation that carries legal responsibility for the scheme (including governance), and other that carries out day to day operations.
Recycling -	'recyclable resource recovery' is when materials are processed to obtain the same (high grade) *or* lower grade quality. The first option is a value optimisation approach consistent with the principles of circular economy, and the second, commonly known as 'recycling', is in fact 'downcycling' - where the value of materials deteriorates with each round of recycling. Recycling is at the low end of the 'waste hierarchy' whereas reuse of entire products, ideally with high value material recovery at the end, is a more 'circular' solution.

Repurposed / Second life	Repurposing batteries simply means reusing them in another application, giving them a 'second life'
Remanufacture / Refurbishment -	Battery remanufacture, also known as 'refurbishment', involves rebalancing or replacing cells or modules, swapping out damaged cells to extend the life of the battery
Scheme Manager	A legally defined term under the WMA. A scheme manager is defined as "the contact person for an accredited scheme". The scheme manager is the entity with legal responsibilities for the scheme under the WMA.
SOH	State of Health. A measure of the remaining capacity of a battery. Usually measured as a percentage (e.g. 80% SOH). This is how much of its originally specified capacity it retains.
WMA	Waste Minimisation Act 2008

1.0 Introduction

1.1 Product Stewardship Scheme Development

This project is working to develop a proposal for a circular product stewardship (PS) scheme for large batteries. [3] The intention is to identify the most appropriate integrated solution for New Zealand, for now and given different future scenarios (taking into account changing battery chemistries, volumes, new recycling technologies and other disruptive technologies such as hydrogen). The context and scope for this project is provided in the Vector New Energy Futures Paper – Batteries and the Circular Economy, and its Technical Addendum. This Paper will be used as a reference point throughout this project to ensure the proposed scheme acknowledges and responds to the environmental, societal (including Māori), cultural and circular economy context for Aotearoa.

There are three key parts to the proposed product stewardship development project:

1. Research into the value chain for large batteries to understand key steps and interactions, chain of custody, costs, potential for recovery charges, issues and risks including health and safety requirements at each stage, consumer response, linkages and changes over time;
2. Where possible, trialling and testing of collection and processing through practical efforts to recycle current large battery stockpiles. The learnings from this process will feed back into the value chain research (NB: *The costs and deliverables of this project element do not form part of deliverables contracted to the Ministry for the Environment*);
3. Development of a 'co-designed' product stewardship scheme that has industry support and meets the requirements of the Waste Minimisation Acti (WMA) 2008 and the Ministry for the Environment's proposed Product Stewardship Guidelines. The scheme will provide flexibility (with pathways that can adapt as the sector develops) and align where appropriate with other product stewardship schemes including portable batteries.

The scheme design will make recommendations on the following:

- Scope of the scheme
- Overall scheme structure ('voluntary' 'regulatory', 'co-design') and design including:
    - Preferred organisational model (Governance, ownership, compliance, regional variations, auditing etc.)

[3] For the purposes of this report 'large batteries' are defined as batteries that are used in electric vehicles, stationary storage, and industrial applications. Lead acid batteries are excluded from the scope as these are currently considered to have viable recovery pathways.

- Programme manager specifications (programme delivery)
- Budgets and financial flows
- Regulatory requirements
- Key roles and interactions
- Timelines and implementation

The scope does not cover procedures and processes for the administration of the scheme, or detail of any standards, performance measurements, targets or reporting. It is expected that these would be developed by the implementing organisation once the scheme is formally approved. How the current project fits into the overall product stewardship scheme development process is outlined in Appendix A.8.0.

1.2 Milestone Two Report

This report presents the outcomes for Activities 1A, 2A, 3A, and 4 of Milestone Two. The Activities and Deliverables for Milestone Two as detailed in the Project Plan are shown in the table below:

Table 1: Project Plan Activities and Deliverables for Milestone Two

Activity	Deliverable
1A. Evaluation of the chain of custody and ownership through the value chain, and how this could be managed (e.g. regulation).	1A. Report on chain of custody and ownership through the value chain. Report will include an evaluation and detailed assessment of: i. Key characteristics of the large battery value chain in NZ ii. Chain of custody and ownership of the value chain iii. Options analysis for managing the chain of custody and ownership of the value chain
1B. Seek Ministry review before publication if report includes references to the Ministry's priority work programme	1B. Provide a copy of the report to the Ministry for review before publication

2A. Analysis of the value chain to determine the potential end-to-end net costs of a comprehensive scheme for large batteries.	2A. Report on potential net costs of a comprehensive scheme for large batteries.
2B. Seek Ministry review and approval before publication report includes references to the Ministry's priority work programme	2B. Provide a copy of the report to the Ministry for review and approval of the references before publication.
3A. Evaluation of options for recovery of costs, so the scheme is self-funding (for example an up-front levy/recycling fee, redeemable deposit, charges), and where and how these would be administered.	3A. Report on options for recovery of costs and where and how these would be administered.
3B. Seek Ministry review and approval before publication if report includes references to the Ministry's priority work programme	3B. Provide a copy of the report to the Ministry for review and approval of the references before publication.

4. Conduct at least 2 workshops and/or interviews with potential consumers, end-users and people who interact with scheme, in particular to scheme charges/incentives (e.g. willingness to pay, key messages).	4. Report on workshop or interviews conducted with consumers, end-users and stakeholders in the value chain. This will include information on: i. Number of participants per event ii. Description of workshop format and/or interview questions iii. Analysis of data collected iv. Participant feedback
5. Milestone 2 Governance Group Meeting and sign-off of milestone deliverables	5. Governance Group Minutes including minuted sign-off of milestone deliverables
6. Submitting Ministry reporting documents	6. Ministry documentation: i. Milestone report ii. Milestone claim form iii. Summary of Expenses iv. Copy of actual Invoice v. Tax invoicing for the Ministry *Note:* ** Reports will include all outcomes of the research including methodology, research findings, and technical appendices as appropriate.* ** The reports will be directed at stakeholders in the industry to ensure that there is widely available, quality information on which to base the product stewardship scheme design.*

In broad terms, Milestone Two builds on the base of information established in Milestone One. Through substantial stakeholder engagement it provides more detail around current practices and options for an industry supported product stewardship programme. Milestone Two provides the knowledge base for the final design phase of the project.

2.0 Milestone Two Methodology

The primary research methodology for Milestone Two was engaging with stakeholders. The research sought to develop a more detailed understanding of the roles different stakeholders throughout the value chain play, now and potentially in the future, and to capture views on how a product stewardship scheme could function and potential issues that may be perceived with the different options.

Information from stakeholders was supplemented where possible with desktop research to develop a sound evidence base.

2.1 Stakeholder Survey

A survey constructed using SurveyMonkey and sent out by e-mail to all 140+ B.I.G. stakeholders. 60 Responses were received between 30 August 2020 and 22 September 2020.

The survey was divided into two parts:

- The first part sought information about each respondent such as what activities in the value chain they undertook, the quantities of large batteries they handle, and the approximate costs and income associated with their activities.
- The second part canvased their views on potential scheme designs. To facilitate this three 'strawman' scheme designs were proposed, and feedback sought on specific aspects of them. Appendix A.6.0 contains the strawman scheme designs presented.

A copy of the survey questions is provided in A.2.0.

2.1.1 Survey Results

The survey was primarily intended gather information to inform the detailed analysis of the value chain as is presented in section **Error! Reference source not found.** below. H owever, for transparency and completeness the results and analysis are presented in Appendix A.3.0.

2.2 Interviews

In addition to the stakeholder survey one on one telephone or in person interviews were conducted with selected stakeholders who were deemed to play a key role or be able to provide vital insight or information. Some stakeholders were engaged with more than once in exploring key information. A list of stakeholders interviewed is provided in Appendix **Error! Reference source not found.**.

There was no specific script for the interviews as the information sought from each stakeholder varied.

3.0 Battery Value Chain

3.1 Definition of Large Batteries

Defining what constitutes a 'large battery' under the scheme will be vital for the effective functioning and administration of the scheme. This is particularly pertinent in the context of the current development of an e-waste product stewardship scheme which will cover all batteries not defined as large batteries. The definitions used will need to ensure consistency between the schemes and avoid unintended consequences such as the erroneous transfer of batteries between the schemes.

3.1.1 Key Issues

This section looks at the major issues and considerations around defining the scope of large batteries that may be subject to the scheme.

Large batteries are the subject of their own product stewardship scheme because they have a different lifecycle / value chain to most other smaller batteries and therefore there are different considerations in relation to how a product stewardship scheme will operate.

The key considerations in regard to the different lifecycle are:

- The life span of the battery. Large batteries can last for up to 10 - 20 years. This means that there is a significant period of time between being placed on the market and them coming to the end of their life
- The maturity of the market and the technology. Large batteries are projected to go through a substantial period of growth due to increased uptake of EVs and increased use in stationary storage applications. The scheme will therefore need to evolve with the growth of end-of-life batteries. Because of their long life there is a long delay between being placed on the market and end of life, which pushes this trend into the future.
- The size and ease of handling of the battery. Large batteries usually require specialist installation, servicing, and removal, and cannot be easily transported to drop off sites or similar.
- The numbers and distribution of the batteries throughout the population. Large batteries are relatively few compared to most smaller batteries. Combined with their longer lifespan this means users will deal with end-of-life large batteries far less frequently.

While there are therefore clear reasons for different product stewardship approaches there are, however, a number issues in respect of where a definition might be drawn. Specifically:

- Large batteries are made up of smaller cells and modules. The large battery could therefore be broken down into smaller batteries. Conversely people may make up large packs from smaller cells or modules.

- Batteries that are not covered under the ‘large battery’ scheme will fall under the e-waste product stewardship scheme (under development). These schemes both have to have the same definitions around the product at the boundaries of the schemes to avoid double duty or gaps. There are also risks potentially for both schemes if the requirements under one scheme are significantly more favourable than the other. For example, if the payments for recycling of batteries under the e-waste scheme is more favourable than under the large batteries scheme this could lead to battery packs being dismantled and cells being claimed under the e-waste scheme, which would lead to an imbalance of funding.

3.1.2 Definition Options

Options for defining the obligations of batteries under the scheme are shown in Table 2 below:

Table 2: Definition Options

Definition	Description	Assessment
Battery size (weight)	A weight figure (e.g. 5kg) could be determined. All batteries over this weight would be included in the scheme The definition would need to specify whether casing and battery management systems are included in the weight.	Requires the weight of the battery to be known at the point of obligation assessment. Consumers could - at the margins - need to know the weight of the battery to know which system it is to be returned under (e.g., can it go in a drop off point for small batteries or not).[4] Weight does also not get around the issue of whether cells, modules, or whole packs are eligible for inclusion. The weight figure would need to be justified – i.e., there has to be a reason for the cutoff point. This begs the question of whether the reason given makes more sense as the point of definition. Weight is likely to decrease for a given capacity as batteries become more energy dense. This could result in battery types moving between schemes over time.
Battery size (dimensions)	A volume figure (e.g. 5 litres) could be determined. All batteries over	Requires the volume of the battery to be known at the point of obligation assessment. Volume is not a widely recorded metric (although dimensions should be available which could be used to calculate volume)

[4] There is a safety risk that consumers could try to break down a battery pack to modules/cells and return these to a 'small' battery collection if this is perceived as a cheaper or easier option for disposal.

Definition	Description	Assessment
	this volume would be included in the scheme. The definition would need to specify whether casing and battery management systems are included in the volume.	Consumers could - at the margins - need to know the volume of the battery to know which system it is to be returned under (e.g. can it go in a drop off point for small batteries or not) Volume does also not get around the issue of whether cells, modules, or whole packs are eligible for inclusion The volume figure would need to be justified – i.e. there has to be a reason for the cutoff point. This begs the question of whether the criteria given makes more sense as the point of definition. Volume is likely to decrease for a given capacity as batteries become more energy dense. This could result in battery types moving between schemes over time
Battery size (Capacity)	A capacity figure (e.g. 5kWh) would need to be determined. All batteries over this capacity would be included in the scheme. Battery capacity would be based on original manufactured nameplate capacity (as capacity can degrade over a batteries lifecycle)	Requires the capacity of the battery to be known at the point of obligation assessment. This information should be readily held. Consumers could - at the boundaries - need to know the capacity of the battery to know which system it is to be returned under (e.g. can it go in a drop off point for small batteries or not) Capacity does also not get around the issue of whether cells, modules, or whole packs are eligible for inclusion The capacity figure would need to be justified – i.e. there has to be a reason for the cut-off point. This begs the question of whether the criteria given makes more sense as the point of definition.

Definition	Description	Assessment
		Capacity is likely to increase for a given weight/volume as batteries become more energy dense. This could result in battery types moving between schemes over time
Usage	A list of battery applications could be drawn up that identifies which types of batteries are eligible. For example: • Motorcycles • Cars • Vans and Utilities • Trucks • Buses • Forklifts • Earthmoving and construction vehicles • Tanks, APCs and military vehicles • Ferries and powered watercraft • Aircraft • Domestic electricity storage systems • Grid scale installations	Definition by usage appears relatively practical and intuitively easy to understand. There are likely to be some calls around the margins as to which battery uses are included or not. (for example, golf carts and mobility scooters) The decision to include or not needs to be justified with reference to practical criteria.

Definition	Description	Assessment
	• Commercial scale installations • Batteries used for vehicle charging applications. The list could be updated over time to take account of new technologies	
End of Life Handling	A simple practical test could be proposed based on handling the battery at end of life. For example, if the battery is not designed to be removed by the consumer and is not able to safely be manually transported by the consumer to a drop off facility then it would be eligible under the Large Battery scheme.	There are still some boundary issues around the definition – for example batteries in mobile phones and laptops are often not designed for removal by consumers, although they can be readily manually transported inside the product. Information on the removability or transportability by consumers may not be readily available on manifests and import databases and it therefore may be difficult to determine obligations based on this criteria alone.

3.1.3 Definition Discussion

Beyond the single types of definitions outlined above, there are options around a hybrid approach – using a number of definitions in concert in an effort to provide clarity and assure practical application. For example, definitions based on usage are likely to be broadly practical and easy to understand. This could be paired with definitions around the end-of-life handling so that the rationale for inclusion by usage is based on one-off rulings as to whether the batteries associated with that type of usage are typically able to be readily removed, handled, and transported by consumers to an e-waste drop off facility or not. Thus, the working definition would be based on usage, but the underlying criteria would be based on ease and safety of removal and handling.

3.1.4 Threshold Quantities

There will need to be a process for registering as a battery importer and participating in the scheme. This is likely to have requirements attached to it which may not be appropriate for private individuals importing for personal use, for example. Therefore, there will need to be either a separate more streamlined process for private individuals (which might entail paying the levy fee, but not becoming a registered scheme member), or an exemption for one-off or small quantities. The thresholds will need to be based on units over a period of time (for example 1 per year).

3.1.5 Battery Chemistries

There are a wide range of battery chemistries used in large batteries, and battery chemistries are changing all the time as the technology advances.[5] In order to ensure future proofing of the definitions it is therefore not likely to be practical to positively define eligible battery chemistries (i.e. list all those that are included). Rather, for the purposes of the scheme design it would make sense for all battery chemistries to be included unless an exemption is specifically made.

For the avoidance of doubt broad types could be named as being included at the outset. For example:

- Lithium based chemistries
- Nickel metal hydride
- Fuel cells

3.1.5.1 Exemptions

At this stage the following battery chemistries are suggested to be exempted:

- Lead Acid based batteries. Lead acid batteries are excluded on the basis that there is a viable and well-established end of life recycling market that succeeds in

[5] Refer to Vector (2019) *New Energy Futures Paper: Technical Addendum*

capturing in the order of 98% of end-of-life lead acid batteries. If this situation were to change then lead acid batteries could be brought into the scheme.

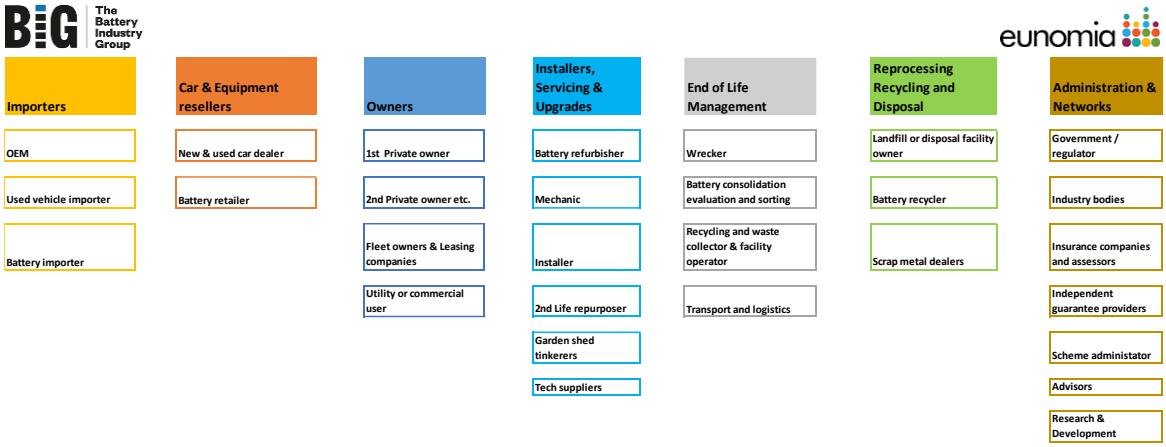
- Flow batteries. Flow batteries have extremely long expected lifespans and can be continually rejuvenated through refreshing the fluids.
- Nickel Cadmium. Nickel Cadmium batteries are an older technology not used in typical large battery applications (such as EVs or stationary storage). They are also problematic to process for recycling and would be a contaminant if included in other chemistry recycling streams.

For both chemistries specifically included and those exempted, technical definitions of each would have to be agreed, and it will be necessary to provide a sound technical rationale for their inclusion or exclusion (for example through reference to a Life Cycle Assessment or Cost Benefit Analysis. Undertaking this is beyond the scope of the current project.

3.2 Key Characteristics of the Large Battery Value Chain in NZ

In Milestone One the value chain was mapped as shown in the figure below:

Figure 1: Large Battery Value Chain Map



As identified in Milestone One, there is substantial activity and a large number of stakeholders involved throughout the value chain. Further detail on current processes based on stakeholder engagement is provided in Appendix A.5.0. However, much of this activity does not impact directly on the functioning of a product stewardship scheme for large batteries. For example, activities such as research and development, technology development and supply, battery maintenance etc., while potentially of interest particularly from a circular economy perspective, do not need to be tracked for the scheme to function effectively.

Conversely, there are a number of elements of the value chain that are central. Milestone One found that, while there are specific incentives relevant to each subgroup, the following key points can be made across the value chain:

- Importers and manufacturers are likely to be incentivised by product requirements, recycling targets, standards, extended ownership (e.g. leasing), and modulated charges
- Advanced disposal/recycling fees ensure end-of-life costs are built into the upfront price. This sends a signal to both manufacturer and customers
- Consumers are likely to be incentivised by deposit refunds or advance disposal fees and changing societal expectations
- Wreckers and facility operators are likely to be incentivised by deposit refunds or advance disposal fees that provide the batteries sufficient residual value to make correct management and disposal economically viable
- Recyclers that are able to receive advance disposal fees will avoid the need to charge, which will ensure an economic supply of end of life batteries.

Building on the work undertaken in Milestone One, the following elements of the value chain have been identified as being vital for the success of the scheme. These are essentially the processes at the start and end of the value chain in New Zealand. They are important because they are where either, a battery becomes part of the scheme, exits through recycling, or undergoes a transformation (such as a second life). Specifically:

Processes following import:

- Identification of batteries on import and assessment of obligation
- Processes for data recording and data sharing
- Processes for assessment of levy/charges and billing of scheme participants.

Processes at end of use:

- Mechanisms for ensuring batteries are correctly identified at end of use and directed to their highest value use
- Processes for identifying where large batteries have been repurposed and new products have been created
- Processes for recording data
- Processes for providing payments/charges to scheme operators.

Processes at end of life:

- Mechanisms for ensuring batteries are correctly identified at end of life and managed under the scheme
- Processes for data recording
- Processes for providing payments and rebates to scheme operators.

These key elements of the value chain are expanded in the sections below.

3.3 Analysis of Value Chain Issues

3.3.1 Processes in Relation to Import

3.3.1.1 Identification of batteries on import and assessment of obligation

When batteries arrive in NZ they need to firstly be identified as meeting the definition of a large battery, so that they can be formally recorded as being part of the scheme.

If regulations are put in place under Section 22 (1) (a) of the WMA which prohibits the sale of a product except in accordance with an accredited product stewardship scheme, there will need to be processes to:

a. Identify the battery and/or obligated party (e.g. the product is correctly coded on the import license and manifest)
b. Ensure that the agency responsible for identifying the obligated party has processes in place to assess the information provided and the obligation under the scheme
c. Confirm that the importer/brand owner is registered with the scheme, and the product can be legally sold in NZ.

Some initial liaison with Customs and NZTA has taken place to inform this research. However further discussion will need to be undertaken in partnership with the Ministry for the Environment to determine the most appropriate method of obtaining the required information if the scheme design is taken forward.

Businesses or organisations that are involved in the import of batteries will need to be able to assess their requirement to be registered. This will require:

a. Clear definitions
b. A process for informing potentially eligible importers of the need to be registered
c. Importers to correctly code and label imported product
d. A database of importers to be developed and maintained. Potential starting points for such a database would include the Vehicle Industry Association (VIA) and Motor Industry Association (MIA).

3.3.1.2 Processes for data recording and data sharing

The next vital step is to ensure that there is accurate recording of the batteries that are imported, including key information that may be of relevance to a product stewardship scheme such as:

- Importer
- Vehicle or system brand
- Battery brand
- Model name/number
- Chemistry
- Capacity
- Dimensions

- Weight
- Date of import
- State of health (SOH)
- Other technical and safety specifications (e.g. voltage, safe temperature range, current, warranty period etc.)

This information will need to be accessed by the agency(ies) responsible for gathering the information. It will need to be accurately collated and kept secure.

There will need to be processes for securely sharing information between key parties that may interact with the battery throughout the value chain. The parties may include:

- Data gathering agency
- Data management agency (may be separate)
- The Scheme Manager and PRO
- NZ Customs
- The Ministry for the Environment
- NZTA
- Mechanics
- Wreckers
- Battery refurbishers & repurposers
- Battery recyclers
- Insurance companies and assessors
- OEMs / battery manufacturers

Each of these parties would likely have access to different levels of information. The data management systems would need to allow for these different levels of access. Data management requirements are discussed in more detail in Appendix A.7.0.

It will be necessary to open discussions with the NZ Customs Service (Customs), NZ Transport Agency (NZTA), and other government agencies on their ability to gather the required information. There may be cost implications for gathering this information.

The main information gathered by Customs relates to the tariff codes (refer to Appendix A.7.3) and product value. Further research and discussion would be required to determine whether the existing tariff codes would be sufficient for the purposes of gathering or monitoring compliance information under the scheme or collecting levy payments.[6]

Government agencies that collect private information (such as Customs) are not legally able to share this information with non-government agencies, except in an aggregated form, i.e., they could potentially provide statistics on the number of batteries imported

[6] It should be noted that Customs does not physically inspect product to verify its technical specifications (except where this relates to a potential tariff or GST obligation), and so may not be in a position to verify detailed technical information (such as battery capacity or chemistry)

and the capacity etc., but not information on specifically what each importer is bringing in.

The NZTA is likely to be in a position to gather most if not all of the required data for EVs when a vehicle goes through Entry Certification, first registration and/or warrant of fitness (WOF). NZTA is reportedly upgrading their systems and there is an opportunity to ensure that the desired fields are included.[7] However, there is no direct provision under S24 of the WMA for NZTA to supply information to the Ministry for the Environment, and it is not clear if they would legally be able to pass individual data records on to non-government bodies.

Even if data were obtained through the NZTA this would not cover stationary storage batteries, replacement batteries and cells, or batteries in non-road legal vehicles (aircraft, water craft, golf carts, defence force vehicles etc.). There would therefore in any case likely need to be other processes for gathering, recording, and sharing information.

A further option for gathering data (and billing) is to identify organisations that may be required to be registered with the product stewardship scheme and require them, as a condition of their registration, to supply the required information on the batteries they have imported/supplied. If a S22(1)(a) regulation is in place, then the supplied information could be audited against Customs import data[8] by the Ministry for the Environment to ensure they are fully complying with the regulations (as provided for in S24 of the WMA). This approach would avoid the need for multiple sources of information.

The potential to track data from a large battery's Chain of Custody is being explored in a project, out of scope for this Milestone Two report, by the B.I.G. Battery Innovation Hub members, Vector and Audi, and B.I.G. Advisory Group member Everledger. Refer Appendix A.7.2 for further details.

3.3.1.3 Processes for assessment of levy/charges and billing of scheme participants

Once accurate data on the batteries that have been imported in compliance with the scheme has been obtained, it will be necessary to levy the charges for participation in the scheme on each importer.

The product stewardship scheme guidance (S4(1)) requires that:

[7] Personal communication with Dana Peterson, Ministry for the Environment

[8] If Customs is not able to supply the required level of information, an alternative could be for central Government to establish a formal register of large batteries or similar. An example of this is Australia's Distributed Energy Resource Register: https://aemo.com.au/en/energy-systems/electricity/der-register

"Full net costs for stewardship of priority products at end of life met by product or producer fees proportional to the producer's market share and ease of reuse or recyclability of their product."

The key points are that the fees need to cover the full (net) costs of the scheme, and that they should be apportioned by market share. In addition, it is expected that fees be modulated in respect of the reuse or recyclability of the product.

The calculation of full net costs is covered in section 4.0.

Market Share

The calculation of market share could be made in a variety of ways:

- **The number of battery units conforming to the definition of a large battery that have been imported in a given period**. Most large batteries will be of a similar size, but equity issues may arise at the ends of each scale – for example a commercial scale battery vs a motorcycle battery. An advantage of this approach is that a large portion of the end-of-life costs is in removing/uninstalling the battery which does not necessarily vary according to battery dimensions, capacity or value.
- **The value of the imported battery units in a given period**. The complicating factor is that batteries may be part of a vehicle or machinery and it may not be easy to provide an accurate verifiable value for just the battery. One option may be to use the spare part value, but this is usually higher than the battery in situ and may not be representative of the actual value.
- **The weight of batteries imported in a given period**. This could be based on a per kg weight unit. This measure would relate well to the cost of recycling the battery at end of life. However, the weight of the battery would need to be carefully defined to ensure it is equivalent across all battery types. Depending on the definition it is not clear if this measure would be available a) to Customs and b) for all importers as part of the product specification.
- **The capacity of batteries imported in a given period**. This information should be readily available to importers and Customs. Capacity bears an approximate relationship to weight, and so is a reasonable measure in terms of recycling cost. However, it bears less relationship to the costs of removal or uninstalling. Also, as energy density increases in new generations of battery, the size and materials needed for a given capacity will decrease. This will disadvantage new technology relative to used imports. It may be possible to compensate for this through eco-modulation.

Eco-modulation

In order to modulate fees in accordance with the reusability or recyclability of the product it would be necessary to have an accurate an objective method of determining reusability or recyclability. Options for this include:

- **Modulating on the basis of design for recyclability**. This is a specific requirement in the product stewardship design guidelines. It is currently problematic to establish an objective measure that will reflect how it might perform in reality. It will depend for example on what recycling process is used, and its 'recyclability' is likely to be related to the value of materials that it contains. New battery chemistries use fewer expensive and problematic materials such as cobalt (which is a good thing) but reducing high-cost materials could in theory make them less 'recyclable' by reducing the financial incentive for recyclers. However, tools such as the *Circulytics* Material Circularity Indicator[9] (MCI) could be used to identify additional, circular value from materials, and mitigate risks from material price volatility and material supply.
- **Modulating on the basis of battery chemistry.** There are many variations of battery chemistries - which is likely to make determining the recyclability problematic. However, there may be some basic differences between battery chemistries that would be able to justify a modulation. For example, NiMH chemistries do not present significant fire risk compared to Li-ion chemistries and could therefore attract a lower fee. Conversely, Ni-cad chemistries are problematic in recycling processes because of their toxicity and so could attract a higher fee (if they were included in scope).
- **Modulating on the basis of battery design for reuse**. If there are specific design features that can be proven to better enable second life, or if a manufacturer is actively taking products back for second life applications there may be some scope for fee modulation. This would likely have to be evaluated on a case-by-case basis for each battery model.
- **Warranted battery life.** Another option for eco-modulation could be to modulate the fee on the basis of the manufacturers warranted battery life. The warranted battery life is a likely a reasonable proxy for the relative durability/longevity. The longer a battery lasts, the lower its environmental footprint is likely to be, and the longer that the cost of recycling is deferred into the future. Deferral of recycling costs will have a definable financial benefit in terms of the costs of that battery to the scheme, and it would therefore be logical to reflect this benefit in lower scheme fees.

Billing

The two key possibilities for billing are for this to be done by a government agency or by the Scheme Manager.

Collection by Government or Government Agency

[9] Material circularity indicator (ellenmacarthurfoundation.org)

Tyrewise notes the following:[10]

- Both Customs & NZTA need specific power to collect a new fee
- Initial research indicated that there were no precedents for a government agency to collect a levy/fee and pay the monies directly to an external organization such as the proposed Product Stewardship Organisation. If monies go to an external organisation, either the organisation is named in the legislation or the money goes through a departmental account and is allocated on set criteria.
- A fee gathered by a government agency such as Customs or NZTA is a taking of money by government and the use of public funds provisions apply
- The right to take money must be approved by Parliament = based in legislation
- Regulatory powers under the Waste Minimisation Act do not specifically include levy-making for product stewardship, but they do allow for regulations on setting a fee for management of a product (the Waste Disposal Levy, established in the Act, is only on waste deposited at Disposal Facilities as defined in the Act).

For motor vehicles that require registration through NZTA, it may be possible for NZTA to undertake billing on behalf of the scheme.[11] The Tyrewise scheme is understood to be in discussions with NZTA to collect an advanced disposal fee on behalf of the scheme at the point of first registration for all tyres imported on a vehicle.[12] This would work by the advance disposal fee being added to the 'on road costs' charged at first registration and would be paid directly by the purchaser of the vehicle. The advance disposal fee will therefore be collected by NZTA and passed to the Tyrewise Scheme Manager. A similar process could be established for large batteries that are in vehicles requiring registration through NZTA.

The advantage of this approach is that it piggybacks on existing well-established systems, and this will help make its introduction more seamless and comprehensive. The disadvantages are:

- that large batteries that are not in vehicles or that do not require NZTA registration are not covered (For example, spares, stationary storage batteries, aircraft, watercraft, military vehicles etc.). This means other billing systems would still be required to administer the scheme, which increases the scheme complexity and the potential for boundary issues between the systems; and,

[10] TYREWISE Stewardship for ELTs p. 61

[11] Initial discussions with NZTA indicate this is a possibility (personal communication with Rick Barber, Principal Advisor – Vehicle Strategy, Safety, Health & Environment, NZTA).

[12] TYREWISE ADVISORY GROUP Regulated Product Stewardship for End of Life Tyres "Tyrewise 2.0" Updated Report. Update on industry solution developed between 2012 - 2015. Prepared by Tyrewise Project Managers, 3R Group Ltd. Released Final 22 July 2020.

- that the advance disposal fee is paid directly by the consumer. While this is likely to be easier for the importer/producer, it would have the effect of making importers less engaged with the scheme and would mean that the consumer rather than the importer or producer is the one, in effect, taking responsibility. This would therefore appear to be inconsistent with the intent of the product stewardship scheme.

Collection by Scheme Manger

The other potentially viable option for billing of scheme participants is for all the billing to be undertaken by the Scheme Manager on the basis of voluntary declarations submitted by scheme participants.

Once the liability of each importer has been determined, administrative processes would need to be in place to issues invoices to each importer/liable party, undertake debt collection and initiate compliance action if payments are not made within mandated timeframes.

The entity undertaking the billing would have access to sensitive commercial information and therefore the processes would need to be secure.

Voluntary declarations provided by scheme participants would be audited by the scheme Regulator. If any discrepancies are found between the declared liabilities and those discovered during audit, an invoice/credit note would be issued for the differential.

Compliance for non-participation

If a S22(1)(a) regulation is in place requiring the sale of large batteries except in accordance with the scheme there would need to be processes in place at the time of the scheme launch to determine non-compliance and undertake enforcement if necessary.

Section 65(1) allows for fines up to $100,000. A high standard of proof and clear evidence of the contravention will therefore be required.

Any prosecution would be undertaken by Government; however, the scheme needs to set out how it will ensure compliance and, if necessary, supply evidence of non-compliance to assist in a prosecution action.

The principal methods for the Scheme Manager to manage compliance issues include the following:

- Maintain an industry database that proactively identifies businesses that are involved in the large battery value chain. The particular focus in compliance terms would be importers.
- Work with industry bodies to identify new operators that have entered the market and may need to be registered

- Liaise with Customs to investigate any instances of product being imported where the importer is not registered under the scheme and determine whether they are required to be.[13]
- Establish systems for accurate recording of imported or newly manufactured product by registered participants
- Check voluntary declaration data against industry metrics
- Provide scheme data to central government to audit for compliance purposes.

Any party that is registered with the scheme but places product on the market in a manner that is not in compliance with the scheme could be deregistered from the scheme, but this would need to be specified in the regulations.

Compliance and audit processes carried out by the scheme Regulator would be in addition to the processes noted above.

3.3.2 Processes at End of Use

3.3.2.1 Mechanisms for ensuring batteries are correctly identified at end of use and directed to their highest value use

One of the design objectives for this product stewardship scheme is that it should aim to enable maximum use of large batteries by encouraging extension of their useful life through refurbishment, reuse (e.g. in another vehicle), or through repurposing (e.g. use as stationary storage) in accordance with the principles of a circular economy.

> *A circular economy is an alternative to the traditional linear economy in which we keep resources in use for as long as possible, extract the maximum value from them whilst in use, then recover and regenerate products and materials at the end of each service life.* – Ministry for the Environment

At present, batteries that have reached the end of use in one application (most commonly a vehicle), tend to have value in further applications. They are either replaced whole into a vehicle (replacing one with a lower state of health), refurbished by replacing faulty or lower function modules or cells, broken down, usually into modules, and the healthy modules used to make up a new pack, or potentially repurposed into other applications. Even at low State of Health (SOH), batteries can still have value.

This process happens now under free market conditions with no incentives or government or industry direction. This is because under current market conditions,

[13] A further possibility which has been raised and which would require further discussion and investigation is for the Ministry for the Environment to issue a licence to obligated parties for them to sell product under the scheme and for Customs to check that the party is appropriately licensed. (Personal communication with Phil Lockwood, NZ Customs).

demand for these used batteries exceeds supply. However, in the future, it is uncertain whether this dynamic will continue. As the use of batteries expands and more batteries degrade and come to the end of their use, the supply will increase. In addition, the price of new batteries is expected to continue to fall, so used batteries will be competing with new batteries on price/performance.[14]

Use of batteries into a second life will likely depend on commitment by manufacturers and private businesses as well as government to invest in and promote second life solutions. There is considerable evidence that this is happening: OEMs such as Nissan[15] and Renault[16] already have a track record of giving their batteries a second life as Energy Storage Systems for buildings, boats, street lighting etc. Here in NZ, the B.I.G. Battery Innovation Hub has been matching second-life entrepreneurs with OEM suppliers of used batteries, and the World Economic Forum Global Battery Alliance report 'A Vision for a Sustainable Battery Value Chain in 2030'[17] promotes second-life applications for large batteries. There is however potential that, without intervention (public or private), supply will exceed demand, and that a viable second life market that operates at scale will need some form of support to become established.

In order to meet the scheme objectives there will therefore be a need to put mechanisms in place to encourage reuse and repurposing - i.e. circular economy options. Options include:

- Funding research and development of circular, second-life solutions in New Zealand. This could be met through a portion of the levy. Additional funding could also be sought from government sources.
- Undertaking market development. This could include working with the private sector and/or government agencies to address market barriers to the adoption of second-life battery products. This could be met through a portion of the levy.
- Introducing a requirement for importers to develop and/or offer second-life options for batteries sold in New Zealand. This could work by exempting those importers that are running/developing or contributing to second-life solutions from the portion of the fees associated with research and market development. This could include manufacturers taking their own products back to repurpose components and materials back into new or re-manufactured batteries.

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[14] Strategic Lift (2020) Second Life EV Batteries Project: Defining the need for a New Zealand strategy for post-EV use. Report to the Ministry for the Environment under the Waste Minimisation Fund

[15] https://www.reuters.com/brandfeatures/second-lives

[16] https://group.renault.com/en/our-commitments/respect-for-the-environment/circular-economy/

[17] http://www3.weforum.org/docs/WEF_A_Vision_for_a_Sustainable_Battery_Value_Chain_in_2030_Report.pdf

- Developing and enforcing standards to ensure that second life batteries are safe and fit for purpose.
- Providing payments to organisations that use end of use batteries to create second-life products. The payments could be calculated in relation to/justified by the extended time given to the battery before it requires recycling.
- Waiving levies for second-life batteries placed on the market.

3.3.2.2 Processes for identifying where large batteries have been repurposed and new products have been created

A characteristic of large batteries is that they are made up of smaller modules and cells. The larger packs may be broken down, cells or modules replaced and/or new battery products made up from used cells or modules.

This creates potential issues around defining when a battery pack ceases to exist or comes into existence and if, and how, it should be tracked. There will therefore need to be process for identifying and tracking batteries that are made up from used modules or cells.

This will be important for the scheme to be able to identify and report on second-life versus recycling (and disposal) outcomes, as well as having implications for the claiming of payments, and/or the payment of fees under the scheme.

There are a range of scenarios that will require definition, and a determination of how the battery is treated under the scheme.

- Where cells or modules in a battery pack are replaced to refurbish the performance. Is there a threshold around the % of the battery that can be replaced before it is considered a new battery?
- Where cells or modules from two or more packs are combined to make up a new pack – whether for the same use or a new type of use
- Where a battery is re-purposed from its original use with or without substantial modification to either the modules/cells layout, casing, temperature management systems, or battery management systems.

In practical terms, when a battery comes to the end of its intended purpose and is repurposed, or is substantially altered it, in effect, becomes a new product. However, because there are practical and financial implications for the scheme, and for those upgrading batteries, there will need to be some technical definitions around where these distinctions lie.

Options for technical definitions may include the following:

- Determine a threshold percentage for cell or module replacement in an existing battery beyond which a battery is considered a new product
- Develop specifications in relation to changes in the battery casing, capacity, cell/module configuration, thermal and battery management systems etc. which could constitute the creation of a new product

- Define changes of use which would constitute the battery being considered a new product.

NB. Development of technical definitions would be for the purposes of enabling payment under the scheme only. Ideally these definitions would align with existing standards or definitions.

Processes for recording data

Where batteries are refurbished or repurposed there will need to be systems for tracking what happens and the transformation that takes place, such as a blockchain Digital Battery Passport being explored by the B.I.G. Battery Innovation Hub. In some circumstances a battery serial number or other identifier that is used to track the battery may no longer be applicable and a new serial number or product identifier may be issued.

In order to track batteries that meet the definition of a repurposed unit (as noted above), the following is likely to be necessary:

- All operators that undertake battery repurposing and/or refurbishment should be registered under the scheme
- Repurposing/refurbishment operators have clear definitions of when a battery pack is deemed to come into or out of existence
- Operators are able to access an online database to:
  a. record battery packs that they dismantle (that will no longer be tracked as packs)
  b. record any new or used cells or modules that are purchased
  c. record new packs that are created from used cells or modules
  d. allocate a serial number or other unique identifier to the new pack
  e. record the quantity of batteries/modules/cells sent to an accredited recycler.

3.3.2.3 Processes for providing payments/charges to scheme operators

Operators that undertake refurbishing and/or repurposing of large batteries may be eligible for payments and or charges under the scheme. There will need to be a clear basis for these charges or payments set out.

The scheme could elect to offer both payments to, and levy charges on, refurbishment/repurposing operators. The rationale for each is as follows:

Payments to battery upgraders

One of the objectives of the scheme is to encourage batteries to have extended use. Battery upgraders could receive a payment under the scheme which would be designed to improve the economics of this options. Because they are extending the life of the battery, they in effect extend its end-of-life costs into the future which, in an NPV

calculation is a financial benefit.[18] The payment could be based on a calculated NPV value (relative to the length of the battery life extension – which could be difficult to verify unless it is warranted by the battery upgrader/manufacturer). Alternatively, it could be based on a figure that is calculated on providing a meaningful incentive for extending the battery life.

As noted above, where a new battery is deemed to have come to the end of its life, and a new product is created, that new product should be registered with the scheme and pay scheme fees in line with an agreed fee structure. The battery upgrader will need to be registered and make declarations about the batteries they have put on the market.

Once the liability of each battery upgrader has been determined, administrative processes would need to be in place to issues invoices to each importer/liable party, undertake debt collection, and initiate compliance action if payments are not made within mandated timeframes.

The entity undertaking the billing would have access to sensitive commercial information and therefore the processes would need to be secure.

Voluntary declarations provided by scheme participants would be audited by the scheme Regulator. If any discrepancies are found between the declared liabilities and those discovered during audit, an invoice/credit note would be issued for the differential. It should be noted that local manufacturers will not be able to be audited using Customs data, and so an appropriate audit regime will need to be developed for non-imported new product.

The key options in relation to charges and payments for this phase include:

- **Charges for new product placed on the market.** There are likely to be a number of challenges to how these charges are calculated and administered. The first is that it will rely on voluntary declarations by the manufacturer of the new product. This will require the manufacturer to have been identified and registered with the scheme and have appropriate access to the system. It will also require clear definitions around when a 'new' product has been created and for these to be interpreted correctly by the manufacturer. If the product requires independent certification by an agency (e.g. registered electrician, NZTA), this could provide a means for independent verification of product placed on the market. There is also the question how the charges are assessed. In theory the same charging regime should be used as for imported batteries (e.g. charge based on capacity), but consideration will need to be given if these charges are

[18] NPV is short for net present value. It is a term used in finance to determine the value of making an investment now, versus making that same investment in the future. In this context money that is not spent on recycling now could be invested for the period by which the battery life is extended (e.g. 7 years), and earn a return. This return (inflation adjusted) would be the NPV of the repurposing option, or the financial value of extending the battery life.

modulated to acknowledge and encourage their second life. The charges could, for example, be modulated based on their SOH or on the basis of the guaranteed life of the battery, or could be waived or reduced on some other basis.

- **Payments for product recovered.** If a battery is deemed to have come to the end of its existing use and is de-registered, the accredited agent could claim for the removal and assessment of the battery and the 'recycling' of any cells, modules or parts that are used in the new product that has been created. This would help lower the input costs and could offset (to a degree) any charges for placing a new product on the market.

3.3.3 Processes at End of Life

3.3.3.1 Mechanisms for ensuring batteries are correctly identified at end of life and managed under the scheme

There will come a point for every battery where it is no longer economic or practical to use for any purpose. This is the end of life. This point will vary for every individual battery. It will be influenced by:

- Its state of health (SOH)
- Whether it is damaged or faulty
- The costs and practicality (including access) of servicing, repair, refurbishment or repurposing relative to purchase of a new battery to fulfil that function.

Batteries that are deemed to be end of life need to be correctly identified so that they can then be correctly managed.

In this scenario it is assumed that the battery will not be sold for further use.

There may be issues around the definition of end of life when a battery has been split into its modules or cells. Some modules or cells may have a further life where others may need to be recycled. It will be important to ensure that the cells that are recycled are done so under the scheme, and do not transfer between the large battery scheme and the e-waste scheme.

The mechanisms that are in place for this aspect depend on an understanding of who will be involved with the batteries and the end of their life and what they are likely to do. Detailed value chain mapping is presented Appendix A.5.0. The dynamics of this value chain may change over time. However, it is likely that in the initial stages of the scheme the key parties and their roles will be the same as the status quo. An owner will seek to get rid of the battery by either:

- contacting an insurance company (if it has been in a crash)
- taking the vehicle to a wrecker
- contacting a company to uninstall their stationary storage array
- taking a vehicle to a mechanic
- calling a tow truck

- contacting the dealer
- trying to sell the car privately ‘as is, where is’, or
- stockpiling, disposing of it illegally, or disposing of it to landfill.

The organisation that ends up with the battery will face the cost of removing, assessing, preparing and recycling the battery. This cost may be dealt with by:

a. Charging the owner for the costs of proper end of life management
b. Illegal disposal. This could include, dumping, leaving the battery in a car and sending it to a shredder, stockpiling (and eventual abandonment)
c. Offsetting the costs of end-of-life management through recovery of other valuable parts or metals.

Options a) and b) are clearly not acceptable under a product stewardship scheme. It is not clear that there will always be sufficient value in an end-of-life EV parts or metals to fully offset the costs of proper removal, handling, and recycling of an EV battery.

It will therefore be important to ensure that there are appropriate measures in place to make sure the battery is safely removed and correctly recycled. Options include:

- Introducing regulations under S23(1)(c) prescribing requirements for the takeback service and the reuse, recycling, treatment or disposal of the product. The intent here would be to require batteries to be removed and managed at end of life only by accredited providers. These providers would have to meet certain standards.
- The accredited providers would be able to claim the costs of removal, storage, transport, and recycling. This would be necessary to ensure that they are incentivised to become accredited and to carry out the work and ensure that the providers under the scheme are able to meet the scheme requirement of taking the battery back at no charge.

3.3.3.2 Processes for data recording

When the battery reaches end of life, this will need to be tracked and recorded. Ideally the system will be able to track specific batteries and even modules. Further discussion of data management is provided in Appendix A.7.0.

The data that will need to be recorded include:

- Serial number/unique identifier
- Party receiving the battery
- Action taken with the battery (e.g. removal, transport, recycling etc.)
- Party the battery is transferred to
- Confirmation of battery specs
- Confirmation that steps for safe transport and handling have been completed
- Calculation of the payment due from the scheme for that action, and automatic crediting of the accredited operator’s account.

The end-of-life process could involve a number of steps and different parties. These include:

- Wrecker
- Party removing battery
- Battery assessor
- Storage and transport
- Recycling consolidator
- Recycler

The system should enable the battery to be tracked through these steps and to verify its final recycling.

Each operator will need to easily be able access the system and log in securely. There will need to be careful definition of user privileges to ensure confidentiality of data.

The system will need to be able to not only track individual batteries through the end-of-life process but enable data on each operator to be collated for the purposes of reporting and calculating payments under the scheme.

3.3.3.3 Processes for accreditation of service providers under the scheme

In order to ensure that batteries are managed properly at the end of life, it will be necessary to establish standards for the removal of the battery and its safe handling, storage, transport, and recycling. Any operators that provide services under the scheme will need to adhere to these standards. This will be important for providing confidence that the scheme is operating in accordance with its purpose.

The fundamental feature of the end of life (ELV) market in NZ is that it is essentially unregulated. Auto dismantlers and scrap metal dealers do not have any established industry standards that they are required to adhere to.[19]

There is therefore no pre-existing framework through which accreditation and compliance with standards can be implemented.

There are also huge numbers of auto-dismantlers nationally. It will be important to ensure that enough of them are able to become accredited under the scheme to provide a nationwide network. Auto dismantlers are likely to only seek accreditation if it makes commercial sense and is not too difficult. This creates a tension (at least initially) between establishing effective standards and ensuring sufficient coverage under the scheme.

As well as auto dismantlers, organisations that are responsible for installing or decommissioning stationary storage applications will need to be accredited. This is likely

[19] Beyond compliance with standard requirements for businesses such as district plans, air land and water discharge consents, Health and Safety legislation etc.

to be less problematic. In the case of grid-connected batteries this must be done by a registered electrician. However, in the case of off-grid installations there is no requirement for using a registered electrician. [20] While it is likely that in stationary storage applications the equipment will be installed or uninstalled professionally, there still exists the potential for some homeowners to undertake this themselves. This is a relatively small community which is likely to be able to be easily targeted separately for education / training.

Options for accreditation processes include:

- Establishing a 'code of conduct' that anyone accredited by the scheme would be expected to adhere to. This could have various levels of enforcement applied (from essentially no enforcement through to regular inspections of every site).
- Establishing a training programme and/or qualification which each accredited operator would have to have staff complete in order to maintain their accreditation. This could link to existing standards where applicable (e.g. AS/NZS 5377: Collection, storage, transport and treatment of end-of-life electrical and electronic equipment).
- Establishing an accreditation process that requires operators to submit written manuals or documentation to demonstrate their processes and their compliance.
- Delivering compliance with service standards through a commercial contracting. process. The standards would essentially be standards for service delivery as part of a contract. The immediate penalty for non-compliance would be cancelling of the contract. The advantage of this approach is that it utilises processes that businesses are familiar with.

Different accreditation processes are likely to be appropriate for different parts of the value chain and potentially for different stages in the evolution of the scheme.

In the case of accreditation of recyclers, it would make sense that the same recyclers are accredited under the large battery and e-waste product stewardship scheme. There could therefore be a single set of standards and a single process for this aspect.

The B.I.G. Safety & Logistics Group is undertaking development of industry guidelines for the safe handling, transport, and storage of batteries which will form the basis for an accreditation process for these activities.

3.3.3.4 Processes for providing payments and rebates to scheme operators

As noted above, key parties may be eligible for payments under the scheme. There will need to be a robust and secure process for calculating and making payments. Parties / activities that may receive payments include:

[20] Personal communication with Raymond Tancrel, Electrical Training Support Manager, ECTO

- Wreckers
- Party removing battery
- Battery assessor
- Storage and transport
- Recycling consolidator
- Recycler.

Parties would need to be registered/accredited under the scheme to receive payments.

There are a number of ways payments could be calculated and these may be different for each activity.

Removal of battery or uninstallation from a stationary storage use. In EVs the battery will be part of a car that is likely to have additional value in terms of parts and scrap metal. This will help make it commercially attractive for a wrecker to accept a car for scrap. However, there will be time, effort, and cost involved in removing the battery and ensuring its correct recycling.[21] A fee could be set that approximately compensates the accredited operator for removing a battery that is then sent for recycling by an accredited recycler (not for further use, where the value of the battery will provide sufficient compensation for its removal).

The fee could be a flat fee by vehicle type (e.g. cars, buses, motorcycles etc.), or could be graduated to reflect differences in time taken for removal. Where the removal fee relates to a stationary storage battery this could be a flat fee by installation type (household, commercial, grid scale) or could be graduated by size (e.g. by kWh, dimension, or weight).

Eventually batteries will all be recorded, and the removal fee could be calculated automatically from information held in the database. To be paid the fee, the remover would have to send the battery to an accredited recycler/recycling aggregator who would verify the battery type and level of fee.

Battery assessment. In most cases the overall SOH of a battery can be determined relatively quickly and the party removing the battery will make a judgment on whether there is second life value or not based on this quick assessment. Further analysis of the individual cells and modules may be undertaken if there is a second life application but is unlikely if the battery is deemed to have insufficient utility based on the overall SOH[22]. In some instances, however there may be assessment undertaken, but it is not clear how this could be reliably compensated (i.e. if compensation is offered for assessment, then

[21] Battery removal should be undertaken by qualified personnel, and by a person or entity accredited under the scheme. Some wreckers may have (or hire) appropriately qualified personnel; however the step of battery removal may need to be undertaken by a separate, specialist operator. This could be met by organisations with nationwide chains or franchises that elect to provide this service.

[22] Personal communication Bill Alexander, Blue Cars

this may simply encourage this fee to be claimed even if the assessment was unnecessary. There would also need to be a mechanism for verifying that the assessment has actually be undertaken.

Storage and transport. While there are clearly costs associated with storage and transport, these are likely to be highly variable according to distance, the quantities involved, the nature of the storage facility, and the time in storage. Compensation for transport could be based on invoices from recognised transport companies. Storage could be based on a flat rate per kg or kWh per a given time period.

Recycling consolidator. A recycling consolidator is responsible for aggregating batteries from a range of sources, preparing them for safe transport to a recycler (e.g. by insulating the terminals, packing to ensure they are not damaged in transit, ensuring shipping conditions are met such as through the use of a fire proof container), negotiating pricing, and arranging the shipping. Payments for these services could be arranged on a contract basis with accredited recycling consolidators.

Recycler. The recycler is responsible for the safe and effective recovery of materials from the end-of-life battery. Payments for these services could be arranged on a contract basis with accredited recycling consolidators.

3.3.4 Mechanisms for Service Delivery

Across all parts of the value chain the question of how to deliver services effectively and efficiently needs to be addressed. The key options include:

- The scheme manager undertakes all work in-house. Under this approach, all services required to deliver the scheme, from operation of collection points through to undertaking battery assessments, and final recycling would be undertaken by the Scheme Manager. This would require the establishment of a full-service organisation from the inception of the scheme.
- The scheme manager retains overall control of the scheme operations but contracts out specific elements of the scheme operation to private businesses or organisations. Under this model the key elements of the scheme operation would need to be identified and procurement processes undertaken to secure these services prior to the scheme inception.
- The scheme sets standards for accreditation of third-party organisations to deliver the scheme. Under this model multiple organisations could provide the same or similar services as long as they met the required standards
- Importers/Producers are required to make provision for the take back and proper end of life management of product they place on the market. The provisions that are put in place would be assessed and audited by the Scheme Manager to ensure compliance.

There are also a wide range of possibilities for hybrid versions of the above service delivery approaches, where two or more of the above different approaches are used together. For example:

- The scheme manager could operate certain elements in-house (e.g. battery assessment centres). This may be appropriate where there are market failures or gaps in geographic service delivery.
- Specific core elements of the scheme are contracted out – such as recycling processes, operation of collection points, transport and storage etc. This is appropriate where it may be important to create economies of scale or ensure there is control over quality or health and safety.
- Some elements may be able to be undertaken by multiple accredited 3rd parties. For example, battery servicing, battery removal, refurbishment, and second-life applications.
- Producers may actually want their product back for recycling or re-manufacture in their own operations, or for use in second life applications. It would make sense to enable this as it is consistent with the producers taking responsibility for the stewardship of their products.

3.4 Options analysis for managing the chain of custody and ownership of the value chain

Options are assessed on a traffic light system as follows:

Viable option for inclusion in the product stewardship scheme design	Possible options for inclusion but some issues	Issues likely to outweigh benefits for scheme

3.4.1 Processes Following Import

Table 3: Assessment of Processes Following Import

Element	Options	Summary of Considerations	Assessment
Processes following import			
Identification of batteries on import and assessment of obligation	Customs identifies batteries that qualify for the scheme as they enter the country	**Benefits** • Customs has a statutory obligation under the WMA to supply information on priority products • Customs will need to identify qualifying batteries to ensure the requirements of s22(1)(a) of the WMA are met. **Issues** • Tariff codes may not precisely align with the definitions under the scheme • Customs can assess and supply information based on declarations but will not undertake detailed technical inspections • There may be some issues in identifying the obligated party as, with vehicles, the importer is not always the owner	Requires further investigation but likely to be an important component

		• Liaison with Customs needs to take place to determine the steps necessary for this to be enacted.	
	Other agencies (e.g. NZTA) identify obligations following import, but prior to use/product being placed on the market	**Benefits** • There are already processes in place that would gather the appropriate information • For EVs the obligated party would be clear. **Issues** • This process would only apply to EVs that fall under NZTA jurisdiction • Government agencies that collect private information (such as NZTA) are not legally able to share this information with non-government agencies, except in an aggregated form. • If some arrangement was able to be made there would have to be payment made to NZTA for gathering the data (and possibly managing the fee collection process). • There is currently no provision under S24 of the WMA for the Ministry for the Environment to access this information for audit purposes	Could form part of the solution but requires further investigation

	Importers identify batteries that qualify for the scheme before import	**Benefits** • Importers will need to identify product that qualifies for the scheme to ensure correct information is included in the shipping manifests and so they understand the full implications of importing the product. **Issues** • Businesses that qualify will need to be identified and supplied with the necessary information • Importers will need to be proactively identified and a database maintained and kept up to date.	Essential Step in the process
Processes for data recording and data sharing	Information gathered by Customs	**Benefits** • Customs is in a position to be able to gather the required information • This data could be provided to MfE for audit purposes. **Issues** • Government agencies that collect private information (such as Customs) are not legally able to share this information with non-government agencies, except in an aggregated form • Whether Customs is able to gather/record all of the required/desired information is yet to be determined.	Customs should gather the information for compliance purposes
	Information gathered by NZTA at point of first registration	**Benefits**	Because other systems and processes will be required to ensure all batteries are captured

		• NZTA is currently upgrading its systems and could potentially include all the required information • Information is planned to be gathered by NZTA on tyres imported on vehicles for the Tyrewise product stewardship scheme (and fees collected). It may be possible to simply add the required information to these arrangements. **Issues** • Government agencies that collect private information (such as NZTA) are not legally able to share this information with non-government agencies, except in an aggregated form. • If some arrangement was able to be made there would have to be payment made to NZTA for gathering the data (and possibly managing the fee collection process). • There is currently no provision under S24 of the WMA for the Ministry for the Environment to access this information for audit purposes • The NZTA would not gather information on spare batteries, stationary storage batteries, or batteries in non-road legal vehicles (aircraft, watercraft, golf carts, defence force vehicles etc.). There would therefore need to be other processes for gathering, recording, and sharing information.	under the scheme the benefits are not clear

	Identify organisations that import qualifying product and require voluntary declarations. Support by MfE Auditing declarations against Customs records	**Benefits** • Relatively straight forward process to establish as it avoids issues with data sharing • Avoids the needs for multiple sources of information • Enables the Scheme Manager to bill the importer (or qualifying party) directly. They can then choose how and the degree to which to pass this cost on • The mechanisms for MfE to audit the scheme participants is provided for in legislation. **Issues** • Qualifying importers must be identified and informed, and then registered with the scheme. This will require constant management. • Relies on voluntary declarations which gives rise the possibility of fee avoidance • Whether Customs is able to gather/record all of the required/desired information is yet to be determined • There is the possibility of discrepancies between customs data and declared data which are legitimate (e.g. recording of time periods, interpretation of definitions). This could lead to disputes or time-consuming processes to sort out.	Likely to be the most straight forward process to establish initially, and offers a single process for gathering data from all battery sources

Processes for assessment of levy/charges and billing of scheme participants	Calculate market share by the number of large battery units imported in a given period.	**Benefits** • Is a simple measure for most large batteries of a similar size (e.g. EV batteries) • Relates well to likely costs with removing batteries from vehicles or uninstalling domestic arrays. **Issues** • Does not provide a fair measure of all batteries that may qualify – for example motorbike batteries vs utility scale storage batteries or truck batteries • Does not necessarily align with end of life costs of recycling which relate to weight for example • Could be linked to the number of modules but modules and their configurations will vary between battery designs.	Likely to be an overly simplistic measure which would disadvantage some market sectors
	Calculate market share by the value of the imported battery units in a given period.	**Benefits** • Is likely to be a reasonable proxy for size which relates to end of life costs • Value needs to be declared on import. **Issues** • If the battery is being imported as part of a machine (including an EV) then the unit value may not be readily or accurately obtainable.	Likely to be impractical to obtain accurate values for embedded batteries

	Calculate market share by the weight of imported battery units in a given period.	**Benefits** • Weight relates directly to recycling costs and is also likely to be a reasonable indicator of transport costs at end of life. • Weight is a common metric gathered by Customs **Issues** • The weight of the product may not be available in Customs data, therefore there would be no way to verify market share. However, this is yet to be determined • There are definition issues around whether the weight includes the casing, BMS or other attachments • If the battery is being imported as part of a machine, then the weight may not be readily or accurately obtainable.	May not be practical to obtain comprehensive, accurate data to calculate or verify claims
	Calculate market share by the nameplate capacity of imported battery units in a given period.	**Benefits** • The capacity of the battery should be readily obtainable from import declarations • Capacity is a reasonable proxy for weight which relates directly to recycling costs and is also likely to be a reasonable indicator of transport costs at end of life. **Issues** • As energy density increases in new generations of battery, the size and materials needed for a given capacity will decrease. This will	Likely to be a feasible option for calculating market share

		disadvantage new technology relative to used imports.	
	Modulate scheme charges by battery recyclability	**Benefits** • 'Recyclability' is a requirement in the guidelines. **Issues** • Recyclability is difficult to define and to measure in a way that is likely to reflect the actual difficulty of recycling • Batteries with high levels of valuable materials will be more valuable to recycle, and so should be incentivised on that basis, however this is not an otherwise desirable design feature • It is not clear what design features would be incentivised through this form of modulation, and if these would be desirable.	Modulating by 'recyclability' is likely to be impractical in the short term but could become increasingly possible if businesses adopt tools such as the Circulytics Material Circularity Indicator.
	Modulate scheme charges by battery chemistry	**Benefits** • Broad types of battery chemistry (e.g. Lithium-ion, Nickel Metal Hydride, solid state) are readily defined and able to be determined from available data • There are clear differences in the costs associated with broad battery types (e.g. Li-ion batteries have higher costs associated with transport and handling). **Issues**	Modulating by broad battery chemistry is possible and will be some reflection of the actual recyclability

		• Most new batteries imported are likely to be variations of Li-ion chemistry and therefore this approach would not offer significant modulation • Minor variations of battery chemistry (e.g. types of lithium ion chemistry such as LMO, NMC, NCA, etc), are more difficult to assess in terms of recyclability • Future battery chemistries will have to be evaluated and assessed.	
	Modulate scheme charges by design for reuse	**Benefits** • Specific design features can enable easier reuse, and so this is a clear benefit. **Issues** • The design for reuse features would need to be assessed on a case by case basis, and clear criteria would need to be developed to justify the level of fee modulation applied.	Further work would be required to enable fees to be modulated on the basis of design for reuse
	Modulate scheme charges by warranted battery life	**Benefits** • Easy to determine and verify • Relates to the cost of the battery to the scheme • Will provide a clear differential between new and used batteries • May encourage longer warranties to be offered to reduce fees. **Issues**	Modulating by warranted battery life is possible and provides some reflection of actual cost of the battery to the scheme

		• Does not relate directly to reusability or recyclability and is not required by the guidelines • May be some differences in how warranties are configured which could add complication • Would need to be checks to ensure warranties are being honoured.	
	Billing of vehicle owners by NZTA	**Benefits** • Utilises existing processes, therefore aiding the easer of introduction • Potential to build on arrangements being developed by Tyrewise • Easier for EV importers. **Issues** • Does not cover all batteries imported, therefore other systems would still be required • Increases the potential for system boundary issues • Would depend on negotiation with NZTA and establishing that they are able to deliver what is required under the scheme • Costs are charged directly to consumers therefore limiting the responsibility the producer is taking.	Possible approach but has issues associated with it

	Billing of battery importers by Scheme Manager	**Benefits** • System would be able to cover all batteries that qualify under the scheme. **Issues** • New billing systems would need to be established • Will require effective audit processes to ensure the integrity of the scheme.	Likely to have the fewest issues overall
Compliance for non-participation	Maintain an industry database that proactively identifies businesses that are involved in the large battery value chain. The particular focus in compliance terms would be importers.	**Benefits** • Would be essential to identify and track organisations that qualify for the scheme. **Issues** • Will require the cooperation of industry to establish and keep the database up to date.	Essential tool
	Work with industry bodies to identify new operators that have entered the market and may need to be registered	**Benefits** • Industry bodies are expected to be a source of reliable information. **Issues** • Existing industry bodies may not cover all qualifying organisations.	Important resource
	Liaise with Customs to investigate any instances of product being imported where the importer is not registered under the scheme and	**Benefits** • A comprehensive process could be expected to be effective in identifying unregistered importers. **Issues**	Essential process

	determine whether they are required to be.	• Scheme definitions will need to align with tariff and client code.	
	Establish systems for accurate recording of imported or newly manufactured product by registered participants	**Benefits** • Accurate information will be essential for enabling compliance. **Issues** • Local manufacture will not be identified by customs. Separate processes will be required.	Essential tool
	Check voluntary declaration data against industry metrics	**Benefits** • Will provide a high-level check that most qualifying batteries are being captured by the scheme. **Issues** • There may be differences in the data and how it is recorded (definitions, time periods etc.) that limit the usefulness of comparisons.	Potential tool
	Provide scheme data to central government to audit for compliance purposes	**Benefits** • Without a strong compliance element the scheme would likely be limited in its effectiveness, due to the issue of free riders and the lack of incentive to comply. **Issues** • Consistent data from the different sources (e.g. Customs data and voluntary declarations) will be required to enable effective compliance.	Essential process

3.4.2 End of Use

Table 4: Assessment of Processes at End of Use

Element	Options	Summary of Considerations	Assessment
Processes at end of use			
Mechanisms for ensuring batteries are correctly identified at end of use and directed to their highest value use	Funding research and development of second life solutions in New Zealand.	**Benefits** • R&D is likely to be essential to ensure products from second life batteries meet the needs of the market and are cost competitive over their lifecycle. Using a portion of the scheme income to support this will insure a reliable targeted source of funding for R&D. **Issues** • This will raise the amount that needs to be charged in fees • Robust funding processes need to be established to ensure that they are equitable and do not result in market distortion or advantage.	Funding of R&D will be important for the scheme success long term
	Undertaking market development.	**Benefits** • New product and market development is required to be reported on under the guidelines • Second-life markets in NZ are currently in their infancy, and there are many uncertainties over future second-life markets. Market development using a portion of the scheme income to support	Market development of second-life will likely be important provided second life products can be competitive in the marketplace

		this will ensure a reliable targeted source of funding and will support the transition to a circular economy. **Issues** • If second life batteries are unable to compete with new batteries on price and performance, then supporting market development may not be the best option long term • This will raise the amount that needs to be charged in fees • Robust funding processes need to be established to ensure that application of funds is equitable and does not unduly advantage particular participants.	
	Introducing a requirement for importers to develop and/or offer second-life options for batteries sold in New Zealand. This could include OEMs taking products back for reuse of components and materials into new products	**Benefits** • This would recognise those importers/OEMs taking initiative in this space • Would stimulate the second life market • Would potentially create jobs and the opportunity to reskill at a regional level. **Issues** • Second-life options may not be practical or viable for some products or situation • Risks adding cost without guaranteeing better outcomes (i.e. there needs to be a viable second-life market to utilise the product)	Further investigation would be required to establish feasibility

		• Could be difficult to enforce. Criteria and processes would have to be developed • Compliance could be difficult for small importers.	
	Providing payments to organisations that use end of use batteries to create second-life products.	**Benefits** • Would provide a clear price incentive to develop and offer second-life products to market. **Issues** • Would work best as a short to medium term measure to allow the market to develop. It is not likely to be economically efficient if the subsidy is permanent • The subsidy would need to be set at a rate that was sufficient to stimulate activity in the market. This may be different at different times and for different products. • This would raise the amount that needs to be charged in fees.	Further investigation would be required to establish feasibility
	Waiving levies for second-life batteries placed on the market	**Benefits** • Would avoid creating a disincentive to develop and offer second-life products to market • Would support a circular economy. **Issues** • Technically a new battery that is created out of used parts should attract the same charges as an imported battery. However, they could claim the	Further investigation would be required to establish feasibility

		end-of-life fees on the batteries that are dismantled to make up the new battery, which would party offset the cost. Further investigation would be required to understand the cost differentials and whether this incentive is required. • This would raise the amount that needs to be charged in fees.	
Processes for identifying where large batteries have been repurposed and new products have been created	Determine a threshold percentage for cell or module replacement in an existing battery beyond which a battery is considered a new product	**Benefits** • Is an intuitive measure and can be relatively easily calculated. **Issues** • Would require definitions around what is considered an existing battery • Would require the timeframe for changes to be considered • May be difficult to determine the level that will capture batteries that should be treated as new batteries under the scheme.	Further investigation would be required to establish feasibility
	Develop specifications in relation to changes in the battery casing, capacity, cell/module configuration, thermal and battery management systems etc. which could constitute the creation of a new product	**Benefits** • Would capture physical changes to the batteries that could constitute a new product. **Issues** • Likely to require very technical definitions • It may be difficult to take account of technology developments in the definitions	Further investigation would be required to establish feasibility

		• Would require the timeframe for changes to be considered • May be difficult to determine the level that will capture batteries that should be treated as new batteries under the scheme.	
	Define changes of use which would constitute the battery being considered a new product	**Benefits** • Could be a relatively intuitive measure to understand • Would capture batteries that are repurposed. **Issues** • Further work would be required to define the different uses, and why the battery should then be considered a new product.	Further investigation would be required to establish feasibility
Processes for recording data	Identify organisations that upgrade batteries and require voluntary declarations of activities that may be eligible to receive payments under the scheme	**Benefits** • Relatively straight forward process to establish • Uses the same process as for importers and so avoids the needs for multiple sources of information. • Enables the PRO to bill/pay the battery upgrader (or qualifying party) directly. They can then choose how and the degree to which to pass this cost on. **Issues**	Likely to be straight forward process to establish initially, and offers a single process for gathering data from all battery sources

		• Qualifying organisations must be identified and informed, and then registered with the scheme. This will require constant management. • Relies on voluntary declarations which gives rise the possibility of manipulation • Will need to be supported by Scheme Manager compliance processes • Could also be supported by MfE Auditing declarations.	
	Battery is dismantled then deregistered and mass balance of parts is accounted for	**Benefits** • Important process to be able to track batteries transitioning into second life • Unless the mass balance is accounted for there will be no way to report what happens to batteries that are dismantled • May be able to utilise the Battery Passport system. **Issues** • Most batteries coming to end of use initially will not be registered in the system, as it will likely rely on voluntary declarations by importers and manufacturers. This means batteries effectively being registered so they can be deregistered • Tracking the mass balance of batteries could be onerous for smaller participants. Parts may be stockpiled. It would require verified battery weights to be known.	Likely to be an important process, but work required to establish its practicality

Processes for payments/charges for scheme operators	Charges for new product placed on the market	**Benefits** • Ensures consistency between imported and locally manufactured product • Charges could be modulated to incentivise second life uses • Some product may be able to be verified by certifying bodies. **Issues** • Relies on voluntary declarations • Clear, easily interpreted definitions of 'new' product will be required • May provide a barrier to second-life uses if charges and payments are not appropriately structured.	Will be an important process, but work required to establish its practicality
	Payments for product recovered.	**Benefits** • Ensures consistency between second-life and recycling options • Could help to incentivise second life uses. **Issues** • Relies on voluntary declarations • The basis for the payments will need to be clearly established.	Will be an important process, but work required to establish its practicality

3.4.3 End of LIfe

Table 5: Assessment of Processes at End of Life

Element	Options	Summary of Considerations	Assessment
Processes at end of life			
Mechanisms for ensuring batteries are correctly identified at end of life and managed under the scheme	Introduce regulations under S23(1)(c) of the WMA to require end-of-life batteries to be removed and managed by accredited providers.	**Benefits** • Will provide legal force to ensure batteries are managed correctly under the scheme. **Issues** • Regulations will need to be clearly drafted to ensure they deliver on their intended purpose and do not have any unintended consequences.	Important process
	Accredited providers can claim the costs of removal, storage, transport, and recycling	**Benefits** • Will provide financial incentive to those managing end of life batteries • Will help ensure that the costs of proper end of life management are able to be recovered. **Issues** • Appropriate fee structures will need to be developed to ensure that costs are adequately recovered and there are no perverse incentives.	Important process
Processes for data recording	If regulations are introduced under S23(1)(c), the accredited providers would be required to supply data as a condition of their accreditation	**Benefits** • Clear requirement for data provision can be established • High degree of compliance can be expected from accredited providers	Likely to be the most robust approach

		• Potential to have a single system for users • The mechanisms to audit the scheme participants could be provided in regulation. **Issues** • Qualifying service providers must be identified and informed, and then registered with the scheme. This will require constant management.	
	If regulations are not introduced under S23(1)(c), or the regulations do not cover all parties that handle batteries at end of life, then voluntary data declarations would be required	**Benefits** • Voluntary declarations could be incentivised through the ability to access payments by being registered with the scheme. **Issues** • Would rely on voluntary reporting which may not be comprehensive • Could be problematic if incentives are insufficient to encourage voluntary participation • If incentives not well structured, they could result in unintended consequences	Reporting is unlikely to be sufficiently comprehensive under a voluntary reporting arrangement
Processes for accreditation of service providers under the scheme	Establishing a 'code of conduct' that anyone accredited by the scheme would be expected to adhere to.	**Benefits** • This would provide a relatively low threshold for accreditation, which would help ensure that small businesses (such as wreckers or used car importers) do not face undue barriers to participation • Auditing or enforcement of the code of conduct could be applied differently over time or for different types of parties in the value chain.	Presents a viable pathway to initiate the scheme and enhance it over time

		Issues • Compliance with the code of conduct may be difficult to enforce • Substantial non-compliance could lead to reputational damage for the scheme.	
	Establishing a training programme and/or qualification which each accredited operator would have to have staff complete in order to maintain their accreditation.	**Benefits** • Would establish clear standards and quality for the operation of the scheme • Protects reputation and helps ensure public confidence • Could be developed and expanded over time, with an initial focus on highest risk activities • Would help upskill workforce in line with a Fourth Industrial Revolution. **Issues** • Would take time to develop the programme and have sufficient numbers certified • Would add time and cost to the accreditation process (and scheme cost) • Could present a barrier for participation, and which in turn could be problematic for ensuring adequate geographic service provision.	Should become an important part of the scheme as it develops but will need to be developed over time
	Establishing an accreditation process that requires operators to submit written manuals or online documentation to	**Benefits** • Clear audit trail to be able to verify the correct processes are in place • Protects reputation and helps ensure public confidence	Worth further investigation as part of a comprehensive approach

	demonstrate their processes and their compliance.	• Could be developed and expanded over time, with an initial focus on highest risk activities. **Issues** • Would add time and cost to the accreditation process (and scheme cost) • Could present a barrier for participation, and which in turn could be problematic for ensuring adequate geographic service provision.	
	Delivering compliance with service standards through a commercial contracting process. The standards would essentially be standards for service delivery as part of a contract.	**Benefits** • Could utilise standard contract documentation and processes • Enforceable through contract provisions • Presents a lower barrier for most businesses than a formal accreditation process. **Issues** • Standards would still need to be set through the contract • May be more limited in the ability to audit and inspect processes.	Presents a viable approach to ensuring service standards
Processes for providing payments and	Flat rate payment by vehicle or installation type for battery removal	**Benefits** • Relatively simple and easy to administer • Schedules could be expanded over time to more accurately reflect incurred costs.	Likely to provide a viable pathway for establishing payments and evolving over time

rebates to scheme operators		• Schedules could be expanded to accommodate OEMs or importers taking back their own product. **Issues** • May not accurately reflect costs for some vehicle or installation types, resulting in the operators either accepting losses, making windfall profits, or not accepting some product types.	
	Graduated payment based on vehicle model/installation type to better reflect actual costs of removal	**Benefits** • Likely to more accurately reflect costs of removal/un-installation. **Issues** • Potentially complicated to establish payment schedules and administer payments.	Unlikely to be practical to establish initially but may be feasible with development over time
	Battery assessment payment included in removal	**Benefits** • In most cases a quick assessment of the battery is all that is required to determine next steps. **Issues** • No payment for assessment could discourage more comprehensive assessments being undertaken which may affect outcome.	Appropriate for the initial scheme configuration, but may need refinement over time
	Separate battery assessment payment	**Benefits** • Ability to provide adequate compensation where more comprehensive assessment is undertaken • Provides some flexibility for different situations.	Unlikely to be practical to establish initially but may be feasible with development over time

		Issues • Could encourage unnecessary assessment activity simply to claim the fee • Assessment costs can vary, so would be complex to come up with an appropriate payment schedule • Would require verification process to ensure the assessment had been undertaken, adding to administration costs.	
	Transport cost based on invoices	**Benefits** • Costs able to be verified • Relates to actual costs. **Issues** • Will require auditing • Claim process may be complex if large numbers of invoices and/or shipping involves mixed loads.	Likely to be practical
	Transport costs based on scheduled shipping rates	**Benefits** • Transparency of claim amounts • Should approximate actual costs. **Issues** • Will require auditing to ensure shipping actually took place • Claim process may be complex if large numbers of loads.	May be open to abuse

	Storage costs based on measure of battery size and time	**Benefits** • Provides some ability to compensate for storage cost. **Issues** • Storage space is usually a fixed cost • The actual costs could vary widely for participants leading to windfall profits or lack of incentive to move product, or inadequate compensation.	Requires further investigation
	Recycler/recycling consolidator payments based on agreed payments schedule with accredited recyclers/ recycling consolidators	**Benefits** • Payments should adequately compensate recyclers based on negotiated schedule • Certainty of costs for the contract term. **Issues** • Will require development of appropriate payment schedules that reflect actual variability of costs.	Likely to be practical

3.4.4 Service Delivery Mechanisms

Table 6: Assessment of Mechanisms for Service Delivery

Element	Options	Summary of Considerations	Assessment
Mechanisms for Service Delivery			
Mechanisms for how to deliver services effectively and efficiently	The scheme manager undertakes all work in-house. Under this approach, all services required to deliver the scheme, from operation of collection points through to undertaking battery assessments, and final recycling would be undertaken by the Scheme Manager	**Benefits** • Provides a high degree of control over quality • Minimises risks around non-compliance • Provides clarity to the public and scheme members. **Issues** • Would potentially be in competition with existing service providers • Unlikely to be practical to develop the in-house capability within the timescales of the scheme • Would require significant capital investment to establish • Reduces flexibility and ability to evolve over time due to sunk capital.	Unlikely to be practical
	The scheme manager retains overall control of the scheme operations but contracts out specific elements of the scheme operation to private businesses or organisations	**Benefits** • Provides a high level of control over all scheme elements • Offers opportunity for flexibility over time • Can help sufficient economies of scale • The contracting process can be used to help deliver efficiency, cost effectiveness, and innovation	Likely to be workable but some drawbacks as a single approach

		• Utilises the skills and capital of existing operators. **Issues** • May leave some operators out of the scheme • May not be the most appropriate approach where there are advantages to having multiple service providers.	
	The scheme sets standards for accreditation of third-party organisations to deliver scheme elements	**Benefits** • Provides some control over scheme elements • Offers opportunity for flexibility over time • Market competition can help deliver efficiency, cost effectiveness, and innovation • Utilises the skills and capital of existing operators. **Issues** • Does not provide opportunity for economies of scale • Level of control over scheme is likely to be reduced (or more difficult) • Could be a large number of organisations to accredit and audit.	Likely to be workable but some drawbacks as a single approach
	Importers/Producers are required to make provision for the take back and proper end of life management of product they place on the market. The provisions that are put in place	**Benefits** • Consistent with encouraging producers to take responsibility for the full life cycle of their products. **Issues**	Unlikely to be practical as a single approach

	would be assessed and audited by the Scheme Manager to ensure compliance.	• Would be difficult for small producers and importers and those with long supply chains • Potential for significant legacy issues • Accrediting and auditing offshore processes may be costly and/or impractical.	
	Hybrid approach. Some mix of the above approaches to deliver a scheme that is tailored to market conditions.	**Benefits** • Likely to be able to develop an appropriate mix that will meet the requirements of the scheme • Excellent ability to evolve the scheme over time using a mix of approaches. **Issues** • Some work required to determine the most appropriate mix of approaches.	Likely to be the most practical approach overall

3.4.5 Legacy and orphan product.

Because the scheme levies fees based on market share of current product but pays for batteries entering end of life, regardless of their provenance, the scheme by design, means there will be no legacy or orphan product.

4.0 Potential Costs of Scheme

A financial model was constructed to estimate the potential costs of running a product stewardship scheme. It should be noted that these costs should be considered rough-order estimates, as costs are likely to vary with the scheme design and how it may be administered, and these have not been determined yet.

4.1 Explanation of the Financial Model

4.1.1 Overview

The model includes fixed costs such as administration costs, governance, data management, communications and education, and research and market development, as well as variable costs associated with the collection and recovery of end-of-life batteries.

In the model, costs are estimated over a 20-year time period (nominally from 2022 to 2041).

In the model the main driver of variations in total cost is the number of batteries that need to be recovered (i.e. that reach the end of their life).

The model also calculates what a potential levy or up-front charge may be for batteries imported/manufactured locally (assuming no fee modulation). The model assumes that the total costs of operating the scheme in a given year will be divided amongst all the batteries placed on the market in that year. This means that number of batteries placed on the market is a key figure for estimating potential unit costs.

To determine the levels of cost and potential charges, three scenarios were developed. The key variant for the scenarios is the numbers of batteries placed on the market and the flow through of these batteries to end of life. The scenarios were chosen to illustrate the potential level of variation that could occur, and so the high and low scenarios are not necessarily considered likely. In all scenarios the growth of EVs is considered to be the primary source of both new and end of life batteries.

The scenarios are as follows:

- **Low Growth Scenario.** Under the low growth scenario, the number of batteries placed on the market is presumed to be a continuation of the recent rate of

increase in market share. This sees the number of EVs added to the fleet grow slowly in absolute terms to about 10% market share by 2041.

- **Central Case Scenario.** The central case scenario sees the number of batteries placed on the market grow steadily until it reaches over 200,000 units per annum in 2028 at which point it levels off. In vehicle terms this equates to approximately 50% market share for EVs. The central case scenario is based on EV projections undertaken for the Battery Second Life project[23].
- **High Growth Scenario.** The high growth scenario sees rapid growth, with EV sales reaching nearly 50% market share by 2029, and the growth continuing albeit at a slowing pace, until approximately 80% market share is reached in 2033 at which point it levels off. The high growth scenario is based on recent projections by Fitch Solutions.[24]

The parameter values, their sources and commentary on how they are used in the model are set out in the Appendix A.9.0.

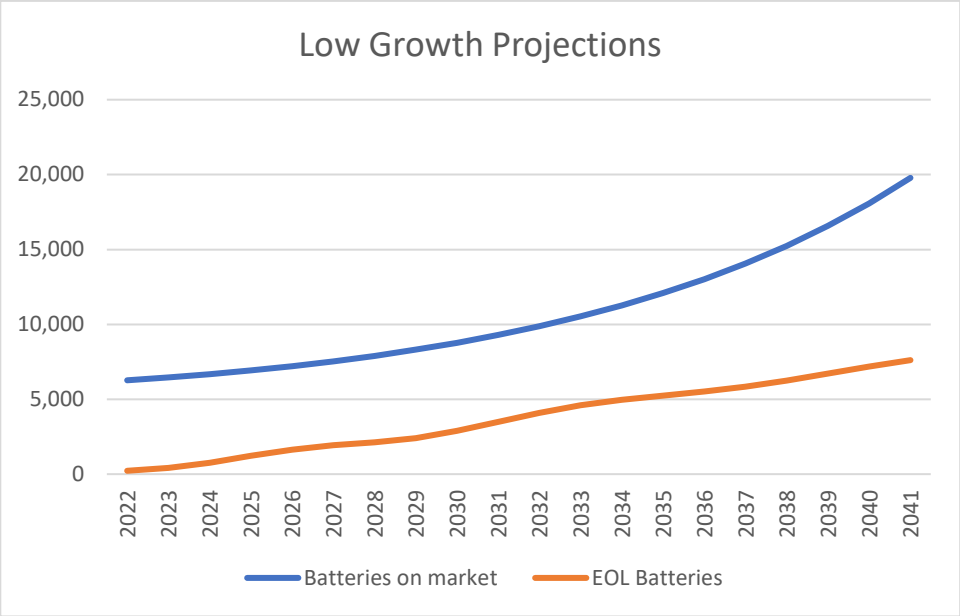
4.1.2 Scenario Projections

The charts below show the numbers of batteries placed and the market and projected to reach end of life (i.e., after any second life and now requiring recycling) for each scenario.

[23] Strategic Lift (2020) *Second Life EV Batteries Project: Defining the need for a New Zealand strategy for post-EV use.* Report to the Ministry for the Environment under the Waste Minimisation Fund

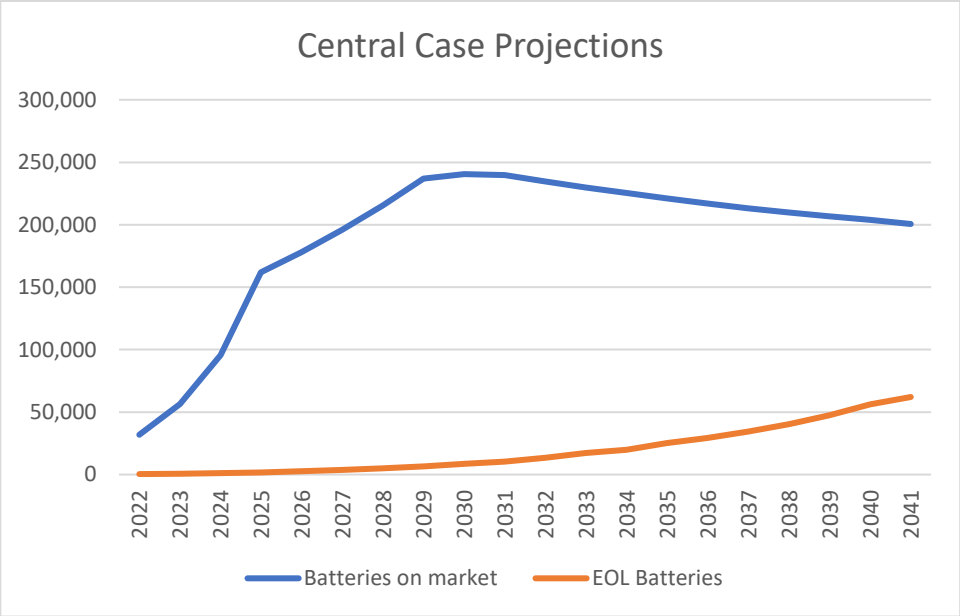
[24] https://www.fitchsolutions.com/corporates/autos/new-zealands-ev-market-gets-boost-new-government-directive-02-12-2020

Figure 2: Annual Batteries Placed on Market and Reach End of Life (Low Growth)



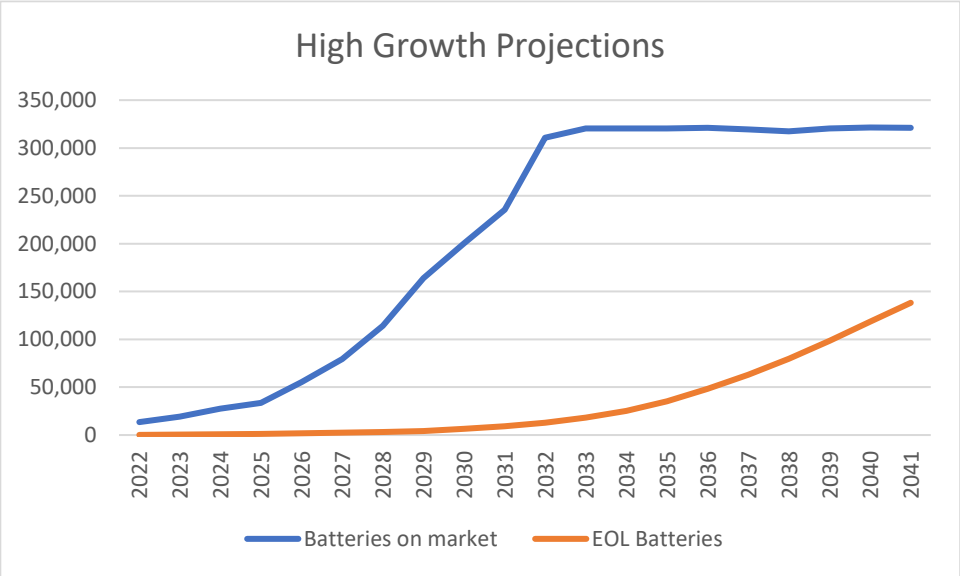
Under the low growth scenario, the numbers of batteries placed on the market climb slowly but accelerate towards 2041. The EOL batteries also climb slowly and by 2041 are less than half of the numbers of batteries placed on the market. This due in part to the assumed long lifetime of stationary storage batteries, few of which reach end of life in the timeframes modelled. The minor bumps in the projected EOL batteries line are due to the variations introduced by an assumed seven-year delay in second-life batteries reaching end of life, and the differences in lifespan between EV and stationary storage batteries and when these flow through to end of life.

Figure 3: Annual Batteries Placed on Market and Reach End of Life (Central Case)



In the central case the numbers of batteries placed on the market climb quickly before levelling off then dropping slightly, while the numbers of EOL batteries climb much more slowly. This results in a large gap between the numbers of batteries placed on the market and those reaching end of life – although the gap has closed marginally by 2041.

Figure 4: Annual Batteries Placed on Market and Reach End of Life (Central Case)



The high growth projections are similar to the central case in that a rapid increase in batteries placed on the market is assumed, which then flattens out, while the numbers reaching end of life continue to climb over time but only partially close the gap by 2041.

A key feature across all of the scenarios is the fact that, within the period modelled, there are expected to be substantially more batteries placed on the market than reach end of life each year. This means that the numbers of EOL batteries can be expected to continue to climb beyond the modelled period.

4.1.3 Model Dynamics

The model contains a number of dynamic values which are set based on certain threshold values. These thresholds can be adjusted and include:

- The point at which onshore processing of batteries become economically viable. Prior to this point all batteries are assumed to be exported and attendant export and shipping costs (including recycling costs) are applied. After this point domestic processing costs are applied.
- The points at which extra staff members are required
- The point at which larger premises for administration are required

4.1.4 Caveats on Future Costs

Future costs of the scheme are uncertain because the industry is going through a rapid and substantial evolution. Key factors which could substantially affect scheme costs, but which are essentially unknown include:

- The lifetime of batteries before they require recycling. The level of uncertainty is increased by the continual rapid evolution of battery technology
- The volumes of EVs and stationary storage batteries that may be deployed
- The viability and scale of-second life markets, and how long batteries will last in these applications
- The future commodity prices for virgin battery feedstocks and recycled materials
- The effectiveness of future recycling processes in recovering battery materials
- The cost of future recycling processes.

For the purposes of the modelling, we have assumed that, aside from the numbers of batteries and some improvement in their energy density, these variables remain static over time.

4.2 Financial Model Results

4.2.1 Total Scheme Costs

Figure and Table below show the estimated total scheme costs under each scenario

Figure 5: Estimated Total Scheme Costs Per Annum by Scenario

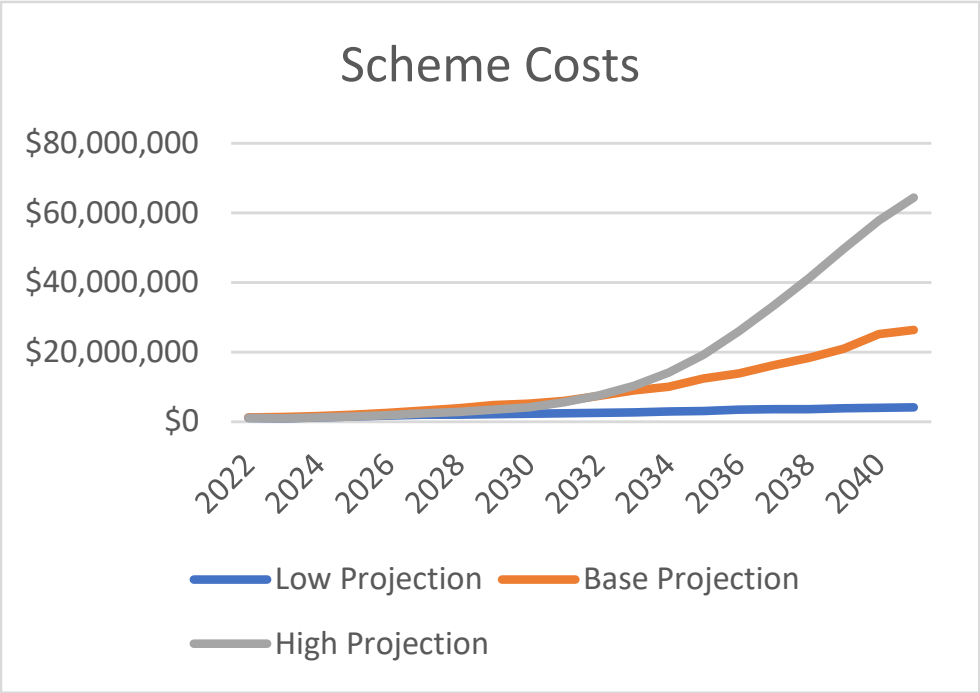


Table 7: Estimated Total Scheme Costs Per Annum by Scenario

Year	Low Projection	Base Projection	High Projection
2022	$1,025,233	$1,276,123	$1,063,322
2023	$966,286	$1,306,862	$1,036,874
2024	$1,189,982	$1,629,697	$1,293,290
2025	$1,507,220	$2,029,192	$1,631,656
2026	$1,782,808	$2,585,992	$1,987,574
2027	$1,952,712	$3,258,011	$2,372,917
2028	$2,009,015	$3,868,122	$2,795,669
2029	$2,093,572	$4,780,072	$3,490,209
2030	$2,213,441	$5,234,938	$4,167,547
2031	$2,340,541	$5,995,724	$5,522,669
2032	$2,534,587	$7,403,580	$7,515,808
2033	$2,730,837	$8,972,099	$10,306,544
2034	$2,928,364	$10,035,967	$14,131,398
2035	$3,052,724	$12,453,198	$19,317,032
2036	$3,400,818	$13,861,688	$26,003,232
2037	$3,523,971	$16,248,500	$33,312,394
2038	$3,642,119	$18,320,833	$41,248,383
2039	$3,793,451	$21,026,167	$49,628,519
2040	$3,964,676	$25,203,234	$57,846,848
2041	$4,163,472	$26,394,962	$64,472,480

The schemes start off with very similar operating costs for the first five years or so, but increasingly diverge after this. By 2041 annual costs under the low scenario are just over $4 million, while they are over 6 times this in the central scenario and approximately 15 times greater under the high scenario. The differences in total scheme costs are driven

primarily by the number of batteries that are assumed to reach end of life and require recovery under the scheme. Under the low scenario 7,625 batteries are assumed to be recovered under the scheme in 2041, while for the central scenario the figure is 62,141, and for the high scenario this climbs to 138,281.

4.2.2 Breakdown of Total Scheme Costs

The following tables show a breakdown of the estimated scheme costs by scenario. A more detailed breakdown of the scheme costs is provided in Appendix A.10.0

Table 8: Summary of Low Scenario Scheme Costs

	2022	2026	2031	2036	2041
Admin	$319,006	$302,457	$304,063	$305,697	$306,488
Governance	$90,000	$90,000	$90,000	$90,000	$90,000
Data Management	$181,796	$51,796	$51,796	$51,796	$51,796
Comms and Education	$85,205	$64,671	$74,745	$87,603	$104,014
Research & Market Development	$110,000	$110,000	$110,000	$110,000	$110,000
Recovery					
Removal and Assessment	$54,566	$382,060	$566,441	$832,889	$1,063,159
Transport and Shipping	$135,839	$696,929	$1,032,042	$1,514,857	$1,926,382
Recycling	$0	$0	$0	$246,031	$313,372
Contingency	$48,821	$84,896	$111,454	$161,944	$198,261
TOTAL	**$1,025,233**	**$1,782,808**	**$2,340,541**	**$3,400,818**	**$4,163,472**

In the early years of the scheme, administration and development costs account for a substantial portion of total costs, however as the number of units reaching end of life increases, this decreases as a proportion, although it is still high compared to the proportion of administration costs that would be expected for product stewardship scheme internationally.[25]

[25] Internationally PS Schemes average around 6.3% of the fee cost for administration (personal communication with Adele Rose, 3R).

Table 9: Summary of Central Scenario Scheme Costs

	2022	2026	2031	2036	2041
Admin	$319,006	$364,537	$370,009	$374,546	$377,815
Governance	$90,000	$120,000	$120,000	$120,000	$120,000
Data Management	$197,694	$115,387	$115,387	$115,387	$115,387
Comms and Education	$97,808	$115,081	$125,156	$138,014	$154,425
Research & Market Development	$110,000	$110,000	$110,000	$110,000	$110,000
Recovery					
Removal and Assessment	$114,696	$614,992	$2,109,585	$5,346,789	$10,509,155
Transport and Shipping	$286,152	$1,022,852	$2,135,257	$5,413,098	$10,638,484
Recycling	$0	$0	$624,819	$1,583,774	$3,112,794
Contingency	$60,768	$123,142	$285,511	$660,080	$1,256,903
TOTAL	**$1,276,123**	**$2,585,992**	**$5,995,724**	**$13,861,688**	**$26,394,962**

Administration costs also represent a large portion of the costs in the early years of the scheme but, by 2041, they are in line with international averages. Battery removal and assessment and transport storage and shipping represent the largest proportions of the total scheme costs once it is mature.

Table 10: Summary of High Scenario Scheme Costs

	2022	2026	2031	2036	2041
Admin	$319,006	$366,840	$374,216	$384,335	$389,673
Governance	$90,000	$90,000	$120,000	$120,000	$120,000
Data Management	$181,796	$67,694	$115,387	$115,387	$115,387
Comms and Education	$85,205	$77,273	$125,156	$138,014	$154,425
Research & Market Development	$110,000	$110,000	$110,000	$110,000	$110,000
Recovery					
Removal and Assessment	$54,566	$426,796	$1,912,727	$10,348,426	$26,203,120

Transport and Shipping	$172,115	$754,325	$1,935,721	$10,482,758	$26,545,887
Recycling	$0	$0	$566,478	$3,066,063	$7,763,870
Contingency	$50,634	$94,646	$262,984	$1,238,249	$3,070,118
TOTAL	**$1,063,322**	**$1,987,574**	**$5,522,669**	**$26,003,232**	**$64,472,480**

In the high growth scenario administration costs decline relatively rapidly as a proportion of total costs and, by 2041, they are below international averages. Battery removal and assessment and transport storage and shipping represent the majority of the total scheme costs once it is mature.

4.2.3 Battery Recovery Costs

The table below shows the average cost of removing and recovering a battery (of 'average' size under the scheme as it develops.

Table 11: Costs per Battery Recovered by Scenario

	Low Projection	Base Projection	High Projection
2022	$4,341	$2,624	$4,341
2023	$2,270	$1,746	$2,255
2024	$1,570	$1,420	$1,567
2025	$1,216	$1,168	$1,189
2026	$1,081	$988	$1,072
2027	$1,011	$884	$994
2028	$945	$783	$903
2029	$866	$729	$809
2030	$765	$613	$655
2031	$669	$577	$602
2032	$617	$546	$577
2033	$594	$522	$565
2034	$590	$505	$557

2035	$581	$493	$548
2036	$615	$475	$538
2037	$603	$471	$529
2038	$583	$455	$517
2039	$565	$444	$504
2040	$551	$448	$487
2041	$546	$425	$466

The unit costs for recovering batteries under the scheme is very high in the early years of the scheme – around $4,500 per battery initially. This is because the costs of establishing and administering the scheme are in effect being spread across a very small number of end-of-life batteries. By the time the scheme matures, the cost per battery has fallen to around $450 -$550 across all the scenarios. The reason the differential between the low scenario and the other scenarios is not greater is because the low scenario has a higher proportion of stationary storage batteries which have a lower average assumed weight (per unit) compared to vehicle batteries.

The same costs are provided below but divided by the assumed weight of batteries recycled to arrive at an indicative cost per kg.

Table 12: Costs per Kg Recovered by Scenario

	Low Projection	Base Projection	High Projection
2022	$12.98	$7.66	$13.47
2023	$6.68	$5.07	$7.17
2024	$4.57	$4.11	$4.88
2025	$3.57	$3.37	$3.63
2026	$3.21	$2.89	$3.20
2027	$3.09	$2.63	$3.03
2028	$3.03	$2.47	$2.81
2029	$2.97	$2.33	$2.57

2030	$2.91	$2.00	$2.11
2031	$2.84	$1.95	$1.98
2032	$2.78	$1.90	$1.89
2033	$2.70	$1.85	$1.82
2034	$2.65	$1.83	$1.78
2035	$2.62	$1.80	$1.75
2036	$2.81	$1.78	$1.73
2037	$2.80	$1.77	$1.71
2038	$2.77	$1.75	$1.70
2039	$2.75	$1.74	$1.70
2040	$2.73	$1.73	$1.69
2041	$2.70	$1.73	$1.69

As can be seen, as the total number of batteries increases, the unit costs decrease.

4.2.4 Fees

This section explores the potential level of fees for batteries placed on the market. Because there is a time lag between batteries placed on the market and them reaching the end of their life, as the market grows, the number of batteries placed on the market will, for a period, be greater than those reaching the end of their life. Assuming the total costs of operating the scheme is spread across the batteries placed on the market, this will result in an initial period where the costs levied per battery/kWh/kg are lower than the actual costs of recovery. As the number of batteries reaching end of life increases however then the unit costs will rise until eventually (when the number of end-of-life batteries and batteries placed on the market is roughly equal), the full costs will be levied on each battery placed on the market.[26]

[26]It is possible, although a long time in the future, that the total numbers of batteries sold in the future could fall. For example, if autonomous EVs become commonplace, and rideshare is the standard transportation model, fewer vehicles may be needed. If these sorts of scenarios play out, then future scheme participants will end up carrying the legacy cost.

Table 13: Fees per Kg by Scenario

	Low Projection	Base Projection	High Projection
2022	$0.52	$0.12	$0.24
2023	$0.48	$0.07	$0.16
2024	$0.57	$0.05	$0.14
2025	$0.69	$0.04	$0.15
2026	$0.79	$0.04	$0.11
2027	$0.82	$0.05	$0.09
2028	$0.81	$0.05	$0.08
2029	$0.80	$0.06	$0.07
2030	$0.80	$0.06	$0.07
2031	$0.80	$0.07	$0.07
2032	$0.82	$0.09	$0.08
2033	$0.83	$0.11	$0.10
2034	$0.83	$0.13	$0.14
2035	$0.80	$0.16	$0.19
2036	$0.83	$0.19	$0.26
2037	$0.80	$0.22	$0.33
2038	$0.76	$0.26	$0.41
2039	$0.73	$0.30	$0.49
2040	$0.70	$0.36	$0.57
2041	$0.67	$0.38	$0.64

As can be seen the charges per kg fall in the central and high growth scenarios to a low point around 2030, before rising again. Although they fall to the lowest point in the

central scenario (as greater numbers of batteries are placed on the market), they then rise quickly as larger numbers of batteries come to end of life. In the low growth scenario, charges slowly continue to rise before starting to fall as the number of batteries placed on the market accelerates.

The following table shows the potential fees per kWh (based on assumed average battery capacity).

Table 14: Fees per kWh by Scenario

	Low Projection	Base Projection	High Projection
2022	$3.11	$0.76	$1.45
2023	$2.85	$0.44	$0.95
2024	$3.39	$0.32	$0.84
2025	$4.14	$0.24	$0.88
2026	$4.70	$0.28	$0.67
2027	$4.93	$0.32	$0.56
2028	$4.84	$0.34	$0.46
2029	$4.79	$0.38	$0.40
2030	$4.80	$0.41	$0.40
2031	$4.79	$0.48	$0.45
2032	$4.89	$0.60	$0.46
2033	$4.94	$0.74	$0.61
2034	$4.95	$0.85	$0.84
2035	$4.81	$1.07	$1.15
2036	$4.98	$1.22	$1.54
2037	$4.77	$1.45	$1.99
2038	$4.55	$1.66	$2.47
2039	$4.36	$1.94	$2.95

2040	$4.18	$2.35	$3.43
2041	$4.01	$2.50	$3.82

The potential fees exhibit essentially the same pattern as for weight. They reach a low point of $0.24 per kWh under the central scenario around 2025 and a high of $4.95 in 2034 under the low growth scenario. By way of illustration, for a 100 kWh battery pack this would be equivalent to fees of around $24 and $495 respectively. This shows the potential variation, not only between scenarios, but how fees may change over time.

4.3 Comment

The financial modelling shows that there is a high degree of potential variability in terms of both the total costs of the scheme and the level of fees that may be applied to batteries placed on the market under the scheme. There are a number of points that can be made however:

- The large potential growth in the number of large batteries placed on the market combined with the substantial time lag between a battery being placed on the market and reaching end of life means that, within the modelled period (i.e. the next 20 years) under all scenarios, only a fraction of the full end of life cost will need to be levied to cover the total cost of the scheme.
- This means that, in the early years of the scheme, the costs levied are unlikely to be high enough to provide substantial disincentive to the purchase of EVs or large batteries.
- Even over the first 20 years of the scheme the full cost of recovering a battery under the scheme will not need to be levied to pay for the full scheme costs.
- In the modelling, some set up costs are accounted for in the first year, and this raises the costs in the first year of the scheme.
- Except in the low growth scenario, the vast majority of scheme costs are directly associated with the recovery of batteries, with only a small proportion of costs associated with scheme administration (1.4% in the high growth, 3.3% in the central case, and 16% of costs in the low growth scenario by 2041).
- The modelling bases the costs of recovery on current costs. However, the current costs are not yet well understood and are still being worked out by those involved in the industry. The costs of recovery – across all aspects of the value chain – from collection to assessment, pre-processing, transport, storage and actual recycling, are highly likely to come down over time as new more efficient systems and processes are developed and economies of scale come into play. To this extent at least, future costs are likely to be over-estimated.

5.0 Options for Recovery of Costs

In this section the options for recovery of costs all assume that there is a single product stewardship scheme for large batteries.

The product stewardship scheme guidance (S4(1)) requires that:

> *"Full net costs for stewardship of priority products at end of life met by product or producer fees proportional to the producer's market share and ease of reuse or recyclability of their product."*

There are a range of options for recovery of costs. These are outlined in the sections below:

5.1 Calculation of Market Share

Calculation of market share is discussed in section 3.3.1.3.

5.2 Advanced Recycling Fee

As noted above, the product stewardship guidance requires that product or producer fees be applied, and that these should be proportional to market share and the reusability or recyclability of the product.

The most obvious way that this could be implemented is through some form of advanced recycling fee where the costs of managing the end-of-life recovery of the product is paid for up front.

The key variations as to how this could be implemented are discussed in the tables below:

Table 15: How the Fee Could be Applied.

Method	Description
Advanced recycling fee is applied to products at point of sale	Under this approach the fee may be split from the cost of the product and itemised separately (similar to GST). The fee would be repatriated to the PRO directly and producers would not be directly involved in payment of the fees. The advantage of this approach is that the costs are transparent to consumers. However, producers in effect have little responsibility, and fee modulation would provide little incentive for producers.
Advanced recycling fee is charged on import or manufacture	The fee would be charged to importers or manufacturers on the basis of market share.

	Importers and manufacturers would then choose how and to what extent they pass these fees on to customers. The advantage of this approach is that producers may be incentivised to seek to reduce their liabilities (through fee modulation).

Table 16: How the Fee Could be Calculated

Method	Description
Advanced recycling fee is calculated on the basis of the projected costs of operating the scheme in a given period	This would likely involve estimating the costs of scheme operation and charging on the basis of budgeted costs. The advantage of this approach is that costs are transparent and less likely to create disincentives to the adoption of battery-based technologies in the short term. The risks are that the actual scheme costs could vary from budgets and so some level of debt or savings may need to be carried over from year to year.
Advanced recycling fee is calculated on the basis of the actual costs of operating the scheme in a given period	This would mean debt funding the scheme, which would incur additional costs and administration. The advantage of this approach is that costs are fully known. Also, because costs of batteries coming onto the market are deferred, this approach would be less likely to create disincentives to the adoption of battery-based technologies in the short term.
Advanced recycling fee is calculated on the basis of the estimated total costs of recovering a large battery under the scheme	This would mean that the full costs of recovery are paid up front and effectively held by the PRO until the battery reaches end of life. Because of the long life of large batteries there are risks that future costs could be different than current estimates, and it could also require the holding of large sums over a long period. Sums held could be invested to create returns that could either offset the costs of the scheme or fund research and development. A disadvantage with this approach is that the full (estimated) costs of managing a battery under the scheme is paid up front, which based on

	current estimates of recovery costs, could be at a level that would significantly affect purchasing decisions.

Further discussion and assessment of these options is provided in sections 3.3.1.3 and 3.4.

5.3 Deposit Refund

A refundable deposit is a method of ensuring that there is sufficient value in the product at the end of its life to encourage its return into the system. An amount is charged up-front (nominally to consumers) that can then be reclaimed when the product is returned. This method makes sense where a lack of sufficient value in the end-of-life product is a barrier to its recovery.

The question of whether an incentive paid to consumers at end of life is necessary and, if so, what the level of incentive should be was explored in our consumer research (refer section 3.0).

An alternative is to pay out the deposit to auto dismantlers or battery un-installers to ensure there is sufficient value for these parties to correctly undertake these activities. However, the same outcome could be achieved simply by ensuring that payments to these parties under the scheme are sufficient.

5.4 Membership Fees

One option for recouping at least a portion of the scheme costs, is to charge some form of membership or registration fee to organisations that are required to participate in the scheme under section 22(1)(a) of the WMA. For example, the membership fee could simply cover administrative costs, based on business size (e.g. turnover), while the operational costs of battery recovery are charged through the advanced recycling fees based on market share. The membership fees would however need to be structured carefully to ensure they were consistent with the requirement under the guidelines to be 'proportional to market share'. The guidelines don't specify how proportionality is calculated so this could possibly be done through charging bands for example. A membership fee would be relatively administratively simple, likely to vary less over time, and be able to be easily charged in advance, which could help in budgeting and cashflow.

5.5 Other Charges

Because the guidelines specify that "*Full net costs for stewardship of priority products at end of life met by product or producer fees…"* this gives little scope for charges that do not fall directly on the producers or products. However, there may be some scope for recovery of costs for activities that may fall outside of direct scheme costs. For example, professional training courses, or recouping costs of compliance where there has been a

breach of standards.[27] The ability to levy any other charges would need to be clarified with the Ministry for the Environment.

5.6 Grant Funding

To meet the requirement to recoup the full costs of the scheme from products/producers, any grant funding could not be applied to the operation of the scheme. However, there may be opportunity for the PRO and/or scheme participants to seek grant funding for projects that could enhance scheme outcomes – such as the development of new technology. Once again, the ability to apply grant funding and the circumstances where it might be possible would need to be be clarified with the Ministry for the Environment.

5.7 How fees could be collected

Discussion of how fees could be collected is provided in sections 3.3.1.3 and 3.4

5.8 How costs could be reimbursed

Discussion of how costs could be reimbursed is provided in sections 3.3.2.3, 3.3.3.4,and 3.4.

6.0 Consumer Research

The product stewardship scheme design needs to identify and take account of the potential realities that consumers will face when they have an end-of-use large battery (or batteries) and offer solutions to ensure maximum engagement and compliance.

Users of batteries should have clear, user friendly, accessible, and economically attractive ways to return large batteries for reuse, refurbishment, or recycling. Any incentive to illegally dispose or seek less optimal disposal routes also needs to be minimised.

This aspect of the research aims to develop an understanding of the needs of consumers so that these can be taken account of in design of the scheme.

6.1 Battery User Group

To meet the aims of this part of the research, the Battery User Group (B.U.G.) was formed. The B.U.G. is a sub-group of the B.I.G. that is focussed on the end-of-life consumer and user experience.

The terms of reference for the B.U.G. are provided in Appendix A.12.1

[27] In the EU the costs charged through the scheme are restricted to 'Necessary Costs' which are defined.

The B.U.G. is chaired by Mandy Mellar, General Manager, AA Battery Service. The members of the B.U.G. are shown in the table below:

Table 17: B.U.G. Members

Name	Organisation
Marcus Baker	Private Stationary Storage user
Bill Alexander	Bluecar
Wayne Herriott	Waste Management
Buddhika Rajapakse	Mercury
Alan Gaskin	Chargenet
Jo Phillips	Vector
Amanda West	LDV
Andrew Bayliss	Ssangyong
Dennis Kelly	Fleetpartners
Carl Hills	Fleetpartners
Letitia Still	Customfleet
Michelle Herlihy	Customfleet
Hayden Johnston	GVI
Nalin Senanayake	iTech
Peng Cao	University of Auckland
Becky Dawson	Mango communications
Gareth Shute	Journalist
Glen Jacobs	NZAMR
Joe Gibson	SIMS Metals
Kathryn Trounson	Better NZ Trust
Mark Lloyd	AA

The B.U.G. has utilised two main research methods to date: A stakeholder workshop and a consumer survey. The outcomes of these are presented in the following sections.

The workshop and consumer survey undertaken to date are to inform a draft product stewardship design. Once a draft design has been developed this will be presented to

the B.U.G. and further feedback sought. At least one further B.U.G. workshop is therefore planned.

6.2 B.U.G. Workshop

6.2.1 Introduction

A workshop for B.U.G. stakeholders was held on 20 November 2020, 10am – 1pm at the Vector Sub-Station in downtown Auckland.

The workshop programme included presentations providing an overview of the B.I.G. project, progress to date and the purpose and intent of B.U.G., before splitting into working groups. The attendees were split into four different groups with the following different broad characterisations:

- Group 1: EV users
- Group 2: Stationary storage
- Group 3: Service providers
- Group 4: Zoom group

Each group was asked to consider the following questions:

- **Question 1.** Who are the different parties who are involved in the End Of Life of large batteries for your user group? What should the responsibilities be of each party?
- **Question 2.** What information does your user group need from each of the different parties?
- **Question 3**. How should this information be communicated?
- **Question 4.** Access. How do consumers want to access EOL services – book a pickup? Local garage? Dealer? Technician?
- **Question 5.** Under a product stewardship scheme 'disposal' must be free to the consumer. However, is this sufficient incentive? Does there need to be a payment? How much? Under what circumstances? What is to stop batteries with value simply being sold privately?
- **Question 6.** Out of all the things you have discussed, what are the top features a scheme should have (or avoid doing)?

Each group then reported back at the end and there was some round-table discussion. Notes from the meeting, including a list of attendees are provided in Appendix A.12.2.

6.2.2 Key Themes

There were a number of key themes to emerge from the workshop, and which were common across the different user groups. These were:

- **The need for easily accessible data.** In particular the ability to access information about the battery such as the chemistry, capacity, state of health, owners, usage etc. Knowing the history and specifications of the battery will help owners assess their options and make decisions about the management of the battery. There

were a number of suggestions for how this information could be managed and accessed. For example: maintaining a database of batteries - initially based on data supplied by the manufacturer, but with a 'service history' that is updated regularly (e.g. each time a car goes through a WOF process or change of ownership) and with records about the battery able to be accessed through a QR code or similar on the vehicle and/or battery.

- **Having accredited agents**. To give consumers confidence that their battery is being correctly serviced, repaired, upgraded, repurposed, or recycled there should be recognised agents that meet standards of professionalism. Being able to simply call on a trusted professional to advise what to do with the battery, including whether it has any value, will remove a lot of hassle and worry for consumers with a battery that has come to end of life. Some groups suggested that there should be restrictions on who was allowed to trade end of life batteries, as they could be hazardous, and knowledge of proper procedures on handling and dismantling are therefore important.
- **Communication and education.** All the groups noted that consumers being able to easily and quickly access information about what to do with their battery – including where to take it/who to call – would be essential. The groups noted the information should be able to be accessed through a range of channels including social media, but also noted that a central website with all of the information would be a core aspect. It was noted that information should be communicated not just to the public but to all those who play key roles in the value chain at end of life, such as towing operators and insurance companies, who may be making initial decisions on where batteries go.
- **Viable money flow.** A number of groups suggested offering rebates to recycle end of life batteries, but all acknowledged that there needed to be financial incentives in the right places to encourage responsible behaviour.
- **Make it simple.** Perhaps the overarching theme of all of the comments was that, for the consumer to make the right decisions in regard to their end-of-life batteries, the process needs to be obvious, simple, and painless.

6.3 B.U.G. Survey

A survey of consumers was undertaken using SurveyMonkey. The survey was promoted through the NZ EV Owners Facebook page and on LinkedIn. The survey was open between 4th of December and the 30th of December. The survey population was not controlled (beyond the selection of channels it was promoted through), and there was no information gathered on the profile of respondents so the results should be taken to be indicative only. A total of 91 survey responses were received as well as social media comments. An analysis of the responses received is presented below.

6.3.1 Question1

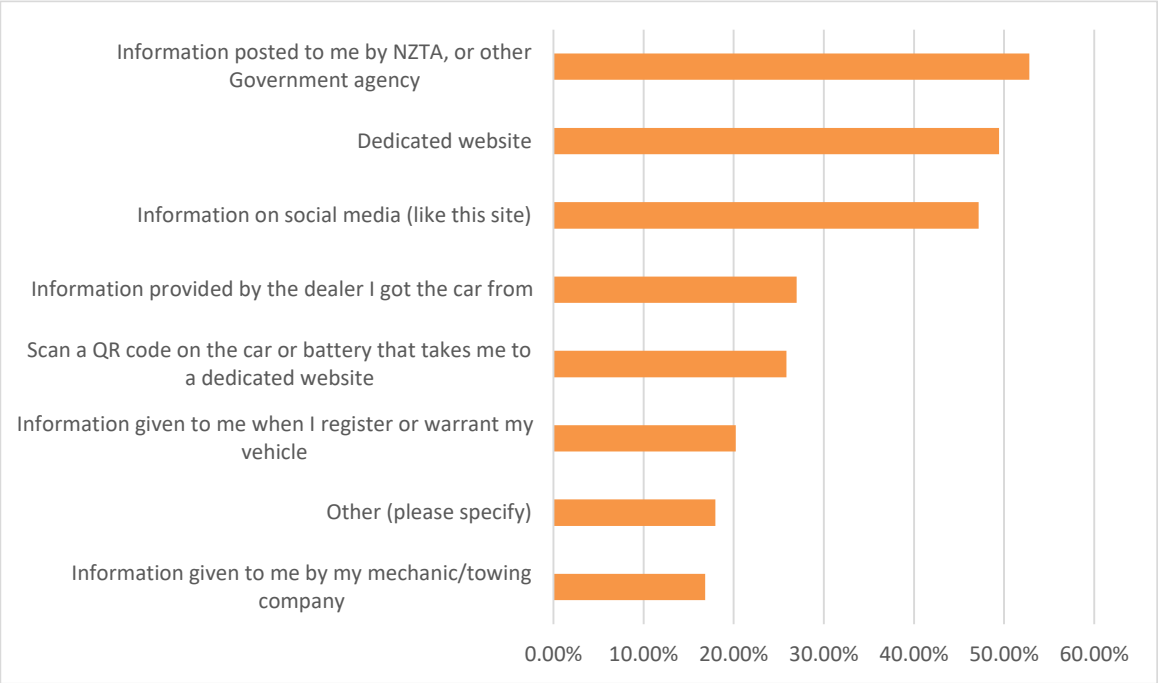
If you end up with a car that you think has a dead battery (i.e. one you couldn't sell), where would you find out what to do with it? Please choose the top 3 most useful options.

Table 18: B.U.G. Survey Question 1 Responses

Options	Responses
Information posted to me by NZTA, or other Government agency	52.81%
Dedicated website	49.44%
Information on social media (like this site)	47.19%
Information provided by the dealer I got the car from	26.97%
Scan a QR code on the car or battery that takes me to a dedicated website	25.84%
Information given to me when I register or warrant my vehicle	20.22%
Other (please specify)	17.98%
Information given to me by my mechanic/towing company	16.85%

Note: As respondents could select up to 3 answers, percentages do not tally to 100%.

Figure 6: B.U.G. Survey Question 1 Responses



The most popular sources of information for respondents were official information from a government agency received through the post, a dedicated website, and social media. The least popular source was information provided by a mechanic or towing company.

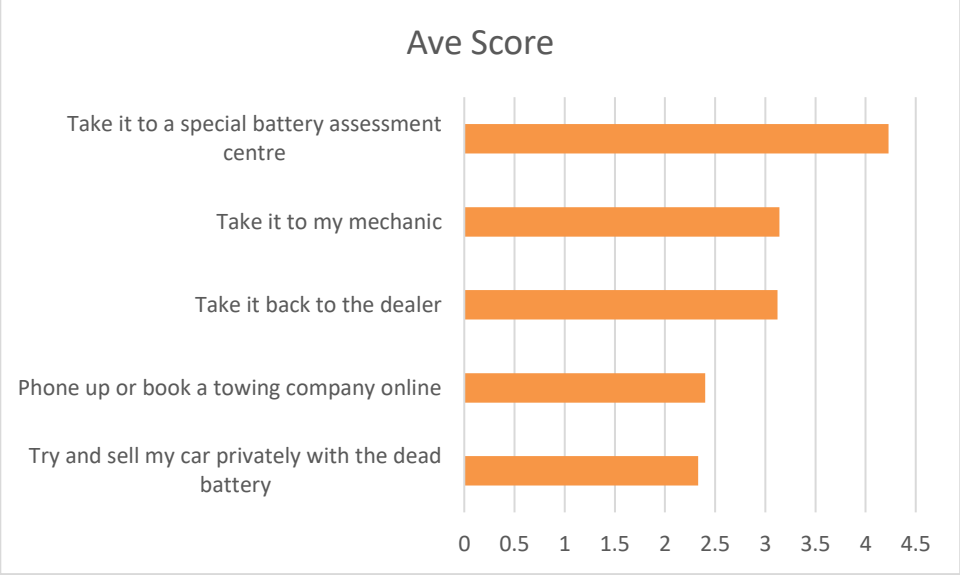
There were 16 'other' responses. These are presented in A.12.3. Some example responses included:

> *"I imagine that wreckers and businesses who provide battery replacement services would be connected to battery recyclers. It would be very uncommon for an individual owner to remove the main battery from an EV and have to dispose themselves. For old batteries which have not come directly from vehicles, a network of well advertised collection points such as eco drop would be most logical. So that everyone knowstt* [sic] *that's the place where you drop lithium batteries."*
>
> *"An EV battery specialist like Blue Cars in Auckland or EVs Enhanced in Christchurch"*
>
> *"Online information is very easy to research & answer this problem."*
>
> *"EVs Enhanced in Chch, or EV FB groups, but batteries don't just die, they slowly degrade over time and always have some kind of trade in value."*
>
> *"Google search"*

6.3.2 Question 2

If you think your car has a dead battery, what options are you most likely to try? Please rank the options below:

Figure 7: B.U.G. Survey Question 2 Responses

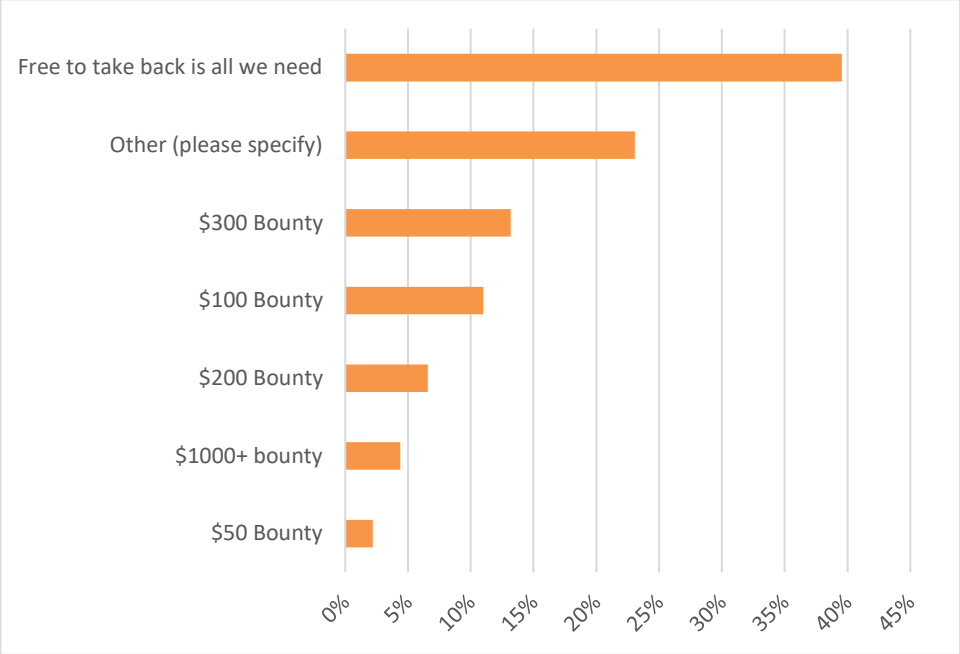


The most popular answer was to take the battery to a special battery assessment centre. This was also the only option to be ranked number 1 by a majority of respondents (53.4%).

6.3.3 Question 3

Under a product stewardship scheme, consumers will be able to hand in a dead battery for at no cost. To encourage more people to hand in batteries we could offer a refund or 'bounty' for bringing a battery (in the car) back to an accredited recycler. What do you think would work best (bear in mind a bounty might mean the car costs more new)?

Figure 8: B.U.G. Survey Question 3 Responses[28]



The most popular response (40%) was that no bounty was needed as long as the battery was free to take back.

The next most popular response was 'other'. The majority of these 'other' responses (13 out of 21) suggested that even when the battery was 'dead' it would still have value and they would be able to sell it. They therefore misinterpreted the question, which was asking what they would do when the battery had no value [This was defined in Question 1, but was not repeated for Question 3, which may have contributed to the confusion]. Four of the 'other' respondents suggested that instead of a monetary value some form of discount off a replacement battery or tax rebate could be provided:

> *"Rebate on purchase of replacement battery or next EV"*
>
> *"Discount off a replacement or reconditioned pack"*

[28] Note: The above responses have been adjusted based on the written responses provided in the 'other' option. Specifically, two respondents nominated a $100 option, and 4 respondents suggested a bounty of over $1,000

"Could offer a voucher off the cost of another electric vehicle car or bike"

"Tax credit against purchase of repair or replacement battery/vehicle"

6.3.4 Social Media Comments

The social media post generated a number of comments. These are presented in Appendix A.12.3. Some key themes from the comments were:

- At the end of use in a vehicle there is usually going to be value in a battery and these options need to be publicised
- There was some debate about whether towing operators and wreckers should be involved in recovery or not as there would be a lot of training needed to handle batteries safely
- That there is opportunity for private enterprise to provide recovery services.

6.4 Consumer Research Discussion and Conclusions

The consumer research has highlighted a number of key factors that will need to be incorporated in the product stewardship scheme design. These include:

- The need for a clear and obvious pathway for how large batteries are dealt with at the end of their life. There should be a network of easily accessible, trusted professionals[29] that consumers can take their batteries to (or vehicles with end of life/end of use batteries in them).
- How to access this pathway needs to be communicated clearly and through trusted information channels. Official sources are likely to be important as they are perceived to be independent and unbiased.
- There needs to be (at least) no financial disadvantage for doing the right thing. Although it was seen as potentially important by some, the need for a payment to consumers was not clear from the research. If the scheme payments are structured correctly there may not be a need for incentive payments to consumers: The most common scenario will be where a battery is part of a vehicle. For the consumer, the battery and the car are in effect a package – and are viewed as one (in the same way the motor and the body are viewed as one in an ICE vehicle). It is likely that, as long as auto dismantlers can be confident that the battery does not have a negative value and they can recoup any costs from its safe removal, there will be sufficient parts and scrap value in the rest of the vehicle for the vehicle overall to still have value. This would mean that, as far as the consumer is concerned, because the car overall has value, there is no need for an additional incentive payment.

[29] The B.I.G. Safety and logistics group is due to publish guidance on the safe management of end of life and end of use large batteries. This is an important component of being able to provide confidence in the systems available to the public.

7.0 Summary and Conclusions

The focus of the work in Milestone two has been to try and determine the practical considerations and constraints for how a large battery product stewardship scheme could operate in NZ, within the parameters established in the legislation and guidance.

The key areas considered included:

- The definition of a large battery
- Processes following import
- Processes at end of use
- Processes at end of life.

Within each of these phases the key actions centred around how obligated batteries could be correctly identified, how data could be recorded and accessed, and how fees and payments could be accurately calculated and made.

7.1 Value Chain Processes

When viewed alongside the guidance, the practical options in these key areas are relatively few, and this begins to point the way towards key elements of the scheme design. The key elements to emerge from the research to date are:

The definition of a 'large battery'. The assessment suggests that a multi-layered definition is likely to be required with the first layer of definition being intended use and the second being end of life handling and/or weight.

Processes following import. The research indicated that voluntary declarations by obligated parties supported by Government audits matching to Customs or other data is likely to be the most workable. Billing of obligated parties should be undertaken by the Scheme Manager based on market share. There are a number of options for how market share could be calculated, but the most workable is likely to be based on the kWh of batteries imported.

Processes at end of use. The research found that voluntary declarations by accredited operators is likely to be most practical. There are a number of possible options for effecting payments for eligible services (such as battery removal and assessment), but further investigation will be required to finalise the processes.

Processes at end of life. It is recommended that regulations under S23(1)(c) of the WMA be introduced to require end-of-life batteries to be removed and managed by accredited providers. To balance this, it would be important to ensure that accreditation processes did not unduly exclude operators and enabled good geographic coverage. Options for achieving this are to manage suppliers through simple contract or supplier agreements and/or requiring adherence to a code of conduct. As with the end of use processes there are a number of possible options for effecting payments for eligible services, but further investigation will be required to finalise the processes.

7.2 Costs

Scheme costs consist of administration costs, which are substantially fixed costs, and the costs of recovery of batteries which vary according to the number of batteries recovered under the scheme. Total scheme costs are therefore driven predominantly by the number of batteries which may be recovered. This is uncertain and will change over time. To address this uncertainty three scenarios were modelled – low, central, and high projections. Although scheme costs are similar to begin with (as the number of batteries coming to end of life is determined largely by historical numbers of batteries places of the market), by the end of the 20-year timeframe used in the projections, the cost have diverged substantially. The low projection costs grow to around $4 million per annum, while the central case costs are estimated at $26 million and the high projection costs at approximately $64 million.

The financial modelling shows that there is a high degree of potential variability in terms of both the total costs of the scheme and the level of fees that may be applied to batteries placed on the market under the scheme.

The full cost of managing an end-of-life battery under the scheme (including, removal, assessment, transport, storage, preparation for export, export and recycling, but excluding overheads) is currently estimated at in the order of $600 – $650 per large battery (assuming an average battery size of around 50 kWh). This cost could change substantially (likely lower) depending on a range of factors, including economies of scale and the possibility of onshore processing or pre-processing. In none of the modelled scenarios over the 20 years model is this full cost assumed to be paid. This is becuase the total costs of managing end of life batteries are spread across all large batteries place on the market, which, for the 20-year period modelled, exceeds the numbers coming to end of life.

7.3 Cost Recovery

There are a number of ways cost recovery could be effected. However, the guidance requires that the full net costs are met by product or producer fees ‘proportional to the producers’ market share’ and adjusted for the degree to which the product is reusable or recyclable. This means that the main method of cost recovery will likely need to be some form of advanced recycling fee, charged to importers based on market share. The advanced disposal fee could apply to all scheme costs or just the variable portion related to product recovery. In this last scenario a membership fee which covers scheme administration costs could be applied (and graduated in the basis of business size). Other charges or income sources could be applied for scheme costs which are not ‘necessary costs’.

7.4 Consumer Research

The consumer research has highlighted a number of key factors that will need to be incorporated in the product stewardship scheme design. These include:

- The need for a clear and obvious pathway for how large batteries are dealt with at the end of their life. There should be a network of easily accessible, trusted professionals that consumers can take their batteries to (or vehicles with end of life/end of use batteries in them).
- How to access this pathway needs to be communicated clearly and through trusted information channels. Official sources are likely to be important as they are perceived to be independent and unbiased.
- There needs to be (at least) no financial disadvantage for doing the right thing. Although it was seen as potentially important by some, the need for a payment to consumers was not clear from the research.

Further consumer research is planned for Milestone 3 as part of the stakeholder engagement process.

7.5 Conclusions

The Milestone Two research has investigated the key issues in formulating a preferred scheme design and has provided a framework for evaluating these. The evaluation, alongside adherence to the Ministry for the Environment's product stewardship guidelines, effectively narrows down the options that will likely be workable in practice across the key design parameters considered. This provides a strong basis for identification of a preferred scheme design in Milestone Three.

7.6 Next Steps

Milestone Three will focus on formulating a draft scheme design and gathering feedback from stakeholders to refine the design and present a preferred scheme design proposal.

In addition to the core elements covered in Milestone Two, there are a number of important scheme design elements which will be explored further in Milestone Three. These include:

- Governance and management structures
- Geographic coverage
- Targets and reporting
- Regulations required
- Interactions with other schemes
- Standards and accreditation
- Import and export barriers and gaps
- Supporting policy and legislation
- Implementation tasks and timelines.

APPENDICES

A.1.0 General Guidelines for Product Stewardship Schemes for Priority Products Notice 2020

Pursuant to section 12(1) of the Waste Minimisation Act 2008, I, The Honourable Eugenie Sage, Associate Minister for the Environment, acting under delegated authority, give the following notice.

1. Title and Commencement—

(1) This notice may be cited as the General Guidelines for Product Stewardship Schemes for Priority Products Notice 2020

(2) This notice takes effect from the date of publication hereof in the *New Zealand Gazette*.

2. Interpretation—

Unless the context otherwise requires:

Producer has the meaning given in section 5 of the Waste Minimisation Act 2008.

Wider community may include, but is not limited to, local councils, iwi, and environmental Non-Governmental Organisations.

Waste hierarchy means, in order of priority, waste prevention, reuse, recycling, recover (materials and energy), treatment and disposal.

3. Time Within Which an Application for Accreditation of the Scheme is Expected to be Made

(1) Applications for accreditation are expected as follows:

a. Within one year from the date of priority product declaration for product categories with existing accredited voluntary schemes that wholly or substantially cover that priority product;

b. Within one year from the date of priority product declaration or co-design recommendations to the Government, whichever is later, for product categories not substantially covered by voluntary accredited schemes for which a co-design process has commenced; or

c. Within three years from the date of priority product declaration for all other priority product categories.

4. Expected Product Stewardship Scheme Effects

(1) Accreditation applications must specify how the proposed scheme will help to achieve the following:

a. Circular resource use

i. Continuous improvement in minimising waste and harm and maximising benefit from the priority product at end-of-life.

ii. Increasing end-of-life management of the priority product higher up the waste hierarchy to support transition to a circular economy in New Zealand.

iii. Investment in initiatives to improve circular resource use, reusability, recyclability and new markets for the priority product.

b. Internalised end-of-life costs

i. Full net costs for stewardship of priority products at end of life met by product or producer fees proportional to the producer's market share and ease of reuse or recyclability of their product.

ii. Free and convenient collection of the priority product for household and business consumers at end-of-life, including rural populations.

iii. Collection and management of legacy and orphaned priority products fully or substantially funded by the scheme.

c. Public accountability

i. Clear information to household and business consumers on how the scheme works, how it is funded, and how to find the nearest collection point.

ii. Transparent chain of custody for collected and processed materials, to both onshore and to offshore processors, and published mass balances showing rates of reuse/ recycling or environmentally sound disposal of the priority products.

iii. Publicly available annual reports that include measurement of outcomes and achievement of targets, fees collected and disbursed, and net cash reserves held as contingency.

d. Collaboration

i. Optimal use of existing and new collection and processing infrastructure and networks, and co-design and integration between product groups.

Expected Product Stewardship Scheme Contents

(1) Accreditation applications must specify how the proposed scheme incorporates or will provide for the following:

a. Governance

i. The scheme will be managed by a legally registered not-for-profit entity.

ii. Annual independent audits will be conducted on scheme performance and included in scheme's annual reports to the Ministry for the Environment. The annual reports must contain the following:

a. financial performance and scheme cost-effectiveness;

b. environmental performance; and

c. agreements with scheme service providers.

iii. Governance arrangements will be established for the initial set up and ongoing development and operation of the scheme that are appropriate to the size and scale of the scheme.

iv. All governance activities will adhere to the Commerce Commission guidelines on collaborative activities between competitors, including but not limited to considering the option of applying for collaborative activity clearance from the Commission for the scheme.

v. The scheme will be the only accredited scheme for that product, or

a. have agreements in place with other scheme managers to enable cooperation and cost-effective materials handling and to prevent confusion for household and business consumers; and

b. demonstrate how net community and environmental benefit (including cost-effectiveness and nonmonetary impacts) will result from multiple schemes for that priority product.

vi. Directors or governance boards will:

a. be appointed through an open and transparent process;

b. represent the interests of producers and consumers of the priority product and the wider community as informed by stakeholder advisory groups; and

c. follow governance best practice guidelines, for example the Institute of Directors of New Zealand *Code of Practice for Directors*, including for the identification and management of conflicts of interest.

b. Scheme operations

i. Services (e.g. collection, sorting, material recovery and disposal) will be procured using transparent, nondiscriminatory and competitive processes open to all competent entities whether existing, new entrant or social enterprise.

ii. Clear, regular and open reporting and communication will be given to scheme participants and stakeholders.

iii. Processes exist to manage commercially confidential or sensitive information appropriately.

iv. All people involved in the scheme will have completed suitable training to complete their roles, including in best practice in prevention and reduction of harm to people and the environment.

v. Ability to obtain new or existing permits held, for all necessary activities in New Zealand in relation to processing and potential export of priority products or their constituent components.

c. Targets

i. All schemes will set and report annually to the Ministry for the Environment on targets that include as a minimum:

a. significant, timely and continuous improvement in scheme performance;

b. performance against best practice collection and recycling or treatment rates for the same product type in high-performing jurisdictions;

c. a clear time-bound and measurable path to attain best practice;

d. implementation phase-in to reflect availability of markets and infrastructure;

e. new product and market development to accommodate collected materials; and

f. measures for public awareness of scheme participant satisfaction and a record of response by the scheme to concerns raised.

ii. Targets will be reviewed and adjusted no less than every three years from the date of accreditation, taking into account changes in the market, natural events and technology.

Dated at Wellington this 29th day of July 2020.

HON EUGENIE SAGE, Associate Minister for the Environment

A.2.0 Survey Content

B.I.G. Large Battery Product Stewardship Survey

Welcome to the B.I.G. Large Battery Product Stewardship Survey

This survey will help us find out about what you do in relation to large batteries and get your initial views on what a product stewardship scheme for large batteries should look like.

It should take no more than about 20 minutes to complete. You can save your progress and come back to complete it later if you need to.

If any questions do not apply to you, just leave them blank.

The scope of a proposed product stewardship scheme that we will design in this project covers large batteries used in stationary storage and electric vehicle applications (it *excludes lead acid* batteries and those used in *e-bikes* and *scooters*).

Thank you for your time and effort in completing this survey.

Contact Details

Please supply your contact details below.

Your individual responses will be kept confidential and either reported as part of aggregated information or anonymised.

Contact Details

Please supply your contact details below.

Your individual responses will be kept confidential and either reported as part of aggregated information or anonymised.

1. Name

2. Contact phone number

3. Organisation

4. Position

Value Chain Involvement

For the next set of questions please indicate where you think your organisation is involved in the large battery value chain. This will help us understand your answers better. You can check as many boxes as apply to you.

5. Importer (check all that apply)

- ☐ OEM
- ☐ Used vehicle importer
- ☐ Battery importer

6. Vehicle and equipment reseller (check all that apply)

- ☐ New and used car dealer
- ☐ Used car dealer
- ☐ Battery retailer

7. Owner (check all that apply)

- ☐ Private owner
- ☐ Fleet owner or leasing/rental company
- ☐ utility or commercial owner

8. Installer Service and Upgrades (Check all that apply)

- ☐ Battery refurbisher

- [ ] Mechanic
- [ ] Installer
- [ ] 2nd life repurposer
- [ ] Tech supplier
- [ ] Private innovator

9. End of battery life management

- [ ] Wrecker
- [ ] Battery consolidation, evaluation, or sorting
- [ ] Recycling and waste collector or recycling/waste facility operator
- [ ] Transport and logistics

10. Recycling processing and disposal

- [ ] Landfill or disposal facility
- [ ] Battery recycler
- [ ] Scrap metal dealer

11. Administration, Networks, Research & Advisory

- [ ] Government/regulator
- [ ] Industry body
- [ ] Finance, insurance or independent guarantee provider
- [ ] Product stewardship scheme administrator
- [ ] Research & Development
- [ ] Advisor

12. Other. Please specify.

Bottom of Form

Current Activities

Top of Form

13. Does your organisation physically handle batteries, or equipment with batteries embedded, as part of your work?

- ○ Yes
- ○ No

Battery Handling

14. Does your organisation own the batteries you handle?

- ○ Yes - all or nearly all
- ○ A mixture
- ○ No, or hardly any

15. What does your organisation do with the batteries? Please provide a brief description.

16. Where do the batteries you handle come from. Check any that apply

- ☐ OEM
- ☐ Used vehicle importer
- ☐ Battery importer
- ☐ New and used car dealer
- ☐ Battery retailer
- ☐ Private owner
- ☐ Fleet owners & Leasing companies
- ☐ Utility or commercial user

- [ ] Battery refurbisher
- [ ] Mechanic
- [ ] Installer
- [ ] 2nd Life repurposer
- [ ] private innovator
- [ ] Tech supplier
- [ ] Wrecker
- [ ] Battery consolidation evaluation and sorting
- [ ] Recycling and waste collector & facility operator
- [ ] Scrap metal dealer
- [ ] Other

17. Who/where do they go once you have finished with them? Please provide information such as the organisation, facility or activity, and approximate geographic location (e.g. local market, national market, export).

18. Does your organisation have a system for tracking batteries (or battery components such as modules, cells, control systems etc.) that you handle ?

- ( ) Yes. Please supply details
- ( ) No

Comment

19. Approximately what quantities of used large batteries do you currently manage annually (number and kg)

Lithium-ion

Nickel Metal Hydride

Fuel cells

Other (please indicate type)

Costs and Income

Please note: Your individual responses will be kept confidential and either reported as part of aggregrated information or anonymised.

20. What are the approximate costs per kg to manage batteries through your processes. If there is more than one distinct process please please itemise them (e.g. removal of end of life battery packs might be separate to servicing or repair of battery packs).

21. What income do you receive from the work you do with large batteries (per kg approx).

22. Please provide an approximate breakdown % by

User charges

Sale of materials or goods for reuse

Grants and Other income

23. Other comments about your organisation.
Please add any final comments about what your organisation does or how is operates.

Future Plans

24. Does your organisation have any future plans to develop capacity or capability relevant to large battery product stewardship. Please check any that apply.

- [ ] Servicing or repair of batteries
- [ ] Collection points for batteries
- [ ] Dismantling/removal/decommissioning
- [ ] Upgrading/refurbishing of battery packs
- [ ] Repurposing into second life applications
- [ ] Supply of technology to enable new functions (e.g. control systems)
- [ ] Supply of battery tracking technology or systems
- [ ] Collection or transport of used batteries
- [ ] Storage of used batteries
- [ ] Assessment of end of use/end of life batteries
- [ ] Providing training or skill development for the sector
- [ ] Pre-processing for recycling
- [ ] Recycling of batteries
- [ ] Use of materials from recycled batteries
- [ ] Research
- [ ] Supporting services (e.g. finance, insurance etc.)
- [ ] Other (please specify)

Product Stewardship Scheme Design (General)

Below are questions on three hypothetical high-level scheme designs for large battery product stewardship. The strawman scheme designs are explained in more detail in a separate document which you can view by clicking here. Please read this carefully before answering the questions.

All designs need to meet the MfE guidelines. These can be viewed here.

25. **Scheme 1: Importer Led.**
The key features are:

Importers responsible for taking back their own product

A single organisation oversees accrediting, monitoring, reporting and compliance

Scheme costs met by a membership fee.

Please rate the Scheme 1 design according to the following criteria. You can provide additional comments in the text boxes

	Strongly meets the criteria	Mostly meets the criteria	Somewhat meets the criteria	Mostly does not meet the criteria	Does not meet the criteria
Compatible with and facilitates a circular economy approach					
Comprehensive (covers all batteries in scope)					
Economically efficient and fair					
Administratively simple to implement and run					
Future proof and flexible					

Comment

26. **Scheme 2: Producer Responsibility Organisation Led.**
The key features are:

Batteries collected and managed by a single organisation

Costs met through advance disposal charge based on market share

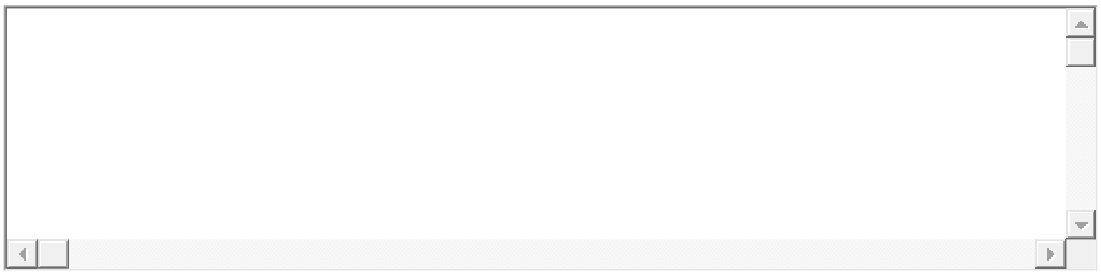
Accredited importers can opt out.

Please rate the Scheme 2 design according to the following criteria. You can provide additional comments in the text boxes

	Strongly meets the criteria	Mostly meets the criteria	Somewhat meets the criteria	Mostly does not meet the criteria	Does not meet the criteria
Compatible with and facilitates a circular economy approach					
Comprehensive (covers all batteries in scope)					
Economically efficient and fair					
Administratively simple to implement and run					

Future proof and flexible					

Comment



27. **Scheme 3: Producer Responsibility Organisation Led with Refundable Deposit.**
The key features are:

Batteries collected and managed by a single organisation

Costs met through advance disposal charge based on market share

Accredited importers can opt to receive their own batteries back once collected

A refundable deposit is attached to each battery to incentivise returns to the system.

Please rate the Scheme 3 design according to the following criteria. You can provide additional comments in the text boxes

	Strongly meets the criteria	Mostly meets the criteria	Somewhat meets the criteria	Mostly does not meet the criteria	Does not meet the criteria
Compatible with and facilitates a circular economy approach					
Comprehensive (covers all batteries in scope)					

Economically efficient and fair					
Administratively simple to implement and run					
Future proof and flexible					

Comment

28. Do you have a preferred scheme design of the three? Please rank the choices. *(note: these are not final scheme designs - variations are possible on each, so please indicate your broad preference even if you might like some changes)*

Scheme 1: Importer Led

Scheme 2: Producer Responsibility Organisation Led

Scheme 3: Producer Responsibility Organisation Led with Refundable Deposit

Any of the above

None of the above

Bottom of Form

Product Stewardship Scheme Design (Detail)

In this section we ask more about some of the specific scheme design features.

Top of Form

29. Goverance.
The Ministry for the Environment Guidelines recommend a single scheme for large batteries but makes allowance for more than one scheme if they can effectively collaborate.

Do you agree there should be one scheme covering all large batteries?

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Comment

30. Targets.
All accredited priority product schemes are required to have targets. Please indicate your views about targets.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Targets should apply to the scheme only with no individual member targets					
All members should have the same targets					
Targets should be bespoke for each member					
Recycling targets only					
Reuse and 2nd life should be included in					

recycling targets					
There should be separate reuse or 2nd life targets					

Comment

31. Funding. The scheme must be self-funding. Please rate the following funding options (bearing in mind some may depend on scheme type).

	Yes. Let's do it	Sure, why not	Meh. Whatever	Rather not	Over my dead body
Membership fee based on business size					
Advanced disposal fee or similar based on market share by weight					
Advanced disposal fee or similar based on market share by kWh					
Refundable deposit					
Combination of methods					

Other (please specify)

32. If there is a refundable deposit applied to imported batteries how should it be calculated and redeemed?

Based on weight (e.g. kg)

Based on kWh

Set rate based on battery type (e.g. vehicle battery, home stationary storage, commercial stationary storage)

Other (please specify)

33. If there is refundable deposit applied to imported large batteries, how much should this deposit be?

34. Rebating of fees. Depending on the scheme design fees collected from importers will need to be applied to meet the costs of parties operating the scheme. Please indicate your views on the suggested methods below:

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Recyclers and collectors reimbursed on the basis of the weight of batteries managed. Unit rates for each process would be set in advance.					
Recyclers and collectors reimbursed on the basis of a contracted rate with fixed and variable portions					
Recyclers and collectors reimbursed on the basis of documented costs incurred					

Other (please specify)

35. Product Design. Fees must be modulated according to criteria such as ease of recyclability and reuse. Please indicate your views below:

	Loving it!	Liking it	Not feeling much at all	No thanks	Get away from here!
Modulation of fees by ease of recycling and reuse should reflect actual costs					
Modulation of fees by ease of recycling and reuse should be set to encourage good design					
Fees should be modulated to take account of recycled content					
Fees should be modulated to take account of guaranteed battery life					
Fees should be modulated to take account of other environmental or ethical criteria (e.g. carbon impact, ethical supply chain traceability etc.)					

Other (please specify)

36. Final Comments. Please provide any additional comments you have on product stewardship scheme design.

A.3.0 Survey Results and Analysis

A.3.1Methodology

A survey constructed using SurveyMonkey and sent out by e-mail to all 140+ B.I.G. stakeholders.

The purpose of the survey was to find out more about the existing stakeholders and their involvement in the value chain, as well as gather some initial views on the potential design of a product stewardship scheme. To achieve this the survey was divided into two parts:

- The first part sought information about each respondent such as what activities in the value chain they undertook, the quantities of large batteries they handle, and the approximate costs and income associated with their activities.
- The second part canvased their views on potential scheme designs. To facilitate this three 'strawman' scheme designs were proposed, and feedback sought on specific aspects of them. Appendix A.6.0 contains the strawman scheme designs presented.

A copy of the survey questions is provided in A.2.0.

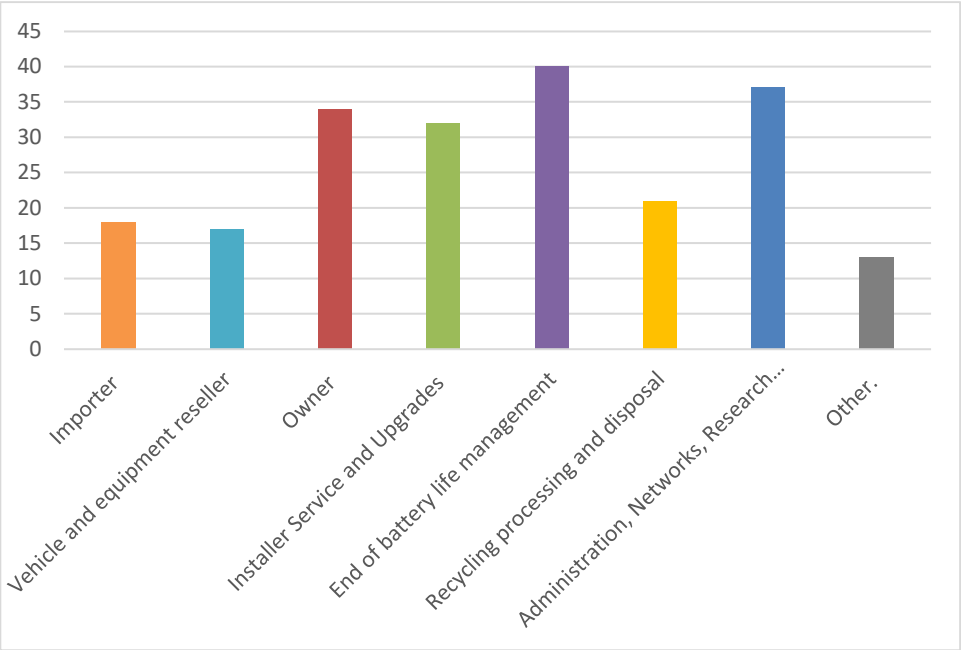
A.3.2Part 1 Responses – Respondent Information

60 Responses were received between 30 August 2020 and 22 September 2020.

A.3.2.1 Value Chain Profile (Questions 5-12)

Respondents were asked to identify their involvement in different parts of the value chain. This is shown in the charts below:

Figure 9: Respondents by Value Chain Classification



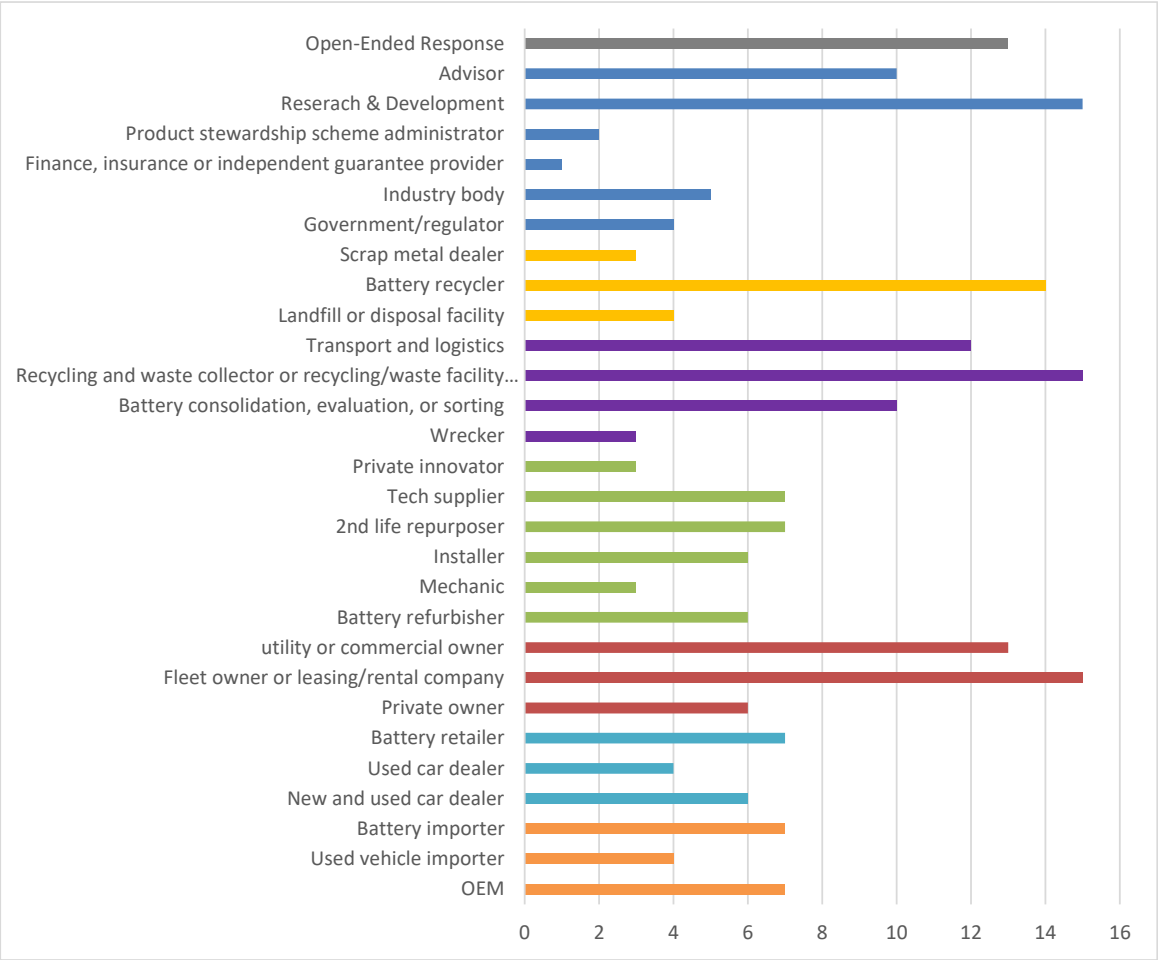
There was a good level of response across the value chain with the numbers involved in end-of-life battery management receiving the most representation followed by administration networks, research & advisory and owners.

The 'other category consisted of the following responses:

- Wrecker Network Operator
- NGO
- Building battery recycling plant
- Importer & distributor of new EV commercial vehicles
- Wrecker Network Operator
- Stationary battery reseller
- Materials science and battery component research
- Future OEM Ownership, Retailing & EV products Commercial strategy
- Building fire safety
- Battery lifecycle management technology solutions provider
- Zero Waste consultant and community representative
- Maori Relationships
- Developer of environmental best-practice criteria (ecolabelling)

Within each broad value chain classification there were sub-classifications. The chart below breaks these down. The subclassifications are grouped by colour consistent with the colours in Figure 9.

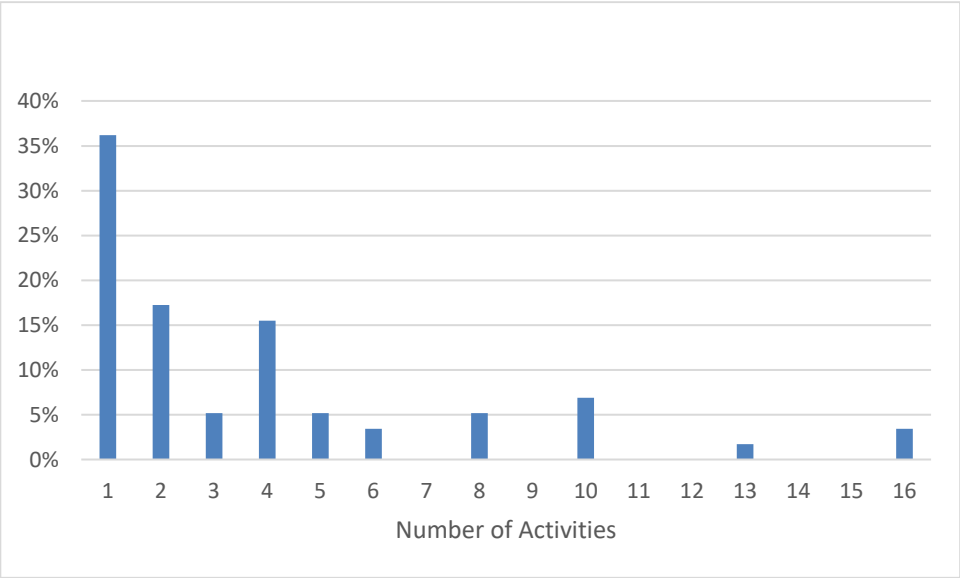
Figure 10: Respondents by Value Chain Classification (Detail)



Even at a more detailed level, the respondents show a good spread of representation across the value chain.

It should be noted that respondents may be involved in more than one aspect of the value chain. The chart below breaks out the number of elements that respondents are involved in.

Figure 11: Number of Activities Respondents Involved In



There are 29 sub-classifications altogether. The largest group (36%) was involved only in one value chain element. However, there were a number of respondents who were involved in a wide range of elements across the value chain. For example, respondents could be involved in battery importing, refurbishing, fleet ownership, research & development etc. Two respondents identified themselves as being involved in 16 aspects of the value chain and another in 13.

A.3.2.2 Q.13: Does your organisation physically handle batteries, or equipment with batteries embedded, as part of your work?

Answer Choices	Responses	
Yes	62.50%	35
No	37.50%	21
	Answered	**56**
	Skipped	**4**

A.3.2.3 Q.14: Does your organisation own the batteries you handle?

Answer Choices	Responses	
Yes - all or nearly all	52.94%	18

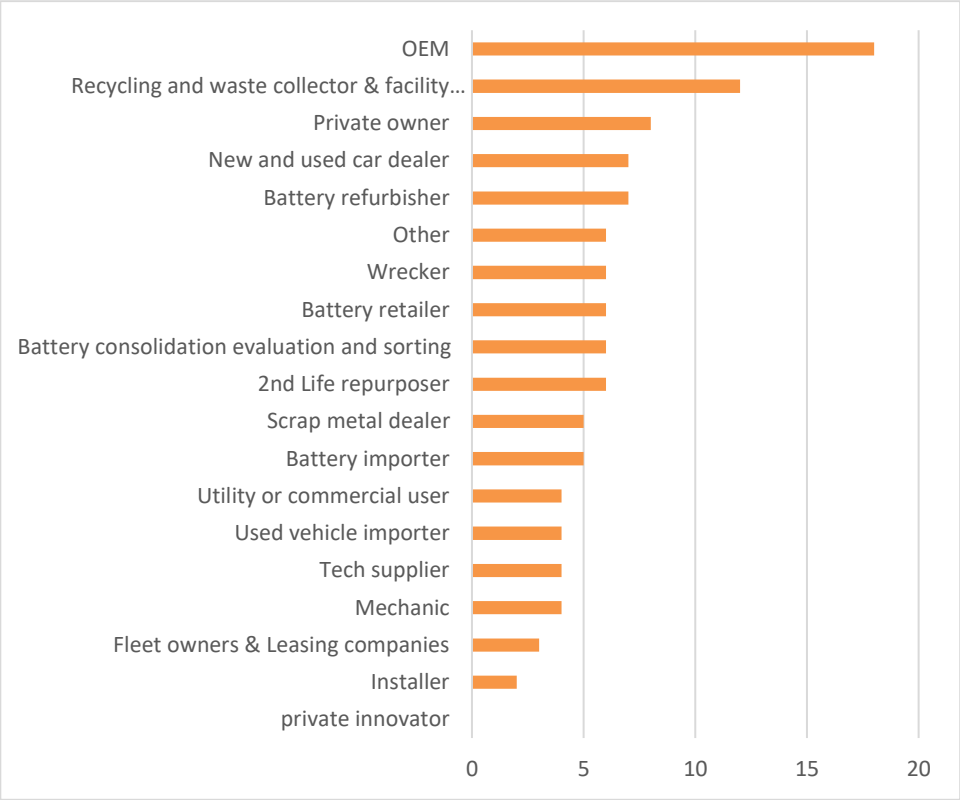
A mixture	23.53%	8
No, or hardly any	23.53%	8
	Answered	**34**
	Skipped	**26**

A.3.2.4 Q.15 What does your organisation do with the batteries?

- *collect, transport, pack and ship overseas for recycling*
- *Utility-scale storage*
- *For a few vehicles, that have been damaged, such our Paxters, the batteries are being stored until there is a circular solution for them.*
- *Break down batteries to recover metals & elements*
- *Fitted to new vehicles we distribute. Remove and replace as required for repairs*
- *We only buy lead acid batteries*
- *refurbish, resell, recycle*
- *In my group, we conduct R&D on batteries, including design and develop new battery cells, electrode materials and battery testing.*
- *In storage at this point*
- *Install them into microgrid energy systems, predominantly in the pacific islands.*
- *Procure, design and install for residential, commercial and utility stationary storage applications*
- *we dismantle and manage EV, ESS and small batteries. we take owner ship at end of life.*
- *Storage*
- *We are New Zealand's Largest Recycler of Lead Acid Batteries. Each year we Export around 10,000MT to South Korea. We hold EPA issued 6 permits to 6 different Recycling Facilities*
- *repurposing and recycling*
- *Repurpose, re-use in bespoke /custom vehicles. Small scale at this time.*
- *Logistics (typically SMALL cells - mobile phones etc)*
- *Battery supplier returns*
- *Fit new/high capacity to cars & Sell lower capacity for repurposing*
- *Sort into different types, sell and recycle*
- *We sell them to solar installers*
- *We are the World's largest Industrial Battery Manufacturer*
- *We are developing the processes for repurposing batteries, regenerate battery electrodes and extract the metals from the battery waste.*
- *Recycled*
- *Refurbish. Develop secondary use i.e. solar power storage*

- *Forklifts and Cars*

A.3.2.5 Q.16: Where do the batteries you handle come from?



Answered: 33, Skipped: 27

A.3.2.6 Q.17: Who/where do they go once you have finished with them?

- *Exported to Australia*
- *None to reach end of life in next 10 years*
- *Resell fleet vehicles to market, utility scale battery storage systems unknown about end of life process.*
- *They are reconstituted into constituent metals / materials for production of new batteries*
- *Cars in our EV fleets are on-sold at end of life with the batteries; Mercury Solar installs batteries in homes and businesses; Our grid-scale battery project has the ability to return the batteries to the OEM.*
- *TBC*
- *AU/Asia for recycling*
- *local market and international market, Korea*
- *hopefully national market and export*
- *Still working this*

- *Governmental organisations in the Pacific Islands*
- *They are installed in NZ, predominantly Auckland, the Pacific Islands and one utility site in Australia. Most of the batteries we've installed in Auckland we still own once installed, even the many residential batteries, in some cases ownership transfers to the property owner after 10 years.*
- *we are in Australia. 27% of the recovered material is sent to Korea to make new batteries.*
- *Stored at Hyundai HQ*
- *All Batteries delivered to us are sent for Recycling under EPA permit to South Korea*
- *export*
- *Small scale it this stage - private vehicle owners, bespoke small marine and other projects*
- *The majority of the small batteries end up in land fill at Hampton Downs*
- *currently local market private innovators but in future commercial organisation (when sufficient available)*
- *Sell reusable batteries and export batteries for recycling to Kobar via Upcycle*
- *Customer's property*
- *Metalman*
- *?Usually involved when failure has occured - disposed of in waste system*
- *N/A.*
- *Repurposed*
- *Scrap yards*
- *Not yet at the stage of making this decision*
- *Return to Lease Company with equipment for next life*

A.3.2.7 Q:18: Does your organisation have a system for tracking batteries (or battery components such as modules, cells, control systems etc.) that you handle?

Answer Choices	Responses	
Yes. Please supply details	41.94%	13
No	58.06%	18
Comment		17
	Answered	**31**
	Skipped	**29**

Response detail:

- *We have a proprietary waste tracking system*
- *No explicit system but we can track batteries via our EV fleet management processes, Mercury Solar inventory/sales records and asset management processes for the grid-scale battery.*
- *Tracked by Fuso warranty system*
- *We meter the performance of the batteries, but the majority of the tracking is done by the manufacturer (Usually Tesla)*
- *Batteries installed on customer sites are tracked through CRM platform, those installed on Vector sites are managed through usual network asset management processes.*
- *internal stock management system.*
- *Serial numbers*
- *All Batteries sent for recycling are sent under EPA Permit and are shipped with a tracking movement document*
- *Only by identification with source packs*
- *Batteries transported in very limited quantities - we do NOT move LARGE cells.*
- *Yes, for our electric vehicles and for lead acid for our truck fleet*
- *We keep sale records*
- *Each battery is monitored over the internet.*
- *Delivery dockets to customers*
- *small scale R&D activities.*
- *This will depend on how the business builds up*
- *Swap forklift batteries*

A.3.2.8 Q.19: Approximately what quantities of used large batteries do you currently manage annually?

Answer Choices	Responses	
Lithium-ion	95.24%	20
Nickel Metal Hydride	38.10%	8
Fuel cells	28.57%	6
Other (please indicate type)	33.33%	7
	Answered	**21**
	Skipped	**39**

Based on the estimates provided, respondents process 5,681.6 tonnes per annum of lithium-ion batteries and 72.5 tonnes of Nickel Metal Hydride batteries. It should be noted that some of the respondents operate processing facilities overseas and the figures they provided include these quantities.

A.3.2.9 Q.20: What are the approximate costs per kg to manage batteries through your processes? If there is more than one distinct process, please itemise them (e.g. removal of end of life battery packs might be separate to servicing or repair of battery packs).

Fourteen respondents answered this question and 46 skipped it.

Responses ranged from $0.90 per kg to $10 per kg with the most common level of charge around $2. It should be noted that many of the costs relate to different processes.

A.3.2.10 Q.21: What income do you receive from the work you do with large batteries (per kg approx)?

Seventeen respondents answered this question and 43 skipped it.

The responses to this question were highly variable. A number of respondents put down income matching their costs while others did not provide numerical answers. Non-numerical answers included:

- *Unsure at this point*
- *Indirect network benefit for the majority of Auckland installs so no direct income. Can't provide for other commercial installs of large-scale projects.*
- *Charge to supplier on delivery.*
- *processing fees + commodity sales*
- *This is commercially sensitive.*

A.3.2.11 Q.22: Please provide an approximate breakdown % by user charges, sale of materials or goods for reuse, grants and Other income

Eleven respondents answered this question and 49 skipped it. Of those answering 5 indicated they receive income from user charges with 3 of these receiving all of their income from this source, 6 indicated they receive income from sale of goods or materials (1 respondent indicated their receive 100% of their income from this source), and 2 respondents indicated their receive some income from grants or other sources.

A.3.2.12 Q.23: Other comments about your organisation. Please add any final comments about what your organisation does or how is operates.

- *Waste Management Technical Services is New Zealands largest specialist hazadous waste company. We have a long history of safely and sucessfully handling and disposing of hazadous material.*
- *We are building the first onshore battery recycling plant to process end of life lithium (and other drycell) batteries into constituent materials and recover Co, Ni & Li for future battery production (closed loop manufacturing)*
- *N/A*
- *I cannot comment for our Association members about volume and numbers*
- *I think it would be valuable for us to reconnect on the topic of EOL equipment now that we are getting back to normal (of sorts)*
- *Where possible, we resell or refurbish locally, export and recycling is our last option*
- *We are a new vehicle seller*
- *Cost summary couldn't be entered above: In NZ, we've deployed Tesla product, please use Tesla's published price. I don't have the cost breakdown - costs include shipping, warehousing in a Chemcare warehouse, install and ongoing warranty support. No costs have been included for end-of-life but also include removal from site, warehousing in Chemcare warehouse, shipping to Australia for end-of-life. There are two parts of our organisation related to batteries:*
    - *1. Networks have procured and installed batteries for network or customer benefit within its network boundaries, Auckland. there is no direct revenue. Batteries are procured from an OEM, in this case Tesla, installed and ownership remains with Vector, or transfers after 10 years in the case of some residential installs.*
    - *2. Commercial sales of commercial and utility scale battery systems here and in the Pacific Islands - procure from an OEM, design, install and support the solution"*
- *we also capture electolyte materials and make the hazard inert prior to recyling or dispossal.*
- *Metalman New Zealand are New Zealand's largest recycler of Used Lead Acid Batteries. We handle batteries on a daily basis and the recycling of them is a core part of our overall business. We see our market reach as a valuable tool and we will utilize this to the best of our ability. Metalman is a New Zealand owned and operated business with 5 branches across the North and South Islands.*

  Currently our costing is based on sending containers of Mixed Waste batteries - Nickel Metal Hydride, Nickel Cadmium and Lithium Batteries (Large and Small and includes EV) to Envirostream in Australia. We have submitted a permit application to the New Zealand and Australian EPA's on Friday the 21st of August 2020. The cost of a permit is exorbitant however it is a necessary step Metalman

must first take in order to ensure these batteries are being recycled safely and effectively as the preferred option of an onshore facility is not yet available in New Zealand.

Recycling these batteries by sending them to Envirostream in Australia is Metalman's short term objective. With backing from Envirostream Australia and Lithium Australia, we are investigating a Joint Venture to establish an onshore battery recycling facility here in New Zealand. This recycling facility would be capable of recycling all batteries (Large and Small) including Alkaline and Zinc Batteries but excluding Nickel Cadmium and Lead Acid batteries. To achieve a successful facility, we would require funding from the Ministry for Environment to assist in establishing the setup and running costs of this facility for at least the first few years.

The onshore facility would be capable in providing collection schemes for businesses large and small. We would work under the same model that has been successfully piloted in Australia by Envirostream.

Metalman New Zealand and their appointed third party collector have created the framework which led a successful recycling scheme operated by the Christchurch City Council. From May 2019 to March 2020 6683kgs of batteries were diverted from landfill and sent to Metalman for recycling. Approx. 3800kgs of Zinc Alkaline Batteries, Approx. 1000kgs of Lithium Batteries, Approx. 600kgs of tool batteries, Approx. 700kgs of Nickel Cadmium with the balance being other and Lead Acid Batteries. The Christchurch City Council has re-signed to this scheme for a further 12 months and will be adding additional drop off locations around Christchurch.

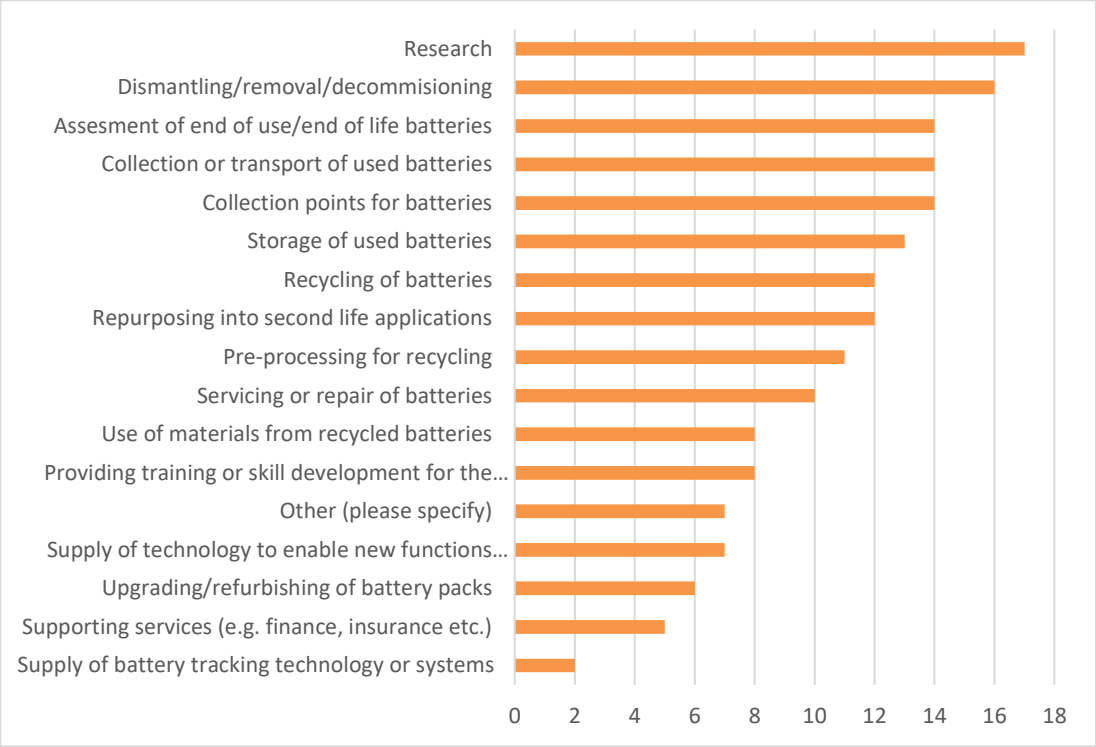
There is large scope for this scheme to be rolled out by every Council operating in New Zealand. Once our permit is issued, we will be able to put a lot more force into both collection and education to divert as much as possible from landfill.

We believe that once New Zealand has an onshore recycling facility a law needs to be passed to prohibit these batteries from entering landfill and to prohibit the public from putting batteries into their rubbish bins at home. Once the public are aware of what is available it will also assist in preventing individuals from hiding batteries in their general Scrap Metal when going to Metal Recyclers. It is an issue every Metal Recycler faces on a daily basis and a solution will mitigate this risk.

- *We are still in the pilot stage and evaluating where the value streams lie. We have been able to realise some income through supply of modules to our subsidiary that builds smaller bespoke EVs. Sourcing stock at a commercially viable price is an issue.*
- *Our logistics brands move only parcels. We do not keep centralised record data of battery movements.*

- *Our DG policy is attached: https://help.nzcouriers.co.nz/dangerous-prohibited-goods/dangerous-goods-policy-nz*
- *We don't have any meaningful metrics of this nature at this time, suffice to say our current costs are too high per kg and we are looking to economies of scale as the business grows*
- *no*
- *Please note, I am only involved in Panasonic's solar batteries. The consumer side of the battery business is separate but these are small batteries.*
- *https://www.enersys.com/*
- *As an emergency responder we deal with product failure rather than ownership issues. Responsibility for disposal usually rests with battery owner. In time ideally FENZ will be providing informed safety advice on safe battery ownership.*
- *Fleet operator*
- *We are a local authority and from a large battery perspective only deal with ex vehicle batteries most of which will be sent to scrap merchants for reprocessing*

A.3.2.13 Q.24: Does your organisation have any future plans to develop capacity or capability relevant to large battery product stewardship? Please check any that apply.



Answered: 45, Skipped: 15

The 'other' responses included the following:

- *No, we would be a customer of some of these services*
- *Involved with MIA & Drive Electric on Disruption Activist duties*
- *Our parent company Freightways may look to invest in the both the logistics and processing components discussed here, leveraging off our nationwide/trans-Tasman infrastructure. The present challenge is understanding the risk and opportunity - e.g., does our current capability address some of the need or will we need wholly new infrastructure?*
- *Supporting community involvement in creating real employment around supporting the recovery of these batteries*
- *Supply of battery life cycle management system with ability to see state of health results and on board second life data*
- *Uncertain of future activities*
- *We are interested in our existing Hazardous Waste service provision and infrastructure could support a large battery re purposing programme.*

A.3.3Part 2 Responses – Scheme Preferences

A.3.3.1 Q.25-27: Scheme preferences by criteria

The 'strawman' schemes for which feedback was sought in brief were:

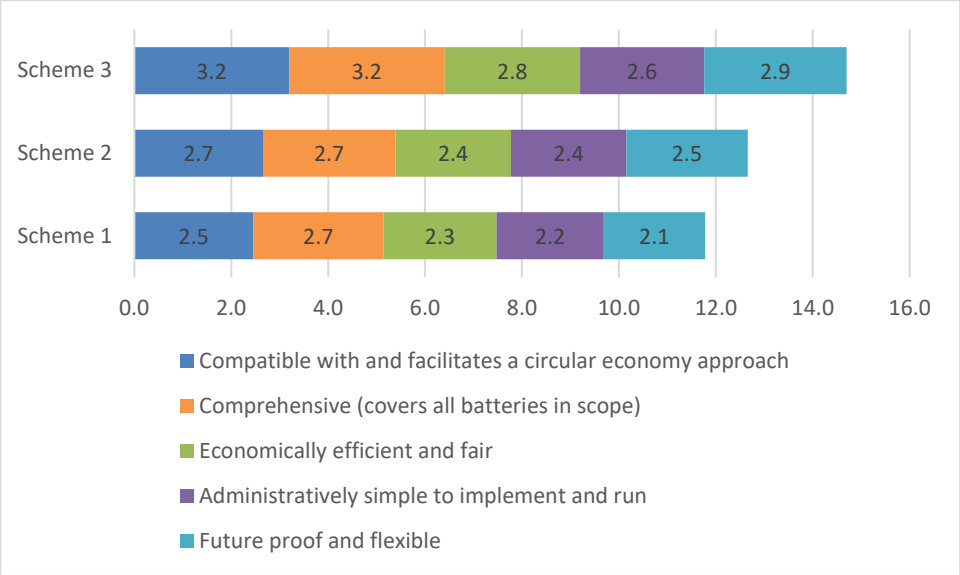
- **Scheme 1: Importer Led.** The key features are:
  - Importers responsible for taking back their own product
  - A single organisation oversees accrediting, monitoring, reporting and compliance
  - Scheme costs met by a membership fee.
- **Scheme 2: Producer Responsibility Organisation Led.** The key features are:
  - Batteries collected and managed by a single organisation
  - Costs met through advance disposal charge based on market share
  - Accredited importers can opt out.
- **Scheme 3: Producer Responsibility Organisation Led with Refundable Deposit.** The key features are:
  - Batteries collected and managed by a single organisation
  - Costs met through advance disposal charge based on market share
  - Accredited importers can opt to receive their own batteries back once collected
  - A refundable deposit is attached to each battery to incentivise returns to the system.

Respondents were asked to rate each scheme according to the following 5 criteria:

- Compatible with and facilitates a circular economy approach
- Comprehensive (covers all batteries in scope)
- Economically efficient and fair
- Administratively simple to implement and run

- Future proof and flexible

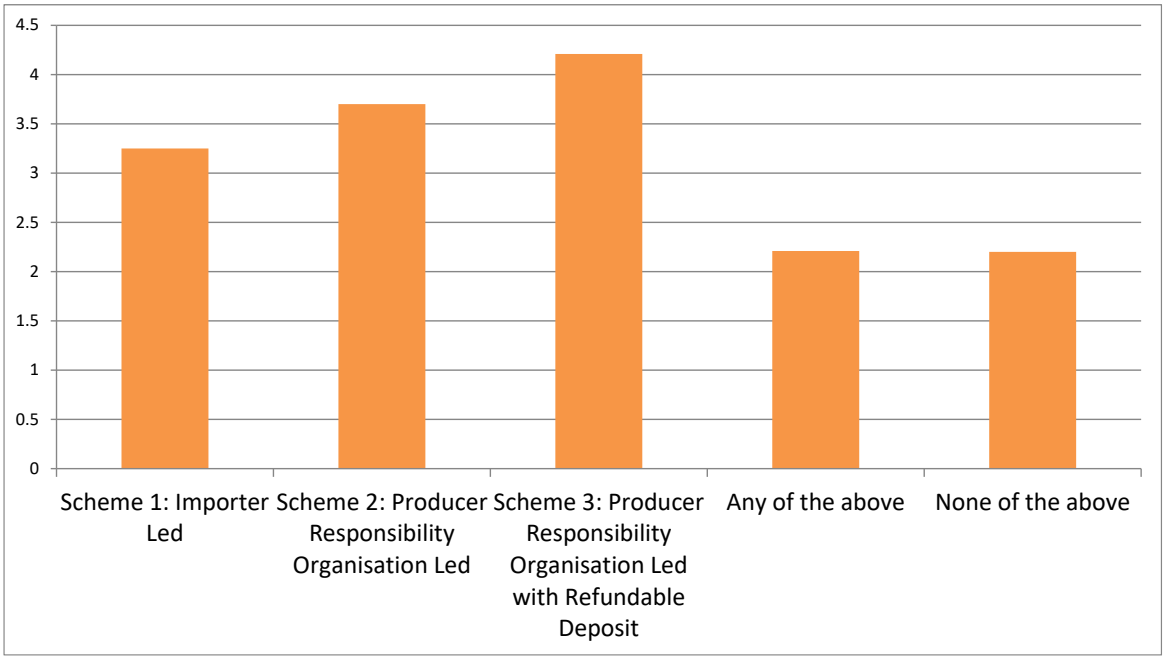
A summary of the responses is shown in the chart below:



Answered:35, Skipped: 25

The scores are out of 4 per criteria (total of 20). All schemes scored favourably on balance but scheme 3 was clearly preferred, scoring highest against all the criteria and overall.

A.3.3.2 Q. 28: Do you have a preferred scheme design of the three? Please rank the choices.



Answered:27, Skipped: 33

The above chart presents an aggregated score across all ranking choices (it is effectively a score out of 5). Scheme three is the most preferred option. It was ranked number 1 by 54% of respondents who provided a ranking. Scheme 2 was ranked second by 55% of respondents to the question and Scheme 1 was ranked third by 48% of respondents to the question.

Respondents were also asked to comment on each of the schemes. Their comments are presented below:

Table 19: Scheme 1 Comments

A more centralised PRO-led model may be able to better co-ordinate and support initiatives to re-use/re-purpose batteries onshore before they are recycled on or offshore.
Many used importers come and go and will take no responsibility for the vehicles. eg Takata Air bags importers *Therefore all the orphan recycle costs are unfairly put on the new importers,*
Regarding access to collection networks, for stationary batteries many that would be classified as an importer are not in the business of battery import so would rely on third-party collection and recycling. *Those importing stationary batteries for resale to other organisations eg an import wholesaler are possibly earning the least revenue in the value chain while they can pass that cost on to the purchaser it may be a bit of a barrier, transparent fees that are passed on could help.* *It could be challenging for importers who sell wholesale to track batteries and remain responsible eg they sell to Vector, Vector sells the battery system to a customer - the importer is reliant on eg Vector having good tracking management.*
What do the organisations taking back the batteries then do with them?
This doesn't cater to the principle that the ownership of the vehicle/ battery changes hands, so an importer doesn't have or retain rights to force a process/policy on an owner. *For EVs, some importers of used are small or independent companies, without the resource, & who change hands regularly, or operate for short time cycles of under 5 years, so up to 20% of EV's may be imported & retailed by operators who won't be around at life end or 2nd life.* *Additionally many source different brands & product types, (also Private light vehicles*

& Commercial vehicles & micro-mobility or heavy goods - so varied). *OEM's can handle it - but won't be interested in a 2nd life value chain or refurbishment/recycling. They will leave that, as now, to waste/dismantlers/recyclers. e.g. in case of accident the insurer & breaker then own the vehicle & battery.* *However - any fee will just get passed on to first buyer - rather than spread over life, so counter productive to selling price. Any fees collected really need spreading over owner registrations for car EV's.*
The programme to collect and reuse batteries must be market led. *Central Government involvement is not necessary and will distort the market.* *I totally do not accept the above approach is necessary.*
BRANZ does not wish to make comment on how any proposed scheme might run.
Biggest issue I see is used imports that are imported by about 400 different small businesses. Second biggest issue is the triage at end of EV life, and there being no requirement to consider repurposing if it is not economical. It might be simple to implement and run but would not capture all batteries. It is also not clear that once broken down to modules or cells it is evident who's battery it was, so process of refurbishing where several batteries are combined to make one good one for reinstallation into an EV might create a set of waste product (the leftovers) that have no clear place to go. *Another issue may be that we think in terms of imported EVs, while there might also be imported batteries brought in for replacement by aftermarket suppliers.*
It will be hard to manage all of the used car importers in this scheme
The governance of the scheme needs to include stakeholders from the whole chain of the lifecycle within Aotearoa. The Importers are not likely to be independent and there is no guarantee that they will support the communities that are involved in the big battery lifecycle.
Feel unable to accurately score as don't know enough about battery importing business.
This scheme does not fully explain how membership fees will cover its overheads. Also, less control over the initial outcomes of the scheme could steer the PS in the wrong direction. This model can work best for mature products such as waste oil or metals etc. but not for batteries.

Membership fees - will these be sufficient to support the scheme?

Table 20: Scheme 2 Comments

The PRO needs to be strongly encouraging of initiatives to re-use/re-purpose batteries onshore before they are recycled on or offshore. This would be one of the key ways in which the PRO could foster circular product stewardship above and beyond an importer-led scheme. *In order for the scheme to be economically efficient and administratively simple, it will be important to scale the PRO model with demand for re-use/recycling. Overbuilding the scheme in its early days could place an excessive burden on relatively few industry participants.*
A fee on imports seems easier to achieve than a membership based fee - membership implies that you can choose, even though in this case it doesn't. *The clear ownership of the PRO seems like it would make the management of the scheme and therefore the success more achievable.*
Better approach than Scheme 1
Costs? - Market share of what? - segments & market data frequently distorted, and Used Imports vs New Imports are measured differently not collated centrally. Different industry bodies & controls. *NZTA have poor systems to provide any reporting & control.* *So any fee needs to be PER unit volumes. The Motor Vehicle Register process identifies BEV, PHEV, Hybrid - so this can be used for accuracy.* *For EV/Hybrid car batteries, a fee at first registration to hold in advance would could feed an industry that forces circularity on the lifecycle. However, the first owner/importer pays all the fee, for a 10-15 yr life, when the subsequent owners from yr 4-15 pay nothing. Any producer fee would be passed on to first consumer in EV price.* *> Alternatively, the annual Rego fee could reflect a nominal annual obligation fee - or through the WOF. to spread the cost over user life. Each User is then funding a levy, just like in ACC portion. Say $15/yr?*
There is no need to have a central organisation. *There is no fee necessary for disposal charges-- the company processing the battery*

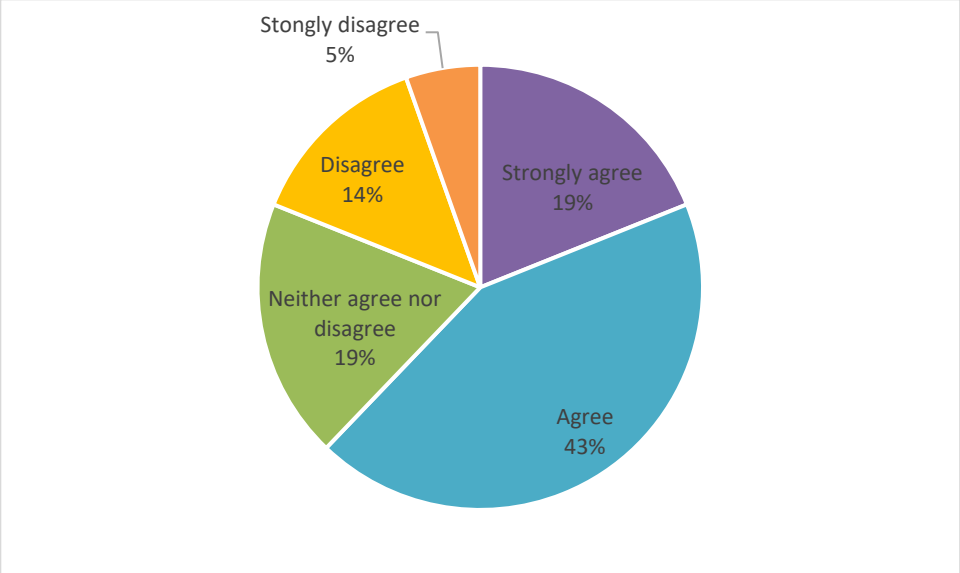
will make the market. *Importers would only supply new batteries.*
BRANZ does not wish to make comment on how any proposed scheme might run.
Biggest issue I see is used imports that are imported by about 400 different small businesses. Currently collecting a levy at time of import will make EVs less attractive vs ICE vehicles. Issue with fact that an EV battery is really an assembly of smaller batteries in modules, which if taken apart are no longer 'a battery'. No method for enabling or encouraging repurposing. No incentive for user to bring back the battery.
The governance of the scheme (the PRO) needs to include stakeholders from the whole chain of the lifecycle within Aotearoa. Importers should not be allowed to opt out of the PRO scheme.
As above
Good scheme maintains control over the lifecycle of the battery and offers flexibility for approved OEMs to recall their batteries to give them the opportunity to test and experiment with their technology and R&D.
not sure what is meant by accredited importers can opt out? Suggest avoidance as opposed to compliance?

Table 21: Scheme 3 Comments

This is the system we'd prefer to see as it ensure that the key players have "skin in the game".
See previous comment.
Cost structure should be based on two factors *1/ The battery size in the vehicle.* *2/ Management fee should be based on market share.* *3/ Costs should be levied at registration time so all vehicles , new and used are captured to avoid orphans* *and unlicensed used importers avoiding the fee.*

I like the idea of a refundable deposit to encourage the recovery, given the long life of the product and potential challenge in tracking changes of ownership (more so for EVs) this could be challenging.
Probably the best approach.
As a battery in EVs change owners several times through life, who will own the deposit? It will be a lot to administer change of owners of the deposit. *Too large a proportion of vehicles also pass through traders at several points of stocking, between owners too. A refundable deposit won't work.* *However, a returns incentive would be viable, if funded within the other schemes - e.g. if there is an annual "EoL/ Recycle Battery" fee in Rego or WOF, make it say $25 p/yr, rather than $15/yr, to generate $10 /yr - so by 15yrs, $150 can be offered as 'amnesty-exchange reward'.*
The only item to control is that batteries must go to a recycling centre and cannot be dumped to waste or buried.
BRANZ does not wish to make comment on how any proposed scheme might run.
More likely to encourage return of battery. Difficult to track batteries and so less simple to run and keep refund linked to the battery it was intended for, if that is the intention. Needs flexibility to enable changing incentive to ensure return. Damages EV market in the short term while EVs are more expensive than ICEVs.
Probably a hybrid of the 2 & 3 would be worth considering
The governance of the scheme (the PRO) needs to include stakeholders from the whole chain of the lifecycle within Aotearoa. This is the option I support because it does not allow opt outs.
As above
Good scheme as well as far as ensuring the application of circular economy. the refundable deposit offers a good incentive and retained value in the large batteries to ensure good handling and guarantees collection aspect. it may be more complex to administer but ensures flexibility for future required changes.
Bingo - I think this captures the broad suite response required to enact behaviour change through incentivisation.

A.3.3.3 Q.29: Governance. The Ministry for the Environment Guidelines recommend a single scheme for large batteries but makes allowance for more than one scheme if they can effectively collaborate. Do you agree there should be one scheme covering all large batteries?



Answered:37, Skipped: 23

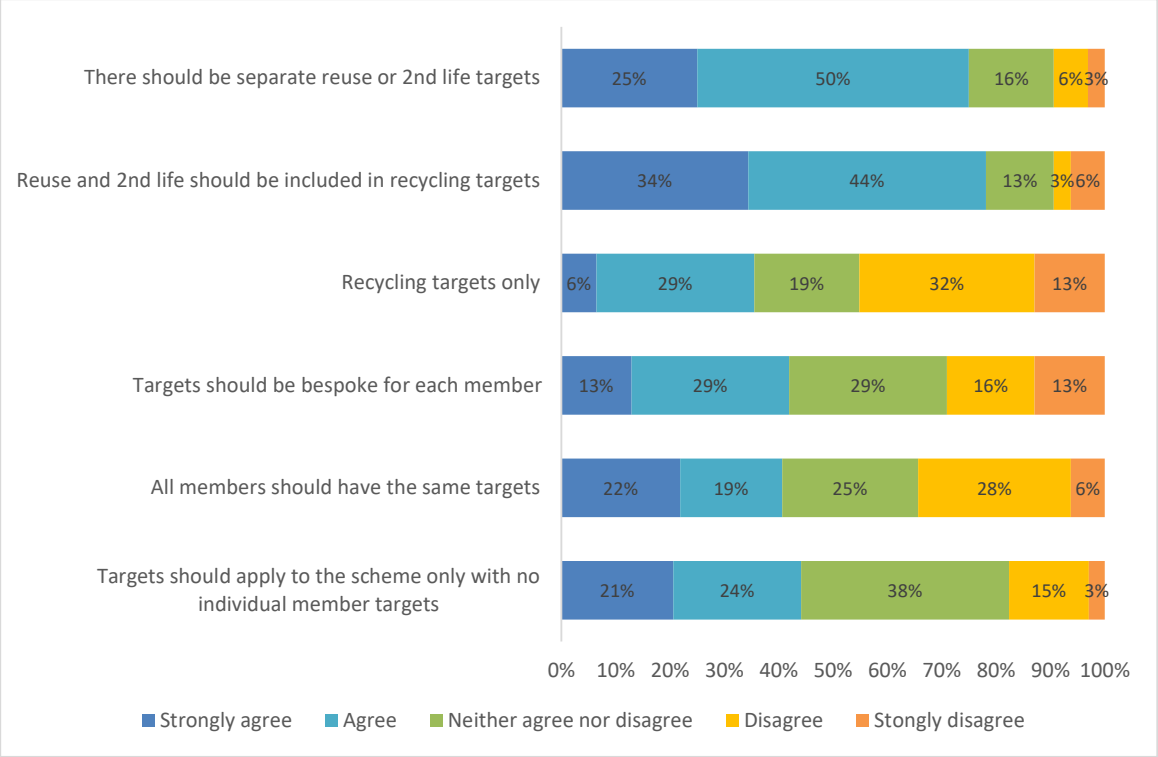
62% of respondents either agreed or strongly agreed that there should be a single scheme covering all large batteries.

Table 22: Comments on Single Scheme

Multiple schemes would make it difficult to ensure that batteries aren't double counted or "misplaced"
A high-level observation is that weight could become a challenging measure as the energy density (and therefore value and complexity) of different battery types will differ.
Please clarify the definition of "large battery".
I think it is going to be costly initially, having more than one scheme seems inefficient
I believe there should be one overall Scheme for Large Batteries and Small Batteries. To recycle large batteries you also need to have the ability to recycle the smaller ones.
Industries vary in structure & company type. The only similarity is that an OWNER should be registered with a battery, so the combined tracking is battery & owner - then a levy can be applied annually that all owners contribute to for it's EoL/Recycling, reuse 2nd life applications . This would also build & maintain a value in the battery

asset, even if the original OEM/Importer writes it off with no value. So the 2nd life/recycling chain has a base value to start from. before the condition/value & usability assessed.
The market for these batteries after they cannot be used in a vehicle is large and varied.
If they can work effectively together, then I see no reason to limit it to a single scheme, although a single scheme might be easier to manage.
The problem is they are not really large batteries. They are assemblies of smaller batteries. Not sure how you square that circle.
Already suggested it may need to be hybrid
This would make it much simpler for the public and resellers etc. to return product at end of life.
Needs alternatives
avoids confusion at an early stage
National coverage with councils given direction on how to participate.

A.3.3.4 Q.30: Targets. All accredited priority product schemes are required to have targets. Please indicate your views about targets.



Answered:34, Skipped: 26

The most well supported statement about targets was that re-use and second life should be included in recycling targets. Almost as well supported was the statement that there should be separate reuse or 2nd life targets. The least well supported statement was that there should be recycling targets only. Together these responses indicate that respondents perceive that reuse and second life should be measured and incentivised.

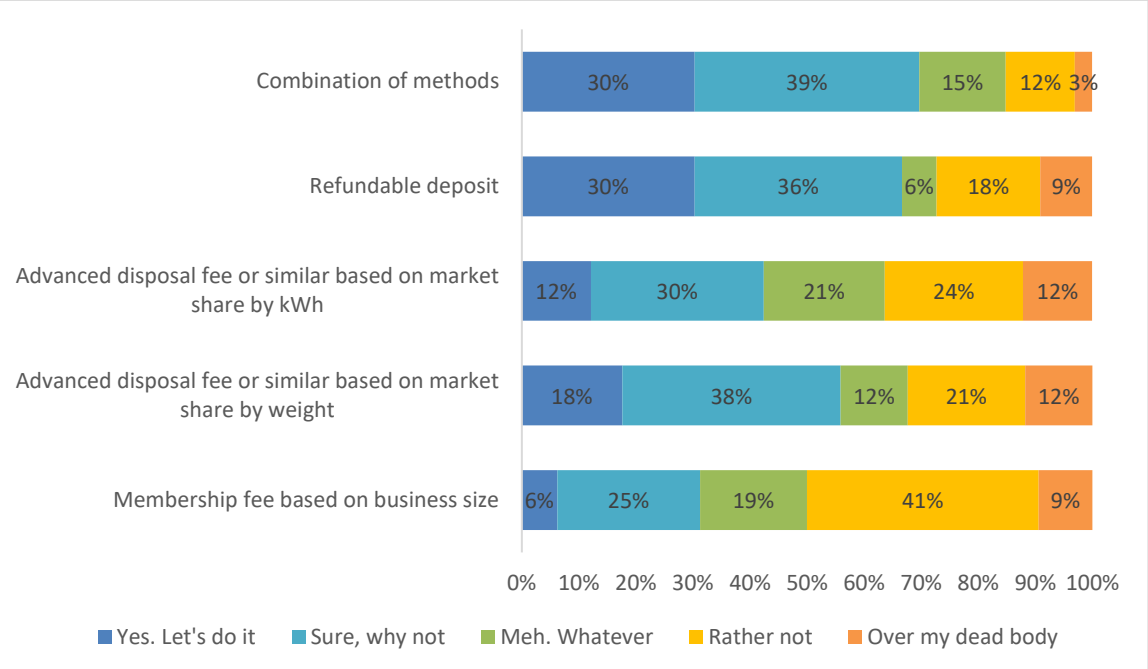
There was greater ambivalence about whether targets should be applied to individual scheme participants or to the scheme as a whole, with no option receiving a majority or 'agree' or 'disagree' responses. The most supported of these statements however was that targets should apply to the scheme as a whole and not to individual members. 45% of respondents either strongly agreed or agreed with this statement while 38% were neutral and only 18% disagreed or strongly disagreed.

There were a number of written comments on this aspect. These are shown in the table below:

There is likely value in having targets/incentives for reuse and recycling to support a strong circular approach. There should be an overall scheme target but how incentives fall on individual members within it needs to be thought about carefully - it should be in proportion to their activity, but probably not the "same" for everyone in an absolute sense.

I think this will need to evolve over time, I think at this point putting in a second-life target now would be difficult but want to see that evolve over time. I think there are differences in EV battery and stationary battery value chains so I don't think targets can necessarily be the same - this will be challenging to set!
The market will develop as batteries become available. There will be no waste
BRANZ does not wish to make comments on any targets set for any scheme proposed
I don't see the purpose of 'members'. Either it applies to everyone or it does not. Strategy for repurposing needs to be decided and then applied accordingly. Targets can also be easy to manipulate.
Targets should be across the board as a percentage of product. Reuse and 2nd life targets are critical and should not be linked with recycling targets.
The use of targets brings the consequence of non-achievement into the discourse. How would this be tracked and implemented? Would a bespoke legislative framework not provide a more strategic framework from which targets could emerge?

A.3.3.5 Q. 31: Funding. The scheme must be self-funding. Please rate the following funding options (bearing in mind some may depend on scheme type).



Answered:34, Skipped: 26

A combination of methods was the most favourably perceived option, followed by a refundable deposit. A membership fee based on business was the least favourably perceived option with 50% of respondents rating it negatively.

There were a number of written comments on this question. These are shown in the table below:

I think "weight" is a little too simplistic. kW/kWh is a better unit of measure for large batteries. The challenge with that is whether safety factors are built in, and mfr's artificially limit or under-report kWh ratings to reduce their recycling costs.
Based on kwh size of the battery in the individual vehicle and charged at registration or border importation Management fee should be charged on a market share basis Deposit refund based on the kwh size of the battery
By weight will be difficult - eg the original Powerwalls weighed approx 100kg, that isn't just the battery but we couldn't separate out the battery weight. The modules in the commercial/utility scale would be easier by weight but the first point will be true for most residential batteries.
None in themselves seem workable & members should not be dissuaded from participating. The deposit pull through from start to EoL /2nd life recycle is troublesome & admin burden. Through life owner annual fees - like a licence fee, should apply. Treat it like a gun? & a car ACC rego fee, rather than like a rental property bond!
All this supposed control is unnecessary. The market will be strong for 2nd use batteries and will develop
BRANZ does not wish to comment on how the scheme might be funded.
The used import component is a huge issue that none of your discussions address. It may be better to create an authority that gathers an annual levy via the vehicle registration system to cover the annual cost of enabling repurposing or recycling. This would simplify the matter a lot. It could be deficit funded, ie recover the cost incurred in 2025 from all EV owners in 2026.
The industry and consumers need to fund it with incentives to encourage longer life batteries, 2nd use options, use of less toxic, more recoverable/reuable materials, etc.

I'm not best placed to determine how best to fund it other than ensure rate and tax payers don't.
Share based on market share, or units sold
very important that it achieves this status. especially in the early years. being overly influenced by members may pose a threat to the scheme
I assume by market share this is the instrument to capture 'sales' and therefore liabilities?

A.3.3.6 Q.32: If there is a refundable deposit applied to imported batteries how should it be calculated and redeemed?

Answer Choices	Responses	
Based on weight (e.g. kg)	17.14%	6
Based on kWh	34.29%	12
Set rate based on battery type (e.g. vehicle battery, home stationary storage, commercial stationary storage)	17.14%	6
Other (please specify)	31.43%	11
	Answered	**35**
	Skipped	**25**

The most popular option was for a refundable deposit to be calculated and redeemed based on the battery capacity. However, a similar number of respondents also selected the 'other' option. These responses are shown in the table below:

kWh and type of battery. Have to match recycling and reprocessing with battery type.
equivalent battery units converted based on weight
unworkable - too many owners to pass through during 1st life.
Not necessary. It all adds costs that make obtaining an electric or hybrid vehicle more expensive.

Given that landfill is generally based on weight (which we are trying to reduce) and the batteries may or may not be in serviceable condition (capacity may vary), this makes the most sense.
It should be able to be flexible so that it can be adjusted as needed to ensure maximum returns.
I'm not best placed to assess this, although I don't think weight should be the criteria.
Wgt or kWh
Pricing should be set by battery chemistry
Battery weights will reduce over time
Does the value of the deposit not have to be tied to the motivation of the user to return it and the original sales value of the battery?

A.3.3.7 Q.33: If there is refundable deposit applied to imported large batteries, how much should this deposit be?

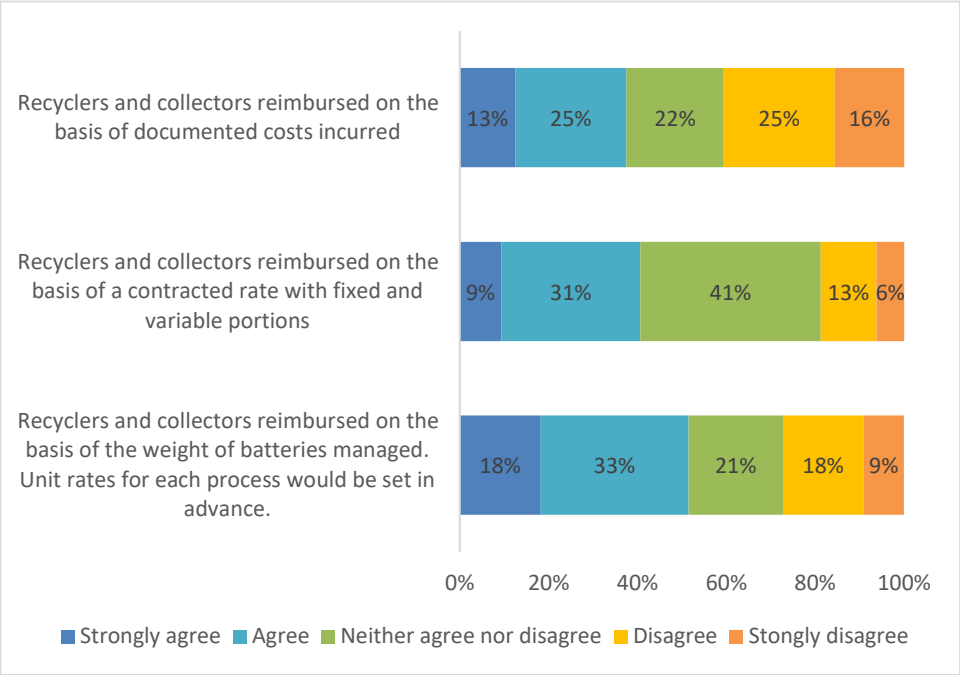
This was an open ended answer. 20 responses were received, and 40 respondents skipped the question. The responses are shown in the table below:

Sufficient to incentivise their return
$2.50 per kg
$20/kWh
Dont know.
Freight cost to sale
Sufficient to incentivise their return
$1000
No idea!
Until the recycling Market is well versed and understood it is difficult to indicate however when batteries are recycled they are recycled on their weight not kWh
4.00

build during life to be $300-$500. So that as a minimum it has that base value of redeemable circular economy in it.
NIL
TBD
See answer above. It will be applied 20 years into the future, you are just guessing.
sufficient to cover recovery and recycling costs
I have no idea how much these cost. The deposit should be sufficient to encourage their return and so perhaps market research should be performed to identify this.
$250 - $1000/battery (USD)
1
Don't have enough info to know
$25 per kWh

A.3.3.8 Q.34: Rebating of fees. Depending on the scheme design fees collected from importers will need to be applied to meet the costs

of parties operating the scheme. Please indicate your views on the suggested methods below:

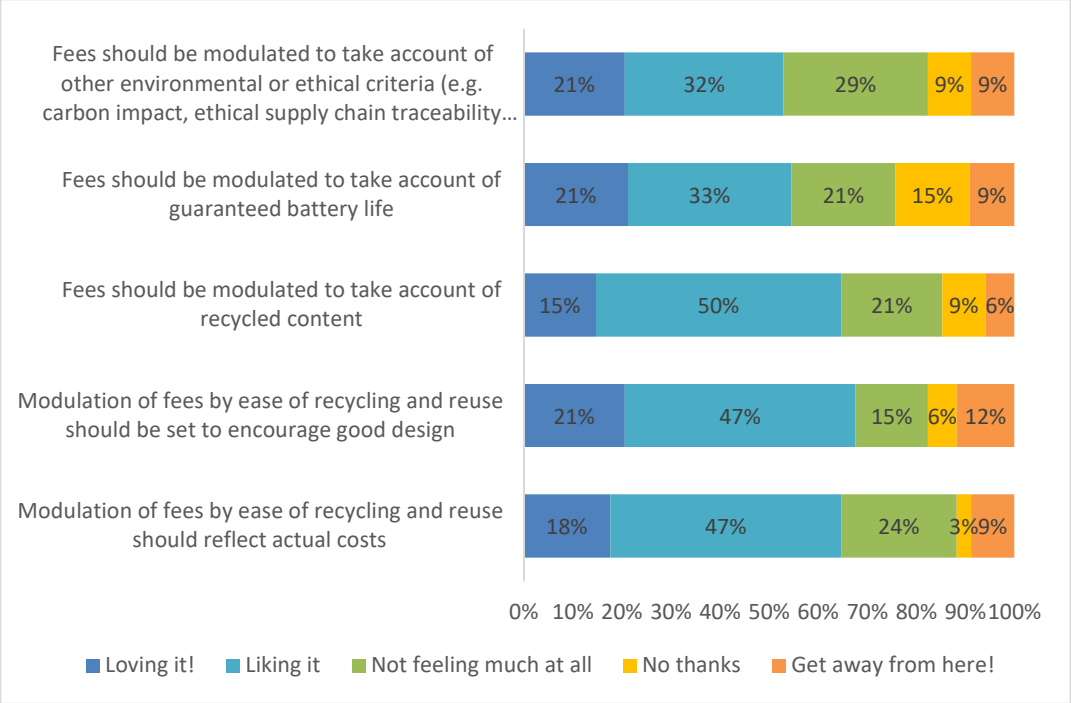


Answered:34, Skipped: 26

The preferred option selected by respondents was "*Recyclers and collectors reimbursed on the basis of the weight of batteries managed. Unit rates for each process would be set in advance.".* Six respondents selected 'other'. Their responses are presented in the table below:

Not sure at this stage, arguments for and against - having known costs upfront vs paying actual costs
BRANZ does not wish to comment on the financial aspects of the operation of the scheme
You make no mention of the potential value of batteries for recycling: do they make a return or do we need to pay the recycler? We are talking 20 years into the future. How can you make these decisions now?
I don't have the background to respond to this, other than I don't believe weight should be a criteria.
Needs to reflect what goes into it
need to keep an open mind on this initially to encourage entrants

A.3.3.9 Q.35: Product Design. Fees must be modulated according to criteria such as ease of recyclability and reuse. Please indicate your views.



Answered:34, Skipped: 26

The views of modulation of fees were not clear cut with all options receiving a majority of favourable responses. Marginally the most popular was for "Modulation of fees by ease of recycling and reuse should be set to encourage good design".

The following comments were also made on this question:

Liking it on all counts but this will be challenging - who determines ease of recycling, reuse. Recycled content and warranted battery life will be easier (assuming there's no penalties if they don't achieve it as the user has influence over the life), like the other ethical components.
All battery designs are developing for long life and efficiency. Any vehicles that don't meet high standards will not sell. There is no need to control this. It adds cost, distorts the market, and leads to unintended consequences.
Batteries from EV's may be sent through this process as a result of a near new vehicle being involved in a collision, therefore the guaranteed life of the battery might be irrelevant and although, designed to be easily recycled in it's original form, might complicate recycling in it's damaged state. So I'm not sure how fees could be fairly modulated in these ways??

These are all so far into the future, who is going to be able to make a sensible assessment of the future cost of dealing with an end of life battery in quarter of a century? Keeping track of the untrackable? Not knowing when that life will actually end?
The scheme needs to be self funded so all the costs need to be covered.
Not sure how much influence nz can have on design
fees could differentiate between original and after-market battery quality

A.3.3.10 Q. 36: Please provide any additional comments you have on product stewardship scheme design.

This was an open-ended question. There were 10 responses while 50 respondents skipped the question.

Ensure the collection points and handlers can be varied and high in number and that they get a handling fee based on weight.
Bring it on.
It is important that the stewardship design also encompasses other small waste batteries. From Laptops to Cell phones to general rechargeable AA Household batteries, many have long reached their EOL and the process for recycling them is much the same as Electric Vehicles batteries, all batteries should all be treated the same. The majority of Landfills around NZ are encapsulating these batteries and they are entering landfill at an alarming rate. Fast tracking a stewardship design that includes both large and small batteries is the best way to divert these recyclable wastes from our landfills
Treat a Big Battery like a gun, or ACC contribution agency model. or like a PPSR register, vested interest & liability. A licence/registration fee required.
Please resist trying to control how batteries are reused. There will be market demand. The main thing preventing startup is a lack of supply. Batteries are in cars longer than many people predicted
No further comments
I think this process is picking up a great idea applied to glass bottles and trying to apply it to crystal balls. There could be some value to encourage better product design to track and charge costs based on the actual cost of disposal of types or classes of battery, but I think they should be charged to consumers in the year they are incurred, rather than trying to guess from this vantage point how things are going to pan out.

Used imports make it imperative to put the cost onto consumers rather than manufacturers or importers.
This survey has taken more than 20min, partly due to interruptions, and it has been difficult to give it full attention and spend enough time considering the questions.
The governance must include representation from the whole industry lifecycle - including collectors. Collection sites must be paid for the service they provide, otherwise the costs of providing the service fall on ratepayers, or the community.
This is a fast-evolving industry and new types of batteries and processes might come to light in the coming years. the scheme should have a built-in flexibility to allow a review of the design every 3-5 years.

A.3.4Summary

The survey yielded valuable information on the views of stakeholders and the activities they undertake. Key points to emerge are noted below:

A.3.4.1 Part 1: Stakeholder Profiles

- The respondents covered the full spectrum of the value chain.
- Many respondents are involved across multiple areas of the value chain
- End of battery life management, administration, networks, research & advisory, and owners were the most heavily represented, with installers, servicing and upgraders also well represented.
- Over half of the respondents physically handle large batteries as part of their involvement
- Over half of respondents do not use any systems for tracking batteries or their components
- Respondents reported processing 5,681.6 tonnes per annum of lithium-ion batteries and 72.5 tonnes of Nickel Metal Hydride batteries. This includes batteries processed in overseas facilities associated with the respondents.
- Most respondents say they have plans to develop capacity and or capability in relation to large battery product stewardship

A.3.4.2 Part 2: Strawman Scheme Designs

- The scheme design viewed most favourably by respondents was Scheme 3 which is a producer responsibility organisation led scheme with the following features:
    - Batteries collected and managed by a single organisation
    - Costs met through advance disposal charge based on market share

    - Accredited importers can opt to receive their own batteries back once collected
    - A refundable deposit is attached to each battery to incentivise returns to the system.
- While most respondents were favourable towards a product stewardship scheme, a number raised concerns about practicality and how things might work in practice. Some frequently mentioned concerns included:
    - There was concern (misconception) among some respondents that the scheme would be trying to track the individual costs of recovering each battery and bill these back to the manufacturer/importer. This would be both complex and have a high risk of there being orphan product.
    - That the cost of the scheme might provide a disincentive to EV adoption. An annual charge (for example paid by consumers as part of an annual vehicle registration charge) rather than an up-front charge was suggested as a viable method for spreading the costs of the scheme
    - It is going to be difficult to track batteries through the system
    - Things will change a lot in the battery space over time and the scheme needs to have flexibility
- A small number of respondents did not see a need for a scheme and were of the view that the market would provide solutions. They saw a product stewardship scheme as mainly adding cost.
- A single scheme for all large end of life batteries was preferred.
- Reuse/second life should be incorporated into targets in some fashion
- A combination of methods to recoup the costs of the scheme was most widely favoured, while a refundable deposit was also viewed favourably
- Views on modulating fees on the basis of environmental criteria were mixed. There was some scepticism as to how this could be equitably achieved and whether fee modulation would have any discernible impact.

A.4.0 Stakeholders Interviewed

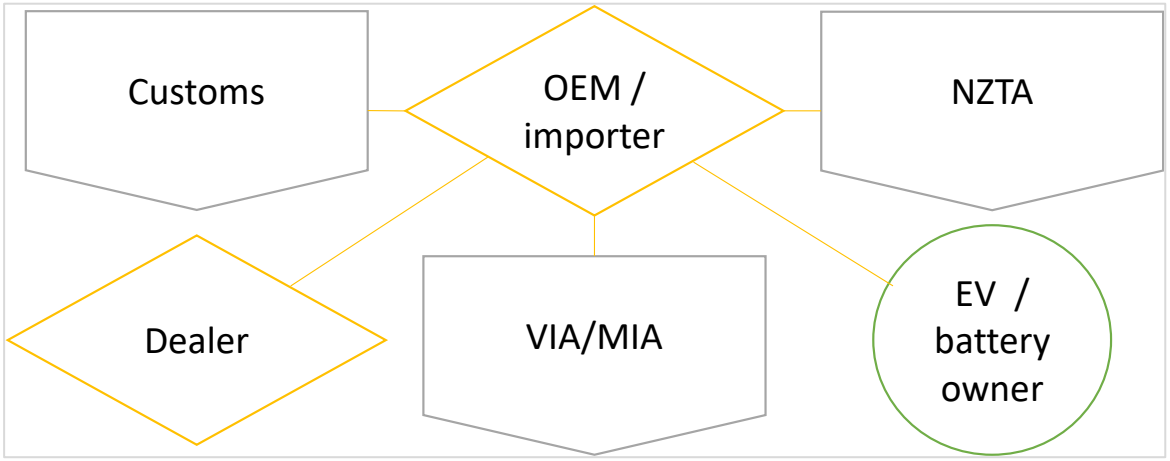
Jo Phillips	Vector
Phil Haynes	Juno & Jupiter
Paul Minnet	Strategic Lift
John Evans	ITRecycla
Jackson White	Vector
Jasmine Faulkner	Metalman
Dana Peterson	MfE
Ken Byng	Car Take Back
Adele Rose	3R
Michael Dudley	Techcollect
Priti Ambani	TCS
Bill Alexander	Blue Cars
Basil Issa	EECA
Raymond Tancrel	ETCO
Phil Lockwood & Kirsty Marshall	NZ Customs
Rick Barber	NZTA

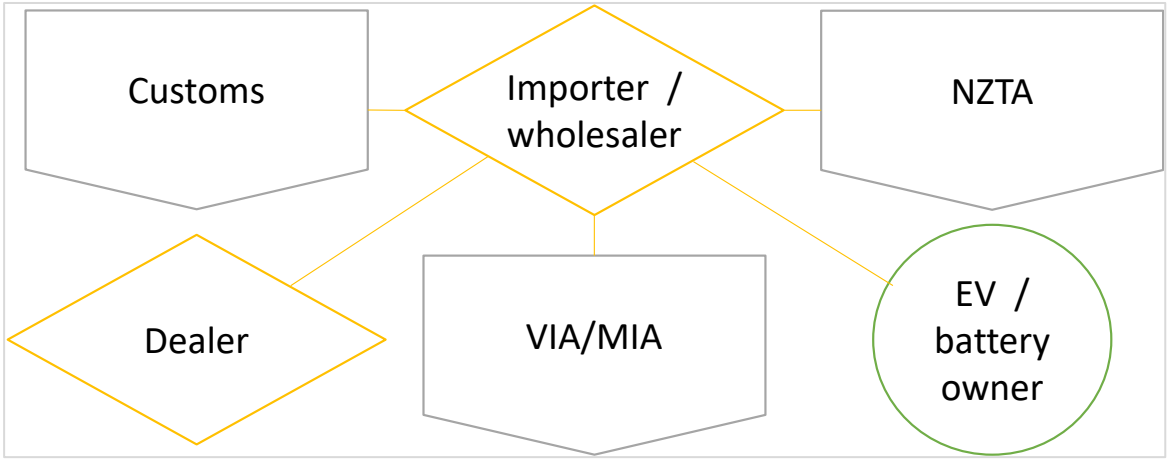
A.5.0 Value Chain Detail

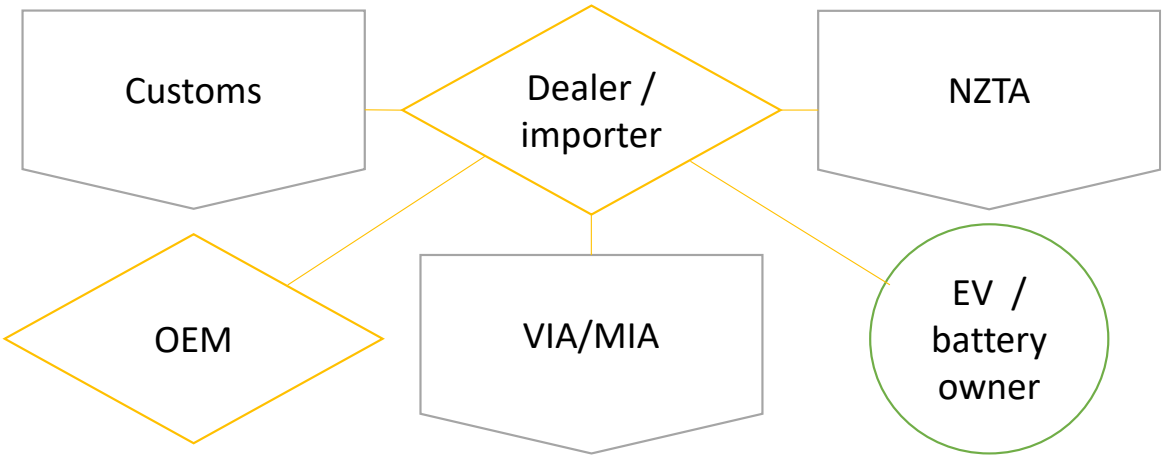
The detailed value chain maps are presented as single layer interactions. Showing all the interactions on a single map becomes too complex to be meaningful. We have therefore broken the interactions down to the individual stakeholder level. For example, we show on a single map the key interactions for an EV owner, or a mechanic, battery recycler etc. While this does result in a lot of maps, it also makes it clear what the key interaction are, which is vital in being able to identify the potential impact of a product stewardship scheme.

The value chain maps do not cover all interactions but focus on those that involve physical action with or transfer of the battery.

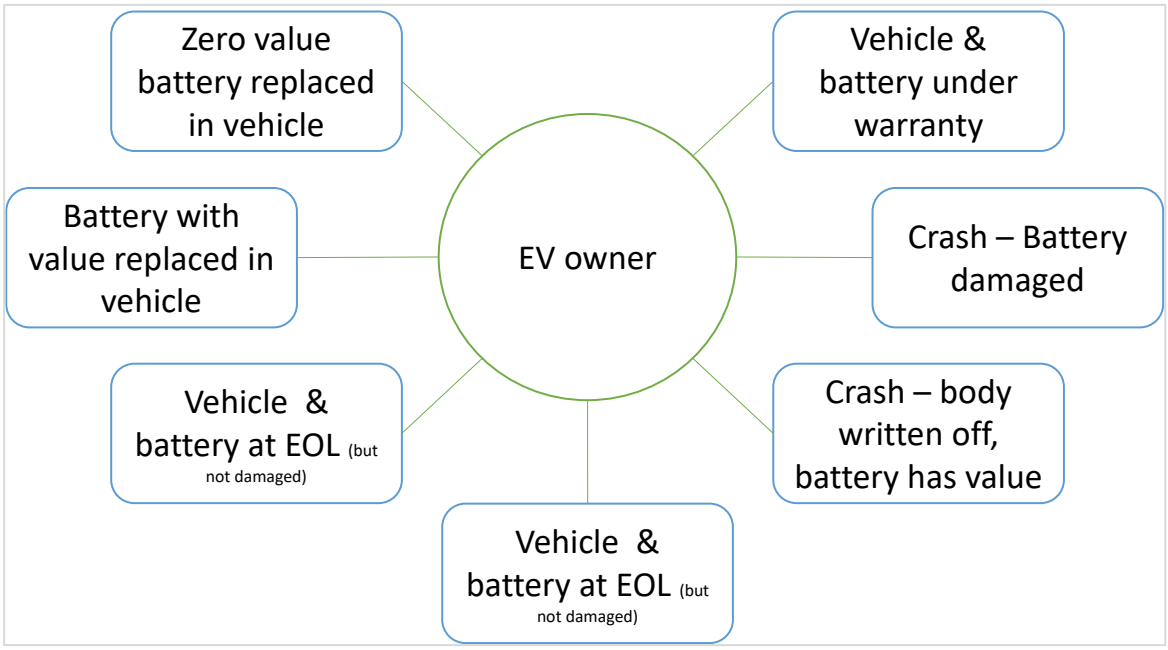
A.5.1Import

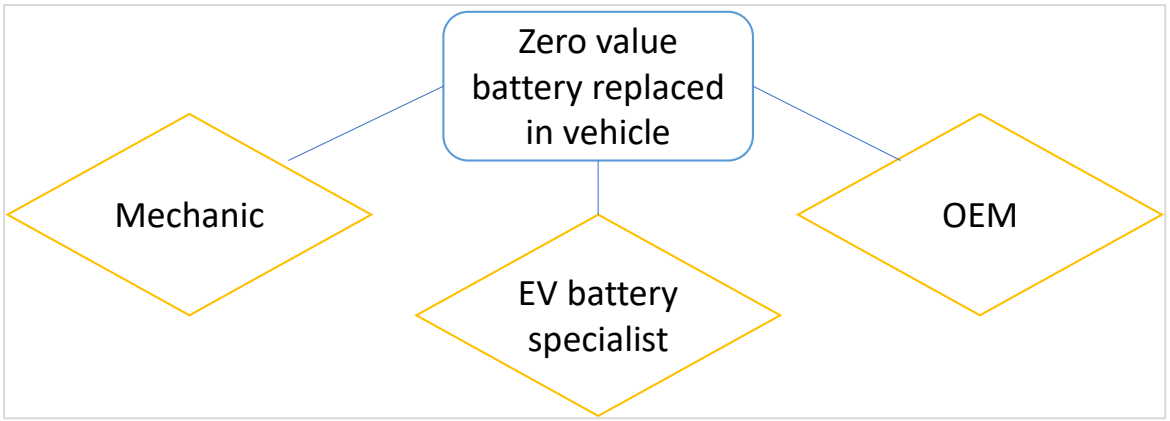


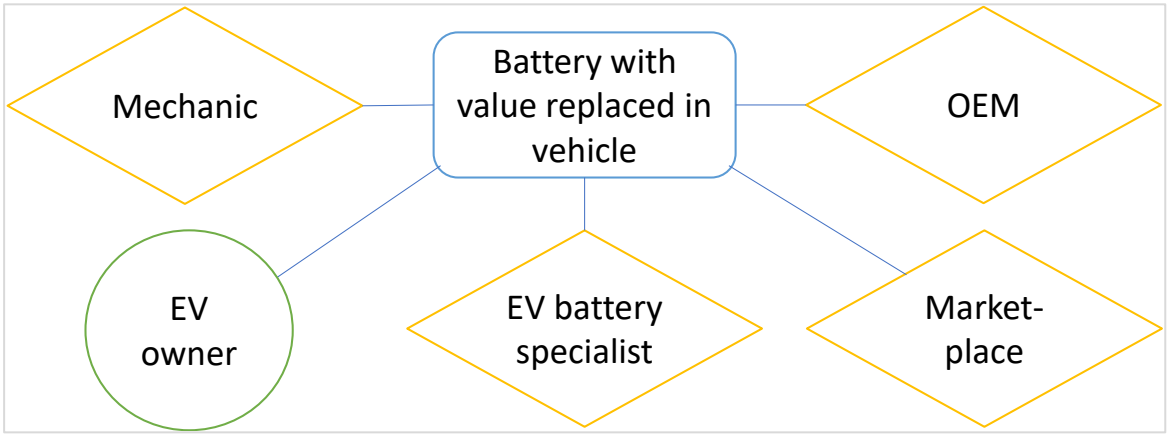


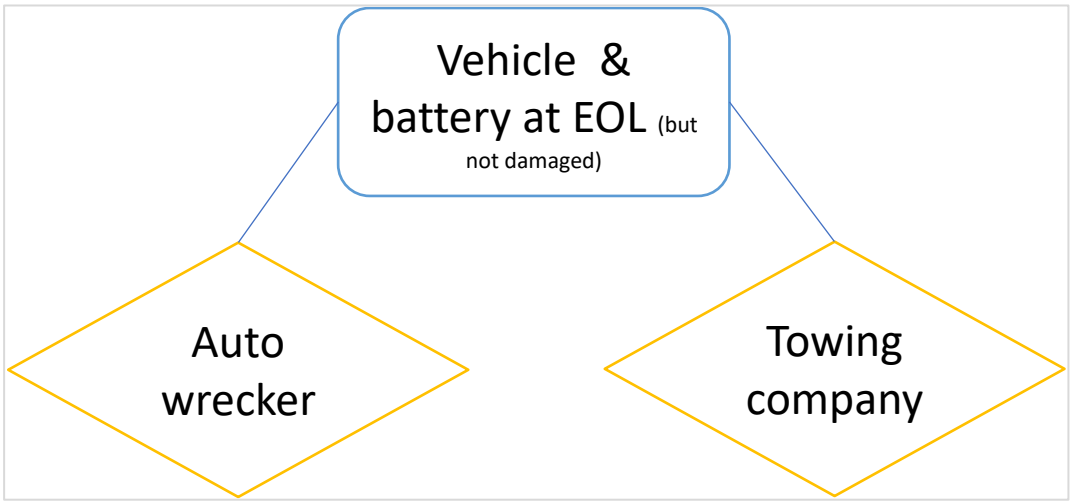


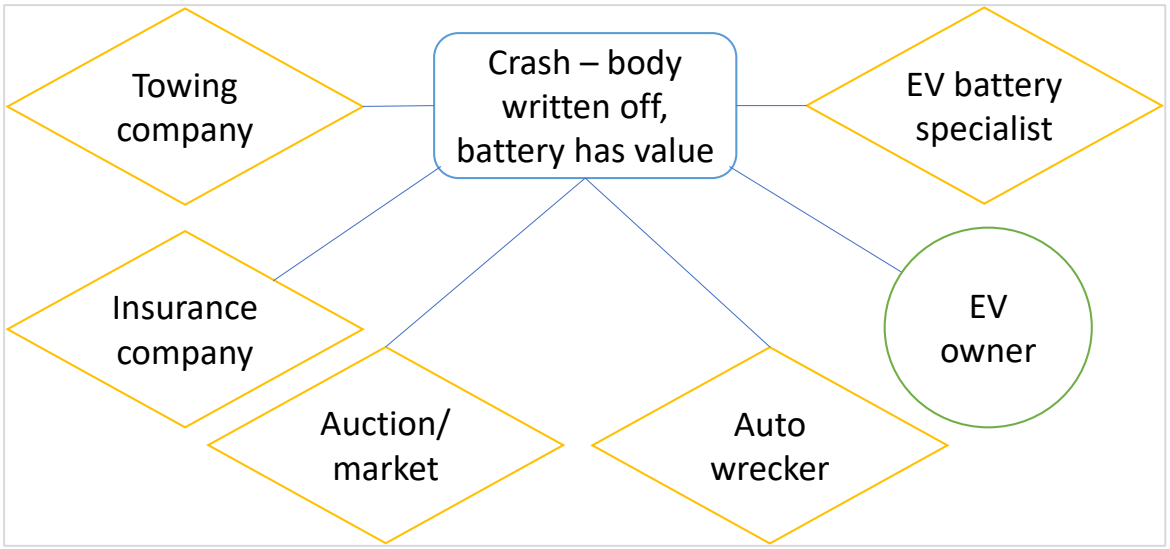
A.5.2End of Use/End of Life

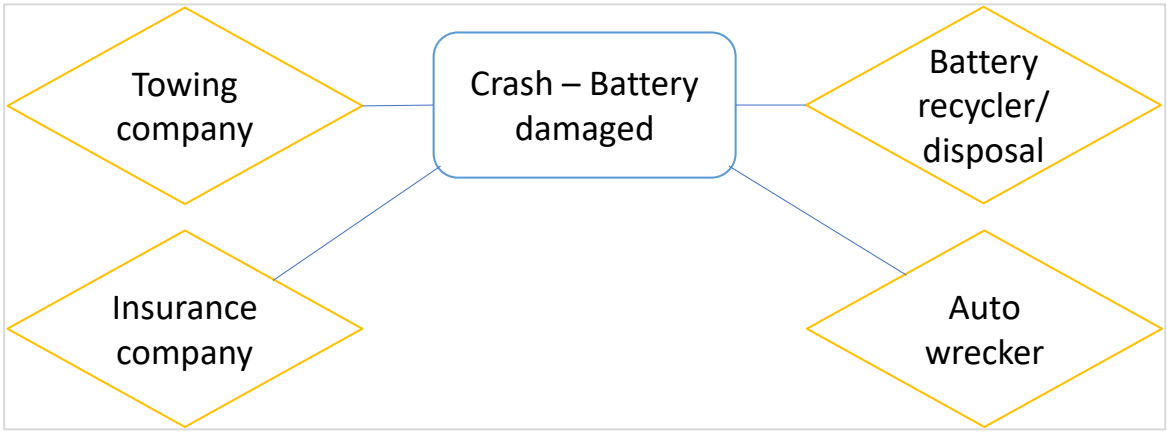


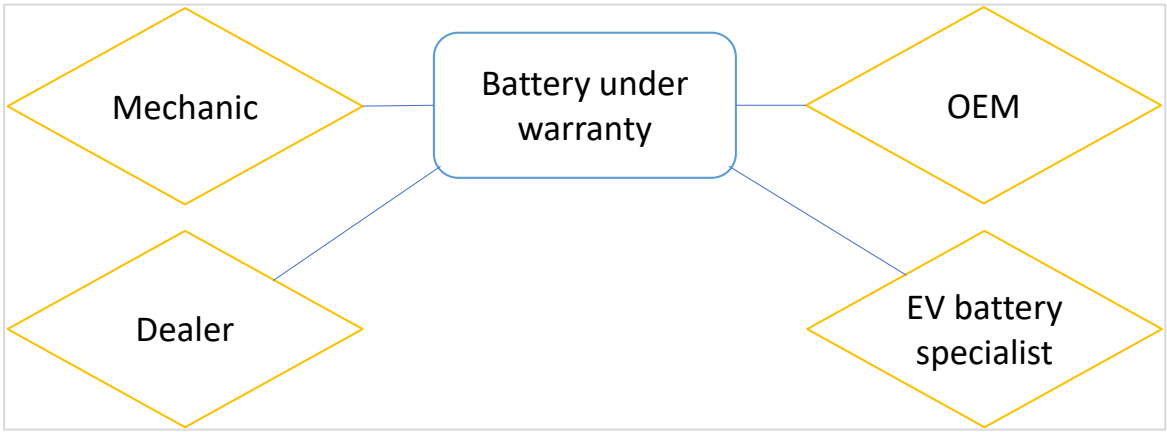

Zero value battery replaced in vehicle
Mechanic
EV battery specialist
OEM

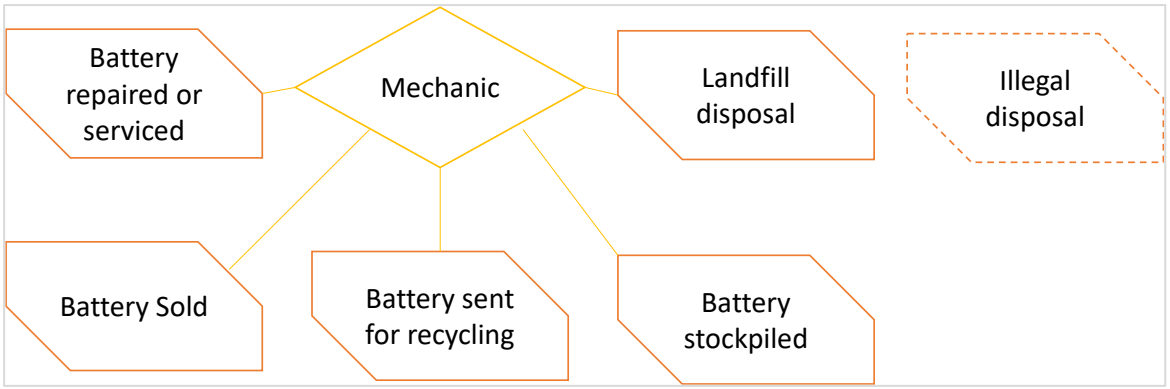

Mechanic
Battery with value replaced in vehicle
OEM
EV owner
EV battery specialist
Market-place

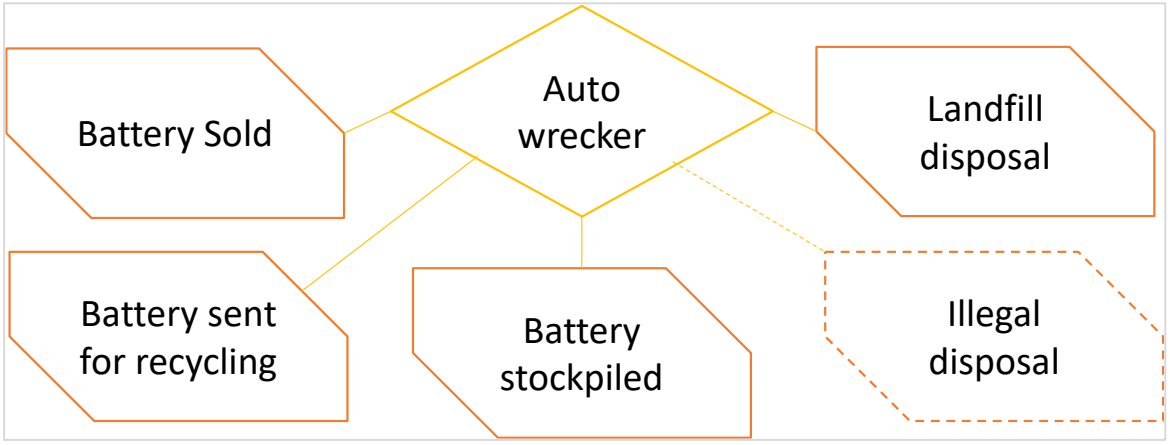

Vehicle & battery at EOL (but not damaged)
Auto wrecker
Towing company

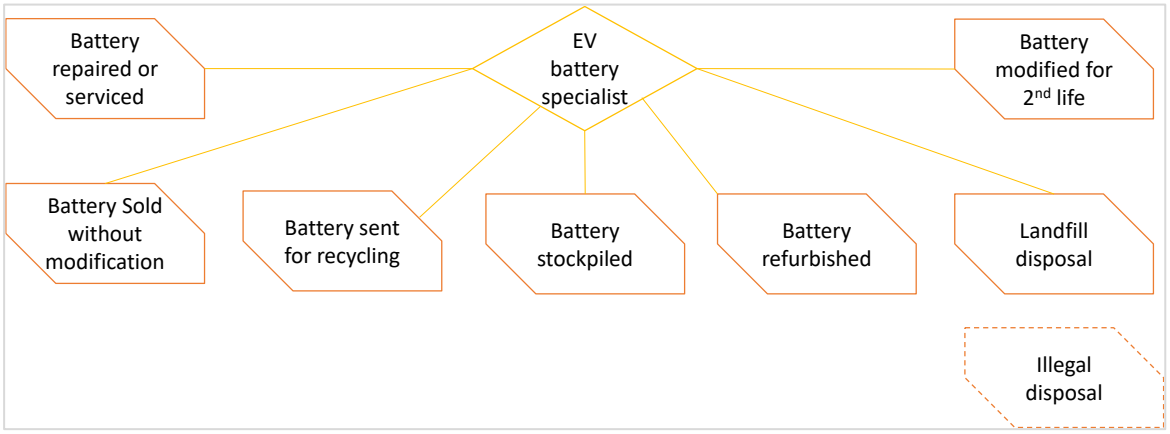

Towing company
Crash – body written off, battery has value
EV battery specialist
Insurance company
EV owner
Auction/ market
Auto wrecker

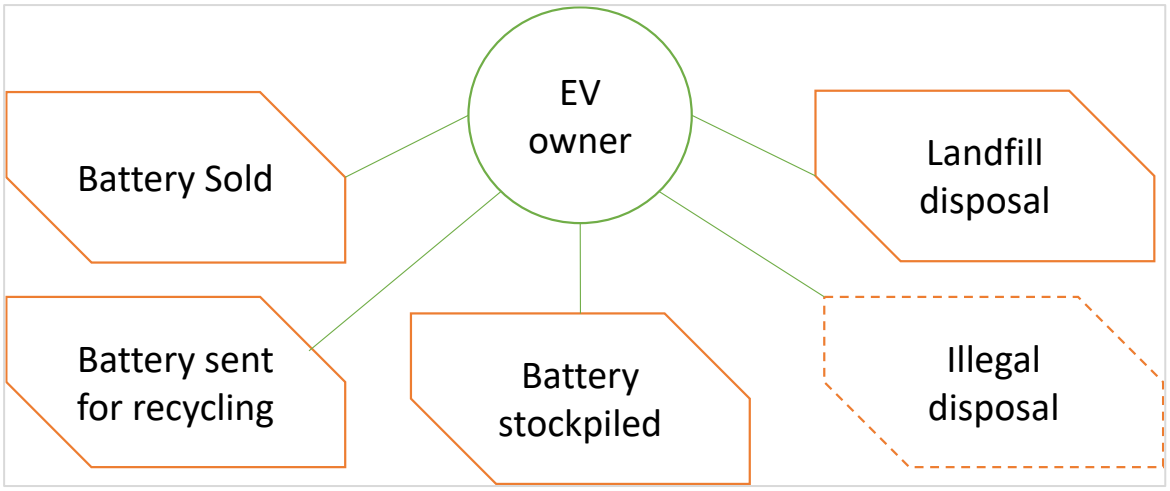

Towing company
Crash – Battery damaged
Battery recycler/ disposal
Insurance company
Auto wrecker

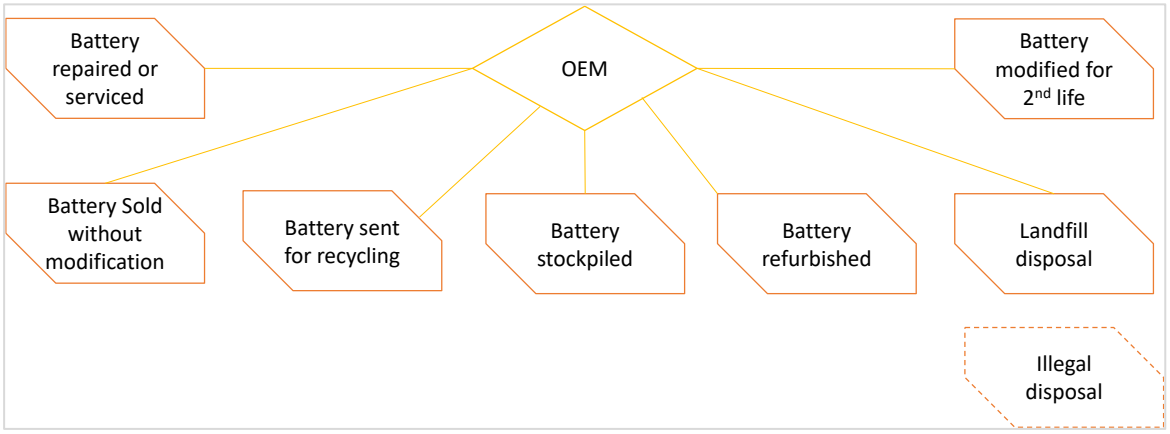

Mechanic
Battery under warranty
OEM
Dealer
EV battery specialist

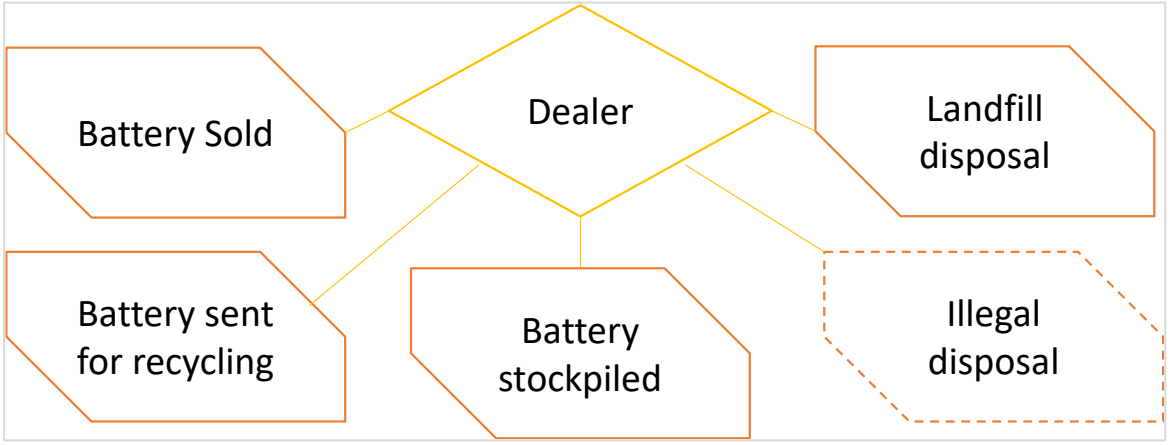

Battery repaired or serviced
Mechanic
Landfill disposal
Illegal disposal
Battery Sold
Battery sent for recycling
Battery stockpiled

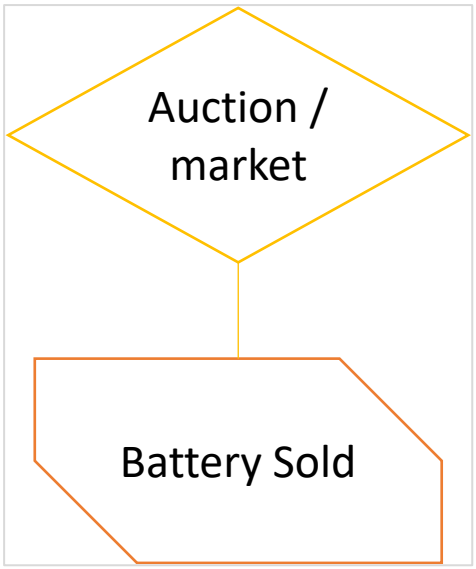

Battery Sold
Auto wrecker
Landfill disposal
Battery sent for recycling
Battery stockpiled
Illegal disposal

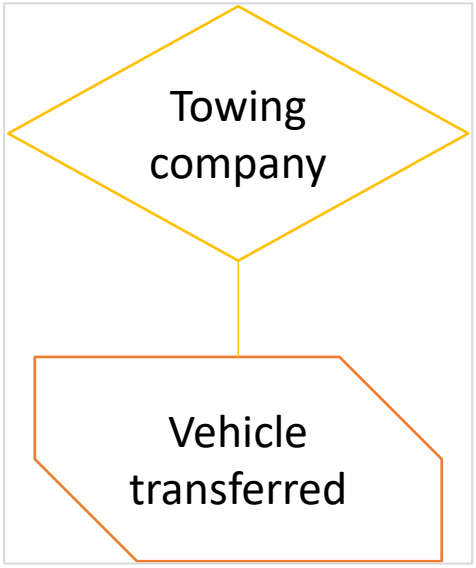

Battery repaired or serviced
EV battery specialist
Battery modified for 2nd life
Battery Sold without modification
Battery sent for recycling
Battery stockpiled
Battery refurbished
Landfill disposal
Illegal disposal

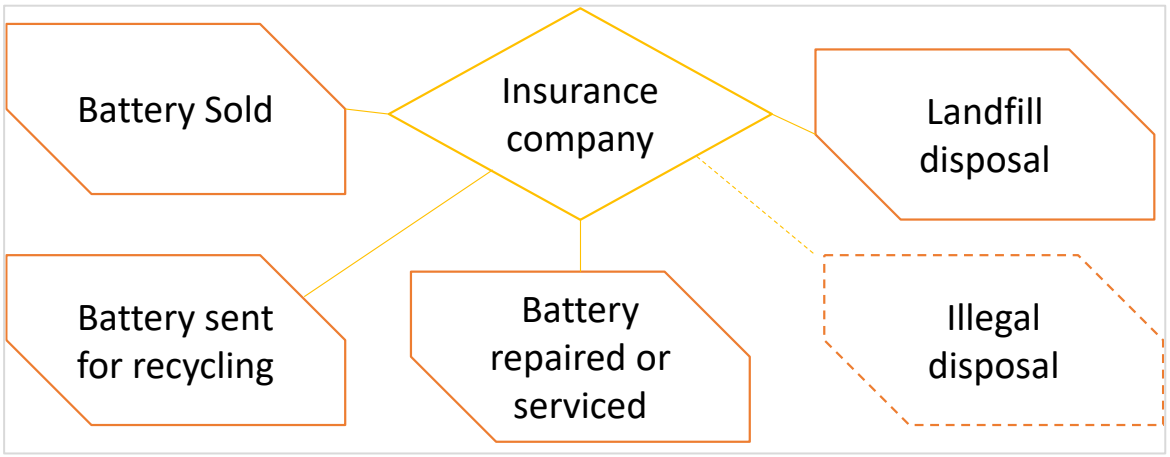

EV owner
Battery Sold
Landfill disposal
Battery sent for recycling
Battery stockpiled
Illegal disposal

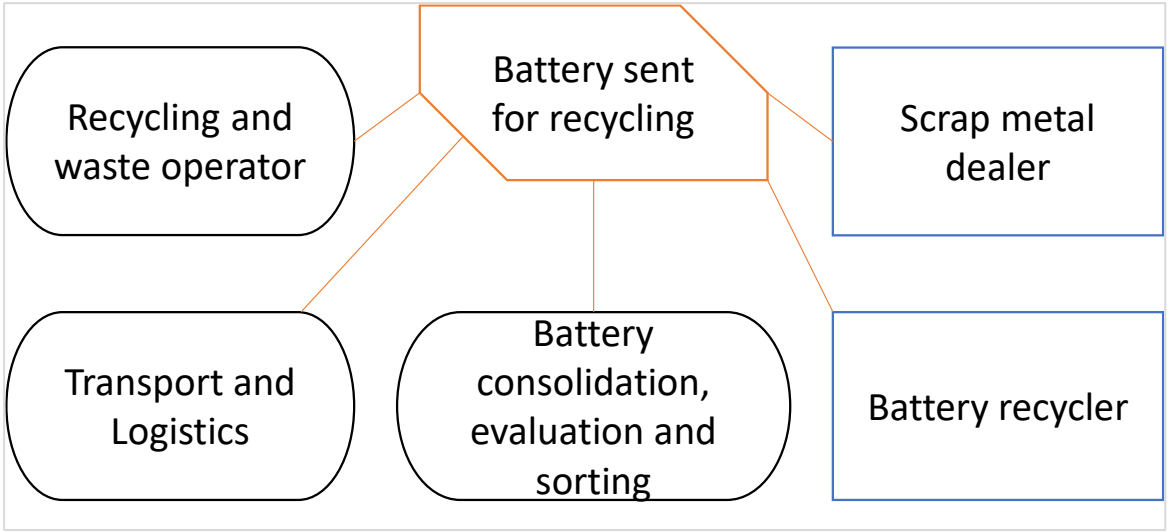

OEM
Battery repaired or serviced
Battery modified for 2nd life
Battery Sold without modification
Battery sent for recycling
Battery stockpiled
Battery refurbished
Landfill disposal
Illegal disposal

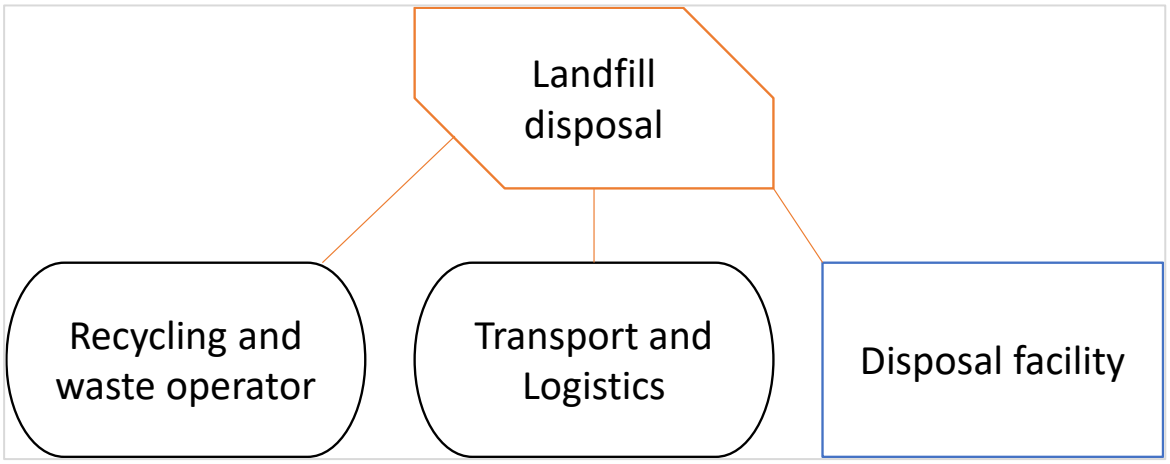

Dealer
Battery Sold
Landfill disposal
Battery sent for recycling
Battery stockpiled
Illegal disposal

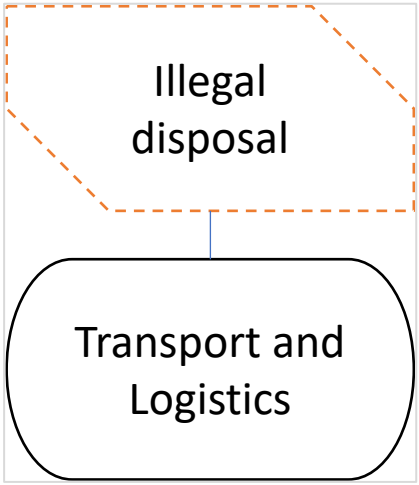

Auction / market
Battery Sold

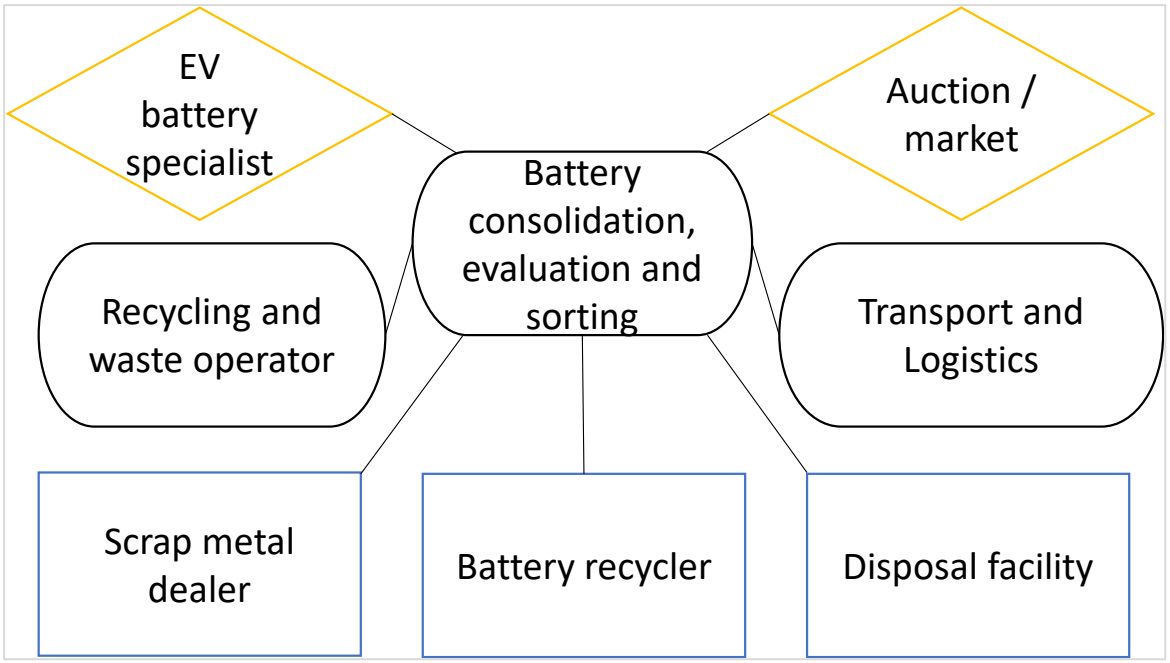

Towing company
Vehicle transferred

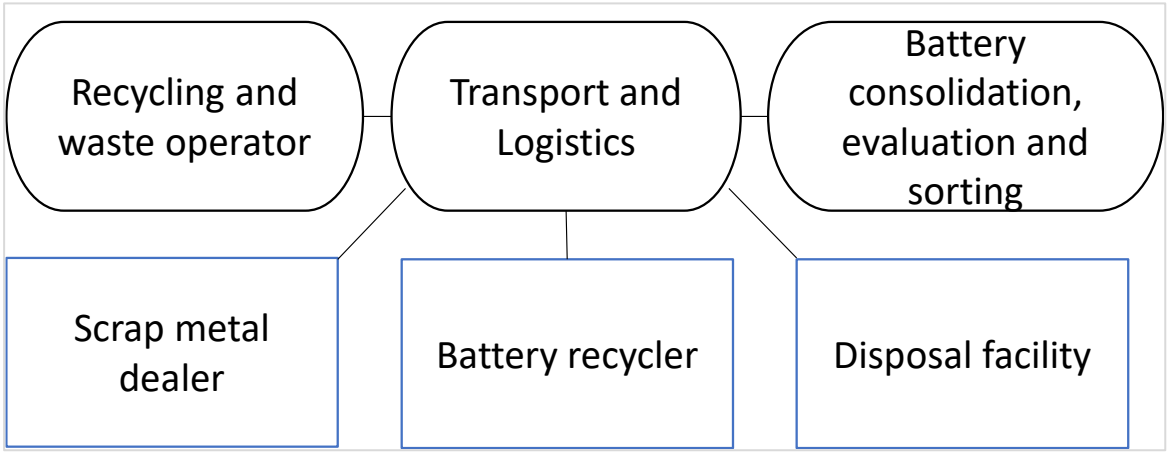

Battery Sold
Insurance company
Landfill disposal
Battery sent for recycling
Battery repaired or serviced
Illegal disposal

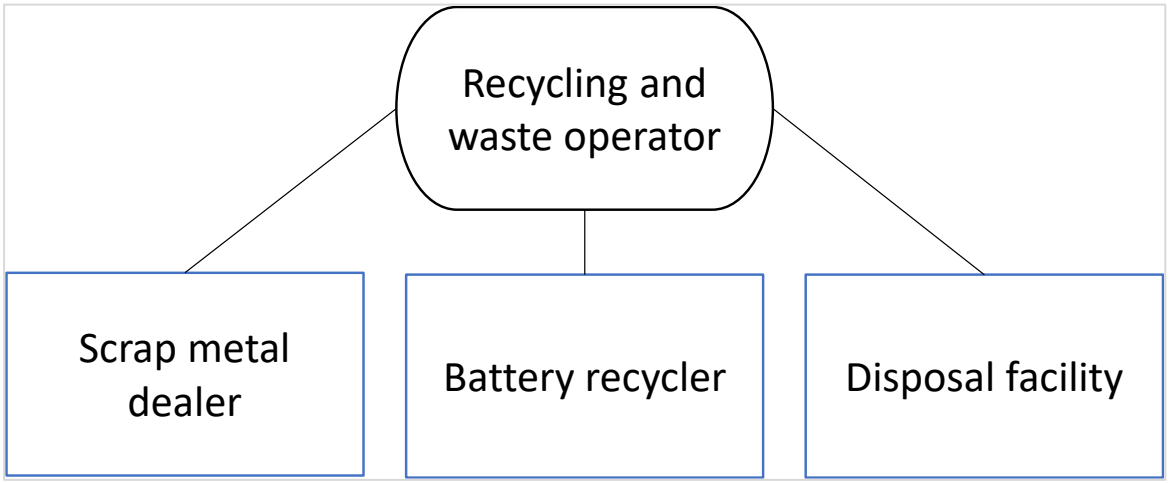

Recycling and waste operator
Battery sent for recycling
Scrap metal dealer
Transport and Logistics
Battery consolidation, evaluation and sorting
Battery recycler


Landfill disposal
Recycling and waste operator
Transport and Logistics
Disposal facility


Illegal disposal
Transport and Logistics


EV battery specialist
Auction / market
Battery consolidation, evaluation and sorting
Recycling and waste operator
Transport and Logistics
Scrap metal dealer
Battery recycler
Disposal facility


Recycling and waste operator
Transport and Logistics
Battery consolidation, evaluation and sorting
Scrap metal dealer
Battery recycler
Disposal facility


Recycling and waste operator
Scrap metal dealer
Battery recycler
Disposal facility

A.6.0 Strawman Scheme Designs

Large Battery Product Stewardship Strawman Scheme Designs

	Scheme 1: Importer Led	Scheme 2: Producer Responsibility Organisation Led	Scheme 3: Producer Responsibility Organisation Led with Deposit Refund
Governance	**Single not for profit scheme**		
	There would be a single not for profit scheme product stewardship organisation. This would be responsible for running the scheme and reporting to central Government.		
Targets	**Recycling and re-use targets**		
	The scheme would set targets for the industry and all participants. Targets would cover re-use and recycling rates.		
Responsibility for collection and recovery	**Importers responsible by default**	**PRO responsible by default**	**PRO responsible by default**
	Importers would be responsible for taking back all product imported into NZ and ensuring it is reused or recycled. Importers who do not want to operate their own collection and recycling schemes can contract to a collection and recycling operator to undertake these actions on their behalf. The collection and recycling	The Scheme governance body would establish a producer responsibility organisation (PRO) that would be primarily responsible for the collection and re-use/recycling of all large batteries imported into NZ. The PRO would potentially tender for delivery of parts of the system (e.g. collection points, recycling plants) to	The Scheme governance body would establish a producer responsibility organisation (PRO) that would be primarily responsible for the collection and re-use/recycling of all large batteries imported into NZ. The PRO would potentially tender for delivery of parts of the system (e.g. collection points, recycling plants) to

	operators would need to be accredited by the Governance organisation.	private operators, but would retain overall control. Manufacturers who have their own internal processes for taking back and sustainably managing their product could apply for accreditation to continue or to initiate their own processes (effectively opting out of the PRO system)	private operators, but would retain overall control. Manufacturers who have their own internal processes for taking back and sustainably managing their product could apply for accreditation to receive their large batteries back once they have been collected by the PRO(effectively opting out of the recycling/2nd life part of the PRO system).
Data management and reporting	**Importers supply data managed by scheme**	**PRO responsible for data**	**PRO responsible for data**
	Data on imported batteries will be collated by the PS scheme managers (either from customs or a combination of NZTA and battery importers). Ideally the batteries will be able to be tracked through their life cycle. Importers and accredited recyclers will be responsible for supplying data to the PS scheme managers on batteries collected, repurposed, and recycled.	Data on imported batteries will be collated by the PRO (either from customs or a combination of NZTA and battery importers). Ideally the batteries will be able to be tracked through their life cycle. Import data will be used to calculate market share for the purposes of levying advanced disposal fees. The PRO would generate data on batteries collected repurposed and recycled through its network. Accredited importers will be responsible for supplying data to the PRO on batteries collected, repurposed, and recycled.	Data on imported batteries will be collated by the PRO (either from customs or a combination of NZTA and battery importers). Ideally the batteries will be able to be tracked through their life cycle. Import data will be used to calculate market share for the purposes of levying advanced disposal fees. The PRO would generate data on batteries collected repurposed and recycled through its network. Accredited importers will be responsible for supplying data to the PRO on batteries received that are repurposed and recycled.
Funding	**Membership fee**	**Advance disposal fee**	**Advance disposal fee and refundable deposit**

	All importers would be required to join the PS organisation and pay a membership fee. The membership fee would cover the costs of data collection, compliance and monitoring, reporting, research and development and public awareness. The fee would be graduated relative to market share or business size. In line with the PS Government Guidelines collection and recycling of large batteries would need to be provided to consumers at no charge. There would be no advance disposal fee or deposit. All costs would be either met internally or if management is contracted out, from charges from the contractor to the importer.	The costs of operating the PRO would be met by an advanced disposal fee, levied on product imported into NZ. The rate of the fee would be reviewed annually, and set based on projected costs of running the PS Scheme (i.e. the costs of the governance body and PRO). The fee would be charged to importers by the PRO. It would be up to importers to choose to pass on this charge to consumers.	The costs of operating the PRO would be met by an advance disposal fee, levied on product imported into NZ. The rate of the fee would be reviewed annually, and set based on projected costs of running the PS Scheme (i.e. the costs of the governance body and PRO). The fee would be charged to importers by the PRO. It would be up to importers to choose to pass on this charge to consumers. In addition to the advance disposal fee, a refundable deposit would be applied. The deposit would be designed to ensure there is sufficient residual value in the battery at end of life to ensure its' recovery. Because the battery would not reach end of life for 10-20 years, a fund would be built up over time, that could be used to partially fund infrastructure, or reduce the costs of other elements of the scheme.
Allocating rebates	**Not applicable**	**Rebated based on unit rates or documented costs**	**Rebated based on unit rates or documented costs**

	Not applicable	A formula for distributing funds to collectors recyclers etc. would need to be determined. This could be on the basis of unit rates or claims based on actual incurred costs. Importers/manufacturers who are accredited to take their own product back would receive a rebate of the portion of the fee relative to the operations they undertake (a portion of the fee would be retained to cover the scheme administration, compliance, reporting etc.)	A formula for distributing funds to collectors recyclers etc. would need to be determined. This could be on the basis of unit rates or claims based on actual incurred costs. Importers/manufacturers who are accredited to take their own product back would receive a rebate of the portion of the fee relative to the operations they undertake (a portion of the fee would be retained to cover the scheme administration, compliance, reporting etc.)
Orphan and legacy product	**Managed by scheme**	**Managed by PRO**	
	Orphan and legacy product which could not be clearly attributed to an importer, would be managed by an accredited collector/recycler contracted to the PS organisation. The cost of this would be divided amongst all PS members according to market share (potentially included in the membership fee)	All orphan and legacy product would be managed by the PRO. The cost of this would be met by the advance disposal fee.	
Product design	**Eco product design driven through producer take-back**	**Modulated fees based on eco-design**	

	Because membership fees do not cover the largest cost components of collection and recovery, the potential incentives for product design in the fees are limited. Requirements for manufacturers to manage their own EOL product would be expected to encourage eco-design. Options to encourage product design could be implemented through modulating research and development contributions based on reuse and recyclability criteria (e.g. batteries with higher recycling costs could attract a higher R&D contribution component).	The advance disposal fee would be modulated to allow for different rates based on eco-design criteria. The guidelines require modulation on the basis of recyclability or re-usability. Other criteria could also be applied. For example, if a battery is guaranteed for longer life, or uses recycled materials this could attract a lower fee. The use of the Global Battery Alliance battery passport or similar could assist in application of fee modulation	
Compliance	**Scheme manager responsible for compliance**	**PRO responsible for compliance**	
	The PS organisation would be responsible for ensuring compliance of each member with the scheme requirements. They would accredit and audit collection and recycling operators. Importers who are not part of the scheme and meeting scheme requirements could be barred from trading under the provisions of the WMA.	The PRO would be responsible for ensuring compliance of each member with the scheme requirements. They would accredit and audit importers operation their own recycling or reuse processes.	
	Importer responsibility	**PRO responsibility**	**PRO responsibility**

Access to collection networks	Each importer would be responsible for ensuring appropriate coverage through their collection networks. Collection functions could be sub-contracted to accredited providers, where an importer is not able to provide adequate coverage with their own networks.	The PRO would be responsible for ensuring appropriate coverage through their collection network. Accredited importers could contract the PRO where an importer is not able to provide adequate coverage with their own networks.	The PRO would be responsible for ensuring appropriate coverage through their collection network.
Public awareness, research and market development	**Scheme manager responsibility**	**PRO responsibility**	
	The PS organisation would be responsible for coordination and delivery of these functions on behalf of members.	The PS organisation would be responsible for coordination and delivery of these functions on behalf of members.	

A.7.0 Data Management

A.7.1Overview

The data management system will be the core operational tool for the scheme in the first instance. Specifications for a data management system will need to be developed and an appropriate system procured and implemented. Precise system specifications are beyond the scope of the current project, however the system requirements in broad terms are set out below.

The data management system will need to record information on large batteries imported into the country and manufactured onshore, track individual battery information at key points in the battery life cycle (including at end of life) and, generate data that can be used for billing, payment and reporting purposes. The system would have to be secure to preserve commercially sensitive information while also allowing users (potentially thousands) different levels of access according to their role in the supply chain.

The table below sets out the key aspects of the data management system requirements at each stage in the value chain.

Note: In the table below, new fields required at each stage are indicated in **bold**. Optional fields are indicated in *italics.*

Table A. 1: Indicative Data Management Requirements

	Key Data Fields	Users & Access	How data Will be Used
Import	• **Unique ID** • **Importer** • **Vehicle or system brand** • **Battery brand** • **Model name/number** • **Chemistry** • **Capacity** • ***Dimensions**** • ***Weight**** • **Date of import** • **Warranty period** • **State of health (SOH)** • **Other technical and safety specifications (e.g. voltage, safe temperature range, current, etc.)***	Product stewardship Scheme Manager: • Full access Ministry for the Environment/Regulator: • Full access Individual importers: • Access to individual records only	At this stage it is assumed that importers will submit voluntary returns on qualifying batteries (e.g., monthly) This information would be used to calculate the fees to be paid by the importers The voluntary data would be provided to the regulator who would audit the information against customs import data Initial indications are that customs will be able to gather the necessary data, however it will need to be determined whether battery definitions match with customs tariff codes and client codes[30] The system would also need to act as a database to track qualifying companies and their compliance status and generate reporting data.

[30] https://www.customs.govt.nz/business/tariffs/tariff-classifications-and-rates/

	Key Data Fields	Users & Access	How data Will be Used
End of use	For battery at end of use • Unique ID • Vehicle or system brand • Battery brand • Model name/number • Chemistry • Capacity • *Dimensions** • *Weight** • State of health • **Reason for removal/end of use** • **Date of dismantling** • Other technical and safety specifications (e.g. voltage, safe temperature range, current, warranty period etc.)* For new battery created/new product • Unique ID • **Manufacturer** • Vehicle or system brand • Battery brand • Model name/number	Product stewardship Scheme Manager: • Full access Ministry for the Environment/Regulator: • Full access Individual battery upgraders: • Access to individual records only	The battery upgrader would need to undertake the following:[31] • Record battery packs that they dismantle (that will no longer be tracked as packs) • Record any new or used cells or modules that are purchased • Record new packs that are created from used cells or modules • Allocate a serial number or other unique identifier to the new pack • Record the quantity of batteries/modules/cells sent to an accredited recycler. The system would also need to act as a database to track qualifying companies and their compliance status and generate reporting data. The data should be able to be audited to check what specifications are

[31] Note: the battery passport would likely have these functions

	Key Data Fields	Users & Access	How data Will be Used
	• Chemistry • Capacity • *Dimensions** • *Weight** • **Date of manufacture** • **BMS – original/new** • **Module count – original/new** • Warranty period • State of health • Other technical and safety specifications (e.g. voltage, safe temperature range, current, etc.)* For battery components at end of life • Quantity (kg) of batteries/modules/cells sent to an accredited recycler • Chemistry(s) of batteries/modules/cells sent to an accredited recycler • Name of accredited party EOL batteries transferred to		provided to customers vs what is recorded the database
End of Life	For battery at end of life • Unique ID • **Party managing the battery**	Product stewardship Scheme Manager: • Full access	The battery recycler would need to undertake the following

	Key Data Fields	Users & Access	How data Will be Used
	• Vehicle or system brand • Battery brand • Model name/number • Chemistry • Capacity • *Dimensions** • Weight • State of health • **Date of export (if applicable)** • **Date of recycling** • **Safety checks/prepared for safe storage/transport** • **Action taken (e.g. removal, transport, recycling etc.)** • **Name of accredited party EOL batteries transferred to**	Ministry for the Environment/Regulator: • Full access Dismantlers (e.g. mechanics, auto dismantlers, scrap metal dealers etc.) • Access to individual records only Individual recyclers: • Access to individual records only	• Confirm receipt of batteries from accredited dismantlers and track Unique ID • Record that batteries have been prepared for safe transport/storage • Record the quantity (kg) of batteries/modules/cells exported (if applicable) • Record the quantity (kg) of batteries/modules/cells recycled The system would also need to act as a database to track qualifying companies and their compliance status and generate reporting data.

* Optional fields

The project team engaged with Priti Ambani, who is the IT technical advisor to B.I.G.. The team was advised that, based on the above specifications, the technical data management requirements are not overly complex and constructing a database that is able to adequately manage the data should not be overly difficult or costly. However, understanding all the potential use cases and how users will interact with the system, and then building an appropriate user-friendly front end is likely to be more involved.

A.7.2Battery Passport Project

The Battery Innovation Hub (BIH) is investigating potential methods to track large batteries from when they enter New Zealand through their life-cycle to end-of-life disposal. Tracking large batteries is not only important for measuring the success of the scheme but also for the way it aims to ensure everyone in the chain of custody understands their role and responsibility in maximising the circular opportunities of these battery resources.

With the help of the Battery User Group, we're seeking insights from those in the automotive and stationary battery storage industries on identifying who would potentially own the battery during its life-cycle and where processes or databases exist that we could align to. The objective is to identify a potential way to track large batteries at a pack level without the need for significant changes to how these products are managed now.

The future-state we're investigating to track large batteries is to align to the Global Battery Alliance's Battery Passport initiative https://www.weforum.org/global-battery-alliance/action. The battery passport would be a digital representation of the battery providing information on the model, chemistry, state of health, and history. The aim is to provide an access-controlled database for industry participants, meeting the different users' database management requirements. It would allow the tracking at a module level where a battery pack is broken down into battery modules for re-purposing. It will go further than just tracking the finished product, it also aims to track the provenance of the materials going into making the battery, for example ensuring the cobalt component has been sourced from a child labour free mine.

The BIH will have more information to share on the battery passport concept in the new year.[32]

A.7.3 Customs Tariff Codes

The tariff codes for 'large batteries' that would apply are for either the batteries themselves or for any products they are embedded in. There would not be a separate tariff code for a battery for example if it is in an EV.

[32] Preliminary discussions, based on an initial demonstration of the prototype battery passport developed by Everledger, suggest that the Everledger platform would have most of the core functionality required for tracking and managing batteries under the scheme. Further discussions will be undertaken during Milestone Three to advance our understanding of this option.

A.7.3.1 Battery Tariff Codes

The tariff codes for secondary batteries (excluding lead acid) are:

8507.40.00 00J No. – Nickel-iron

8507.50.00 00B No. – Nickel-metal hydride

8507.60.00 00F No. – Lithium-ion

8507.80.00 10L No. – Other accumulators

8507.90.00 00G – Parts

The key point here is that there is no further breakdown by size, weight or capacity. This means it would not be possible to distinguish between small and large batteries on the basis of existing tariff codes.

A.7.3.2 Vehicle Tariff Codes

The main tariff codes for electric and hybrid vehicles are:

87.02 Motor vehicles for the transport of ten or more persons, including the driver:

8702.20.00 – With both compression-ignition internal combustion piston engine(diesel or semi-diesel) and electric motor as motors for propulsion

8702.30.00 – With both spark-ignition internal combustion reciprocating piston engine and electric motor as motors for

8702.40.00 – With only electric motor for propulsion

87.03 Motor cars and other motor vehicles principally designed for the transport of persons (other than those of heading 87.02), including station wagons and racing cars:

8703.40 – Other vehicles, with both spark-ignition internal combustion reciprocating piston engine and electric motor as motors for propulsion, other than those capable of being charged by plugging to external source of electric power:

8703.50 – Other vehicles, with both compression-ignition internal combustion piston engine (diesel or semi-diesel) and electric motor as motors for propulsion, other than those capable of being charged by plugging to external source of electric power

8703.60 – Other vehicles, with both spark-ignition internal combustion reciprocating piston engine and electric motor as motors for propulsion, capable of being charged by plugging to external source of electric power:

8703.70 – Other vehicles, with both compression-ignition internal combustion piston engine (diesel or semi-diesel) and electric motor as motors for propulsion, capable of being charged by plugging to external source of electric power:

8703.80 – Other vehicles, with only electric motor for propulsion:

It should be noted however that there are hundreds of classifications which would need to be examined to ensure the codes were sufficiently comprehensive.

Initial research into the tariff codes for vehicles suggest that the tariff codes capture hybrids, plug in hybrids, and BEVs for passenger vehicles and buses, as well as a range of other vehicles such as golf carts, forklifts, motorhomes, motorcycles etc. The codes allow for new and used vehicles to be distinguished as well. Further detailed research into the tariff codes would be required to determine the suitability of these codes for gathering data, auditing scheme compliance, and/or levying charges under the scheme.

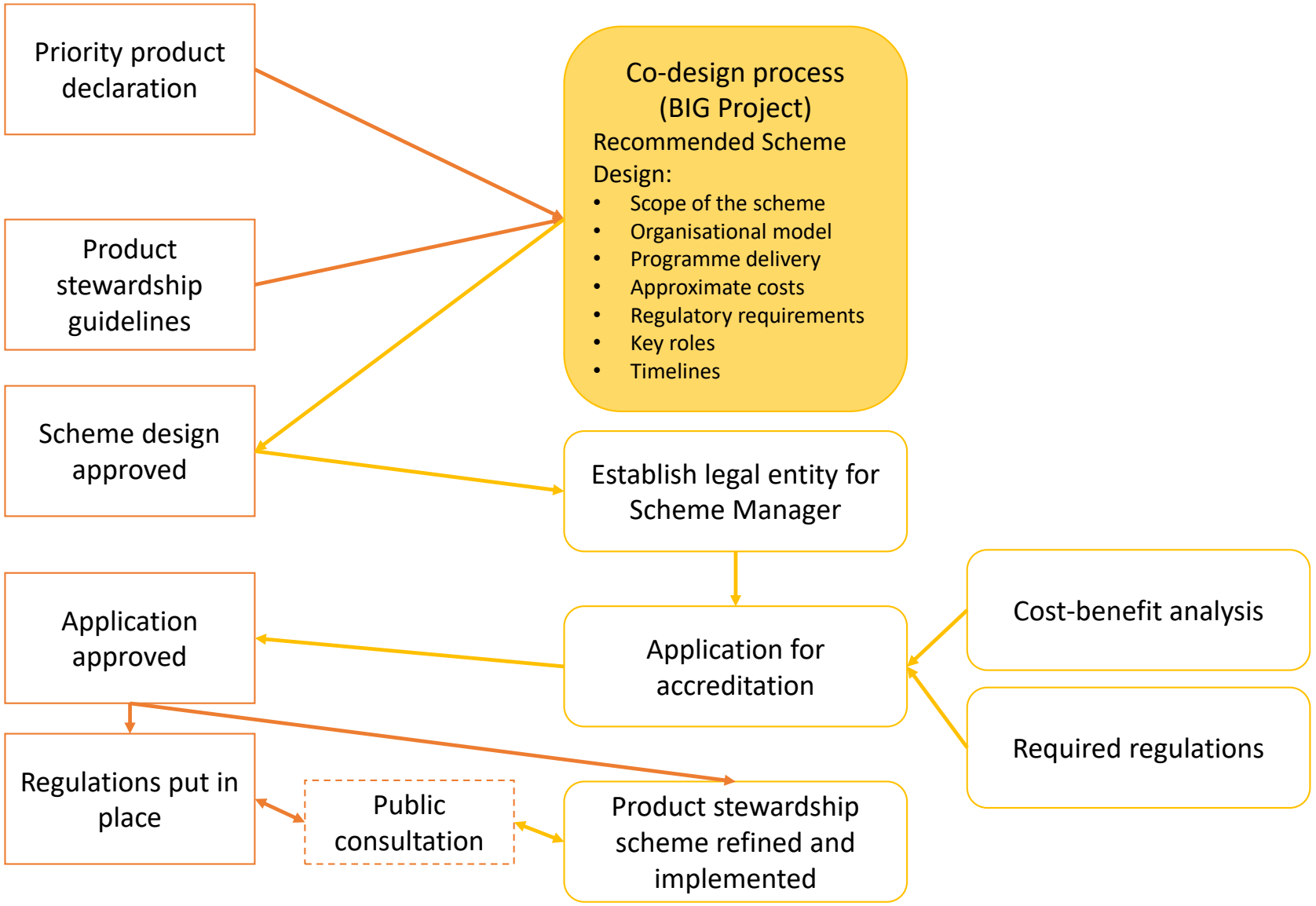
In initial discussions with Customs, they advised that, as a rule they prefer not to introduce new tariff codes, however it is possible. Tariff classifications use an 11 digit code. The first 7 are set by international systems. These are very difficult to change or add to - although the NZ Government can make requests. It is possible to use the last 4 digits for new NZ specific sub-classifications (in practice it would probably be the last 3 for motor vehicles). This is something that would need to be negotiated if there was a case for it. In practice adding one more code level (e.g. for battery capacity) could result in lots of extra codes by the time all the sub-classifications are accounted for (e.g. tractors, trucks, buses etc etc.). The more complex the classifications, the greater the probability of errors in the coding.

A.8.0 Product Stewardship Scheme Development Process

The chart below outlines the overall product stewardship scheme development process and how the current B.I.G. project fits into this process.

The key point is that following the completion of the big project there will be a number of further steps that will be required before the recommended product stewardship scheme can be implemented. These include:

- Establishing a legal entity (or entities) to govern and operate the scheme
- Applying for accreditation
- Formal public consultation
- Establishing required regulation


Priority product declaration
Product stewardship guidelines
Scheme design approved
Co-design process (BIG Project)
Recommended Scheme Design:
• Scope of the scheme
• Organisational model
• Programme delivery
• Approximate costs
• Regulatory requirements
• Key roles
• Timelines
Establish legal entity for Scheme Manager
Application approved
Application for accreditation
Cost-benefit analysis
Required regulations
Regulations put in place
Public consultation
Product stewardship scheme refined and implemented

A.9.0 Financial Model Parameters and Assumptions

	Value	Source	Comment
Quantities			
Estimate of eligible vehicles sold	Varies	Central case projection from: Strategic Lift (2020) Second Life EV Batteries Project: Defining the need for a New Zealand strategy for post-EV use. Report to the Ministry for the Environment under the Waste Minimisation Fund. Low projection based on 4-year linear rate of increase. High projection based on recent market projections accounting for new Government initiatives: https://www.fitchsolutions.com/corporates/autos/new-zealands-ev-market-gets-boost-new-government-directive-02-12-2020	The second life project conducted extensive modelling of scenarios around the potential quantities of used batteries that can be expected in NZ. Eunomia was given access to the model and we have based our central case on their projections. The projection predicts sales to rise to around 200,000 units by 2028 then to level off. The low projection simply extrapolates the current sales trend which has seen market share increase by 0.4% per annum in absolute terms. The Fitch Solutions report predicts that EVs will make up 49.9% of vehicle sales by 2030. With an annual growth rate of up to 64.4% between 2021 and 2025. We extrapolated this trend with a slowing growth rate until 80% market share was reached then levelled the numbers off through to 2041.
Estimate of eligible batteries sold	Varies	Based on Vector (2019) new energy futures paper: batteries technical addendum & Strategic Lift (2020) Second Life EV Batteries Project: Defining the need for a New Zealand	There is much uncertainty around the potential sales of stationary storage batteries. Domestic systems are predicted to remain relatively static Vector (2019), and it is unclear the extent to

		strategy for post-EV use. Report to the Ministry for the Environment under the Waste Minimisation Fund.	which grid and commercial scale systems will be deployed. Within the forecast period projections of eligible battery sales have limited impact on EOL projections because most stationary storage systems will last in the order of 20 years or more.
EOL Vehicles	Varies	Strategic Lift (2020) Second Life EV Batteries Project: Defining the need for a New Zealand strategy for post-EV use. Report to the Ministry for the Environment under the Waste Minimisation Fund Low projection based on 4--year linear rate of increase. High projection based on recent market projections accounting for new Govt initiatives: https://www.fitchsolutions.com/corporates/autos/new-zealands-ev-market-gets-boost-new-government-directive-02-12-2020	The second life project conducted extensive modelling of scenarios around the potential quantities of used batteries that can be expected in NZ. Eunomia was given access to the model and we have based our central case on their projections. Projections of EOL batteries were based on an assumed average life in current use of 15 years for new vehicle batteries and 7 years for second hand batteries. Projections assume a normal distribution around 15 years with all batteries assumed to reach end of life between 10-20 years. In the model 40% of batteries from new vehicles are assumed to have a second life – either in a vehicle or repurposed as some form of stationary storage. This is assumed to add an average of 7 years life before they are recycled.
EOL stationary batteries	Varies	Based on data from Strategic Lift (2020) Second Life EV Batteries Project: Defining the need for a New Zealand strategy for post-EV use. Report to the Ministry for the Environment under the Waste Minimisation Fund, and Vector (2019) New Energy Futures Paper: Batteries technical addendum.	Within the forecast period projections of eligible battery sales have limited impact on EOL projections because most stationary storage systems will last in the order of 20 years or more.

Assumed weight of vehicle batteries	350kg	Based on average battery weights for most popular BEV models. Obtained from https://batteryuniversity.com/learn/article/electric_vehicle_ev	Battery weights were assumed to remain static – increases in battery capacity to meet the demand for greater vehicle range are assumed to be largely offset by improvements in energy density.
Assumed weight of stationary batteries	115kg	Based on the weight of a single Tesla Powerwall 2 unit (114kg)	Installations including commercial and grid scale installations are assumed to be multiples of this value
Assumed kWh	50kWh rising at 2% pa	Based on average battery capacity for most popular BEV models. Obtained from https://batteryuniversity.com/learn/article/electric_vehicle_ev	Battery capacity is assumed to increase over time. Several articles suggested there has been a 5-8% pa increase in battery capacity over time, but we were not able to find any reliable data to support this. 2% pa was applied as a conservative estimate.
Batteries to second life	48%	Strategic Lift (2020) Second Life EV Batteries Project: Defining the need for a New Zealand strategy for post-EV use. Report to the Ministry for the Environment under the Waste Minimisation Fund (Table 22)	In this context 'second life' also includes batteries reused in an EV without substantial modification. At the end of the batteries first use, 48% are assumed to go into a second use, which is assumed to result in an extra 7 years of use on average before recycling.
Batteries to recycling	52%	The remainder once second life uses are accounted for	
PRO			
Staff			

Manager	*$102,035*	*https://www.seek.co.nz/career-advice/article/a-guide-to-salaries-in-your-industry*	*Sales Manager*
Admin	*$53,351*	*https://www.seek.co.nz/career-advice/article/a-guide-to-salaries-in-your-industry*	*Accounts Officers/Clerks*
Compliance and membership manager	*$77,820*	*https://www.seek.co.nz/career-advice/article/a-guide-to-salaries-in-your-industry*	*Account and Relationship Management*
Data manager (see below)			
Rent	$400 per week initially	Estimate based on survey of rental space for 4 person office space	
Opex	$30,000	Estimate	
Legal and accountancy	35,000	Adele Rose, 3R	
Governance			
Independent Chair	$50,000- -$80,000	Adele Rose, 3R	Remuneration for independent chair partially dependent on the size of the scheme
Board Travel and expenses	$10,000		
Directors insurance	$30,000		
Data management			

Data collection	$95,387	https://www.seek.co.nz/career-advice/article/a-guide-to-salaries-in-your-industry	Database development and administration. Assume 1/3 time contractor for less than 20,000 vehicles pa, ½ tome for 20,000 to 75,000, and full time for over 75,000.
Database including customer interface	$150,000	Priti Ambani, Director, New Business & Innovation TCS & B.I.G. Technical Advisor	Database itself is likely to be relatively simple but time and expense is likely to come in designing the customer interface
Consumer design and testing	$50,000	Priti Ambani, Director, New Business & Innovation TCS & B.I.G. Technical Advisor	Research to inform customer interface design and ensure database is fit for purpose
Maintenance and upgrades	10% of development costs	Estimate	
Comms and Education			
Website	$30,000 + 10% annual service cost	Development costs	
Branding and promotional material	$30,000	Estimate	
PR staff time	One third of $75,616 to start	https://www.seek.co.nz/career-advice/article/a-guide-to-salaries-in-your-industry	One third of staff time to start. Rising over time to full time. Social media management, campaign planning, targeted media etc.
Research & Market Development			
Funding	$100,000	Placeholder amount	Funding could be made available to members and targeted

Scheme administration	10% of fund value	Placeholder amount	Time to assess funding applications and monitor funded projects
Recovery			
Battery removal	$100	Blue Cars	Average per battery
Assessment	$25	Metalman	Average per battery. Based on 1 hour staff time
Transport in NZ	$45	Based on $4 per km for a 10 tonne load and 300km average journey	Average per battery
Storage	Varies btw $1.37 per kg and $0.45 per kg	Metalman	Storage cost varies based on the utilisation of site capacity
Preparation for shipping	$0.28	Metalman	Includes staff time and materials to palletise, shrink wrap and load into fire-proof containers.
Shipping	$0.28 - $0.15	Metalman	Shipping varies based on volume and amortising of fixed costs for export permits.
Recycling cost	$0.00 to $0.20	Metalman	Initially batteries are assumed to be exported for recycling. Once batteries reach a threshold quantity and it becomes economic to undertake pre-processing and/or full recycling onshore all batteries are then assumed to be processed/recycled onshore. The recycling cost includes sale of commodities and payback of capex over 10 years.

A.10.0 Modelling Detail

A.10.1 Low Growth Scenario

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Quantities																							
Estimate of eligible vehicles sold	6,935	5,448	5,226	5,664	5,809	5,981	6,182	6,415	6,682	6,986	7,333	7,726	8,172	8,675	9,244	9,888	10,616	11,440	12,374	13,433	14,637	16,007	17,570
Estimate of eligible batteries sold	500	535	572	613	655	701	750	803	859	919	984	1,052	1,126	1,205	1,289	1,380	1,476	1,579	1,690	1,808	1,935	2,070	2,215
EOL Vehicles	36	89	221	424	783	1,417	2,302	3,034	3,448	3,624	3,841	4,153	4,483	4,958	5,505	6,020	6,338	6,560	6,808	7,104	7,446	7,834	8,286
EOL stationary batteries	10	12	14	16	18	21	25	29	33	39	45	52	61	71	82	96	111	129	150	174	203	236	274
Cumulative Vehicle batteries	18,727	24,086	29,090	34,330	39,356	43,920	47,800	51,181	54,415	57,778	61,269	64,843	68,531	72,249	75,988	79,856	84,134	89,014	94,579	100,909	108,099	116,272	125,556
Cumulative Stationary storage batteries																							
Assumed weight of vehicle batteries	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Assumed weight of stationary batteries	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
Ave battery weight	299.1	323.0	336.5	341.6	344.6	346.5	347.5	347.8	347.7	347.5	347.3	347.1	346.9	346.7	346.5	346.3	346.0	345.5	344.9	344.4	343.8	343.1	342.5
Assumed kWh	50	51.0	52.0	53.1	54.1	55.2	56.3	57.4	58.6	59.8	60.9	62.2	63.4	64.7	66.0	67.3	68.6	70.0	71.4	72.8	74.3	75.8	77.3
Batteries to second life	17	43	106	204	376	680	1,105	1,456	1,655	1,739	1,844	1,993	2,152	2,380	2,642	2,890	3,042	3,149	3,268	3,410	3,574	3,760	3,977
Batteries to recycling	28.82551323	58	129	236	426	758	1,239	1,649	1,932	2,127	2,419	2,892	3,497	4,105	4,600	4,966	5,251	5,534	5,842	6,248	6,717	7,199	7,625
Total battery weight to recycling (kg)	7,739	17,612	41,847	78,968	144,666	260,255	421,812	555,401	631,310	664,013	704,325	761,852	822,876	910,429	1,011,349	1,106,695	1,166,206	1,208,735	1,256,395	1,312,945	1,378,558	1,452,928	1,539,574
Annual increase		9,873	24,236	37,120	65,698	115,589	161,557	133,590	75,909	32,703	40,311	57,527	61,024	87,553	100,920	95,346	59,511	42,529	47,659	56,550	65,613	74,370	86,646
% annual increase		*128%*	*138%*	*89%*	*83%*	*80%*	*62%*	*32%*	*14%*	*5%*	*6%*	*8%*	*8%*	*11%*	*11%*	*9%*	*5%*	*4%*	*4%*	*5%*	*5%*	*5%*	*6%*
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Costs																							
PRO																							
Staff				$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206
Manager				*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*
Admin				*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*
Compliance and membership manager				*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*
Data manager (see below)																							
Rent				$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800
Opex				$30,000	$32,496	$35,092	$37,271	$38,451	$38,977	$39,179	$39,416	$39,738	$40,057	$40,483	$40,932	$41,317	$41,540	$41,691	$41,856	$42,044	$42,254	$42,482	$42,482
Legal and accountancy				$35,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Total	$0	$0	$0	$319,006	$296,502	$299,098	$301,277	$302,457	$302,983	$303,185	$303,422	$303,744	$304,063	$304,489	$304,938	$305,323	$305,546	$305,697	$305,862	$306,050	$306,260	$306,488	$306,488
			0%	33%	32%	26%	21%	18%	16%	16%	15%	14%	14%	13%	12%	11%	11%	9%	9%	9%	8%	8%	8%
Governance																							
Independent Chair			$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000
Board Travel and expenses			$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Directors insurance			$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000
Total	$0	$0	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000
Data managament																							
Data collection			$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796
Database				$15,000																			
Front end				$135,000																			
Consumer design and testing			$50,000																				
Maintenance and upgrades					$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
Total	$0	$0	$81,796	$181,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796
Comms and Education																							
Website				$30,000	$3,000	$3,000	$3,000	$3,000	$15,000	$3,000	$3,000	$3,000	$3,000	$15,000	$3,000	$3,000	$3,000	$3,000	$15,000	$3,000	$3,000	$3,000	$3,000
Branding and promotional material				$30,000	$31,500	$33,075	$34,729	$36,465	$38,288	$40,203	$42,213	$44,324	$46,540	$48,867	$51,310	$53,876	$56,569	$59,398	$62,368	$65,486	$68,761	$72,199	$75,809
PR staff time			$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205
Total	$0	$0	$25,205	$85,205	$59,705	$61,280	$62,934	$64,671	$78,494	$68,408	$70,418	$72,529	$74,745	$89,072	$79,516	$82,081	$84,775	$87,603	$102,573	$93,692	$96,966	$100,404	$104,014

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Research & Market Development																							
Funding				$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000
Scheme administration				$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Total	$0	$0	$0	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000
Recovery																							
Battery removal			$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100
Assessment			$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
Transport in NZ			$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45
Storage				$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311
Preparation for shipping				$96	$97	$97	$97	$97	$97	$97	$97	$97	$97	$97	$97	$97	$97	$97	$97	$96	$96	$96	$96
Shipping				$96	$82	$70	$63	$58	$56	$54	$53	$52	$51	$51	$50	$50	$50	$49	$49	$49	$49	$49	$49
Recycling cost	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$0	$0	$170	$672	$659	$648	$641	$637	$634	$632	$631	$630	$629	$629	$628	$628	$627	$627	$627	$626	$626	$626	$625
Battery removal	$0	$0	$23,491	$43,967	$80,159	$143,778	$232,673	$306,221	$348,101	$366,269	$388,649	$420,527	$454,370	$502,840	$558,713	$611,593	$644,862	$668,894	$695,853	$727,821	$764,916	$806,991	$856,008
Assessment	$0	$0	$5,535	$10,599	$19,583	$35,414	$57,552	$75,838	$86,192	$90,599	$96,036	$103,823	$112,071	$123,942	$137,623	$150,509	$158,438	$163,995	$170,210	$177,593	$186,158	$195,854	$207,151
Transport in NZ	$0	$0	$10,524	$19,697	$35,093	$63,462	$103,132	$135,902	$154,456	$162,353	$172,097	$186,051	$200,831	$222,103	$246,620	$269,712	$283,921	$293,879	$305,017	$318,247	$333,596	$350,970	$371,214
Storage	$0	$0	$57,331	$71,910	$96,403	$132,711	$189,815	$249,931	$284,090	$298,806	$316,946	$342,833	$370,294	$409,693	$455,107	$498,013	$524,793	$543,931	$565,378	$590,825	$620,351	$653,817	$692,808
Preparation for shipping			$11,723	$22,121	$40,525	$72,905	$118,162	$155,584	$176,848	$186,009	$197,302	$213,417	$230,511	$255,037	$283,308	$310,017	$326,688	$338,602	$351,952	$367,794	$386,174	$407,007	$431,279
Shipping			$11,717	$22,111	$40,506	$72,871	$118,107	$155,512	$176,767	$185,924	$197,211	$213,319	$230,405	$254,920	$283,178	$309,875	$326,538	$338,446	$351,790	$367,624	$385,996	$406,820	$431,081
Recycling cost			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$246,031	$255,732	$267,243	$280,598	$295,735	$313,372
Total	**$0**	**$0**	**$120,320**	**$190,405**	**$312,270**	**$521,142**	**$819,441**	**$1,078,989**	**$1,226,454**	**$1,289,959**	**$1,368,242**	**$1,479,970**	**$1,598,483**	**$1,768,535**	**$1,964,549**	**$2,149,718**	**$2,265,240**	**$2,593,778**	**$2,695,933**	**$2,817,148**	**$2,957,789**	**$3,117,194**	**$3,302,913**
Total	**$0**	**$0**	**$197,001**	**$976,412**	**$920,273**	**$1,133,316**	**$1,435,447**	**$1,697,912**	**$1,859,726**	**$1,913,347**	**$1,993,878**	**$2,108,039**	**$2,229,086**	**$2,413,892**	**$2,600,797**	**$2,788,918**	**$2,907,356**	**$3,238,874**	**$3,356,163**	**$3,468,685**	**$3,612,811**	**$3,775,882**	**$3,965,211**
Charge per Battery	*$0.00*	*$0.00*	*$33.98*	*$155.57*	*$142.36*	*$169.60*	*$207.06*	*$235.25*	*$246.62*	*$242.02*	*$239.74*	*$240.13*	*$239.75*	*$244.32*	*$246.91*	*$247.52*	*$240.44*	*$248.78*	*$238.64*	*$227.58*	*$218.01*	*$208.87*	*$200.41*
Contingency (held in reserve)	**$0**	**$0**	**$9,850**	**$48,821**	**$46,014**	**$56,666**	**$71,772**	**$84,896**	**$92,986**	**$95,667**	**$99,694**	**$105,402**	**$111,454**	**$120,695**	**$130,040**	**$139,446**	**$145,368**	**$161,944**	**$167,808**	**$173,434**	**$180,641**	**$188,794**	**$198,261**
Reserve (cumulative)			*$9,850*	*$58,671*	*$104,684*	*$161,350*	*$233,122*	*$318,018*	*$411,004*	*$506,672*	*$606,366*	*$711,768*	*$823,222*	*$943,916*	*$1,073,956*	*$1,213,402*	*$1,358,770*	*$1,520,714*	*$1,688,522*	*$1,861,956*	*$2,042,597*	*$2,231,391*	*$2,429,651*
Operating time on reserve (months)			*0.6*	*0.7*	*1.3*	*1.6*	*1.9*	*2.1*	*2.5*	*3.0*	*3.5*	*3.9*	*4.2*	*4.5*	*4.7*	*5.0*	*5.3*	*5.4*	*5.7*	*6.1*	*6.5*	*6.8*	*7.0*
Total including Contingency	**$0**	**$0**	**$206,851**	**$1,025,233**	**$966,286**	**$1,189,982**	**$1,507,220**	**$1,782,808**	**$1,952,712**	**$2,009,015**	**$2,093,572**	**$2,213,441**	**$2,340,541**	**$2,534,587**	**$2,730,837**	**$2,928,364**	**$3,052,724**	**$3,400,818**	**$3,523,971**	**$3,642,119**	**$3,793,451**	**$3,964,676**	**$4,163,472**
Average Charge per Battery	*$0.00*	*$0.00*	*$35.67*	*$163.35*	*$149.48*	*$178.08*	*$217.41*	*$247.01*	*$258.95*	*$254.12*	*$251.73*	*$252.14*	*$251.74*	*$256.54*	*$259.25*	*$259.90*	*$252.46*	*$261.21*	*$250.57*	*$238.96*	*$228.91*	*$219.32*	*$210.44*
Charge per Kg	$0.00	$0.00	$0.11	$0.52	$0.48	$0.57	$0.69	$0.79	$0.82	$0.81	$0.80	$0.80	$0.80	$0.82	$0.83	$0.83	$0.80	$0.83	$0.80	$0.76	$0.73	$0.70	$0.67
Charge per kWh	$0.00	$0.00	$0.68	$3.11	$2.85	$3.39	$4.14	$4.70	$4.93	$4.84	$4.79	$4.80	$4.79	$4.89	$4.94	$4.95	$4.81	$4.98	$4.77	$4.55	$4.36	$4.18	$4.01
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Charge per battery recovered				$4,341.13	$2,270.47	$1,570.24	$1,216.37	$1,081.12	$1,010.52	$944.66	$865.62	$765.41	$669.31	$617.47	$593.70	$589.72	$581.41	$614.57	$603.19	$582.92	$564.73	$550.70	$546.04
Charge per kg battery recovered.				$12.98	$6.68	$4.57	$3.57	$3.21	$3.09	$3.03	$2.97	$2.91	$2.84	$2.78	$2.70	$2.65	$2.62	$2.81	$2.80	$2.77	$2.75	$2.73	$2.70

A.10.2 Central Case Scenario

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Quantities																				
Estimate of eligible vehicles sold	5,664	5,809	5,981	6,182	6,415	6,682	6,986	7,333	7,726	8,172	8,675	9,244	9,888	10,616	11,440	12,374	13,433	14,637	16,007	17,570
Estimate of eligible batteries sold	613	655	701	750	803	859	919	984	1,052	1,126	1,205	1,289	1,380	1,476	1,579	1,690	1,808	1,935	2,070	2,215
EOL Vehicles	424	783	1,417	2,302	3,034	3,448	3,624	3,841	4,153	4,483	4,958	5,505	6,020	6,338	6,560	6,808	7,104	7,446	7,834	8,286
EOL stationary batteries	16	18	21	25	29	33	39	45	52	61	71	82	96	111	129	150	174	203	236	274
Cumulative Vehicle batteries	34,330	39,356	43,920	47,800	51,181	54,415	57,778	61,269	64,843	68,531	72,249	75,988	79,856	84,134	89,014	94,579	100,909	108,099	116,272	125,556
Cumulative Stationary storage batteries																				
Assumed weight of vehicle batteries	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Assumed weight of stationary batteries	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
Ave battery weight	341.6	344.6	346.5	347.5	347.8	347.7	347.5	347.3	347.1	346.9	346.7	346.5	346.3	346.0	345.5	344.9	344.4	343.8	343.1	342.5
Assumed kWh	53.1	54.1	55.2	56.3	57.4	58.6	59.8	60.9	62.2	63.4	64.7	66.0	67.3	68.6	70.0	71.4	72.8	74.3	75.8	77.3
Batteries to second life	204	376	680	1,105	1,456	1,655	1,739	1,844	1,993	2,152	2,380	2,642	2,890	3,042	3,149	3,268	3,410	3,574	3,760	3,977
Batteries to recycling	236	426	758	1,239	1,649	1,932	2,127	2,419	2,892	3,497	4,105	4,600	4,966	5,251	5,534	5,842	6,248	6,717	7,199	7,625
Total battery weight to recycling (kg)	78,968	144,666	260,255	421,812	555,401	631,310	664,013	704,325	761,852	822,876	910,429	1,011,349	1,106,695	1,166,206	1,208,735	1,256,395	1,312,945	1,378,558	1,452,928	1,539,574
Annual increase	37,120	65,698	115,589	161,557	133,590	75,909	32,703	40,311	57,527	61,024	87,553	100,920	95,346	59,511	42,529	47,659	56,550	65,613	74,370	86,646
% annual increase	*89%*	*83%*	*80%*	*62%*	*32%*	*14%*	*5%*	*6%*	*8%*	*8%*	*11%*	*11%*	*9%*	*5%*	*4%*	*4%*	*5%*	*5%*	*5%*	*6%*
	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Costs																				
PRO																				
Staff	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206	$233,206
Manager	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*
Admin	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$53,351*
Compliance and membership manager	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*
Data manager (see below)																				
Rent	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800	$20,800
Opex	$30,000	$32,496	$35,092	$37,271	$38,451	$38,977	$39,179	$39,416	$39,738	$40,057	$40,483	$40,932	$41,317	$41,540	$41,691	$41,856	$42,044	$42,254	$42,482	$42,482
Legal and accountancy	$35,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Total	$319,006	$296,502	$299,098	$301,277	$302,457	$302,983	$303,185	$303,422	$303,744	$304,063	$304,489	$304,938	$305,323	$305,546	$305,697	$305,862	$306,050	$306,260	$306,488	$306,488
	33%	32%	26%	21%	18%	16%	16%	15%	14%	14%	13%	12%	11%	11%	9%	9%	9%	8%	8%	8%
Governance																				
Independent Chair	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000
Board Travel and expenses	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Directors insurance	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000
Total	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000
Data managament																				
Data collection	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796	$31,796
Database	$15,000																			
Front end	$135,000																			
Consumer design and testing																				
Maintenance and upgrades		$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
Total	$181,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796	$51,796
Comms and Education																				
Website	$30,000	$3,000	$3,000	$3,000	$3,000	$15,000	$3,000	$3,000	$3,000	$3,000	$15,000	$3,000	$3,000	$3,000	$3,000	$15,000	$3,000	$3,000	$3,000	$3,000
Branding and promotional material	$30,000	$31,500	$33,075	$34,729	$36,465	$38,288	$40,203	$42,213	$44,324	$46,540	$48,867	$51,310	$53,876	$56,569	$59,398	$62,368	$65,486	$68,761	$72,199	$75,809
PR staff time	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205	$25,205
Total	$85,205	$59,705	$61,280	$62,934	$64,671	$78,494	$68,408	$70,418	$72,529	$74,745	$89,072	$79,516	$82,081	$84,775	$87,603	$102,573	$93,692	$96,966	$100,404	$104,014

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Research & Market Development																				
Funding	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000
Scheme administration	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Total	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000
Recovery																				
Battery removal	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100
Assessment	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
Transport in NZ	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45
Storage	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311	$311
Preparation for shipping	$96	$97	$97	$97	$97	$97	$97	$97	$97	$97	$97	$97	$97	$97	$97	$97	$96	$96	$96	$96
Shipping	$96	$82	$70	$63	$58	$56	$54	$53	$52	$51	$51	$50	$50	$50	$49	$49	$49	$49	$49	$49
Recycling cost	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$672	$659	$648	$641	$637	$634	$632	$631	$630	$629	$629	$628	$628	$627	$627	$627	$626	$626	$626	$625
Battery removal	$43,967	$80,159	$143,778	$232,673	$306,221	$348,101	$366,269	$388,649	$420,527	$454,370	$502,840	$558,713	$611,593	$644,862	$668,894	$695,853	$727,821	$764,916	$806,991	$856,008
Assessment	$10,599	$19,583	$35,414	$57,552	$75,838	$86,192	$90,599	$96,036	$103,823	$112,071	$123,942	$137,623	$150,509	$158,438	$163,995	$170,210	$177,593	$186,158	$195,854	$207,151
Transport in NZ	$19,697	$35,093	$63,462	$103,132	$135,902	$154,456	$162,353	$172,097	$186,051	$200,831	$222,103	$246,620	$269,712	$283,921	$293,879	$305,017	$318,247	$333,596	$350,970	$371,214
Storage	$71,910	$96,403	$132,711	$189,815	$249,931	$284,090	$298,806	$316,946	$342,833	$370,294	$409,693	$455,107	$498,013	$524,793	$543,931	$565,378	$590,825	$620,351	$653,817	$692,808
Preparation for shipping	$22,121	$40,525	$72,905	$118,162	$155,584	$176,848	$186,009	$197,302	$213,417	$230,511	$255,037	$283,308	$310,017	$326,688	$338,602	$351,952	$367,794	$386,174	$407,007	$431,279
Shipping	$22,111	$40,506	$72,871	$118,107	$155,512	$176,767	$185,924	$197,211	$213,319	$230,405	$254,920	$283,178	$309,875	$326,538	$338,446	$351,790	$367,624	$385,996	$406,820	$431,081
Recycling cost	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$246,031	$255,732	$267,243	$280,598	$295,735	$313,372
Total	**$190,405**	**$312,270**	**$521,142**	**$819,441**	**$1,078,989**	**$1,226,454**	**$1,289,959**	**$1,368,242**	**$1,479,970**	**$1,598,483**	**$1,768,535**	**$1,964,549**	**$2,149,718**	**$2,265,240**	**$2,593,778**	**$2,695,933**	**$2,817,148**	**$2,957,789**	**$3,117,194**	**$3,302,913**
Total	**$976,412**	**$920,273**	**$1,133,316**	**$1,435,447**	**$1,697,912**	**$1,859,726**	**$1,913,347**	**$1,993,878**	**$2,108,039**	**$2,229,086**	**$2,413,892**	**$2,600,797**	**$2,788,918**	**$2,907,356**	**$3,238,874**	**$3,356,163**	**$3,468,685**	**$3,612,811**	**$3,775,882**	**$3,965,211**
Charge per Battery	*$155.57*	*$142.36*	*$169.60*	*$207.06*	*$235.25*	*$246.62*	*$242.02*	*$239.74*	*$240.13*	*$239.75*	*$244.32*	*$246.91*	*$247.52*	*$240.44*	*$248.78*	*$238.64*	*$227.58*	*$218.01*	*$208.87*	*$200.41*
Contingency (held in reserve)	**$48,821**	**$46,014**	**$56,666**	**$71,772**	**$84,896**	**$92,986**	**$95,667**	**$99,694**	**$105,402**	**$111,454**	**$120,695**	**$130,040**	**$139,446**	**$145,368**	**$161,944**	**$167,808**	**$173,434**	**$180,641**	**$188,794**	**$198,261**
Reserve (cumulative)	*$58,671*	*$104,684*	*$161,350*	*$233,122*	*$318,018*	*$411,004*	*$506,672*	*$606,366*	*$711,768*	*$823,222*	*$943,916*	*$1,073,956*	*$1,213,402*	*$1,358,770*	*$1,520,714*	*$1,688,522*	*$1,861,956*	*$2,042,597*	*$2,231,391*	*$2,429,651*
Operating time on reserve (months)	*0.7*	*1.3*	*1.6*	*1.9*	*2.1*	*2.5*	*3.0*	*3.5*	*3.9*	*4.2*	*4.5*	*4.7*	*5.0*	*5.3*	*5.4*	*5.7*	*6.1*	*6.5*	*6.8*	*7.0*
Total including Contingency	**$1,025,233**	**$966,286**	**$1,189,982**	**$1,507,220**	**$1,782,808**	**$1,952,712**	**$2,009,015**	**$2,093,572**	**$2,213,441**	**$2,340,541**	**$2,534,587**	**$2,730,837**	**$2,928,364**	**$3,052,724**	**$3,400,818**	**$3,523,971**	**$3,642,119**	**$3,793,451**	**$3,964,676**	**$4,163,472**
Average Charge per Battery	*$163.35*	*$149.48*	*$178.08*	*$217.41*	*$247.01*	*$258.95*	*$254.12*	*$251.73*	*$252.14*	*$251.74*	*$256.54*	*$259.25*	*$259.90*	*$252.46*	*$261.21*	*$250.57*	*$238.96*	*$228.91*	*$219.32*	*$210.44*
Charge per Kg	$0.52	$0.48	$0.57	$0.69	$0.79	$0.82	$0.81	$0.80	$0.80	$0.80	$0.82	$0.83	$0.83	$0.80	$0.83	$0.80	$0.76	$0.73	$0.70	$0.67
Charge per kWh	$3.11	$2.85	$3.39	$4.14	$4.70	$4.93	$4.84	$4.79	$4.80	$4.79	$4.89	$4.94	$4.95	$4.81	$4.98	$4.77	$4.55	$4.36	$4.18	$4.01
	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Charge per battery recovered	$4,341.13	$2,270.47	$1,570.24	$1,216.37	$1,081.12	$1,010.52	$944.66	$865.62	$765.41	$669.31	$617.47	$593.70	$589.72	$581.41	$614.57	$603.19	$582.92	$564.73	$550.70	$546.04
Charge per kg battery recovered.	$12.98	$6.68	$4.57	$3.57	$3.21	$3.09	$3.03	$2.97	$2.91	$2.84	$2.78	$2.70	$2.65	$2.62	$2.81	$2.80	$2.77	$2.75	$2.73	$2.70

A.10.3 High Growth Scenario

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Quantities																				
Estimate of eligible vehicles sold	12,897	18,572	26,744	32,690	54,564	78,572	113,144	162,927	199,500	234,469	309,499	319,171	319,171	319,159	319,489	317,779	315,860	318,731	319,439	319,045
Estimate of eligible batteries sold	613	655	701	750	803	859	919	984	1,052	1,126	1,205	1,289	1,380	1,476	1,579	1,690	1,808	1,935	2,070	2,215
EOL Vehicles	424	783	1,442	2,456	3,391	4,285	5,450	7,445	10,803	15,253	21,765	30,989	43,580	60,658	82,684	106,722	132,909	160,516	187,588	209,406
EOL stationary batteries	16	18	21	25	29	33	39	45	52	61	71	82	96	111	129	150	174	203	236	274
Cumulative Vehicle batteries	45,294	63,083	88,385	118,619	169,792	244,078	351,773	507,254	695,952	915,168	1,202,903	1,491,085	1,766,676	2,025,177	2,261,981	2,473,039	2,655,990	2,814,205	2,946,056	3,055,696
Cumulative Stationary storage batteries																				
Assumed weight of vehicle batteries	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Assumed weight of stationary batteries	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
Ave battery weight	341.6	344.6	346.6	347.7	348.0	348.2	348.3	348.6	348.9	349.1	349.2	349.4	349.5	349.6	349.6	349.7	349.7	349.7	349.7	349.7
Assumed kWh	53.1	54.1	55.2	56.3	57.4	58.6	59.8	60.9	62.2	63.4	64.7	66.0	67.3	68.6	70.0	71.4	72.8	74.3	75.8	77.3
Batteries to second life	204	376	692	1,179	1,628	2,057	2,616	3,574	5,185	7,322	10,447	14,875	20,918	29,116	39,688	51,227	63,796	77,048	90,042	100,515
Batteries to recycling	236	426	771	1,302	1,810	2,368	3,076	4,293	6,362	9,171	13,016	18,253	25,373	35,227	48,310	62,967	79,734	98,546	118,700	138,281
Total battery weight to recycling (kg)	78,968	144,666	264,836	449,846	620,538	783,785	996,331	1,360,255	1,972,104	2,783,068	3,969,313	5,649,373	7,942,581	11,052,588	15,063,357	19,440,662	24,209,437	29,237,308	34,168,098	38,143,357
Annual increase	37,120	65,698	120,170	185,010	170,692	163,247	212,547	363,924	611,849	810,964	1,186,245	1,680,060	2,293,208	3,110,006	4,010,769	4,377,305	4,768,775	5,027,871	4,930,790	3,975,259
% annual increase	*89%*	*83%*	*83%*	*70%*	*38%*	*26%*	*27%*	*37%*	*45%*	*41%*	*43%*	*42%*	*41%*	*39%*	*36%*	*29%*	*25%*	*21%*	*17%*	*12%*
	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Costs																				
PRO																				
Staff	$233,206	$233,206	$233,206	$233,206	$286,557	$286,557	$286,557	$286,557	$286,557	$286,557	$286,557	$286,557	$286,557	$286,557	$286,557	$286,557	$286,557	$286,557	$286,557	$286,557
Manager	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*	*$102,035*
Admin	*$53,351*	*$53,351*	*$53,351*	*$53,351*	*$106,702*	*$106,702*	*$106,702*	*$106,702*	*$106,702*	*$106,702*	*$106,702*	*$106,702*	*$106,702*	*$106,702*	*$106,702*	*$106,702*	*$106,702*	*$106,702*	*$106,702*	*$106,702*
Compliance and membership manager	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*	*$77,820*
Data manager (see below)																				
Rent	$20,800	$20,800	$20,800	$20,800	$31,200	$31,200	$31,200	$31,200	$31,200	$31,200	$31,200	$31,200	$31,200	$31,200	$31,200	$31,200	$31,200	$31,200	$31,200	$31,200
Opex	$30,000	$32,496	$35,195	$37,654	$39,083	$40,111	$41,199	$42,703	$44,624	$46,459	$48,440	$50,490	$52,539	$54,597	$56,578	$58,222	$59,650	$60,889	$61,916	$61,916
Legal and accountancy	$35,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Total	$319,006	$296,502	$299,201	$301,660	$366,840	$367,868	$368,956	$370,460	$372,381	$374,216	$376,197	$378,247	$380,296	$382,354	$384,335	$385,979	$387,407	$388,646	$389,673	$389,673
	32%	30%	24%	19%	19%	16%	14%	11%	9%	7%	5%	4%	3%	2%	2%	1%	1%	1%	1%	1%
Governance																				
Independent Chair	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000
Board Travel and expenses	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Directors insurance	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000
Total	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000
Data managament																				
Data collection	$31,796	$31,796	$47,694	$47,694	$47,694	$95,387	$95,387	$95,387	$95,387	$95,387	$95,387	$95,387	$95,387	$95,387	$95,387	$95,387	$95,387	$95,387	$95,387	$95,387
Database	$15,000																			
Front end	$135,000																			
Consumer design and testing																				
Maintenance and upgrades		$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
Total	$181,796	$51,796	$67,694	$67,694	$67,694	$115,387	$115,387	$115,387	$115,387	$115,387	$115,387	$115,387	$115,387	$115,387	$115,387	$115,387	$115,387	$115,387	$115,387	$115,387
Comms and Education																				
Website	$30,000	$3,000	$3,000	$3,000	$3,000	$15,000	$3,000	$3,000	$3,000	$3,000	$15,000	$3,000	$3,000	$3,000	$3,000	$15,000	$3,000	$3,000	$3,000	$3,000
Branding and promotional material	$30,000	$31,500	$33,075	$34,729	$36,465	$38,288	$40,203	$42,213	$44,324	$46,540	$48,867	$51,310	$53,876	$56,569	$59,398	$62,368	$65,486	$68,761	$72,199	$75,809
PR staff time	$25,205	$25,205	$37,808	$37,808	$37,808	$75,616	$75,616	$75,616	$75,616	$75,616	$75,616	$75,616	$75,616	$75,616	$75,616	$75,616	$75,616	$75,616	$75,616	$75,616
Total	$85,205	$59,705	$73,883	$75,537	$77,273	$128,904	$118,819	$120,829	$122,940	$125,156	$139,483	$129,926	$132,492	$135,185	$138,014	$152,984	$144,102	$147,377	$150,815	$154,425

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Research & Market Development																				
Funding	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000
Scheme administration	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Total	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000
Recovery																				
Battery removal	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100
Assessment	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
Transport in NZ	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45
Storage	$468	$468	$468	$468	$468	$468	$468	$468	$468	$468	$468	$468	$468	$468	$468	$468	$468	$468	$468	$468
Preparation for shipping	$96	$97	$97	$97	$97	$98	$98	$98	$98	$98	$98	$98	$98	$98	$98	$98	$98	$98	$98	$98
Shipping	$96	$97	$89	$77	$69	$64	$60	$58	$56	$55	$54	$53	$52	$52	$51	$51	$50	$51	$50	$50
Recycling cost	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$829	$831	$824	$812	$805	$800	$796	$793	$791	$791	$790	$789	$788	$787	$787	$787	$786	$786	$786	$786
Battery removal	$43,967	$80,159	$146,295	$248,076	$342,010	$431,878	$548,861	$749,051	$1,085,501	$1,531,398	$2,183,545	$3,107,078	$4,367,574	$6,076,940	$8,281,324	$10,687,208	$13,308,312	$16,071,921	$18,782,359	$20,967,977
Assessment	$10,599	$19,583	$36,043	$61,402	$84,786	$107,136	$136,247	$186,137	$270,067	$381,328	$544,118	$774,714	$1,089,504	$1,516,458	$2,067,103	$2,668,049	$3,322,716	$4,012,910	$4,689,696	$5,235,143
Transport in NZ	$19,697	$35,093	$64,590	$110,033	$151,936	$191,988	$244,154	$333,557	$483,959	$683,340	$975,059	$1,388,288	$1,952,391	$2,717,492	$3,704,248	$4,781,145	$5,954,307	$7,191,134	$8,403,935	$9,381,377
Storage	$108,186	$163,629	$201,485	$264,456	$304,937	$352,703	$448,349	$612,115	$887,447	$1,252,381	$1,786,191	$2,542,218	$3,574,162	$4,973,664	$6,778,511	$8,748,298	$10,894,247	$13,156,789	$15,375,644	$17,164,511
Preparation for shipping	$22,121	$40,525	$74,188	$126,015	$173,831	$219,561	$279,101	$381,047												
Shipping	$22,111	$40,506	$68,325	$99,085	$123,621	$144,496	$172,668	$225,426												
Recycling cost	$0	$0	$0	$0	$0	$0	$0	$0	$401,411	$566,478	$807,932	$1,149,899	$1,616,669	$2,249,693	$3,066,063	$3,957,040	$4,927,697	$5,951,093	$6,954,728	$7,763,870
Total	**$226,681**	**$379,496**	**$590,927**	**$909,068**	**$1,181,121**	**$1,447,762**	**$1,829,381**	**$2,487,333**	**$3,128,385**	**$4,414,926**	**$6,296,846**	**$8,962,196**	**$12,600,300**	**$17,534,247**	**$23,897,248**	**$30,841,740**	**$38,407,278**	**$46,383,847**	**$54,206,362**	**$60,512,878**
Total	**$1,012,688**	**$987,499**	**$1,231,705**	**$1,553,958**	**$1,892,927**	**$2,259,921**	**$2,662,542**	**$3,324,009**	**$3,969,093**	**$5,259,685**	**$7,157,912**	**$9,815,756**	**$13,458,475**	**$18,397,173**	**$24,764,983**	**$31,726,090**	**$39,284,174**	**$47,265,257**	**$55,092,237**	**$61,402,362**
Charge per Battery	*$74.96*	*$51.36*	*$44.88*	*$46.47*	*$34.19*	*$28.45*	*$23.34*	*$20.28*	*$19.79*	*$22.33*	*$23.04*	*$30.63*	*$41.99*	*$57.38*	*$77.13*	*$99.31*	*$123.66*	*$147.40*	*$171.35*	*$191.13*
Contingency (held in reserve)	**$50,634**	**$49,375**	**$61,585**	**$77,698**	**$94,646**	**$112,996**	**$133,127**	**$166,200**	**$198,455**	**$262,984**	**$357,896**	**$490,788**	**$672,924**	**$919,859**	**$1,238,249**	**$1,586,304**	**$1,964,209**	**$2,363,263**	**$2,754,612**	**$3,070,118**
Reserve (cumulative)	*$60,484*	*$109,859*	*$171,445*	*$249,143*	*$343,789*	*$456,785*	*$589,912*	*$756,113*	*$954,567*	*$1,217,551*	*$1,575,447*	*$2,066,235*	*$2,739,159*	*$3,659,017*	*$4,897,266*	*$6,483,571*	*$8,447,780*	*$10,811,042*	*$13,565,654*	*$16,635,772*
Operating time on reserve (months)	*0.7*	*1.3*	*1.6*	*1.8*	*2.1*	*2.3*	*2.5*	*2.6*	*2.7*	*2.6*	*2.5*	*2.4*	*2.3*	*2.3*	*2.3*	*2.3*	*2.5*	*2.6*	*2.8*	*3.1*
Total including Contingency	**$1,063,322**	**$1,036,874**	**$1,293,290**	**$1,631,656**	**$1,987,574**	**$2,372,917**	**$2,795,669**	**$3,490,209**	**$4,167,547**	**$5,522,669**	**$7,515,808**	**$10,306,544**	**$14,131,398**	**$19,317,032**	**$26,003,232**	**$33,312,394**	**$41,248,383**	**$49,628,519**	**$57,846,848**	**$64,472,480**
Average Charge per Battery	*$78.71*	*$53.93*	*$47.12*	*$48.79*	*$35.90*	*$29.87*	*$24.51*	*$21.29*	*$20.78*	*$23.44*	*$24.19*	*$32.16*	*$44.08*	*$60.25*	*$80.99*	*$104.27*	*$129.85*	*$154.77*	*$179.92*	*$200.69*
Charge per Kg	$0.25	$0.17	$0.15	$0.16	$0.11	$0.10	$0.08	$0.07	$0.07	$0.07	$0.08	$0.10	$0.14	$0.19	$0.26	$0.33	$0.41	$0.49	$0.57	$0.64
Charge per kWh	$1.50	$1.03	$0.90	$0.93	$0.68	$0.57	$0.47	$0.41	$0.40	$0.45	$0.46	$0.61	$0.84	$1.15	$1.54	$1.99	$2.47	$2.95	$3.43	$3.82
	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Charge per battery recovered	$4,502.41	$2,436.32	$1,677.59	$1,253.35	$1,098.35	$1,002.06	$908.81	$813.06	$655.09	$602.16	$577.42	$564.64	$556.94	$548.35	$538.26	$529.04	$517.32	$503.61	$487.34	$466.24
Charge per kg battery recovered.	$13.47	$7.17	$4.88	$3.63	$3.20	$3.03	$2.81	$2.57	$2.11	$1.98	$1.89	$1.82	$1.78	$1.75	$1.73	$1.71	$1.70	$1.70	$1.69	$1.69

A.11.0 Alignment with E-Waste Product Stewardship Scheme

Throughout Milestone Two, the project team has been in regular communication with the Techcollect E-waste product stewardship scheme designer.

The teams have discussed a range of issues relevant to both scheme designs in an effort to ensure that the schemes are compatible and, if implemented, able to function together effectively. The key areas of focus during have included:

- Definitions for large batteries. It was agreed that both schemes should use the same definitions to avoid definition issues
- Common standards and accreditation criteria, particularly for end-of-life recyclers, who may be the same parties under both schemes
- Charges and payments, to ensure equity and minimise the incentive for material to move between schemes
- Data management. It may be useful if both schemes use the same (or compatible) data management systems which could help manage tracking of batteries that are on the boundaries of the schemes (or move between schemes), and ensure data is comparable.

The outcomes of these discussion will be reported on in Milestone 3.

A.12.0 B.U.G.

A.12.1 Terms of Reference

B.I.G. Battery User Group

Terms of Reference

1 October 2020

Battery User Group (B.U.G.)

Terms of Reference

PURPOSE

This Terms of Reference (ToR) document describes the terms of reference for the Battery Users Group (B.U.G.), specifically the background to the B.I.G. and expectations of B.U.G. members.

BACKGROUND

In any future scenario it will be vital that users of batteries have clear, user friendly, accessible, and economically attractive ways to return large batteries for reuse, refurbishment, or recycling. Any incentive to illegally dispose or seek less optimal disposal routes needs to be minimised.

The product stewardship scheme design therefore needs to identify and take account of the potential realities that consumers will face when they have an end-of-use large battery (or batteries) and offer solutions to ensure maximum engagement and compliance.

The B.U.G. is a working group established to help B.I.G. ensure that the needs of consumers are correctly identified and included in the PS scheme design.

KEY DELIVERABLES

The key deliverable to B.I.G. is recommendations on how the product stewardship scheme can best reflect the needs of consumers. These may include but are not limited to:

- Messaging content
- Messaging channels
- Access to facilities
- Access to services
- Financial incentives (such as deposit refunds)
- Non-financial incentives (such as behavioural nudges)
- Advance disposal fees
- Chain of custody (Ownership and responsibility)
- Clarity and ease of use of the final proposed Scheme

In addition, B.I.G. anticipates that B.U.G. members will have queries and questions about the Scheme and its implementation. B.U.G. members may also wish to participate in or propose other B.I.G. working group projects. The B.I.G. Core Delivery Team will coordinate responses to questions and would welcome B.U.G. member involvement in other projects such as pilots etc where appropriate.

METHODOLOGY

B.U.G. will develop recommendations on the needs of consumers by:

Convening one or more workshops/focus groups to identify the key needs and solutions for consumers in relation to large battery end of life management.

And/or

Undertaking a consumer survey to gauge consumer awareness and preferences.

MEMBERSHIP

The B.U.G membership will include:

- Private vehicle owners/representatives
- Private stationary storage owners/ /representatives
- Vehicle leasing and hire companies
- Fleet owners
- Network utilities operating stationary storage facilities
- Commercial entities operating stationary storage facilities

ROLES & RESPONSIBILITIES

Chair: Mandy Mellar, General Manager – AA Battery Service

Meeting facilitation and research: Duncan Wilson, Eunomia Research & Consulting

Group organisation, minutes and support: Sarah Pritchett, WasteMINZ

GOVERNANCE

All members of B.U.G. will abide by the values, expectations and requirements set by the B.I.G. Terms of Reference as applicable to B.U.G.

REPORTING REQUIREMENTS

Updates from B.U.G. will be provided to the B.I.G. Core Delivery Team by the B.U.G. Chair at quarterly intervals or more frequently if required. Findings will be communicated to B.I.G. for distribution through its members to inform discussion.

Interim findings to be reported by 30th November 2020.

Final recommendations to be reported by 31 January 2021. B.U.G. updates will also be provided for each B.I.G. News newsletter and social media channels.

WORK PLAN, INCLUDING ACTIVITY SCHEDULE

B.U.G. will meet as required (tele or video conference or face to face).

FUNDING

B.U.G. does not have an allocated budget and all costs of operation will be met by members of B.U.G. or B.I.G. or through acquired sponsorship; the B.I.G. Governance Group and Core Delivery Team is able to provide guidance on funding as required.

END

A.12.2 Workshop 1

The notes from workshop 1 are provided below:

B.I.G. Battery User Group Workshop 1: Notes

10am – 1pm, 20 November 2020, The Vector Sub-Station, the corner of Plumer and Quay Streets

ATTENDEES

In Person:

Mandy Mellar, General Manager – AA Battery Service: Chair

Juhi Shareef, B.I.G. Chair, Vector

Duncan Wilson, Eunomia Research & Consulting: Meeting facilitation:

Sarah Pritchett, WasteMINZ: Administration

Bill Alexander, Bluecar

Kane Bublitz, Mercury

Jo Phillips, Vector

Amanda West, LDV

Darren Mansell, LDV

Peng Cao, University of Auckland

Gareth Shute

Joe Gibson, SIMS

Mark Lloyd, AA

On Zoom

Kathryn Trounson, Better NZ Trust.

Marcus Baker, Finite Planet Ltd

Letitia Still, Customfleet

Hayden Johnston, GVI

Carl Hills, Fleetpartner

APOLOGIES

Buddhika Rajapakse, Mercury

Alan Gaskin, Chargenet

Becky Dawson, Mango communications

Andrew Bayliss, Ssangyong

Nalin Senanayake, iTech

WORKSHOP PURPOSE

The workshop's aim was to:

- Update B.U.G. members on the scheme design progress to date
- Identify the issues and concerns that end-users will face when they have a large battery (or batteries) that have come to end of use
- Seek solutions for how these concerns can be addressed in the context of the Large Batteries Product Stewardship Scheme design

GROUP 1: EV USERS (Facilitated by Duncan)
Group Members: Gareth Shute, Peng Cao, Mark Lloyd
Content
Question 1. Who are the different parties who are involved in the End Of Life of large batteries for your user group? What should the responsibilities be of each party?
Manufacturers: May have warranty responsibilities **Importers:** May have warranty responsibilities **Wreckers:** Take the cars. Only accredited ones. Notify of danger **Owners:** Need to take to an accredited agent **Retailers** (new and used): Potentially be collection points **Insurance companies**: Crashes are main source of batteries Ensure assessment and accredited agencies used **Auction houses** (incl trade me): make sure all sales link with scheme – may need to be regulation to control sales **NZTA/Registration.** Data/Notified of change of ownership
Question 2. What information does your user group need from each of the different parties?
Manufacturers: Battery passport **Importers:** Data on every battery brought in – chemistry, SOH, rate, capacity, size, weight **Wreckers:** Are they accredited, charges/rebates, where, how to return. They need to know how to ID batteries, know where to send them, how to store etc. **Owners:** Owners need to know to take to an accredited agent, what return/replacement requirements are, and they can't be charged **Retailers** (new and used): Who accredited agents are, what process is. Government needs to communicate requirements to importers and retailers **Insurance companies**: direct where wrecks go and how. Need EV knowledge **Auction houses** (incl trade me):

NZTA/Registration. What are legal requirements?
Question 3. How should this information be communicated?
Depends on the available information. – For example, there could be a QR code on the windscreen (and on battery) that takes you to info about the battery (chemistry etc). Milk powder example. – info about who the manufacturer is via barcode. – Importers supply info to the database – Retailers and customers know how to access. Like rego info (battery info could be linked) – Accredited wreckers listed on website?
Question 4. Access. How do consumers want to access EOL services – book a pickup? Local garage? Dealer? Technician?
1) Crash. Tow truck. Needs to know EV transport procedure/danger. Insurance companies organise correct procedure (Side point – are accredited electricians needed?) 2) Whole replacement – EOL Car unsellable as a vehicle. Probably OK to drop off – need to know where so need easy to find info 3) Battery replacement. Either consumer takes to wrecker as usual and onus is on wrecker. If consumer takes apart themselves then onus is on them 4) Home batteries. Accredited uninstaller required.
Question 5. Under a PS scheme 'disposal' must be free to the consumer. However, is this sufficient incentive? Does there need to be a payment? How much? Under what circumstances? What is to stop batteries with value simply being sold privately?
Adjust pricing of handed in batteries so even true End of Life can generate a payment to the consumer. Perhaps pricing of second life could be adjusted down to make the economics work?
Question 6. Out of all the things you have discussed, what are the top features a scheme should have (or avoid doing)?
1) How to deal with data, ten years(?) before battery passports become standard? Need QR code accessible to all a. High level info on database b. Could be updated if battery changes c. Could be linked to rego

d. Similar to milk powder barcodes
e. Importer adds info

2) Key parties need to know:
   a. Towtruck driver/need to know how to transport – accredited agents
   b. Insurance company – directs where cars go
   c. Wreckers need to be accredited and do right thing
3) At EOL there should be a rebate based on SOH so lower the SOH the higher the rebate – enable the right thing to be done.

GROUP 2: STATIONARY STORAGE (Facilitated by Jo)

Group Members: Kane Bublitz, Jo Phillips, Joe Gibson

Content

Question 1. Who are the different parties who are involved in the End Of Life of large batteries for your user group? What should the responsibilities be of each party?

Mercury

- stationary battery (1MW)
- corporate EV fleet - mix of owned and leased
- B2C EV fleet - all owned and leased to an end-customer
- Solar business including batteries and residential sales

Responsibilities:

- 1MW battery mercury owns and is responsible
- Some leased so some fleet company responsibility
- B2C fleet – plan to sell before end of life so no further responsibility
- Sales of batteries to residential customers through the solar business – currently don't necessarily see themselves as responsible for the battery once sold but suggested that's for discussion

Sims

- EOL vehicles, a few are EV or hybrid * path to Sims is: insurance assessment to auction to wreckers to recyclers/Sims
- Don't take vehicles with Li ion batteries
- Difficulty in removing the batteries and risk in removing
- No outlet for hybrid/EV batteries

Responsibilities

- Wreckers should remove the batteries before they get to recyclers or add another step in the cycle which could be the battery assessment and removal (so whether current wreckers or another entity)

Vector

- Owns residential and utility scale batteries
- Sells batteries through subsidiaries, incl NZ and Pacific Islands
- 1MW battery solution in Australia

- Corporate EV fleet - all leased

Responsibilities

- For Vector-owned batteries responsible
- For sold batteries current position is that Vector would still be responsible in some way
- Corporate EV fleet – no responsibility, Lease co responsible

Question 2. What information does your user group need from each of the different parties?

- Recyclers – when shredding a vehicle – knowing exactly what is in the battery materials – handling the shredded materials, is there anything toxic?
- Who can handle a battery, e.g. an electrician?
- Material sheets
- State of charge
- State of health
- Has the battery been in an accident?
- Reason for removal/disposal
- What was it's second life?
- Age
- Serial number, batch
- Who can remove the battery?
- Where does the battery go once removed?
- Who can you get used batteries from?

Question 3. How should this information be communicated?

Scannable code on product

- Centralised database
- Pack level
- Module – maybe
- Cells? Could track if a whole pack has been refurbished so probably cells removed

Question 4. Access. How do consumers want to access EOL services – book a pickup? Local garage? Dealer? Technician?

- Readily accessible via 'FAQ'/Info hub
- List of service suppliers located on the centralised hub
- Calling wrecker/insurer
- Stationary batteries go back to retailer/supplier
- Or contact stewardship not for profit to collect if entity no longer exists i.e. if the business you purchased from / installed goes out of business – support from the scheme to find someone to decommission and take the battery

Question 5. Under a PS scheme 'disposal' must be free to the consumer. However, is this sufficient incentive? Does there need to be a payment? How much? Under what circumstances? What is to stop batteries with value simply being sold privately?

Money - Penalty – Consumer/retailer

Education programme – incentive

Circumstances:

- If customer the customer can't have the battery removed by the retailer or installer and they do contact the Scheme or supporting body to have the battery removed and disposed of in accordance with the scheme they should receive a bounty payment
- If a battery is removed early due to a fault / under warranty there should be no payment – manufacturer / retailer / importer responsibility
- If used import and reaches end-of-life and the vehicle reaches a wrecker – should receive a bounty/payment
- If new
  - Fault – retailer - no payment
  - Worn – wrecker - payment
  - Sold – new customer responsibility - either gets sold again (no payment), wrecker (wrecker gets payment), or battery replacement/refurb service (payment to eg Blue Cars)

Question 6. Out of all the things you have discussed, what are the top features a scheme should have (or avoid doing)?

1. Trace battery back to first life
2. Make it super simple and easy
3. Centralised data
4. Incentive

GROUP 3: SERVICE PROVIDERS (Facilitated by Mandy)

Group Members: Amanda West, Darren Mansell Bill Alexander, Mandy Mellar

Content

Question 1. Who are the different parties who are involved in the End of Life of large batteries for your user group? What should the responsibilities be of each party?

- Commercial Businesses I.e., fleet companies/dealerships/home power suppliers - Responsibility is on them to provide a pathway back to accredited repurposes/recyclers
- Private owners – Responsible to use accredited repairers
- Second hand car owner (3^{rd}-4^{th} owners) - use accredited repairers, ensure their batteries are registered
- Car repairers – accredited to R – R or R
- Home Powerbank owners - Responsible to use accredited repairers and accredited suppliers
- Insurance companies/Wreckers - responsible to follow process and use accredited repairers/recyclers

Question 2. What information does your user group need from each of the different parties?

- Tracking of information during lifecycle
- Change of purpose needs data update, potentially by QR/bar codes
- History, age, Installation by accredited installer
- Modified> SOH
- Can the battery be repurposed?
- Basic battery description – history, Battery recyclers – want to know the battery health

Question 3. How should this information be communicated?

- Information in the new vehicle to inform user/owner of battery responsibility
- Website for more info – registration
- Incentive to return battery to recycler
- Registration – deregistration - Flag up as ‘EV Battery’

Question 4. Access. How do consumers want to access EOL services – book a pickup? Local garage? Dealer? Technician?
- Website – book pickup 0800 number - Accredited dealers/technicians' website/labels on the batteries on what to do?
Question 5. Under a PS scheme 'disposal' must be free to the consumer. However, is this sufficient incentive? Does there need to be a payment? How much? Under what circumstances? What is to stop batteries with value simply being sold privately?
- Value awareness - Payment based on SOH measures, more given for batteries that can be repurposed ideal, Size of the batteries - Selling batteries privately should be limited - Legislation – on who can sell used batteries - i.e., not on TradeMe - High voltage limit - Registered sellers
Question 6. Out of all the things you have discussed, what are the top features a scheme should have (or avoid doing)?
1. Data management - effective to encompass all large batteries and their life cycle 2. Accreditation - to repair/recycle/repurpose 3. Communication / Education - making it commonplace to know where to go and what to do 4. Money - create the most viable flow to ensure EV usage is encouraged and easy to use

GROUP 4: ZOOM GROUP (Facilitated by Sarah)

Group Members: Kathryn Trounson, Marcus Baker, Letitia Still, Hayden Johnston, Carl Hills

Content

Question 1. Who are the different parties who are involved in the End Of Life of large batteries for your user group? What should the responsibilities be of each party?

EV drivers – if they buy new they generally on-sell to secondhand market.

Fleet managers – Also lease a lot of EVS but not reaching end of battery life as being onsold into secondhand market. A big consideration for a lot of fleets is what is the end of life for these batteries? That adds to decision whether to lease one or not. It is a plus that fleet vehicles can be onsold into NZ market, but so far not a lot are being sold onto the market.

Stationary storage system owners and retailers – The end-of-life process for lead acid batteries is well known but for lithium-ion batteries it is not so clear. Lots of brand new off grid and on grid lithium-ion batteries are selling on the market i.e. through Harrisons and Solar City for e.g. without much discussion on the end-of-life process. There is a smaller secondhand market. Tesla power wall's lose their capacity slowly but most people generally buying second tier static storage system to store excess solar power, which don't have same longevity. EVs are actually more important than static systems or for large scale i.e. schools, hospitals, large businesses.

Responsibility: As EV and static storage system owners or fleet managers we are mostly responsible for keeping the battery in good order when using it so it is kept being useful for as long as possible. The incentive to do so would be to get a better price for on-selling your vehicle.

Question 2. What information does your user group need from each of the different parties?

- Can a battery be pulled apart? What can be salvaged? Is that salvage safe? Ie If your car is written off in an accident can the battery be salvaged?
- Maintaining batteries – how best to maintain a battery. Try to educate people on how to treat their batteries.
- Swapping cells out of leaf batteries: damaged packs
- Promote refresh over replacing batteries

Question 3. How should this information be communicated?

- Infographic. Different ways of digesting info - every which way
- Point of sale booklets
- EECA produces great booklets which could be replicated
- Social media
- TV
- Every way possible and as many ways possible.

Question 4. Access. How do consumers want to access EOL services – book a pickup? Local garage? Dealer? Technician?

Access to EOL

- Online platform for repurposing second life batteries – very heavy/not just anyone can remove
- Technician replaces battery or repairs so technician needs to be responsible for EOL as a service. Ie they come to your house to replace or fix battery or you drive to service centre if possible.
- Via trade-ins for e.g.:
    - May be entire vehicle or upgrade old pack via dealer/technical
- Generally, the EOL pathway for EV users is an upgrade of either car or battery which involves a technician or a retailer, so this lends itself nicely to the service people/technicians/retailers being the people responsible for EOl (unless car is being sold on private market)
- Technicians need to know which batteries can be used for something else and how much life left etc.

-

Question 5. Under a PS scheme 'disposal' must be free to the consumer. However, is this sufficient incentive? Does there need to be a payment? How much? Under what circumstances?

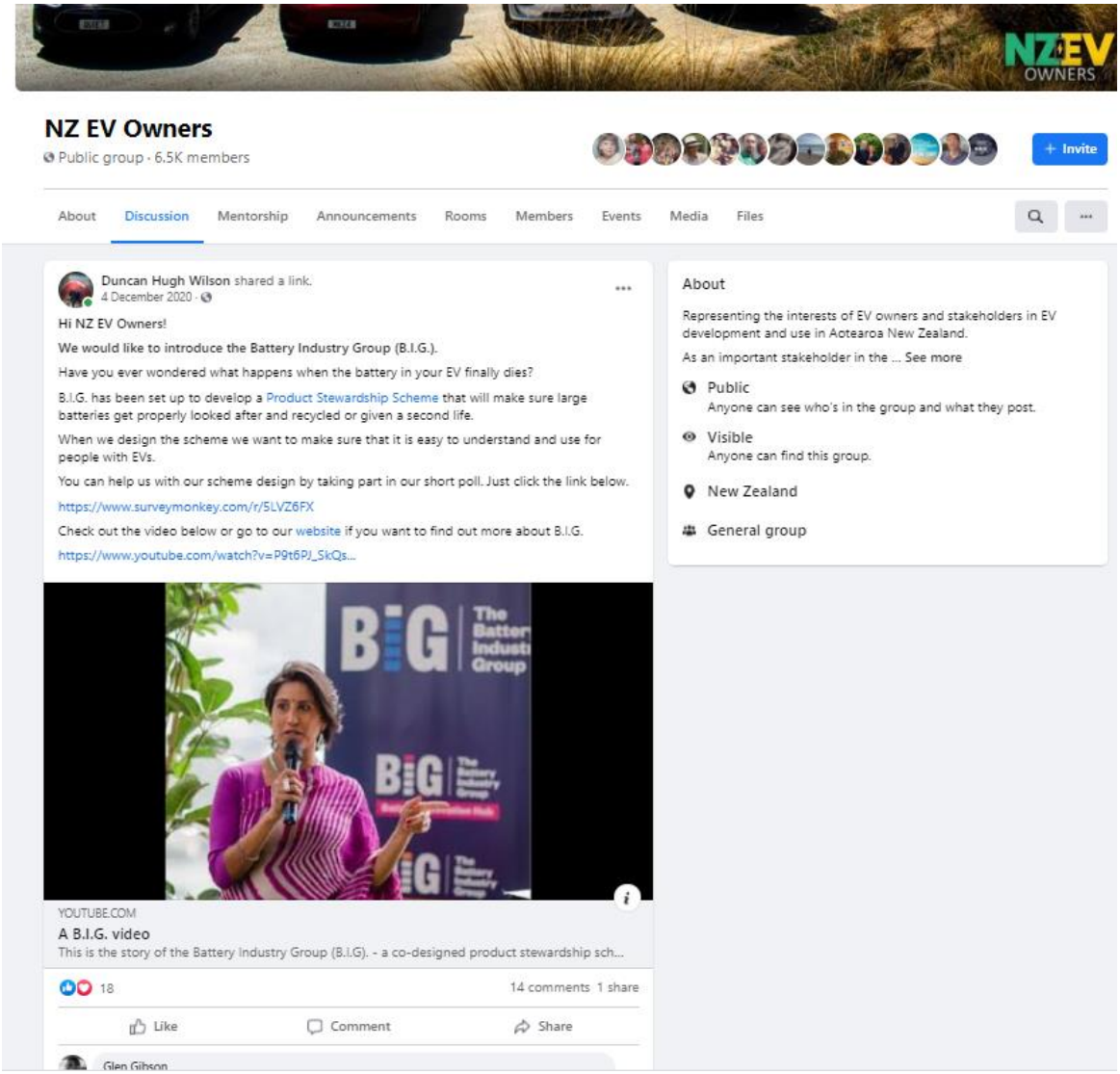
What is to stop batteries with value simply being sold privately?
– Landfill ban on e-waste would ensure the right thing is done with batteries – Insurance companies are involved with a wrecked car so need to be part of the solution – A returnable deposit could be offered but hard to manage if vehicle is onsold multiple times – Cost is a barrier for EV/Batteries – adding more costs will a create more barriers – Car wreckers – payment for them to encourage them to do right thing? – Centralised trading platform for batteries – wreckers/retailer - not sell on private market (Make sure trademe on board re not selling second life batteries) – Consequences for selling on private trademe or disposing of in landfill – Cost needs to be built in – cost of disposal, netting of usability of the battery.
Question 6. Out of all the things you have discussed, what are the top features a scheme should have (or avoid doing)?
1. Clearly defined path. i.e. once PS is enacted it is broadcast far and wide. Mass communication – the why the how and the what – stewardship 101 2. Clearly targeting the top of the waste hierarchy. What recycling means – how much is lost and how much is extracted and why it is important to be a kaitiaki (steward) the whole way through the system 3. Not cost prohibitive easy and economically makes sense – good selling point 4. Does not create barriers to participation

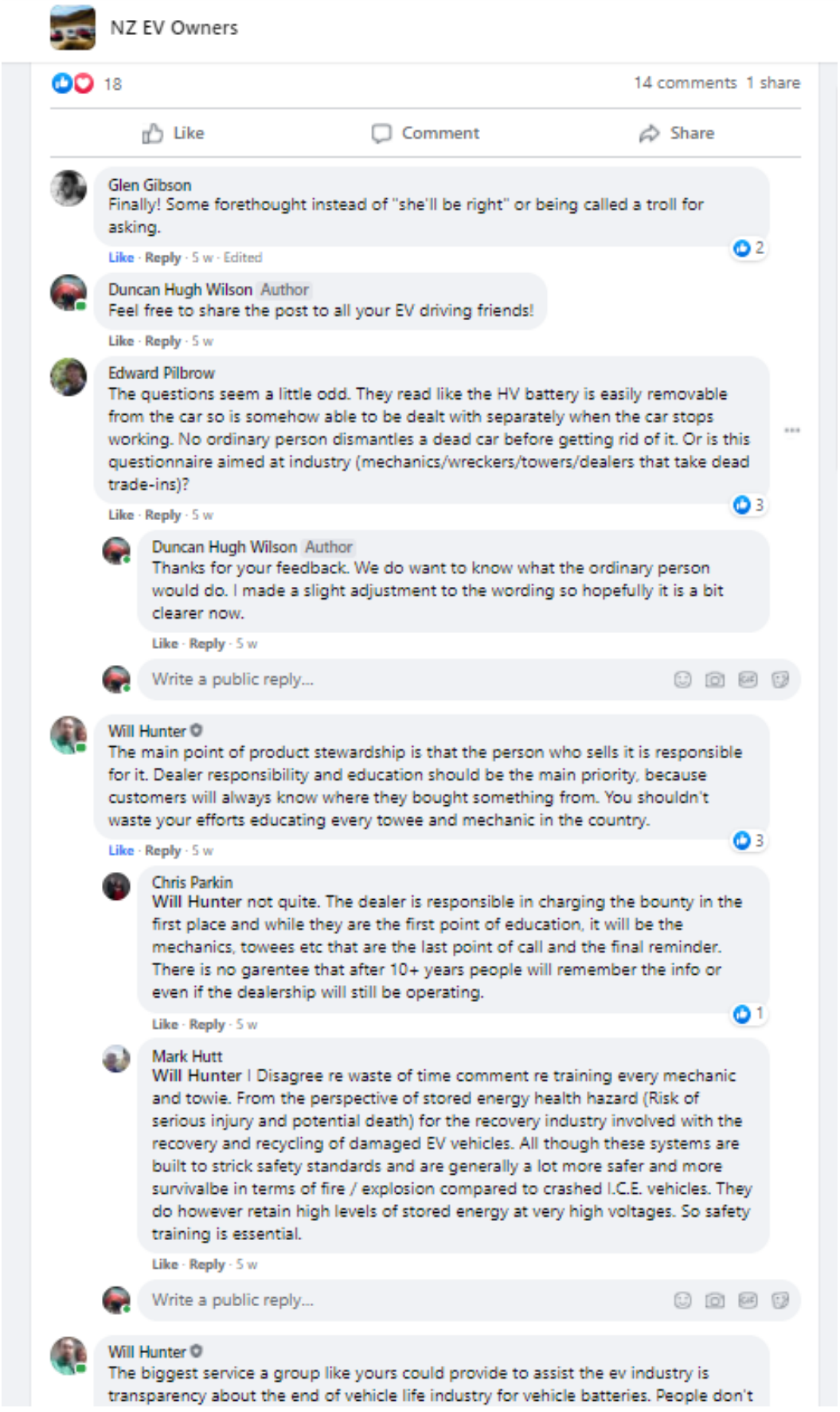
IDEAS '2ND LIFE' BOARD

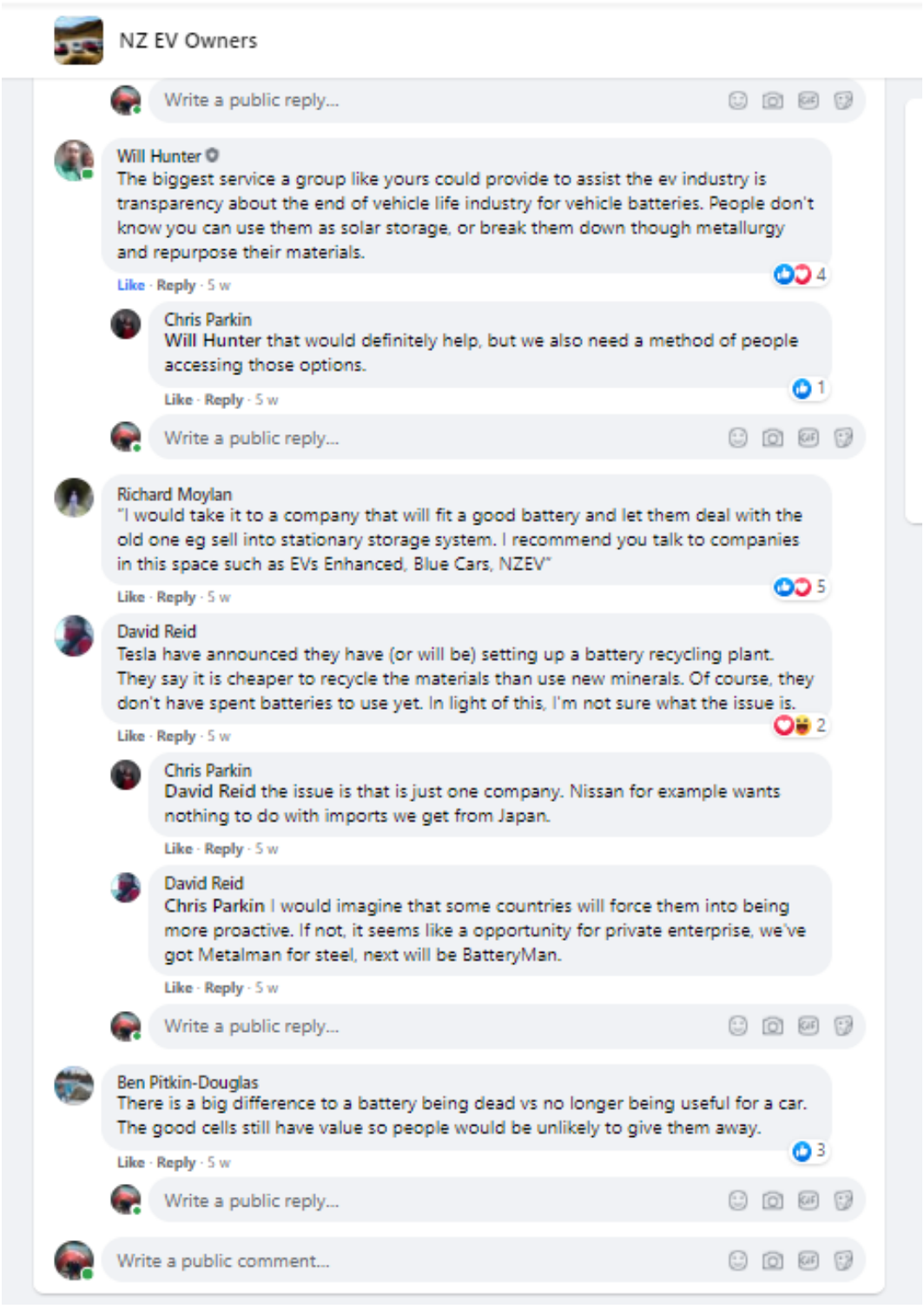
- Car Wreckers – probably will deal with batteries – need to include in the group
- Money flow – who to and how much?
- How does this work towards/against EV uptake?
- PS scheme needs to be linked to EV incentive scheme so net result is not disincentive

- Links to e-waste scheme. Battery packs can be broken up into cells, (and vice versa) then would fit under e-waste scheme. Needs to not have mismatch in cost/incentive under each scheme to avoid creating loopholes and deliberate transfer between each scheme.

A.12.3 Survey




NZ EV Owners
18
14 comments 1 share
Like
Comment
Share
Glen Gibson
Finally! Some forethought instead of "she'll be right" or being called a troll for asking.
Like · Reply · 5 w · Edited
2
Duncan Hugh Wilson Author
Feel free to share the post to all your EV driving friends!
Like · Reply · 5 w
Edward Pilbrow
The questions seem a little odd. They read like the HV battery is easily removable from the car so is somehow able to be dealt with separately when the car stops working. No ordinary person dismantles a dead car before getting rid of it. Or is this questionnaire aimed at industry (mechanics/wreckers/towers/dealers that take dead trade-ins)?
Like · Reply · 5 w
3
Duncan Hugh Wilson Author
Thanks for your feedback. We do want to know what the ordinary person would do. I made a slight adjustment to the wording so hopefully it is a bit clearer now.
Like · Reply · 5 w
Write a public reply...
Will Hunter
The main point of product stewardship is that the person who sells it is responsible for it. Dealer responsibility and education should be the main priority, because customers will always know where they bought something from. You shouldn't waste your efforts educating every towee and mechanic in the country.
Like · Reply · 5 w
3
Chris Parkin
Will Hunter not quite. The dealer is responsible in charging the bounty in the first place and while they are the first point of education, it will be the mechanics, towees etc that are the last point of call and the final reminder. There is no garentee that after 10+ years people will remember the info or even if the dealership will still be operating.
Like · Reply · 5 w
1
Mark Hutt
Will Hunter I Disagree re waste of time comment re training every mechanic and towie. From the perspective of stored energy health hazard (Risk of serious injury and potential death) for the recovery industry involved with the recovery and recycling of damaged EV vehicles. All though these systems are built to strick safety standards and are generally a lot more safer and more survivalbe in terms of fire / explosion compared to crashed I.C.E. vehicles. They do however retain high levels of stored energy at very high voltages. So safety training is essential.
Like · Reply · 5 w
Write a public reply...
Will Hunter
The biggest service a group like yours could provide to assist the ev industry is transparency about the end of vehicle life industry for vehicle batteries. People don't


NZ EV Owners
Write a public reply...
Will Hunter
The biggest service a group like yours could provide to assist the ev industry is transparency about the end of vehicle life industry for vehicle batteries. People don't know you can use them as solar storage, or break them down though metallurgy and repurpose their materials.
Like · Reply · 5 w
4
Chris Parkin
Will Hunter that would definitely help, but we also need a method of people accessing those options.
Like · Reply · 5 w
1
Write a public reply...
Richard Moylan
"I would take it to a company that will fit a good battery and let them deal with the old one eg sell into stationary storage system. I recommend you talk to companies in this space such as EVs Enhanced, Blue Cars, NZEV"
Like · Reply · 5 w
5
David Reid
Tesla have announced they have (or will be) setting up a battery recycling plant. They say it is cheaper to recycle the materials than use new minerals. Of course, they don't have spent batteries to use yet. In light of this, I'm not sure what the issue is.
Like · Reply · 5 w
2
Chris Parkin
David Reid the issue is that is just one company. Nissan for example wants nothing to do with imports we get from Japan.
Like · Reply · 5 w
David Reid
Chris Parkin I would imagine that some countries will force them into being more proactive. If not, it seems like a opportunity for private enterprise, we've got Metalman for steel, next will be BatteryMan.
Like · Reply · 5 w
Write a public reply...
Ben Pitkin-Douglas
There is a big difference to a battery being dead vs no longer being useful for a car. The good cells still have value so people would be unlikely to give them away.
Like · Reply · 5 w
3
Write a public reply...
Write a public comment...

Survey Other Responses:

Question 1:

What's a dead battery? I have 47 batteries in my car which one is dead.
No zuch thing
All of the above?
If all cells in the pack are past their usable life, then recycle the pack. Otherwise replace the faulty cells.
General research online, and discussion with other EV owners.
I imagine that wreckers and businesses who provide battery replacement services would be connected to battery recyclers. It would be very uncommon for an individual owner to remove the main battery from an EV and have to dispose themselves. For old batteries which have not come directly from vehicles, a network of well advertised collection points such as eco drop would be most logical. So that everyone knowstt that's the place where you drop lithium batteries.
An EV battery specialist like Blue Cars in Auckland or EVs Enhanced in Christchurch
Online information is very easy to research & answer this problem.
Not clear on whether these are current sources or just our preferences- very little "real " guidance available
EVs Enhanced in Chch, or EV FB groups, but batteries don't just die, they slowly degrade over time and always have some kind of trade in value.
Google search
I would expect the recycling centre to mange it and get a replacement battery from the maker who would have worked out how to replace them in cars by then. Also how to use what is left in the battery that's usable recycle
Get it collected by a car wrecker
Bill Alexander at Blue Cars
Friend

Question 3

Why would I bring it in if you're taking it out of my car - then what - you going to sell me a new one?
What does “for at no cost” mean. you no speak inglish
Still no such thing
If all cells in the pack are past their usable life, then recycle the pack. Otherwise replace the faulty cells. Even at 30% capacity a 75kWh pack enough capacity to serve a home - so $10000
It's unlikely that a battery will be completely dead. There may be some dead cells, or the overall battery pack no longer had sufficient capacity. I would be looking to have the battery pack converted into home storage, or given some second life before recycling.
The "dead" battery is worth way more than this
Dead battery in the car has more value than these options
I don’t understand this question. If I had a car with a zero value battery I would sell the car or replace the battery. I wouldn’t take the battery somewhere without getting a new battery or a new car
None - what would you then do with the car?
As above, batteries don't just die, they degrade slowly, so will always have some remaining capacity and therefore residual value to sell, most likely as a trade in through the specialist who upgrades the battery (like EVs Enhanced). It will be places like that, or wreckers that dispose of batteries. If I'm disposing of the battery without upgrading it, then the whole car would need to be scrapped.
I think it depends on what kills the battery. For ex, was it just few cells that bring down the battery. The battery contains lots of metals etc so a payment would be worthwhile it is commercially viable.
Rebate on purchase of replacement battery or next EV
Discount off a replacement or reconditioned pack
My understanding is that when my battery is no longer useful as a car battery I'll be able to use it for home storage.
Could offer a voucher off the cost of another electric vehicle car or bike
Tax credit against purchase of repair or replacement battery/vehicle

100 should cover travel or towing costs? If it's a cost neutral proposal it would be more likely people will do it?
I'd rather get it recycled myself to use in home PV, but $100 should be effective enough without encouraging theft.
Based on it's usable state when given up
$1500
Might look at home use with solar
Dead batteries are not useless - buy them at market value
I would take it to a company that will fit a good battery and let them deal with the old one eg sell into stationary storage system. I recommend you talk to companies in this space such as EVs Enhanced, Blue Cars, NZEV
A dead car is a much bigger problem than worrying about a few hundred dollars.
Given that a dead battery is worth $1000s in scrap metal value alone, this seems like a poorly worded scenario.
1000
$1000. No one is going to hire a trailer, some how lift a 300kg battery onto it then drive for hours around the city to some battery recycling place.

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