New Zealand Battery Product Stewardship Research

Milestone 1: Background Research

Report for the Ministry for the Environment

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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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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.

This Milestone One report covers:

- Background including New Zealand context and legislative considerations
- Product stewardship scheme elements
- Review of key international schemes
- Overview of NZ Value Chains.

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.

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 an informal stakeholder group that has been assembled to provide input and oversight for this project.

E.2.0 Background

New Zealand has no formal nationwide system for managing and recovering end of life large batteries, although individual businesses are exploring opportunities for recovery and recycling.

[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

E.2.1 Legislation

Batteries were proposed as a priority product under the Waste Minimisation Act 2008 in Government consultation launched in August 2019.. This product stewardship scheme design project has assumed a 'co-design' approach will be applied, which would require Government regulation to be enacted. However, it needs to be emphasised that large batteries were not, at the time of commencing the scheme design, declared a priority product.

E.2.2 Project Links

The project is working to take account of other relevant work in New Zealand including:

- Progress on developing on-shore recycling capacity for batteries
- Product stewardship scheme for tyres
- Product stewardship scheme for e-waste
- Initiatives on small batteries
- The Second Life EV Battery Strategy Project
- The Right to Repair Working Group of WasteMINZ.

E.3.0 Product Stewardship Scheme Elements

There are many possible elements to a product stewardship scheme that must work together to create an effective set of drivers which will deliver better environmental outcomes. Some of the tools that could form part of a product stewardship scheme include:

- Advanced disposal fees
- Recycling targets and standards
- Product content
- Deposit refunds
- Changes to product design
- Ownership models
- Consumer information
- Collection networks
- Financing mechanisms
- Reuse, including remanufacture
- Membership fees
- Management and Governance.

E.4.0 Review of International Schemes

Our review of relevant product stewardship schemes internationally has revealed that there do not appear to be any product stewardship schemes in operation that specifically address large batteries. This means that there is no 'model' scheme that we can directly learn from or base a New Zealand approach on. Nevertheless, there are some important lessons that can be derived from overseas experience. These include:

- Definitions and clarity around what is included in a product stewardship scheme is vital
- Produce responsibility organisations (PROs) can lower costs and reduce duplication of systems for producers and importers but also dilute the incentive for individual manufacturers to adopt sound practices and improve design
- A single organisation model appears to be better for consistency of communication and awareness raising
- Not-for-profit collection organisations are considered to be better vehicles for management of schemes because for-profit organisations may compromise safety or quality to deliver profit
- A voluntary scheme is likely to have issues in implementation in New Zealand and would not be an option if batteries are declared a priority product
- Appropriate collection, assessment, processing and treatment infrastructure will need to form part of any product stewardship scheme
- Deposit schemes can help with collection although this will depend on who is able to claim the deposit
- Advanced recycling fees (ARCs) can also be effective in ensuring there is sufficient value to enable recovery, however if producers simply pass on these charges directly to customers, then this reduces the financial incentive for manufacturers
- Well-designed extended producer responsibility (EPR) systems can drive circularity far more effectively than ARCs alone, by setting mandatory preparing for reuse and recycling targets and ensure that every part of the value chain contributes in an equitable way (e.g. based on market share); covering the net costs (over and above revenues from sales) of collection, sorting and treatment, through to consumer communications, infrastructure development and R&D costs
- The application of fee modulation based on the environmental credentials of a battery is likely to become more common and should be considered as part of a product stewardship scheme design for New Zealand.

E.5.0 Overview of New Zealand Value Chains

Work on the New Zealand value chains highlighted the following:

- There are a wide range of organisations involved in the value chain that do not necessarily physically handle batteries, such as research organisations, government agencies, finance companies, insurance companies etc
- Organisations may have a range of roles throughout the value chain
- The movement of batteries is generally simpler at the start and end of the value chains but more complex in the middle where multiple pathways become possible
- The money flows are generally from the middle of the value chain (the owners) outwards
- Overall, there is the potential for more cost than value associated with good management of batteries across the value chain
- Currently there is a lack of incentives to design batteries for optimal circular economy outcomes
- Placing appropriate incentives at the key points in the value chain will be a critical component in the design of a successful product stewardship scheme
- Ideally there will be the means to track batteries through their lifecycle in order to effectively measure performance of a product stewardship scheme.

The research canvassed a range of tools and approaches that could form a part of the design of the Circular Product Stewardship Scheme for Large Batteries. Subsequent phases of the project will explore the appropriateness of these for New Zealand.

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List of Tables, Figures and Boxes

1.0 Introduction

1.1 Product Stewardship Scheme Development

This project is working to develop a proposal for a circular product stewardship scheme for large batteries.[2] 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 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.)

[2] 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.

1.2 Milestone One Report

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

Table 1: Project Plan Activities and Deliverables for Milestone One

Activity	Deliverable
1. Establish working groups and stakeholder communications tools (e.g.website, sharepoint)	1. Working groups and stakeholder communications tools established: i. Website ii. Sharepoint site for B.I.G. members iii. Terms of Reference for B.I.G. and working groups iv. Membership spreadsheet held on Sharepoint
2. Review product stewardship scheme designs for large batteries implemented overseas (case studies) and develop recommendations for New Zealand	2. Case Studies Report providing: i. Review of product stewardship scheme designs for large batteries implemented overseas ii. Recommendations for New Zealand.

3. Map the value system (comprised of value chains). This will identify key scheme components, key interactions, issues such as free riders, imitation parts, avoidance, key change points and levers.	3. Report providing: i. An initial assessment of the key characteristics of the large battery value chain in NZ ii. Value system map with key scheme components, key interactions, issues such as free riders, imitation parts, avoidance etc., key change points and levers *Note: This report will also draw on work already undertaken outside of the WMF funded project.
4. Milestone 1 Governance Group Meeting and sign-off of milestone deliverables	4. Governance Group Minutes including minuted sign-off of milestone deliverables
5. Submitting Ministry reporting documents	5. Ministry documentation: i. Milestone report ii. Milestone claim form iii. Summary of Expenses iv. Copy of actual Invoice v. Tax invoicing for the Ministry

In broad terms, Milestone One aims to establish a knowledge base to inform Milestone Two, which will involve substantial stakeholder engagement and provide more detail around current practices and options for an industry supported product stewardship programme.

1.3 Design Parameters for a Large Battery Product Stewardship Scheme in NZ

The Product Stewardship Movement suggests the 'following rules of thumb' for an effective product stewardship programme:

- First, to have a substantial impact on recycling rates and waste diversion, a programme must provide incentives for consumers to return their products for recycling.
- Second, the programme must include penalties for noncompliance, to give firms an incentive to perform.

- And third, the programme must provide firms with the flexibility to use low-cost compliance strategies without compromising overall environmental goals.[3]

For the purposes of this Stage 1 work, The Product Stewardship Scheme for Large Batteries is assumed to have the following proposed design objectives:

- **Compatible with and facilitate a circular economy approach** – i.e. it will incentivise not only collection and safe management of end of life batteries but will encourage changes to battery design and ownership models that enable batteries and their components to optimise their lifespan and be re-integrated into manufacturing and production systems at the end of their life, including re-use.
- **Comprehensive.** It should cover all batteries in scope and avoid free riders.
- **Economically efficient and fair.** This means the scheme will reflect (to the degree possible) the costs imposed by appropriately managing batteries through their life cycle
- **Administratively simple to implement and run.** The scheme should be able to be understood and complied with by all stakeholders
- **Aligned with statutory guidelines and regulations.** The scheme design will require Government approval to become operational and will take all statutory requirements into account.
- **Future proof and flexible.** The scheme needs to account for the fact that batteries are a rapidly evolving technology and sector, and specific solutions that are appropriate now may not be in the future. For this reason, the scheme should not, for example, be tied to specific recovery pathways, and should not discourage manufacturers who wish to take their products back from doing so. The scheme design may recommend variations for different timeframes or situations (e.g. scale).

These design objectives will be consulted on and finalised through the stakeholder engagement process.

1.4 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.[4] The paper and its Technical Addendum cover a range of issues that lay the groundwork for the design of a large batteries product stewardship scheme:

- Scope: What is covered under the heading of large batteries

[3]Palmer and Walls (2002) The Product Stewardship Movement Understanding Costs, Effectiveness, and The Role for Policy https://media.rff.org/archive/files/sharepoint/WorkImages/Download/RFF-RPT-prodsteward.pdf

[4] 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

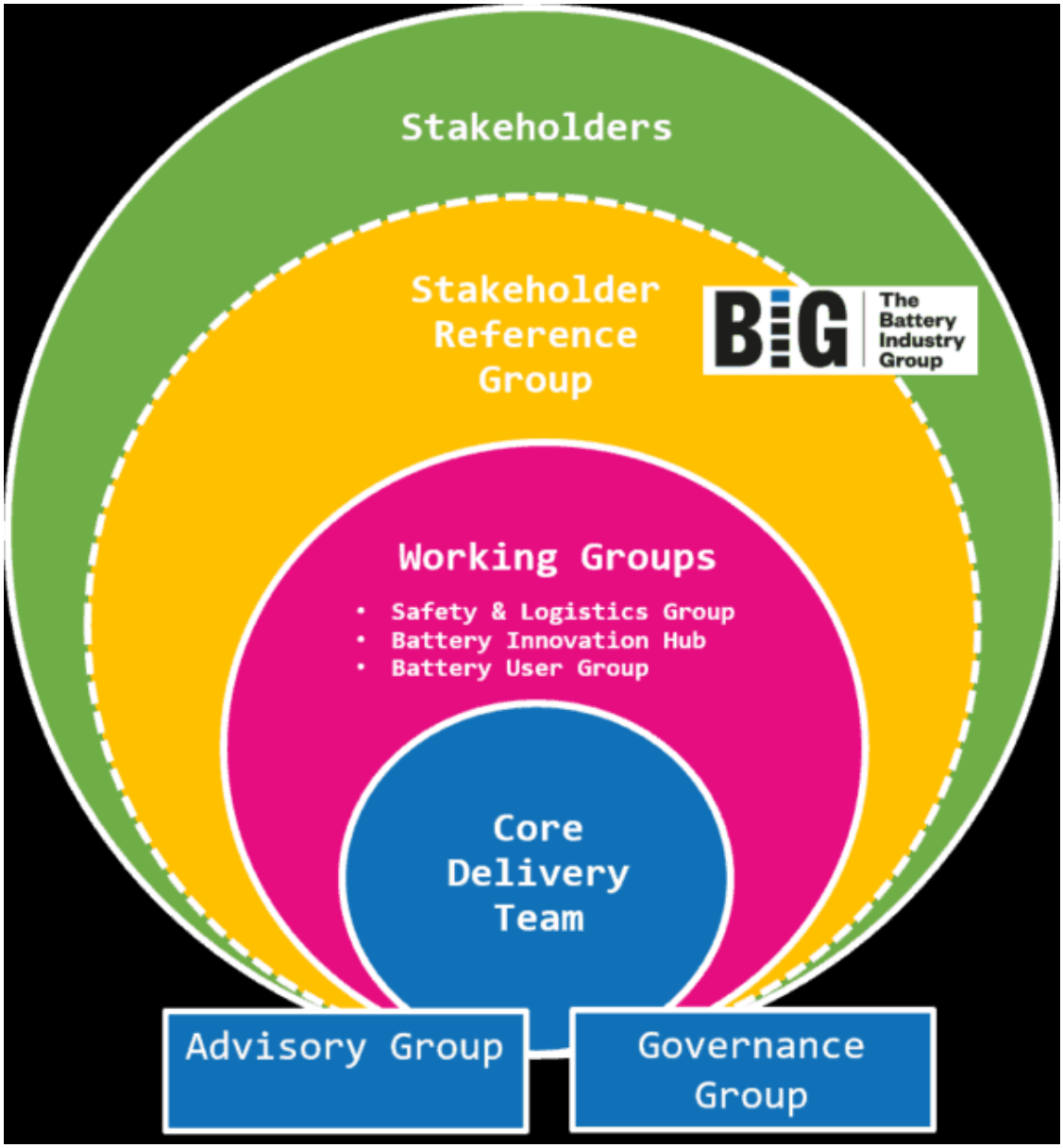
- Legislation and policy settings
- Battery chemistries and technologies
- Battery data and projections
- Recovery pathways
- Material markets and forecasts
- The current state of play and batteries in the linear economy
- What a circular economy for large batteries could look like
- Transitioning to a circular economy future
- Opportunities in the new battery ecosystem

The work was led by Vector who formed a Battery Leaders Group, informed by researched commissioned from Eunomia and also involved a large group of stakeholders (including the Battery Leaders Group, the precursor to the Battery Industry Group) who contributed to the outcomes of the project.

1.5 B.I.G.

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 an informal stakeholder group that has been assembled for this to provide input and oversight for this project. There are over 100 members at present.

The structure of the group is shown in the diagram below:



For more information refer to https://big.org.nz/. Note: The Battery User Group has not yet been formally launched.

2.0 Background

2.1 New Zealand Context

New Zealand has no formal nationwide system for managing and recovering end of life large batteries, although individual businesses are exploring opportunities for recovery and recycling.

The use of batteries and the variety of battery types on the market has been growing significantly and is set to increase substantially in the next 5-15 years, particularly given the demands of the 4th industrial revolution[5]. New technologies (such as electric cars, battery electric storage solutions, electric bikes, smart devices etc.) are developing and being deployed rapidly, and batteries are integral to all these technologies.

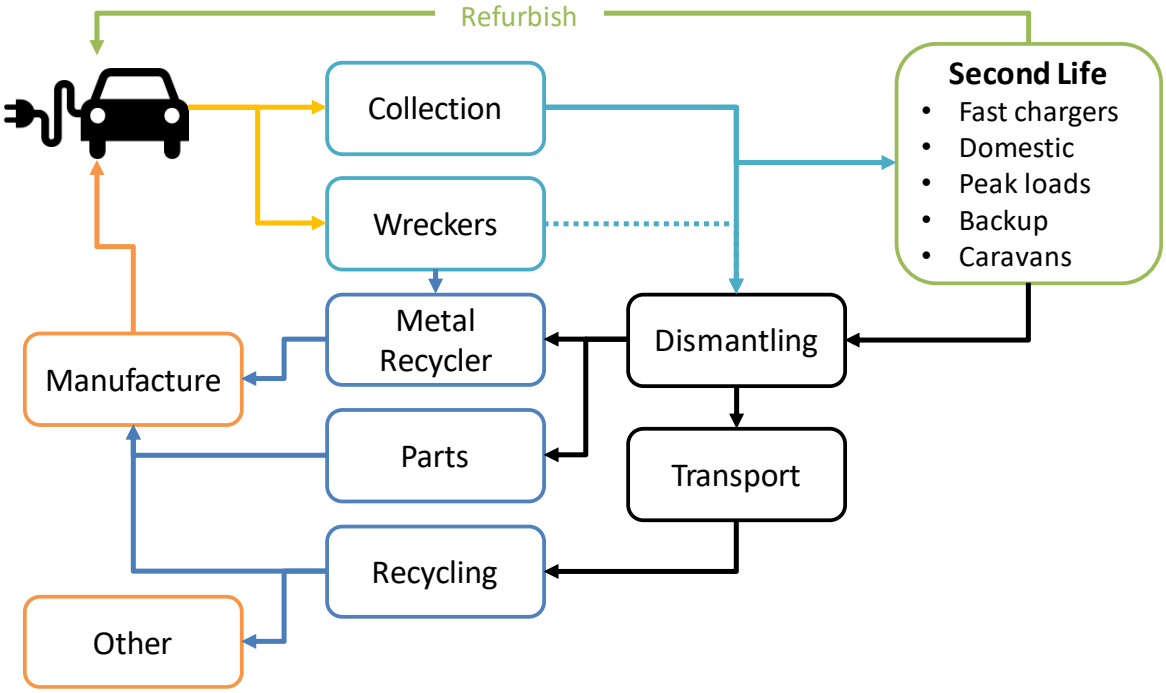
When a large battery (defined by use in electric vehicles or as stationary energy storage for electricity networks or industrial, commercial or domestic use) reaches the end of its use there needs to be a pathway for its safe management and recovery. In previous work it was estimated that, excluding lead-acid batteries, in New Zealand approximately 1,000 large batteries could reach end of use in 2020. Some of these batteries are likely to be refurbished or recycled but, based on current practices, a large proportion will likely be stockpiled or left in end of life vehicles and shredded.

While there are some limited pathways for collection and sorting of batteries in NZ, there is no widely accessible system capable of capturing the majority of batteries disposed of, and there is currently no facility for processing and recovery of materials locally. Batteries that are collected are sorted and shipped overseas for processing. This not only means the recovery of batteries is subject to the instability of international market fluctuations, but it represents a loss of opportunity to add value locally. For batteries to play their part in enabling a circular economy, there needs to be circular pathways for the batteries themselves. They need to be designed for recovery, and systems must be in place to facilitate their integration back into the value chain, whether this is manufacturers taking their own products back for integration into new products, or the use of batteries or materials recovered from batteries into different products.

The current pathways for recovery are summarised in the diagram below:

[5] https://www.weforum.org/focus/fourth-industrial-revolution

Figure 1: Summary of Recovery Pathways



Further information on the current situation and future projections in provided in the Vector New Energy Futures Paper and Technical Addendum.[6]

2.1.1 Onshore Processing: IT Recycla, and ReMarkIT Recycling Processes

A number of recyclers have been investigating recycling or pre-processing of batteries onshore. Two of these have plans to establish operational plants by the end of 2020 or shortly thereafter:

- IT Recycla, located in the Hutt Valley, are in the process of constructing a facility that will take all dry battery types (it will not take lead acid). It will shred the batteries and recover the plastics and metals for recycling (locally where possible). The remaining materials (in the form of a dried paste) will be sent to other facilities for recovery. This is expected to be offshore for most chemistries but will be onshore where possible. The plant is expected to be of sufficient capacity to process all batteries currently sold in NZ.[7]
- ReMarkIT has sought funding to develop a process to recycle lithium ion batteries, with EV batteries being particularly targeted. Nickel Metal Hydride

[6] 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

[7] Personal communication with John Evans, IT Recycla, 02 July 2020

batteries may also be able to be included in the process. The process will recover all materials including the lithium and the cobalt from Li-Ion batteries. It is expected to have sufficient capacity to process all of the Li-Ion batteries in NZ including project volumes for the next 5 years.

In addition, ReMarkIT has developed software for tracking the mass balance of e-waste, including batteries, through the recycling process. Funding has also been sought to further develop this so that it can be made available for free to recyclers as a Software as a Service application.[8]

2.1.2 Other NZ Project Links

There are potential linkages with other product stewardship related projects under way in New Zealand. As part of the scheme development it is intended that any synergies with other schemes or initiatives are explored and taken into account. Key schemes are noted briefly below.

2.1.2.1 Tyres

The potential synergy with tyres is that there are many of the same stakeholders involved as tyres and EV batteries are both associated with vehicles. There may be opportunities to use similar tracking systems and also to align the scheme designs.

Tyres were included in the MfE's priority product consultation in 2019.[9] The scope of tyres under consideration is:

(a) all pneumatic (air-filled) tyres and certain solid tyres for use on motorised vehicles (for cars, trucks, buses, motorcycles, all-terrain vehicles, tractors, forklifts, aircraft and off-road vehicles)

(b) all pneumatic and solid tyres for use on bicycles (manual or motorised) and non-motorised equipment.[10]

Tyrewise was set up in 2012 to provide a framework for the development of a stewardship programme to manage end-of-life tyres in New Zealand.

The industry-led framework for a mandatory stewardship programme for end-of-life tyres was signed off and presented to then Minister for the Environment in August 2013. To progress the scheme required tyres to be declared a priority product.

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[8] Personal communication with Tim Findlay ReMarkIT, 02 July 2020

[9] Ministry for the Environment (2019) Proposed priority products and priority product stewardship scheme guidelines. Consultation document 2019

[10] Tyres used on bicycles (manual or electric), wheelbarrows and trolleys are not covered by the current Tyrewise proposal. These tyres involve other stakeholders and may require a separate scheme. However, the lack of current recycling infrastructure and likely end-of-life processing technologies and markets are similar.

In 2017 funded was awarded to a number of projects aimed at addressing end of life tyres (a tyre shredding facility in Auckland and the use of the shredded tyres as fuel at the Golden Bay cement works in Ruakaka). This step postponed any decision about declaring tyres a 'priority product' until the results of this funding investment materialised and effectively put Tyrewise 'on hold'.

Following the release of the priority product consultation document in 2019 the scheme was resurrected.

The new Tyrewise project will update the Tyrewise Product Stewardship Scheme reports produced as part of the original project in 2012-2013. The updated content will include the current situation, best practice, preferred stewardship options, mass balance data on tyre imports and the recovery and recycling of end of life tyres from 2015 to 2018.

Consultation will then take place on the preferred stewardship option which will include all registered tyre importer and resellers and registered collectors, recyclers and end market developers of end-of-life tyres.[11]

2.1.2.2 E-waste

The Government sought advice from computer and television brand owners and e-waste recyclers in 2006–08. Two models were proposed, both requiring regulated participation to succeed.

Further work was undertaken in 2014-15 and a report by consultants SLR was published in 2015 that found there was insufficient data to enable a regulated product stewardship scheme to be justified:[12]

> *"Although the feedback from a number of stakeholder groups was clear on the need for a regulated scheme, and despite some stakeholders indicating that reasonable robust data was available and would be forthcoming, the information provided and reviewed for this study does not satisfactorily prove that current management of e-waste in New Zealand causes significant environmental harm and that significant benefits could be achieved through e-waste management under a product stewardship scheme."*

The MfE's 2019 consultation document however includes e-waste in the scope for priority products:

> (*a) large rechargeable batteries designed for use in electric vehicles, household-scale and industrial renewable energy power systems including but not limited to lithium-ion batteries*
> *(b) all other batteries (eg, batteries designed for use in hand-held tools and devices)*

[11] https://www.tyrewise.co.nz/about/
[12] SLR (2015), E-*waste Product Stewardship Framework for New Zealand*. Report for the Ministry for the Environment

(c) all categories of waste electrical and electronic equipment (WEEE) defined in Annex II of European Directive 2012/19/EU (eg, 'anything that requires a plug or a battery to operate').[13]

At the time of writing there has been no decision announced regarding a product stewardship scheme for e-waste.

2.1.2.3 Small Batteries

As noted above small batteries are also included in the scope of schemes to be declared priority products. A distinction is made between small batteries and large batteries because there are potentially different management approaches required for each across their lifecycle. Despite this there are also some clear potential synergies, in particular at the end of life where there is potential to share evaluation, sorting, and processing infrastructure.

The WasteMINZ Health and Safety Sector Group is currently coordinating a lithium ion battery working group for handheld lithium ion batteries– because of fire risks in recycling and rubbish trucks. A range of key stakeholders are on the working group including ITRecycla, Waste Management, EnviroNZ, Christchurch and Marlborough councils (who have household battery collections), FENZ, Upcycle and Remarkit.[14]

2.1.2.4 Second Life EV Battery Strategy Project

The purpose of this project is to evaluate the need for a specific strategy for New Zealand to ensure that EV batteries that reach the end of their EV-life, but have remaining capacity, give their maximum return before heading to recycling.

The project is being carried out by consultancy Strategic Lift Ltd., and is jointly funded by the Waste Minimisation Fund and Winstone Wallboards Ltd. Winstone Wallboards is interested in the built-environment implications of second-life batteries installed as stationary storage in residential, commercial, or industrial applications. The project is nearing completion, with a draft report due in mid-July.

The project has reviewed the issues and uncertainties of the topic, and has now developed a comprehensive model for predicting the availability of 'post-EV-Life' batteries across the full range of sizes and states of health each year to 2050. The key finding to date is that, rather than a large block of EV batteries reaching the end of their use in an EV and delivering large numbers of somewhat homogenous batteries each year, the main source of post-EV-life batteries is more likely to be the removal of batteries from vehicles that have been scrapped for non-battery reasons such as accidents or wear of other components. The implication is that the numbers of ex EV batteries that have sufficient capacity to be viable in second life applications may be

[13]Ministry for the Environment (2019) Proposed priority products and priority product stewardship scheme guidelines. Consultation document 2019

[14] These and other small battery stakeholders are all included in the BIG membership

lower than they previously anticipated. While Strategic Lift Ltd is a member of B.I.G., their conclusions are not necessarily endorsed by B.I.G. or its other members.

2.1.2.5 Right to Repair Working Group

The Right to Repair Working Group is a working group under the Product Stewardship Sector Group of WasteMINZ. The aim of the group is to promote the inclusion of right to repair principles in product stewardship scheme design. Right to Repair is a growing global movement that advocates for better design for repairability to ensure items are used for their original purpose for as long as possible before being repurposed or recycled. The European Union has adopted right to repair principles within its Eco Design Directive 2019 which requires that by 2021 appliance makers will make spare parts and manuals available to independent repair shops for up to a decade and ensure parts must not require specific equipment to fix. The Right to Repair Working Group is producing a report which is due for publication in July 2020.

2.2 Legislative Structure

2.2.1 Product Stewardship Provisions of the Waste Minimisation Act 2008

The purpose of the Waste Minimisation Act 2008 (WMA) is to encourage waste minimisation and a decrease in waste disposal to protect the environment from harm and obtain environmental, economic, social and cultural benefits.

One of the central tools the WMA provides to facilitate these goals is provision for product stewardship schemes.

The WMA allows the Minister to declare a product to be a 'priority product'. If a product is declared a priority product then a product stewardship scheme must be developed and accredited. If a product is not declared a priority product then a voluntary scheme may be developed (but there is no requirement to do so).

Under Section 14 any scheme that is accredited (including voluntary schemes) is required to meet a range of conditions including the following:

- Define the scope and the products or brands it applies to
- Set measurable targets including timeframes for achieving the targets
- Say how the scheme will be monitored and reported on
- Set out how compliance will be achieved
- Outline how the scheme will be funded.
- Establish how the scheme will be governed and managed.

2.2.1.1 Voluntary Schemes

Voluntary schemes can be developed by an industry sector who then apply to the Minister to have the scheme accredited.

Under the voluntary mechanism no regulation is required and there is no requirement on any actors in the sector to participate in the scheme.

The following voluntary product stewardship schemes have been accredited by the Minister for the Environment:[15]

- Agrecovery rural recycling programme
- Envirocon product stewardship
- Fonterra Milk for Schools Recycling Programme
- Fuji Xerox Zero Landfill Scheme
- Holcim Geocycle Used Oil Recovery Programme (no longer operating)
- Interface ReEntry Programme
- Kimberly Clark NZ's Envirocomp Product Stewardship Scheme for Sanitary Hygiene Products
- Plasback
- Public Place Recycling Scheme
- Recovering of Oil Saves the Environment (R.O.S.E. NZ)
- Refrigerant recovery scheme
- RE:MOBILE
- Resene PaintWise
- The Glass Packaging Forum

Further details on each of the above schemes are available on: http://www.mfe.govt.nz/waste/product-stewardship/accredited-voluntary-schemes

2.2.1.2 Priority Products

If the Minister for the Environment declares a product to be a priority product, a product stewardship scheme must be developed and accredited to ensure effective reduction, reuse, recycling or recovery of the product and to manage any environmental harm arising from the product when it becomes waste.[16]

The key difference between voluntary scheme and schemes for priority products is that regulation is likely necessary for a priority product to ensure full industry participation. This is provided for under section 22.

As of the time of writing one priority product has been declared under the WMA, which is plastic shopping bags. The ban on plastic shopping bags came into force in July 2019.

Priority Product Consultation 2019

In 2019 the Government consulted on six proposed priority products:

- Tyres

[15] http://www.mfe.govt.nz/waste/product-stewardship/accredited-voluntary-schemes
[16] Waste Minimisation Act 2008 2(8)

- E-waste
- Agrichemicals and containers
- Refrigerants and other synthetic greenhouse gases
- Farm plastics
- Packaging.

The results of the consultation have not yet been made public.

Under the category of e-waste, the consultation document made specific mention of batteries as being include in the scope:

> (*a) large rechargeable batteries designed for use in electric vehicles, household-scale and industrial renewable energy power systems including but not limited to lithium-ion batteries*
> *(b) all other batteries (eg, batteries designed for use in hand-held tools and devices)*
>
> *(c) all categories of waste electrical and electronic equipment (WEEE) defined in Annex II of European Directive 2012/19/EU (eg, 'anything that requires a plug or a battery to operate').*[17]

The consultation document also spelled out the Government's preferred approach for priority products which they term a 'co-design regulated approach'. Under this type of approach the Government would:

- Set a framework for regulated product stewardship
- Issue guidelines that product stewardship schemes applying for accreditation for priority products will be expected to meet
- Work with stakeholders to design:
  - appropriate schemes for accreditation under the WMA
  - ways to 'level the playing field' (potentially using the WMA or other regulations)
- Monitor scheme outcomes
- Make and enforce any necessary regulations.

Producers of priority products and stakeholders involved in the lifecycle would work together and with the government to develop an appropriate scheme design that met the guidelines and, once the scheme was accredited, would participate in the scheme.

The Government's view is that this type of approach can allow a scheme to be more flexible and practical for industry to implement while still delivering on the Government's product stewardship objectives.

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[17]Ministry for the Environment (2019) Proposed priority products and priority product stewardship scheme guidelines. Consultation document 2019

The current product stewardship scheme design has assumed a co-design approach will be applied. However, it needs to be emphasised that large batteries were not, at the time of commencing the scheme design, declared a priority product, and no final guidelines have yet been issued by the Ministry for the Environment.

Guidelines for Priority Product Stewardship Schemes

In the consultation document the Government also released proposed guidelines for priority product stewardship scheme design. The guidelines cover the following scheme elements:

1. Intended objectives and outcomes
2. Fees, funding and cost effectiveness
3. Governance
4. Non-profit status
5. Competition
6. Stakeholder engagement and collaboration
7. Compliance
8. Targets
9. Timeframes
10. Market development
11. Performance standards, training and certification
12. Liability and insurance
13. Design for environment
14. Reporting and public accountability
15. Public awareness
16. Monitoring, compliance and enforcement
17. Accessible collection networks

Further detail on these criteria is provided in Appendix A.1.0. The product stewardship scheme for large batteries being developed will adhere to these guidelines.

2.2.2 Customs

Any large battery scheme will require identification and tracking of batteries imported into New Zealand, whether they are in vehicles, or as packs, modules or cells. This may require liaison with Customs to ensure that these items can be correctly identified in declarations and ownership tracked to ensure all required organisations are participating in the scheme.

2.2.3 Basel Convention

The 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (commonly called the Basel Convention) aims to reduce the amount of waste produced by signatories and regulates the international traffic in hazardous wastes. It requires prior approval of hazardous waste imports and exports and requires exporting countries to ensure that hazardous waste will be managed 'in an environmentally sound manner'. The Convention emphasises the principle of 'generator

responsibility' for disposal of wastes and requires parties to minimise the environmental effects of the movement and disposal of hazardous waste.[18]

In terms of batteries, the Basel Convention only specifically identifies batteries containing mercury, cadmium and lead as hazardous waste. It does not recognize the presence of other constituents in alkaline manganese and zinc carbon batteries (e.g. zinc and copper compounds) as sufficient to render them hazardous; accordingly, these batteries are non-hazardous waste.[19]

However, the main way that the Basal Convention is applied in NZ is through the 'Imports and Exports (Restrictions) Prohibition Order (No 2) 2004'[20] Under this Prohibition Order lithium-ion batteries would be classified as hazardous waste (and therefore be controlled) due to having flammable, spontaneous combustion or corrosive properties.

A Basel permit must be granted to enable hazardous waste to be shipped to other parties who are a part of the Basel Convention. This applies whether the wastes are being shipped for the purposes of recovery or treatment and disposal.

2.2.4 Waigani Convention

The Waigani Convention is a regional agreement under the 1989 Basel Convention. It applies the strict controls of the Basel Convention to the South Pacific area and ensures that hazardous waste cannot travel from New Zealand or Australia to another Pacific country, or to Antarctica.

2.3 Market Drivers

Previous research work[21] found the following:

- There is likely to be a substantial increase in the numbers of large batteries coming to end of life in New Zealand over the next 10-15 years. The increase in numbers is driven by the accelerating adoption of EVs in particular, with stationary storage applications also becoming important. Projections in respect of the expected future uptake of EVs and stationary storage applications are

[18] http://www.mfe.govt.nz/more/international-environmental-agreements/multilateral-environmental-agreements/key-multilateral-0
[19] https://www.nema.org/Policy/Environmental-Stewardship/Documents/Treatment%20Basel%20Convention.pdf
[20] https://www.nema.org/Policy/Environmental-Stewardship/Documents/Treatment%20Basel%20Convention.pdf
[21] Adapted from the Vector (2019) New Energy Futures Paper: Batteries and the Circular Economy, Technical Addendum. Available from: https://www.vector.co.nz/articles/vector-s-new-energy-futures-paper-on-batteries-and

uncertain however. There are currently no strong incentives or impediments to their uptake.[22]

- The numbers of big batteries reaching end of life is currently small, and so this has not created issues to date (although there is still a need to safely manage these small numbers), but numbers are growing rapidly and so there is a limited window for getting formal schemes in place that will be able to adequately manage end of life batteries. New Zealand is likely to be at the forefront of the issue of end of life large batteries due to our relatively high proportion of second hand imported EVs and our remote location meaning we may not be able to benefit from reverse logistics arrangements manufacturers have in place in other locations.
- Each brand owner has different drivers and different approaches and there will need to be flexibility to accommodate these different approaches within a product stewardship regime.
- There is potential to extend the life of EV batteries through refurbishing and second-life uses. The extent to which these second life uses are taken up will depend on whether there is a match between the supply of second life batteries and the demand for them (at particular price points) in second life applications. Second life uses may also have to compete with recycling if the supplies of raw materials (in particular cobalt), are constrained and manufacturers seek to use reclaimed batteries as a source of raw materials.
- The increasing complexity of battery design (particularly battery and thermal management systems) may, in the future, make it more difficult to adopt EV batteries for second life uses unless this is taken into account during battery design.
- The development of onshore processing or pre-processing for recycling end of life batteries will depend largely on the economics.[23] Overseas facilities are likely to have lower processing costs due to economies of scale. However, because there are high costs involved in making batteries safe for transport, being able to avoid these costs could make local processing or pre-processing economic.

As noted in 2.1.2.4 the Second Life EV Battery Strategy Project, currently being undertaken suggests that the number of batteries coming to the end of their life may be delayed relative to projections. Early projections assumed that EV batteries will cease to be viable in vehicles once their State of Health (SOH) gets below around 70%-80%/. However, evidence suggests that, for the current EV fleet in NZ, many vehicles are being continued to operate well below 70%, and people are simply using them for short daily trips. If this is what is likely to happen into the future this could mean that the numbers

[22] At the time of writing a proposed 'feebate' scheme, which would incentivise new zero and low emission vehicles and provide disincentives for high emission vehicles, has been shelved by the Government.
[23] Government regulation could mandate or enable more onshore processing

of ex EV batteries that are viable in second life applications may be limited and so this would have implications for the scale of second life applications.[24]

It is uncertain however the degree to which this is an 'early adopter' phenomenon, and applicable only to a certain sector of the market (which may become saturated) or representative of how vehicle owners will behave long term. Because of this and other factors (such as some brands potentially guaranteeing battery range and so refurbishing batteries earlier), it is likely that it is still too early to accurately predict the quantities and viability of batteries that will be available for second life.

3.0 Product Stewardship Scheme Elements

The following definition of Product Stewardship is from the Product Stewardship Council:[25]

> *Product Stewardship is the act of minimizing health, safety, environmental and social impacts, and maximizing economic benefits of a product and its packaging throughout all lifecycle stages. The producer of the product has the greatest ability to minimize adverse impacts, but other stakeholders, such as suppliers, retailers, and consumers, also play a role.*
>
> *Product stewardship seeks to ensure that those who design, manufacture, sell, and use consumer products take responsibility for reducing negative impacts to the economy, environment, public health, and worker safety. These impacts can occur throughout the lifecycle of a product and its packaging, and are associated with energy and materials consumption; waste generation; toxic substances; greenhouse gases; and other air and water emissions.*
>
> *In a product stewardship approach, manufacturers that design products and specify packaging have the greatest ability, and therefore greatest responsibility, to reduce these impacts by attempting to incorporate the full lifecycle costs into the cost of doing business. There are two related features of Product Stewardship policy:*
>
> 1. *shifting financial and management responsibility, with government oversight, upstream to the producer and away from the public sector; and*
> 2. *providing incentives to producers to incorporate environmental considerations into the design of their products and packaging.*

There are many possible elements to a Product Stewardship Scheme, that must work together to create an effective set of drivers which will deliver better environmental

[24] Second Life EV Battery Strategy Project, Personal communication with Paul Minet
[25] https://www.nzpsc.nz/faq/

outcomes. Some of the tools that could form part of a Product Stewardship Scheme include:

- **Advanced disposal fees**. These consist of charges levied on importers or resellers that cover the cost of end of life management. These charges would typically be expected to be passed on to customers
- **Recycling targets and standards.** Product stewardship schemes will normally set minimum targets for recovery, as well as what happens to recovered materials
- **Product content.** Schemes can require manufacturers to have specific minimum or maximum content of certain materials or substances including recycled content and minimising the use of hazardous materials
- **Deposit refunds.** These are a tool to give value to a product at the end of its life so that there is incentive for people to return it to a collection point for proper processing and/or disposal
- **Changes to product design.** Schemes may require specific design standards to be met – for example designing for disassembly so that products components can be more easily recovered
- **Ownership models.** Schemes may require the ownership of a product to remain with a manufacturer, importer or retailer. For example, products may be leased or rented rather than sold. This incentivises manufacturers to not only take products back but design them for recycling, refurbishment or second life
- **Consumer information.** Providing good information to consumers is a vital link in ensuring consumers make the right choices when faced with end of life products
- **Collection networks.** Schemes may be required to establish and maintain collection networks sufficient to enable widespread access
- **Financing mechanisms.** Providing funding or access to funding for infrastructure or collection services is a potential requirement of product stewardship schemes
- **Reuse, including remanufacture.** Schemes could stipulate a portion of end of use products need to be refurbished or go back into second life applications
- **Membership fees.** Schemes will typically establish membership fees. These could be nominal fees, could cover basic scheme administration costs, or could cover the full cost of a scheme operations. Where full costs are covered this would typically have to be linked to market share or some other metric to ensure costs are fair and equitable
- **Management and Governance**. A scheme is usually run by a product stewardship organisation. There may be separate organisations for the governance (oversight) and management (running of the scheme). Some schemes may establish a producer responsibility organisation (PRO) that undertakes collection and processing of end of life products on behalf of companies.

It should be noted that this is not an exhaustive list and many variations exist on the types of tools outlined above.

4.0 Review of International Schemes

This section provides an overview of the key schemes that are operational or planned and that relate to large batteries.

4.1 Global Battery Alliance

The Global Battery Alliance (GBA) is a public-private collaboration platform of 70 public and private sector organisations. It was founded in 2017 and is working globally to help establish and collaborate on a sustainable battery value chain. The member organisations include key companies involved in the raw materials extraction, manufacture, use and recovery of batteries (e.g. Audi, BASF, London Metal Exchange, Mitsubishi Corporation, Umicore), public and international organisations (such as OECD, UNEP, World Bank), NGO's, and 'knowledge partners' (e.g. Everledger, SAP, Harvard University). It is worth noting that B.I.G. project members have had good engagement with the GBA who are a member of B.I.G. and the B.I.G. product stewardship scheme project is mentioned twice in a GBA white paper.[26]

The GBA aims to:

- Establish a circular battery value chain that is a major driver to achieve the Paris Agreement targets
- Transform the economy in the value chain, creating new jobs and economic value
- Safeguard human rights and economic development in line with the UN Sustainable Development Goals.

To deliver on these aims the GBA working on the following flagship programmes[27]

Battery Passport and Sustainable Battery Label

Battery Passport is a digital platform being developed to exchange data among all authorized lifecycle stakeholders to support a sustainable value chain for electric vehicle (EV) and stationary batteries. It will verify material provenance, disclose the greenhouse gas (GHG) footprint, measure sustainability and general environmental impact, track compliance with human rights and anti-corruption policies, and advance battery life extension and recycling.

The Battery Passport would be the basis for exploring a sustainable battery label or quality seal to transform the market for batteries towards sustainable outcomes by 2030. The GBA intends to have a prototype established by the end of 2020 and to have the Passport fully operational by the beginning of 2023. The BIH has started an initial

[26] Global Battery Alliance (2020) *Battery Passport: Key Enabler for a Sustainable and Circular Battery Value Chain Discussion Paper*, World Economic Forum 2020

[27] https://www.weforum.org/global-battery-alliance/action

investigation to trial a prototype of Everledger's battery passport as a potential option to track large batteries throughout their lifecycle in New Zealand. A small amount of funding is required to complete the trial. The funding process was interrupted due to Covid 19.

The Battery Passport, if widely implemented, could be a tool for implementing 'eco-modulation' – i.e. varying fee structures in a product stewardship scheme based on environmental and ethical credentials

Responsible Sourcing – Cobalt Roadmap

A responsible sourcing program with an initial focus on cobalt is being created to help eliminate or reduce child and forced labour in the battery value chain before 2030. This will be done through a comprehensive systems analysis, an impact measurement framework, fostering the identification and adoption of best practices, scaling up responsible artisanal and small-scale mining (ASM), and responsible sourcing of all materials in the value chain.

Low-Carbon Economy Programme

This programme will develop a consistent measurement of GHG emissions, strategies to lower emissions throughout the value chain and to accelerate battery adoption in electric transport and energy storage systems. This could enable 30% of the required emissions reductions to stay within the 2° Paris Agreement goal in these industries by 2030.

Circular Economy Programme

Blueprints and regulatory frameworks will be established to accelerate recycling, improve end-of-life management and enable the integration of batteries in the grid.

4.2 EU Legislation and Directives

The European Union has a comprehensive range of directives covering waste and materials management. In general, the directives set out the requirements for member countries in terms of the types of schemes and measures that have to be in place, how they should operate, and performance standards they are expected to attain. The performance standards may also come with sanctions that the member country will be liable for if they do not achieve the standard. Each Member State (i.e. EU country) is then expected to design and implement their own schemes and legislation that will enable them to meet the requirements of the directives.

The most relevant directives for large batteries are the End of Life Vehicles Directive 2000/53/EC and the Batteries and Accumulators Directive 2006/66/EC. Each of these and how they interact are summarised below.

4.2.1 End of Life Vehicles Directive

4.2.1.1 Overview

Directive 2000/53/EC – (the "ELV Directive") on end-of life vehicles aims at making dismantling and recycling of ELVs more environmentally friendly. It sets clear quantified targets for reuse, recycling and recovery of the ELVs and their components. It also puts responsibility on producers to manufacture new vehicles without hazardous substances (in particular lead, mercury, cadmium and hexavalent chromium), and promotes the reuse, recyclability and recovery of waste vehicles.

The ELV Directive targets both the production and recovery phases of the lifecycle. It places the responsibility primarily on vehicle manufacturers to increase the share of components that can be recycled and the feasibility of that recycling. However, Member State governments are also expected to enable the necessary framework conditions. Categories of vehicles covered under the ELV Directive include:

- Motor vehicles with at least four wheels for transporting passengers and with a maximum of nine seats (category M1)
- Motor vehicles with at least four wheels for transporting goods that weigh no more than 3.5 tonnes (category N1)
- Three-wheel motor vehicles.

Under the Directive, Member States must establish systems for the collection of waste and ensure that the vehicles are transferred to authorized treatment facilities (ATFs). In terms of waste treatment, Member States must ensure that the storage and treatment of end of life vehicles is in accordance with Annex I of the ELV Directive.

An important feature of treatment is de-pollution (Minimum technical requirements for treatment in accordance with Article 6(1) and (3)) prior to shredding, and battery removal is an important component of that de-pollution, governed by licencing of ATFs. This approach to authorisation, of what had previously been vehicle and metal scrap yards, drastically improved standards and reduced related pollution incidents (e.g. oil and battery fluid seepage into the ground) across the EU. The advent of electric vehicles dramatically changes the de-pollution aspects given that the batteries are generally in the floor-pan of the vehicle and far harder to remove than the normal starter accumulator found under the bonnet on most vehicles.

The following recycling and recovery targets are defined by Article 7 the Directive.

- The degree of recovery (recycling plus energy from waste - on average per vehicle per year by weight): 95% by 1 January 2015; and
- Reuse and recycling increased to (on average per vehicle per year by weight): 85% by 1 January 2015.

4.2.1.2 Implementation

Prior to the ELV directive, many member states already had systems in place that resulted in reasonable levels of recovery. By 2010, 13 countries had introduced

'circulation' or 'road' taxes. These must be paid annually by all car owners. The incentive is to declare the disposal of the car to avoid continuing to pay the tax. A number of other Member States introduced "premiums", whereby car users are entitled to receive a certain amount of money for any ELV disposed of, in exchange for the purchase of a new vehicle (sometimes called a scrappage scheme). Such schemes exist, or have recently existed, in Germany, Spain, Finland, Italy, the Netherlands, Poland, Portugal, Slovakia and the UK (a new scheme, for example, offers a rebate when switching to an electric vehicle).[28]

Each country has structured the implementation of the Directive differently. A key difference is whether the schemes are run by a producer responsibility organisation (PRO) or whether the requirements are put on individual companies to comply. In Germany for example, car producers/importers have individual contracts with collection and dismantling facilities (individual scheme) while in other countries, Producer Responsibility Organisations (PROs), acting as collective schemes, have been set up to co-ordinate and finance the take-back and recovery of ELVs on behalf of producers.

The individual producer responsibility (IPR) approach has the advantage of incentivising manufacturers directly, while a PRO approach generally leads to lower costs of compliance for the industry. PROs allow producers to reap economies of scale, but also to gain in efficiency by outsourcing collection, treatment and payment to qualified economic operators, sharing recycling experience and ensuring transparency. One criticism of PROs is that they remove incentives for eco-design improvements since a collective duty means that efforts to improve recyclability of cars through design may not directly benefit the manufacturer but the whole association of producers.

The table below shows the variations in implementation structures across EU Member States as of 2014.

[28] Bio Intelligence Service (2014) Ex-post evaluation of certain waste stream Directives Final report European Commission – DG Environment 18 April 2014

MS	Start date of EPR scheme(s)	Collective or individual	If collective, number of EPR schemes	Government or producer-led
AT	2002	Individual		Producer-led
BE	1999; 2004	Collective	1	Producer-led
BG	2004	Collective	2	Producer-led, regulated by government
CY	N/A	N/A	N/A	Government regulated
CZ	2009	Individual	N/A	Government-led, producer-funded
DE	1998; amended in 2002 to transpose the European ELV directive			Producer-led
DK	N/A	Collective	1	Government-led
EE	2009	Individual	N/A	Producer-led
ES	2002	Collective	1	Producer-led
FI	2004	Collective	2	Producer-led, regulated by government
FR	2006	Individual	N/A	Producer-led
GR	2004	Collective	1	Government-led, producer-funded
HU	Unknown	Appears to be individual	N/A	Appears to be producer-led
HR	2006	Individual	N/A	Government-led
IE	2006	Individual	N/A	Producer-led, regulated by the government
IT	2005	Collective	1	Producer-led network
LT	2005	Both		Producer-led
LU	2003	Both	1	Producer-led
LV	2004	Collective and individual	1	Producer-led
MT	2004			

NL	1995 for voluntary (ARN); 2002 for legally binding (ARN); 2011 for scooter-specific scheme	Collective	2	Producer-led
PL	2006	Collective	1	Government-led
PT	2004	Both	1	Producer-led
RO	2004	Individual	N/A	Producer-led
SE	1975 for Swedish system; 1998 in line with EU Directive	Collective	3	Government-led, producer-funded
SI	2003			
SK	2001	Collective	1	Government-led
UK	2005	Collective	2	Producer-led

Source: Bio Intelligence Service (2014) Ex-post evaluation of certain waste stream Directives Final report European Commission – DG Environment 18 April 2014

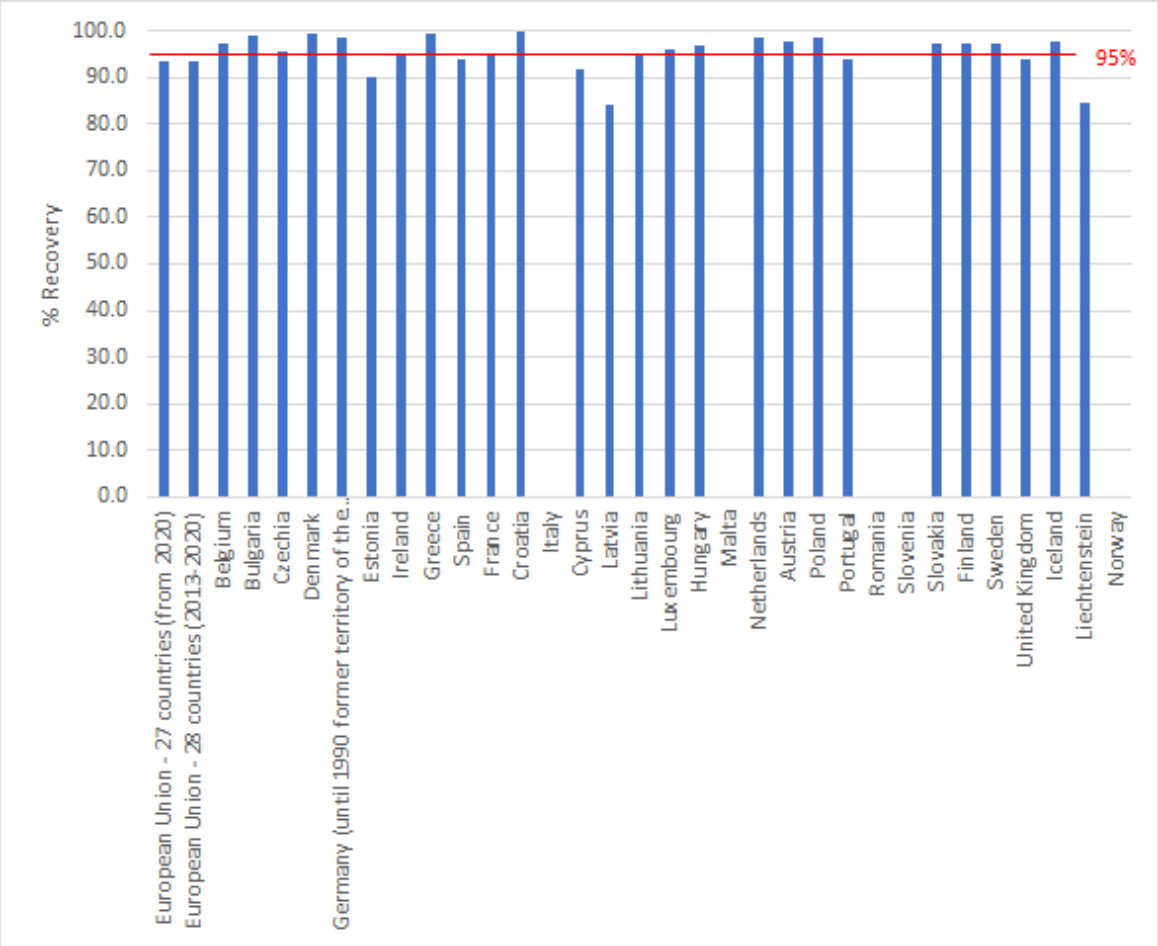
4.2.1.3 Performance

The chart below shows the status of member countries as of 2017 in relation to the 95% recovery target (of vehicles separately collected).

An assessment in 2010 found that the four hazardous substances mentioned in the Directive (lead, mercury, cadmium, and hexavalent chromium) had almost been phased out. [29]

[29] A study conducted by the OekoInstitut showed that lead emissions have been reduced by 99.6%, cadmium by 96% and hexavalent chromium nearly completely (99.99%). Öko-Institut (2010) ELV Directive Annex II: analysis of costs and environmental benefits of heavy metals ban, and proposal for better regulation

Figure 2: End-of-life vehicles - Reuse, Recycling and Recovery 2017



Source: https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

As can be seen from the chart, the majority of countries have met or exceeded the target as of 2017. However, there are some question marks about the above figures as they represent the recovery rates at Authorised Treatment Facilities. A proportion of ELVs are thought to be exported but illegally classified as used vehicles. [30]

The ELV Directive is soon to be revised, with revisions being considered this year, including how to classify the increasing number of electrical and electronic products in cars, which could be covered by either the ELV or WEEE directives. EV batteries will also need careful consideration in terms of how they are managed. This new scheme with have to be a more advanced EPR system that complies with the Waste Framework Directive minimum requirements.

[30] Bio Intelligence Service (2014) Ex-post evaluation of certain waste stream Directives Final report European Commission – DG Environment 18 April 2014

4.2.1.4 Relationship to the Batteries Directive

A key interaction between the ELV Directive and the Batteries Directive is in terms of the de-pollution requirements. An assessment in 2014 found that, in general, the two Directives seem to be coherent in terms of scope, however, it noted that there may be inconsistencies between the targets of the ELV Directive and the Batteries Directive, particularly give a transition to EVs:

> *"The ELV targets are calculated based on the weight of the ELV. Commission Decision 293/2005,216 based on Article 7(2) of the ELV Directive, gives several options to determine the vehicle weight: use of registration documents, certificates of conformity, or if not available, manufacturer's specifications. Once the ELV is weighed, it is depolluted and dismantled before going to shredding. Batteries are removed and handed over to battery recyclers for further treatment or use in other industrial applications. With the expected rise in the number of EVs, this may be important, as the batteries are very big and heavy. ELV recyclers count this as "recycling". Therefore, there is a high percentage added to the target to be reached by the ELV recyclers, while they have no control over it. Battery recyclers have their own recycling efficiency targets to reach, which for Li-ion batteries is only 50%.*
>
> *In addition, batteries are sometimes given back to producers to be recharged. If these batteries count in the weight of the ELV and counted as recycled as soon as they can be given to battery recyclers, it will be easy to reach the ELV targets for recycling. On the other hand, if the batteries given to producers are removed from the weight of the vehicle to be recycled, it will be much more difficult to reach the recycling target."*[31]

It is worth noting that the EV batteries are considered Industrial Batteries (motive power sources), rather than Automotive (starter batteries only).

4.2.2 Batteries Directive

4.2.2.1 Overview

The Batteries and Accumulators Directive 2006/66/EC applies to all batteries and accumulators placed on the market. It explicitly prohibits the placing on the market batteries and accumulators containing mercury or cadmium.

The Directive distinguishes between 'portable batteries' and 'industrial and automotive batteries'. Portable Batteries are defined as being under 4kg if for consumer use, and hence this encompasses a wide range of rechargeable batteries for cordless devices, e-bike and other e-mobility batteries, as well as the more common AA, AAA and 9V types. The chemistries vary but are largely NiMH and Li-Ion for rechargeables and alkaline for

[31] Bio Intelligence Service (2014) Ex-post evaluation of certain waste stream Directives Final report European Commission – DG Environment 18 April 2014 p 142

non-rechargeables. Batteries from vacuum cleaners, electronic equipment, cordless power tools etc, are all classified as portable whether they are used by businesses or households (they are termed dual-use), so long as they are under 4kg.

Automotive and Industrial Batteries are over 4kg, or designed specifically for professional or industrial use, and traditionally are almost all lead-acid types, although Li-Ion types are increasingly taking more and more market share. As well as large automotive, EV and stationary storage batteries, industrial batteries can also include a range of smaller batteries, such as from handheld electronic payment terminals, professional video equipment, backup batteries for electric doors, measurement equipment etc.

Other key features of the Directive are:

- Restrictions on the heavy metal content of batteries sold in Member States. This includes cadmium and mercury
- Member States are responsible for ensuring that appropriate collection schemes are in place. The collection schemes should enable appropriate access with regard to population density
- The establishment of minimum collection rates and recycling targets for Member States. The collection rate is set on the basis of average sales (Placed on Market – POM) in the three preceding years, so that targets are proportional to consumption. The minimum collection rates specified in the directive, for portable batteries only, are:
    - 25 % by 26 September 2012; and
    - 45 % by 26 September 2016.

  The recycling rate only applies to the batteries separately collected, and is defined as excluding energy recovery:

    - 65% for lead acid batteries
    - 75% for nickel-cadmium batters
    - 50% for all other batteries (including Li-Ion)
- Schemes should avoid barriers against imports or trade restrictions
- Producers (excluding very small producers) must be registered. Producers should finance the costs of collecting, treating and recycling all collected batteries and accumulators minus any profit made through sale of recovered materials
- Third parties can be established to deliver the schemes
- Schemes should operate with no fee for end users
- Registered producers of industrial & automotive batteries have to take-back all waste batteries regardless of chemistry or origin; automotive batteries from private/ non-commercial vehicles shall not involve charges to end-users
- Member States may use economic instruments to promote the collection of waste batteries and accumulators or to promote the use of batteries and accumulators containing less polluting substances, for instance by adopting differential tax rates

- The Directive also contains requirements that appliances are designed to enable the ready removal of batteries, and all appliances and e-waste collected (under the Waste Electrical and Electronic Equipment Directive 2002/96/EC) have to have their batteries removed
- Member States report on collection and recycling rates
- Member States are responsible for establishing penalties
- Member States shall encourage the development of new recycling and treatment technologies and promote research into environmentally friendly and cost-effective recycling methods for all types of batteries and accumulators
- Export of used batteries for recycling or processing is allowed but is subject to other EU controls.

It's important to note that while the Batteries Directive prohibits landfilling or incineration of automotive and industrial batteries, there is no current collection target. This largely stems from the fact that lead-acid batteries have intrinsic value at the end of life, in that both the lead and sulphuric acid has value, and to a lesser extent the polypropylene used for the case. This helps to incentivise collection by providing (at least in some cases) a net value that exceeds the costs of collection and reprocessing. The lead price is the main driver. Li-Ion is far more complex to recycle, however, with only Cobalt being of real value (given the current low price of Lithium)[32], and consequently the system needs financial support from EPR to operate. Recycling rates for Lithium-Ion remain low in the EU as they are a currently only a small fraction of the overall waste and do not have separate collection and recycling targets.

4.2.2.2 Implementation

All Member States have enacted national legislation to give effect to the Batteries Directive. They were required to do this no later than 26 September 2009. The relatively simple part relates to compliance with the heavy metal content requirements, and while European producers were in compliance, imports, particularly from Asia, were found to exceed set limits. Market surveillance does not appear to be sufficient to prevent non-compliant batteries from entering the market and it is known that there are counterfeit replacement batteries being sold online as well as other non-CE compliant batteries (CE mark is used to show compliance with safety and other market entry requirements).[33]

In terms of the collection and reprocessing elements, the Directive has been implemented in a variety of ways across Member States. The table below notes the different models in terms of their overall structure (mostly collective schemes, called Producer Responsibility Organisations (PROs); either single or multiple – the two central

[32] https://tradingeconomics.com/commodity/lithium

[33] Bio Intelligence Service (2014) Ex-post evaluation of certain waste stream Directives Final report European Commission – DG Environment 18 April 2014 p162

categories below), the pros and cons of that overall approach, and the Member States where they are employed.

Table 2: Battery Scheme Structure Models

Model	Characteristics	Pros	Cons	Member States
State fund model	Producers pay fees or taxes to a state fund that is used by relevant public bodies to finance collection operators and manage overall waste batteries treatment process.	**Relatively high legal certainty for producers.** The tax/fee is usually charged by customs code and there is a high degree of enforceability when the fee is collected by tax or customs authorities.	**Reduced accuracy of collection rate.** Custom code does not distinct between portable and industrial battery types and makes capturing batteries integrated in EEE difficult as they fall	Most of the pre-Batteries Directive organisations in CEE and also in Sweden and Denmark were based on this model.

Model	Characteristics	Pros	Cons	Member States
			under the customs code of EEE. **Risk of improper allocation of the fund.** Government may allocate funds to programmes not related to the waste batteries thus distorting the market and putting unjustified fiscal pressure on manufacturers and consumers	Currently, elements of the model are used in Slovakia, Lithuania, Malta, Iceland, Denmark (restricted to financing collection by municipalities)
Single organisation (environmental agreement) model	Batteries manufacturers commit to organise and fund a single collection scheme and typically carry additional charges if mandatory collection targets are not met.	**Centralised and effective collection infrastructure.** Single operator creates the provision of sufficient collection points for consumers and ensures the take-back of waste batteries from all entities that collect them without distorting competition between the organisations. **Effective consumer awareness measures.** Nationwide coordination optimises the effectiveness of consumer awareness measures.	**High negotiation power compared to other waste sector operators and consumers.** Single collection scheme tends not to reduce fees to reflect actual costs, etc. **No incentives for producers to reduce recycling costs.** As all producers are charged the same fee, they have no incentives to reduce recycling costs.	Early battery and WEEE organisations in Western Europe were mostly based on this model (Austria, Belgium, and the Netherlands) Currently in place in Belgium, Greece, the Netherlands, Cyprus, and Luxembourg Spain and Portugal in process to transition to competing scheme
Competing organisations model	Several organisations collect waste batteries and usually compete on the level of fees charged to producers. In some Member States, they are obliged to co-ordinate the development of	**Reductions of fees and, therefore, reduction of treatment costs.** Competing organisations seek to lower their waste management costs in order to attract producers with lower fees. Competition drives fees down in neighbouring countries	**Impeded control of waste battery flows.** The risk of inaccurate data reporting increases with the number of supply and trading relationships between collecting schemes. **Lack of transparency as organisations do**	The UK, Bulgaria, Latvia, Poland, Austria, Italy, France, Germany, Czech Republic, Hungary, Latvia, Lithuania, Ireland, Slovenia and Estonia 19 Member States now use a

Model	Characteristics	Pros	Cons	Member States
	nationwide collection infrastructure and consumer awareness measures.	with monopolistic collection system.	**not disclose their financial and operational information to public.** This creates distrust between organisations and SMEs struggle to decide which organisation to choose. **Little investment in the collection network.** If there is no co-ordination between organisations, they tend to underinvest in the infrastructure.	multi-organisation model.
Model without organisations (producers fund battery collectors directly)	Each producer finances authorised waste battery treatment companies directly and collection targets are imposed on each of them.			Legally, this model is in place in Slovakia and Poland.

Source: Bio Intelligence Service (2014*) Ex-post evaluation of certain waste stream Directives Final report European Commission* – DG Environment 18 April 2014 p187-89

During the transposition of Batteries Directive 2006/66/EC, many Member States aimed to align battery organisations with WEEE organisations to reduce administrative burdens for producers and to enable synergies of the collection networks. In consequence, 21 of the 29 EEA countries (the wider European Economic Area) now use a multi organisation model that combine WEEE and (portable) Batteries.

It is important to understand the way that these systems work in broad terms, firstly for portable batteries. In general, the retailers (which have an obligation to collect waste batteries) and other community collectors (e.g. municipalities, schools, businesses) collect the portable batteries in containers provided by the collective scheme/s (the PRO/s), who then arrange for collection (using their waste contractors) and pay for reprocessing of the batteries collected. There is a notable correlation between a take-back obligation for municipalities and the collection rate achieved (i.e. it tends to be

higher). In nine countries (AT, BG, GR, IE, IC, LU, PT, SK, SI), municipalities are (or can be) held responsible for collection in addition to retailers34.

In general, the costs of the whole system (including any infrastructure developments) are split between the producers on a current market share basis. The 'producer' is defined as the organisation placing the batteries on the market, i.e. the manufacturer of the battery or the importer. It is worth noting that in general the fee is not an advanced recycling or disposal charge or tax paid at the point of sale. This type of charge is paid by the consumer and is not considered 'true' EPR since it does nothing to drive producer responsibility and eco-design.

Automotive and industrial batteries are treated very differently. There are no collection targets (although there are recycling 'efficiency' targets) but there is a landfill and incineration ban as noted, plus the producers, or third parties acting on their behalf, have to take back waste industrial batteries and accumulators from end-users, regardless of chemical composition and origin. Independent third parties may also collect industrial batteries and accumulators; meaning waste companies and the informal sector which is still active in some low-income countries. This essentially means that the vast majority of large batteries come back via business collections, rather than retail or municipal, e.g. via car service garages, commercial waste companies, scrap metal dealers and authorised ELV treatment operators.

The Directive allows Member States to use economic instruments to promote the collection of waste batteries and accumulators or to promote the use of batteries and accumulators containing less polluting substances, for instance by adopting differential tax rates. In most EU countries this is not done since the value of the battery material (lead-acid in the main), combined with the landfill/incineration ban, is sufficient incentive to ensure that the system manages itself, however refundable deposits are used for automotive batteries in some countries, including Greece and Germany. In the latter, retailers of automotive batteries are obligated to charge a deposit of 7.50 Euros, including value-added tax, from end consumers if they do not return a used battery when purchasing a new one[35]. Distributors offering automotive batteries using distance selling (e.g. online) are given the option of returning the deposit by accepting a proof of return instead of the actual used battery. The proof must document the proper disposal, for example through a public waste management utility or a local retailer. Distributors who offer batteries of the same kind are obligated to take back used automotive batteries free of charge and provide proof to the consumer.

[34] The collection of waste portable batteries in Europe in view of the achievability of the collection targets set by Batteries Directive 2006/66/EC, EPBA, 2017 (update)
[35] https://www.bmu.de/en/law/batteries-act/

4.2.2.3 Performance

In terms of portable batteries, the systems have struggled to reach the 2016 45% collection target, and while (in 2018), close to 48% of portable batteries sold in the EU were collected for recycling, 11 Member States have failed to reach the target[36]. About a third of batteries placed on the market (POM) are integrated with products (embedded batteries) and recovery of these batteries is low (some being lost from WEEE reprocessing), with rates ranging from 3% to 20% across different Member State Schemes. [37] Collection rate targets for portable batteries are based on the average amount of batteries POM over a three-year period, yet not all batteries placed on the market are available for recycling three years later. Newer rechargeable batteries have longer lifetimes and hoarding behaviours (e.g. for cordless devices) are delaying when batteries are available for recycling (it is estimated that about 40% of POM are not available for recycling). Portable batteries are also very easy to throw in the residual waste, and the predominantly 'bring' collection systems, which are far from convenient (i.e. the battery has to be taken to the collection point, often in a retail store), and lack of any financial incentive, make collection rates hard to achieve.

By contrast, it is claimed that ~99% of automotive and industrial lead-acid batteries are collected and recycled[38], although, due to a lack of collection target, or formal collection system, the data is thought to be unreliable. Data is difficult to track in the sense that: automotive batteries have an average life expectancy of more than six years, with a large lag between sales and waste arisings, and batteries collected can be placed on the market in one country and then collected at end-of-life in another country. This is due to automotive batteries often being exported/imported as part of a second-hand vehicle: for instance the rate of export of second-hand vehicles from Germany to Eastern European countries will impact the battery collection rate of the exporting as well as the importing countries.

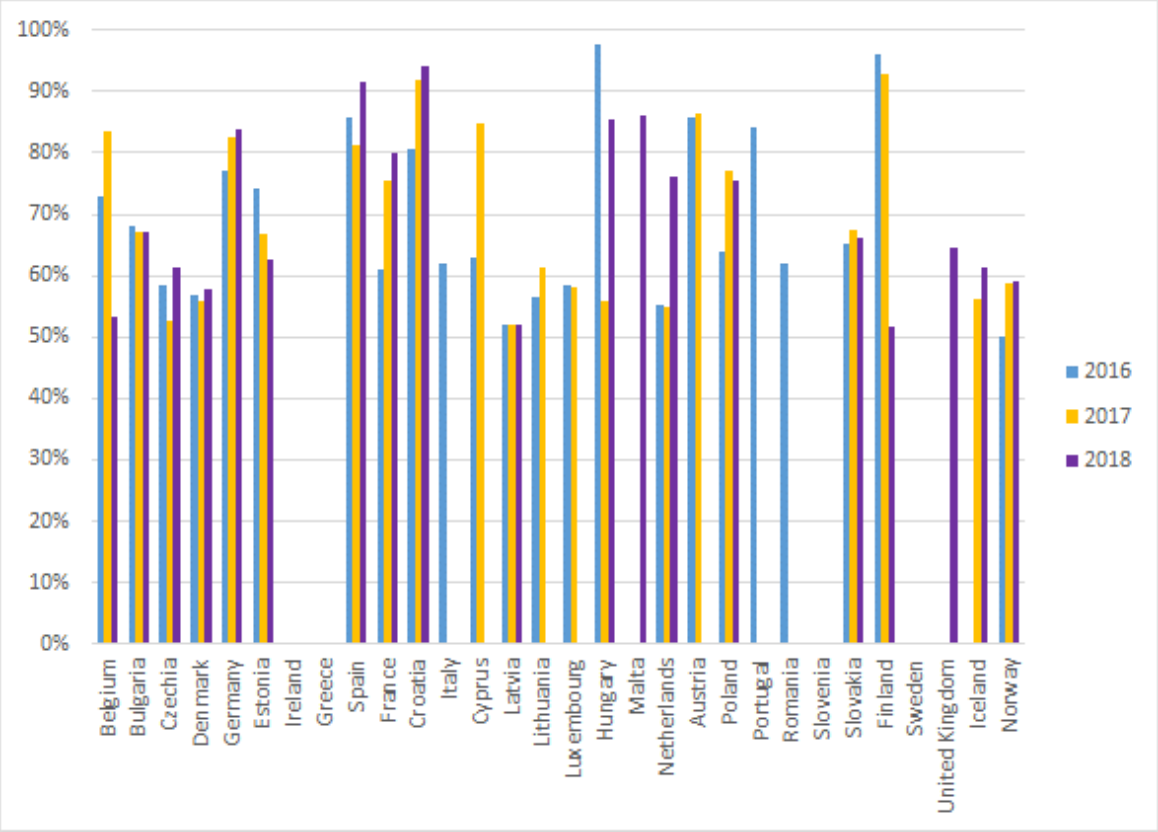
The chart below shows three years of recycling efficiency data (rather than collection rate) for all batteries excluding lead-acid and batteries containing cadmium; i.e. predominantly larger rechargeable Li-Ion and NiMh.

[36] https://ec.europa.eu/eurostat/statistics-explained/index.php/Waste_statistics_-_recycling_of_batteries_and_accumulators#:~:text=For%202018%20(or%20the%20most,the%20lead%20content%20was%20recycled.

[37] Bio Intelligence Service (2014) Ex-post evaluation of certain waste stream Directives Final report European Commission – DG Environment 18 April 2014 p 180

[38] The Availability of Automotive Lead-based Batteries for Recycling in the EU 2010-2012. Eurobat et al

Figure 3: Battery Recycling Efficiency: Other Batteries and Accumulators 2016-2018



Source: https://appsso.eurostat.ec.europa.eu/nui/setupDownloads.do

As can be seen all countries for which data is available had exceeded the 50% target for 'other batteries', although 50% of a Li-Ion battery is poor from a circular economy perspective.

4.2.3 Commentary on the EU Experience to Date

The EU Directives are wide ranging in scope and cover all elements of the life cycle of the products from standards around what can be placed on the market, labelling, the requirement to establish collections schemes, targets for collection and recovery, standards for reprocessing, exporting, and reporting.

The directives however are not prescriptive in how they are transposed and leave each Member State to determine the necessary legislation and mechanisms for implementation. They generally require states to adhere to principles of fairness (all producers should bear responsibility equally), that schemes should be cost effective, and not impose unnecessary burdens on producers, and that appropriate sanctions for non-compliance should apply.

The lack of prescriptiveness at the EU level, while allowing Member States flexibility to fit with their existing arrangements, has the effect of leading to a lot of variation in how schemes are implemented which in turn creates cross border issues, complexity in

management and reporting, and a range of different levels of performance. While portable battery schemes have struggled to achieve a 45% collection rate, automotive and industrial battery recycling has been a relative success story, with collection rates thought to be close to 100%, driven by the inherent material value and in some cases an additional refundable deposit mechanism.

European experience highlights the importance of clearly defining scope and battery category definitions (e.g. defining product categories, end-of-life). Problems arise when definitions are unclear or don't reflect market, or consumer reality. The UK, for example, has been criticised for allowing automotive lead-acid batteries into portable battery collections, and, because of their weight, significantly (and falsely) increasing apparent collection rates.[39] Some newer e-mobility and cordless device batteries (if over 4kg) will be classified as 'industrial batteries' and are supposed to be disposed of in industrial take back programs, and yet they will arise in the home and hence consumers will use portable battery collections for disposal.

An evaluation by the Australian Battery Recycling Initiative (ABRI) notes the following regarding the implementation of the Battery Directive:

> *The EU system is fragmented owing to different Member States' translations of the Directive. Furthermore, within each Member State there is unique regional implementation. This results in additional complexity and inconstancies between states that are challenging for key stakeholders. Significant challenges include:*
>
> *Difficulties identifying liable parties and uncertainties and inaccuracies in reporting with implications for compliance and enforcement.*
>
> *Traceability issues whereby Importer/ buyer address/ distributer address causes reporting misrepresentations*
>
> *Difficulties for importers to track in which Member State a product will be sold, which can lead to double counting.*
>
> *Accounting challenges to reporting of flows with import / export of batteries across State borders.*
>
> *Specifically considering portable batteries, three scheme models have been applied: state funded models, single organisation models and competing organisation models. Another key difference between Member States is whether the municipalities and/or the retailers are responsible for the collection. Analysis of collection rate data indicates that these different models can all achieve high rates.*
>
> *Key insights from EU experience include:*

[39] Bio Intelligence Service (2014) Ex-post evaluation of certain waste stream Directives Final report European Commission – DG Environment 18 April 2014 p187-89

- *Single organisation models a have proved to be better for consistency of communication and awareness raising.*
- *Not for profit collection organisations are considered advantageous:*
    - *There is a risk when organisations are 'for profit' drives prices down with little regard for quality or safety.*

Free riders are not considered to be such an issue in Europe due to the regulated approach. The main concern with regards to free riding is the sale of batteries and products containing batteries through e-commerce. One interviewee reflected on the importance of managing free riders in terms of scheme credibility but did not see this as a major challenge.[40]

In addition, in circular economy terms, the Batteries Directive mainly focuses on the end-of-life phase of a battery. There are requirements that restrict the use of certain hazardous substances and requirements around removability from appliances, however, there are no other eco-design requirements and no recognition of 2nd life or refurbishment options for their management.

4.2.4 The Future of EU Battery Recycling

To date, while the EU schemes have had a focus on portable batteries, there is recognition that automotive and industrial batteries need to be treated differently. However in the legislation, and its transposition into national schemes, there has, as yet, been very limited attention paid to how EV and stationary storage Li-Ion batteries are best dealt with, the focus being on commercially attractive Lead-Acid batteries. Li-Ion industrial batteries (including EV batteries) are likely to have quite different requirements across their lifecycle relative to other types of industrial batteries and they are growing in number. By 2030 15%-30% of new car sales will be EVs and demand is growing for battery storage systems, so-called stand-by power supply (SPS), used in renewable energy schemes to compliment wind and solar and to provide supplementary power at peak times. Whilst historically these have been based on lead acid systems, they are now being superseded by modern batteries (Flow, Sodium-sulphur, Lithium-ion, Solid state batteries).

At present it is thought that as few as 5% of lithium-ion batteries (including smaller ones for mobile devices) are recycled in the EU, although this will rise as EV producers get involved in battery recovery from vehicles under the ELV Directive requirements to remove batteries at end of life and will be accountable for the collection and recycling of spent lithium-ion batteries. At present only Umicore recycle batteries in the EU and even then, this plant does not recover lithium. Enabling 2nd life for EV batteries in stationary SPS applications is an important emerging market that will help plug the gap prior to

[40] ARBI (2017) *BATTERY STEWARDSHIP: ACCESSING INTERNATIONAL EXPERIENCE*. Prepared by Libby Chaplin, Australian Battery Recycling Initiative and Nick Florin, University of Technology Sydney: Institute for Sustainable Futures

more comprehensive collection and reprocessing comes online in the EU. Some organisations believe that low levels of reuse and recycling of Li-ion batteries in the EU are down to inadequate policy drivers of investment rather than technology constraints[41].

Extended producer responsibility (EPR) is designed for exactly this situation whereby the commercial drivers don't exist, and producers have to help finance end-of-life. The Batteries Directive is currently under review, and one key aspect will be how a wide range of large Li-Ion batteries will be dealt with, given that Li-Ion battery materials have less inherent value than they cost to collect and reprocess. Deposit schemes can help with collection, although in this case the large batteries are more likely to be handled by businesses such as automotive garages and waste contractors than individuals or the informal sector and hence the deposit system is less helpful.

While a simple advanced recycling charge (ARC) could be applied, at the point of sale (e.g. as a battery, or in the price of a car, or an energy storage unit) this has its limitations and the same approach applied to portable batteries seems likely for non-lead-acid large batteries, with potentially a separate collection target for Li-Ion batteries. Well-designed EPR systems can drive circularity far more effectively than ARCs alone, by setting mandatory preparing for reuse and recycling targets and ensure that every part of the value chain contributes in an equitable way (e.g. based on market share); covering the net costs (over and above revenues from sales) of collection, sorting and treatment, through to consumer communications, infrastructure development and R&D costs.[42]

The lack of eco-design drivers is also soon to be addressed, since under the revised Waste Framework Directive (2018), Minimum Requirements for EPR have to include so-called eco-modulation of producer fees to reward the better producers and hence incentivise eco-design. This applies not just to end-of life considerations such as recyclability, but other factors such as durability, energy density, recycled content, reparability, upgradeability etc. Member States are already beginning to eco-modulate for portable batteries (e.g. France) in advance of the EU timetable which takes effect over the next few years. In addition, the EU is looking at the potential for an Eco-Design Regulation for industrial batteries as a means to set minimum requirements for the next generation of large batteries.

This is all part of a wider 'green mobility' agenda which includes a comprehensive action plan for batteries that will help create a competitive and sustainable battery "ecosystem" in Europe. The European Battery Alliance (EBA) was launched in October 2017 and the immediate objective is to create a competitive manufacturing value chain in Europe with sustainable battery cells at its core. Covering the EU demand alone requires at least 10 to 20 'gigafactories' (large-scale battery cell production facilities) and access to secondary raw materials by recycling will be a key element. The existing market

[41] WHICH? (August 2018): The Problem With Cordless Appliances

[42] Necessary system costs over and above what market revenues provide

for automotive lead-based batteries in the EU can be predominately met with recycled material.

Asia is poised to dominate EV battery recycling as it has already for small electronic Li-Ion batteries, but a new initiative, the EIT RawMaterials innovation project ReLieVe (Recycling Li-ion batteries for electric Vehicle), developed by EIT RawMaterials industry partners Eramet, BASF and SUEZ, aims to recover all key minerals. Around 50,000 tons of batteries are expected to be recycled by 2027 in Europe and it could be multiplied almost tenfold by 2035.

Box 1 – French portable battery modulation

In EU Member States, the majority of battery EPR fee structures (for portable batteries) are based on battery weight, with some schemes also using additional factors such as type and chemistry to set costs. Such approaches reflect the collection and recycling cost of a particular chemistry and taking weight into account (as with most WEEE systems) rewards lighter weight and hence reduced use of materials in the product. Eco- modulation could be used to make recycling cheaper and easier, for example by influencing design for recyclability, but also to drive the wider circular economy benefits around durability and reuse, i.e. of rechargeables, and use of more sustainable battery materials.

France has the most developed eco-modulation system for portable batteries. The SCRELEC fees for portable batteries, rechargeable ('secondary batteries' or accumulators) and single use (primary) batteries are shown for 2018:

Accumulator	Contribution in Euros excl. taxes per kilo
Secondary Lithium	0,479
Nickel metal hydride (Ni-MH)	0,398
Lead	0,559
Nickel-Cadmium (Ni-Cd)	0,998

Battery	Contribution in Euros excl. taxes per kilo
Alkaline	0,372
Zinc carbon	0,559
Primary lithium (cylindrical and button cell)	2,448
Button Cell (alkaline, Silver oxyde, zinc air…)	3,672
Zinc Air	0,439

Bonus

Bonus	Contribution in Euros excl. taxes per kilo
Lithium accumulators with Cobalt	0,456
Alkaline battery « Eco »	0,360

Source: SCRELEC

It is notable that:

- the secondary (rechargeable) batteries have a lower fee in general than the primary single use batteries;
- a bonus is applied for use of recycled content (Eco Alkaline) and less harmful chemistries (lithium with cobalt which Screlec suggest have "a positive economic and environmental impact due to their composition and lifetime";[1]
- the bonus is small – 0.456 vs 0.479 (5% reduction) and 0.36 vs 0.372 (a little over 3% reduction); and
- the fees per battery are very small – e.g. €0.0086 for a single LR6 (AA) that might cost at least €0.5, i.e. just 2% or so of the product price.

France's Circular Economy Roadmap (2018) has guided the review of fee modulation and will likely make it more stringent than at present to have greater impact. France is considering modifying its modulation approach to include lifespan (charge capacity in mAh), rechargeability and the use of recycled materials. In particular the French legislation foresees:[1]

- Malus for Zinc Carbon batteries (+70% in 2020, +100% in 2022 vs alkaline), given the low capacity and short lifespan.
- Bonus for NiMH rechargeables (-50% vs alkaline)

4.3 Australia – Battery Stewardship Council Proposed Stewardship Scheme for Batteries

4.3.1 Overview

The Battery Stewardship Council (BSC) is an industry organisation formed in 2018 with the purpose of designing and implementing a stewardship scheme for batteries.[43] A fourth and final version of the scheme design was released in November 2019 and, although not all stakeholders are supported of the voluntary approach[44], as of 12 May 2020, the application for accreditation of the scheme from the Australian Competition and Consumer Commission (ACCC) was reported to be progressing positively.[45]

[43] The BSC was appointed by the Queensland State Government to progress the design of industry-led product stewardship options for batteries. QLD had been leading the approach since 2013 when batteries were first added to the Australian Federal Environment Minster's Priority Product List (Section 108A of the PS Act).

[44] Refer summary of ACCC submissions as of 13 May 2020

[45] https://bsc.org.au/wp-content/uploads/2020/05/BSC-Communique-2020-05-12.pdf

The scope of the scheme is to cover all types of batteries except automotive lead-acid. It has been designed to enable the inclusion of e-bike, electric vehicle and energy storage batteries, although these are not the initial focus of the scheme, and their inclusion will be dependent on discussions with industry and government. [46]The information in this summary is focused on what is most relevant to a large battery scheme.

There are the following core elements of the scheme operation:

- Battery collection
- Funding
- Governance
- Accreditation

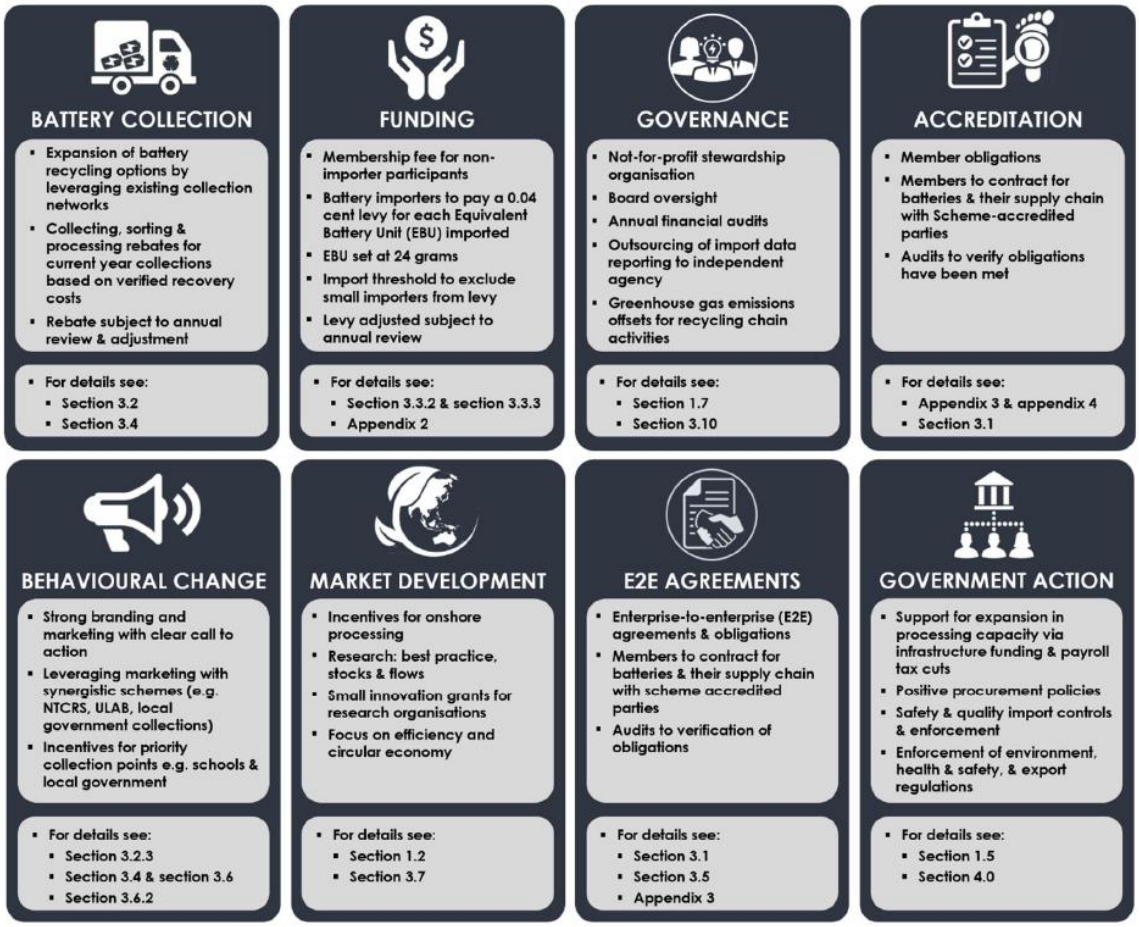
In addition, the following key supporting actions are outlined in the scheme design:

- Behavioural change
- Market development
- Enterprise to enterprise agreements
- Government action

The key aspects of each element are shown in the graphic below:

[46] Battery Stewardship Council. *Proposed Stewardship Scheme for Batteries*, November 2019

Figure 4: Core Elements of the Proposed Scheme



Source: Battery Stewardship Council. *Proposed Stewardship Scheme for Batteries*, November 2019

The key mechanisms for how the scheme will operate are as follows:

- A levy is imposed on all imported batteries which is expected to be passed on to consumers in battery prices. The levy is calculated on the basis of weight irrespective of battery chemistry. The rate of the levy has initially been set at AUS$0.04 per 24 grams (the average weight of an AA cell – referred to as an Equivalent Battery Unit or EBU). This is equal to $1.67 per kg.
- Non importing organisations involved in the supply chain (e.g. collectors, retailers, sorters, recyclers) pay a membership fee. This has been initially set at $1,000 per annum. Membership will enable organisations to participate in the scheme and claim rebates
- Members are required to commit to actions appropriate to their role in the supply chain such as, labelling, recycling chain tracking, environmental and health and safety and quality reporting, supply chain audits, and contracting only with other accredited members
- A key part of the scheme is Enterprise to Enterprise (E2E) agreements, which require members to acquire/supply batteries only from other accredited scheme

members. This measure is designed to address scheme free-riding which can compromise the success of voluntary industry-led product stewardship approaches

- Accredited members are able to claim a rebate on the returned batteries they manage. The rebates are initially set at: $2.50/kg for collections in metropolitan areas, $3.50/kg for collections in regional/remote areas, $1.00/kg for sorting, and $1.00/kg for processing. The levy and rebate levels assume that 100% of batteries placed on the market will be levied but that only 30% of batteries will be redeemed through the scheme. If the return rate is higher, a higher levy will be necessary.
- All levy rates and rebates to be reviewed annually to ensure that the income and expenditure are aligned
- Performance measures will be set for the scheme. This could include metrics such as the number of members and participation by the sector, the collection rate of batteries, number of collection points etc. Standards will also be set for accredited recyclers who would be expected to achieve a 90% recovery rate for recycling of materials
- Investment in domestic infrastructure including processing (to be lead primarily but Federal, State, and Territory governments
- Scheme promotion.

4.3.2 Legislation and Regulation

The Australian Product Stewardship Act 2011 allows for three types of accredited product stewardship schemes:[47]

- **Voluntary.** These schemes can be initiated by industry and do not require regulation to be enacted. Product stewardship organisations that are accredited by the Australian Government must meet specific requirements that ensure they carry out their activities in a transparent and accountable manner.
- **Co-regulatory.** These are product stewardship schemes that are delivered by industry and regulated by the Australian Government. The schemes are typically designed by industry but require regulation to ensure that the operate effectively (for example eliminating free riders). The exact requirements (for example,

[47] https://www.environment.gov.au/system/files/resources/3947fa3a-8404-472c-92c9-1745e6954558/files/fs-product-stewardship-act.pdf

Note: there are also alternate/hybrid industry-led product stewardship pathways. They include Voluntary-Accredited (like AMTA's MobileMuster program) and the ACCC-authorisation model being pursued by BSC – another example of a ACCC-authorised voluntary approach is AU's tyre scheme administered by Tyre Stewardship Australia or the DrumMuster program. ACCC authorisation is typically required when levies are involved.

where there is a requirement to meet a certain recycling target) and details of the activities to be carried out by a scheme operator must be detailed separately in regulations for each scheme.

- **Mandatory.** Mandatory product stewardship is developed and implemented by Government. It places a legal obligation on parties to take certain actions in relation to a product. Requirements that can be placed on parties using the legislation include the labelling of products, making arrangements for recycling products at end of life, or requiring a deposit and refund to be applied to a product. To date there are no mandatory product stewardship schemes in Australia.

The Product Stewardship Act also sets out the governance arrangements (the 'who does what'), the powers of the Regulator (the Australian Government), and the reporting and audit requirements for organisations delivering product stewardship schemes. This includes details about how the Government will ensure compliance under the law, how it will be enforced, what constitutes an offence under the law and what penalties may apply if the law is breached.

The Proposed Stewardship Scheme for Batteries (PSSB) takes a voluntary approach under the legislation. The proposed mechanism to provide a disincentive for 'free riders' and ensure broad industry participation is the use of Enterprise to Enterprise Agreements. This aspect is currently being reviewed and assessed for ACCC authorisation (along with the proposed rebate structure).

The Enterprise to Enterprise Agreements mean that retailers and brands who participate in the scheme will only source batteries, and battery life-cycle management services, from parties who join the BSC and participate in the scheme. For example, if a retailer signs up to the scheme and a battery brand doesn't, the retailer will not source products from them.

To protect the public and corporate interests, industry-led schemes involving collective action need to be authorised by the Australian Competition and Consumer and Commission (ACCC) and may also be accredited by the Australian Government under the Commonwealth Product Stewardship Act.

4.3.3 Structure and Governance

The BSC is a not for profit company limited by guarantee. The role of the BSC is to

- Implement the product stewardship scheme for end-of-life batteries
- Administer the accreditation of members of the Scheme monitor, audit and report on the development of the Scheme
- Undertake education, awareness and information activities to promote the Scheme and the value of end-of-life battery utilisation
- Collect and manage funds received to meet the objectives of the Scheme.

The BSC will be managed by a Board of Directors elected by the members of the Scheme. The administration arrangements have not been determined but are likely to include a core administrative function and outsourcing of elements to specialist organisations

where there are efficiencies. To protect commercial confidentiality, it is proposed an independent organisation be engaged to determine and report imports for the purposes of calculating the levy for each importer.

4.3.4 Application of Fees

The levy of $0.04 per 24g would be imposed on all imports. It is intended that this be passed on to consumers as a transparent and visible fee.

The levy applies to 'loose batteries or batteries contained within battery packs'. This excludes plastic casings and circuits.

It is proposed that payments be levied quarterly. It is not clearly stated, but seems to be implied, that members would be levied directly by the BSC and would pay the levy to the BSC.

Members that pay the levy and operate take back schemes will be able to pay a net levy (i.e. levy minus rebate), provided that can supply documentary evidence of their recovery.

There will be a threshold to exclude very small importers where the costs of administering the levy would exceed the income.

A membership fee, initially set at $1,000, will also be payable by non-importing member organisations. This is mainly to provide some equity of funding for stakeholders.

Batteries that are covered by other product stewardship schemes (for example those imported in electronic equipment) are exempted from the scheme to avoid double counting.

4.3.5 Expenditure and Rebates

The stakeholder input and economic modelling suggests the following expenditure profile:

Element	% Expenditure
Administration	7%
Marketing	5%
Accreditation	2%
Auditing	6%
Collection rebate	50%
Sorting rebate	15%
Processing rebate	15%

The primary rationale for introducing a levy is to be able to provide a rebate to address market failure in the collection, sorting, and recycling of batteries.

As noted above, rebates are initially set at: $2.50/kg for collections in metropolitan areas, $3.50/kg for collections in regional/remote areas, $1.00/kg for sorting, and $1.00/kg for processing. The levels of all rebates will be monitored to ensure that they are at the appropriate level.

Members must be accredited for the particular rebate they are claiming. They will need to provide documentation of their actual and verifiable costs. These will be subject to audit. The available information however does not specify what documentation or level of verification will be required.

It should be noted that the rebate per kg would total $4.50 - $5.50. This is clearly substantially more than the levy of $1.67 per kg. This is because the BSC is expecting an initial recovery rate of around 30%, while the levy is expected to be applied to 100% of batteries. If the recovery rate increases, the levy would be increased proportionately so that costs are met. The voluntary nature of the scheme however raises some issues as to whether the levy will be able to be applied to 100% of batteries.

4.3.6 Standards

It is anticipated standards will be developed for:

- Import calculations
- Collection point quality, health and safety
- Safe and legal storage and transport
- Sorting facility quality, environmental, health & safety management systems
- Processing facility QEH&S management systems
- Downstream tracking of materials
- Calculation of collection, sorting and recovery rates.

4.3.7 Supporting Elements

In addition to the core elements of the Scheme's functions there are a number of supporting actions. These are divided into BSC actions and complementary measures by Government,

4.3.7.1 Supporting BSC Actions:

- **Marketing and education.** The BSC will be responsible for developing a scheme brand and communicating to consumers about the importance of battery recycling and the drop off options in their area. A branding and marketing strategy will be developed and implemented to help deliver this.
- **Market research and development**. There are a range of current challenges faced by the recycling sector could be addressed through research and development. Areas identified include:
  - Innovation in collection sorting and processing

- Health and safety
- Processing efficiencies
- Managing and monitoring of stocks and flows
- Technology development
- Risk assessment and best practice
- Emerging chemistries
- Export processes
- Policy settings and international agreements

These activities will not be able to be funded from scheme income and so Government funding is likely to be required to support them.

4.3.7.2 Supporting Government Actions

- **Infrastructure Funding**. It is suggested BSC could assist in evaluating funding for battery related infrastructure
- **Continued management of batteries not collected in the scheme.** This is will be important as the scheme transitions in. It is of particular relevance for jurisdictions like Victoria who have been funding battery collection and recycling services for over 20 years and aim to transfer all services to a product stewardship program once established
- **Import standards and restrictions.** This is important to reduce the number of poor quality or dangerous batteries entering the local market
- **Research.** This could include developing recycling technologies that could yield commodities with a higher commercial return
- **Procurement.** Government procurement could include minimum standards for battery quality and recycled content.

4.3.8 Commentary

The Australian PSSB is designed first and foremost for small battery types although they state the intention in that the design will enable large batteries (mobility and stationary storage) to be included.

However, the scheme design does not appear to give consideration of how large batteries have a different life cycle and different impacts through the value chain. In particular:

- The Enterprise to Enterprise arrangements, which are a cornerstone in avoiding free riders, are unlikely to be effective for large batteries due to the tight relationships between OEMs, importers, and dealers. i.e. a brand could simply elect not to participate but still have access to markets through its existing channels.
- There is a much greater potential for second use applications
- There is a higher requirement for disassembly, testing, and potentially greater H&S risks (such as high voltage), and hence potentially greater cost for this component

- The time lag between when batteries are placed on the market and when they reach end of life is potentially an order of magnitude longer
- There will be less of a requirement for widely distributed collection systems for members of the public and for public-facing communications
- There may intermediate steps that do not conform to the collection/sorting/processing typology for rebates. For example, removal from vehicles, partial disassembly and preparation for transport, or pre-processing for recycling.

These issues will mean the inclusion of large batteries is likely to require more research and consultation before it is clear how this scheme would operate in practice. Nevertheless, the elements of the overall scheme structure (with an upfront levy, rebates to scheme members, and auditable standards and targets) are likely to be applicable for a large battery scheme.

4.4 Other

4.4.1 United States

There is no national mandatory product stewardship scheme for batteries in the United States.

The Rechargeable Battery Recycling Corporation (RBRC) operates a battery recycling program called Call2Recycle throughout the United States and Canada. RBRC provides businesses with prepaid shipping containers for rechargeable batteries of all types while consumers can drop off batteries at numerous participating collection centres. It claims that no component of any recycled battery eventually reaches a landfill. Other programs, such as the Big Green Box program, offer a recycling option for all chemistries, including primary batteries such as alkaline and primary lithium.[48]

Despite voluntary industry programs to collect and recycle batteries, like Call2Recycle, only 12% to 15% of rechargeable batteries (and a much smaller percentage of single-use batteries) are being recycled in the U.S.[49] Financial contributions from battery producers to the recycling programmes are voluntary in most states, which means that the current programmes enable “free riders” whose products are recycled at the expense of other companies.

The Product Stewardship Institute (PSI) a membership-based organisation advocates nationally for “extended producer responsibility” (EPR) laws that require all battery producers to sustainably finance and run convenient recycling programs for batteries of all types.

[48] https://en.wikipedia.org/wiki/Battery_recycling#Battery_recycling_by_location
[49] https://www.productstewardship.us/page/Batteries#

To date the only regulated EPR scheme in the US that covers batteries is in Vermont which was passed in 2014 and has been operational since 2016. A brief summary of the programme is provided below:

- The scheme covers only primary (non-rechargeable) batteries
- Manufacturers selling batteries in the State have to have a 'Stewardship Plan' to manage proper recycling/disposal of all batteries sold in the State
- Retailers are prohibited from selling primary batteries from producers that are not registered under the scheme
- Retailers and municipalities can act as collectors
- There are 102 collection points across the State
- 21 battery producers representing 70+ brands are part of the scheme
- Manufacturers are required to pay an administrative fee of $15,000 to the Vermont Agency of Natural Resource (VANR)
- Costs are to be identified by the manufacturer in their Stewardship Plan
- Packaging, transportation, and recycling are paid for by the manufacturer.
- Consumers are able to recycle their primary batteries at no cost.[50]

4.4.2 Japan

Japan's product stewardship initiatives take place in the context of a long standing and overarching policy package working towards a 'Sound Material-Cycle Society' (SMCS).

This policy package incorporates existing legislation and programmes and provides a framework to develop new areas of work with the overall aim of reducing the impact of products during their life-cycle. The SMCS is largely a strategic and legislative tool, which takes are more holistic approach rather than targeting a specific sector or material.

The 'Fundamental Law for Establishing a Sound Material-Cycle Society' was passed in 2000 and sets out the criteria of a SMCS and the key principles. The Ministry for Environment for Japan, which was established in 2001, has primary responsibility for this Law. The three principles of the Fundamental Law were:

1. Prevent products from becoming waste (later to represent the reduce of 'the Three Rs');
2. Promote cyclic use of circulative resources (reuse/recycle); and
3. Ensure appropriate disposal.

The approaches of 'discharger's responsibility' and 'extended producer responsibility' were given considerable force through use of legislative tools.[51]

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[50] Australian Battery Recycling Initiative (2018) Summary of Product Stewardship Case Studies. Industry Working Group Report. From: https://bsc.org.au/wp-content/uploads/2019/05/05.-Summary-of-Product-Stewardship-Case-Studies-180308.pdf

[51] OECD (2009) *Policy Instruments for Sustainable Materials Management*, Prepared by Eunomia Research & Consulting

There is no specific programme in place related to batteries, but batteries tend to be dealt with through the e-waste legislation and programmes.

Key features of how the e-waste programmes operate are as follows:[52]

- Producers are required by law to take physical responsibility for specific types of goods under the legislation (2001)
- Targets for recycling and reuse of specific goods are set by legislation
- For example, targets for recycling under the "Home Appliance Recycling Law" are set on the basis of a proportion of materials depending on appliance type. For example, air conditioners were originally set at 60% and moved to 70% after 5 years; however, CRT television sets have remained at the original target of 50%.
- The goods covered by the "Home Appliance Recycling Law" are named within the legislation by type (i.e. "refrigerators")
- Consumers are financially responsible for disposal of their goods under the "Home Appliance Recycling Law". This responsibility is managed through the purchase of multi part disposal manifest or 'docket' for each appliance requiring disposal
- Prices for disposal of each type of appliance are set by the government, however disposal costs for generic goods are set higher than those of branded products, creating some incentive for consumers to purchase locally-made branded products, and covering costs for products that may not have been designed for disassembly
- Some goods can be taken to local post offices (who play a major role in Japanese EPR)for collection (e.g. TVs), others can be returned to the retailers from which they were purchased, or picked up by arrangement with a collection unit
- A section of a multi-part disposal docket is kept by the appliance's former owner as proof that the article was disposed of in a lawful manner. Post office and retailer collection points also keep a section of this multi-part disposal docket when the materials are collected from the public in order to track the scheme
- This docket informs a central database, that provides information to an online tracking system that allows consumers to confirm the correct disposal of their appliance or computer equipment
- Figures for items received and the level of recycling achieved are submitted by recycling plants on a monthly basis.

[52] Taken from: Chong, J., Mason, L., Pillora, S., Giurco, D. (2009). Briefing Paper– Product stewardship schemes in Asia: China and Taiwan, Japan, South Korea. Paper prepared for Department for the Environment, Water, Heritage and the Arts, by the Institute for Sustainable Futures, UTS: Sydney. Accessed: https://www.environment.gov.au/system/files/resources/86ada0a0-8c0a-4ad0-b925-67b81a27463b/files/product-stewardship-asia.pdf

4.5 Recommendations for New Zealand

Our review of relevant product stewardship schemes internationally has revealed that there do not appear to be any product stewardship schemes in operation that specifically address large batteries. This means that there is no 'model' scheme that we can directly learn from or base a New Zealand approach on. Nevertheless, there are some important lessons that can be derived from overseas experience. These include:

- Definitions and clarity around what is included in a product stewardship scheme is vital
- PROs can lower costs and reduce duplication of systems for producers and importers but also dilute the incentive for individual manufacturers to adopt sound practices and improve design
- A single organisation model appears to be better for consistency of communication and awareness raising
- Not for profit collection organisations are considered to be better vehicles for management of schemes because for profit organisations may compromise safety or quality to deliver profit
- A voluntary scheme is likely to have issues in implementation in New Zealand and would not be an option if batteries are declared a priority product
- Appropriate collection, assessment, processing and treatment infrastructure will need to form part of any product stewardship scheme
- Deposit schemes can help with collection although this will depend on who is able to claim the deposit
- Advanced recycling fees (ARCs) can also be effective in ensuring there is sufficient value to enable recovery, however if producers simply pass on these charges directly to customers, then this reduces the financial incentive for manufacturers
- Well-designed EPR systems can drive circularity far more effectively than ARCs alone, by setting mandatory preparing for reuse and recycling targets and ensure that every part of the value chain contributes in an equitable way (e.g. based on market share); covering the net costs (over and above revenues from sales) of collection, sorting and treatment, through to consumer communications, infrastructure development and R&D costs
- The application of fee modulation based on the environmental credentials of a battery is likely to become more common and should be considered as part of a product stewardship scheme design for New Zealand.

5.0 Overview of NZ Value Chains

This exercise aims to understand the structure of large battery value chains in New Zealand and how organisations and individuals (e.g. consumers) interact with other parts of the value chain. The value chain maps are intended to be 'living' documents that will be added to and amended through the project.

5.1 Value Chain Map

A value chain map was first constructed that provided a comprehensive categorisation of all stakeholders. A draft of this was uploaded to Sharepoint and input sought from BIG stakeholders. A copy of the draft high-level value chain map is shown in Figure 5. A version which also maps key stakeholders onto the value chain can be viewed on Sharepoint <<Click here>>.

The Value Chain Map organises participants in a Large Batteries Product Stewardship Scheme into different groups (represented by columns) and into different subgroups under each column. This mapping enables a level of granularity around functions but also recognises functional groupings. The mapping allows stakeholders to participate in multiple points in the chain and recognises that there are a range of stakeholders, who may have vital roles, but that are not directly involved in handling or ownership of batteries.

The individual stakeholder mapping exercise also showed where in the value chain stakeholder representation is strong and where there is a lack of representation. The strongest areas are government and statutory bodies, industry bodies, and advisors and research & development. The areas that are under-represented are private consumers, used vehicle importers, installers, mechanics, wreckers, insurance and guarantee providers.

5.2 Battery Flows

Figure 6 shows probable physical battery flows across the value chain. The batteries mostly move from left to right across the chain. At each end of the chain (import and recycling, reprocessing and disposal) the flows are relatively simple, but in the middle of the chain (between owners, servicing and upgrades, and end of management) the relationships become complex, and batteries can take multiple pathways.

This is an important insight for the design of the scheme as it suggests that if the administration of the scheme is to avoid complexity, it will be important to focus the key scheme drivers on each end.

The battery flow value chain map can also be viewed on Sharepoint <<Click here>>.

5.3 Money Flows

Figure 7 maps the probable transfer of money through the value chain. Like for the battery pathway, the money flows are simpler at each end and more complex in the

middle. Unlike for the physical flow of batteries however money does not flow from left to right, but essentially from the middle outwards. On the left half of the value chain the batteries are regarded as having value and people pay for them. On the right half of the chain the batteries are more likely (though not exclusively) to represent a cost to manage, and those handling them will generally need to recoup these costs through charging.

The map also notes that money flows are not necessarily attached to physical batteries, as other organisations such as insurance and finance companies and guarantee providers may also have a financial interest and, if a product stewardship scheme were implemented, the scheme administrators would be a centre for financial transactions.

The money flow value chain map can also be viewed on Sharepoint <<Click here>>.

5.4 Gaps and Issues

The value chain map in Figure 8 notes key issues and gaps associated with each sub-group. While there are specific issues relevant to each subgroup the following key points can be made across the value chain:

- Importers and resellers do not have ownership of the product once it is sold. Beyond brand and customer considerations there is no incentive to design for environmental considerations or take responsibility for products at the end of their life.
- Owners are faced with cost issues if they need to dispose of or service the batteries. This may provide a disincentive for purchase or an incentive for disposing of in the cheapest manner
- There is a need for clear consistent information and collection networks and options outside of new vehicle ownership
- Businesses involved in servicing and upgrades need to make a clear value proposition to customers where these services compete with new products or disposal options.
- There may be a lack of value in used batteries that limit the application of best environmental practice by those involved in end life management.
- Second life batteries with limited remaining capacity may not compete on cost but could still find markets due to a better overall environmental footprint
- There is a lack of standards and regulation in respect to end of life management
- There is a need for infrastructure for collection, sorting and management of end of life batteries
- Recycling at end of life represents a cost
- There is a need for on-shore processing that can scale relative to the demand.

Overall, the most critical issues can be characterised as there being the potential for more cost than value in the correct management of batteries across the value chain, and a lack of incentives to design for optimal outcomes.

The gaps and issues value chain map can also be viewed on Sharepoint <<Click here>>.

5.5 Change Points and Levers

Figure 9 identifies key change points and levers that could apply for each subgroup in the value chain. The question addressed in the value chain map was: Who will be incentivised by which initiatives?

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 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.

The change points and levers value chain map can also be viewed on Sharepoint <<Click here>>.

Figure 5: Value Chain Map

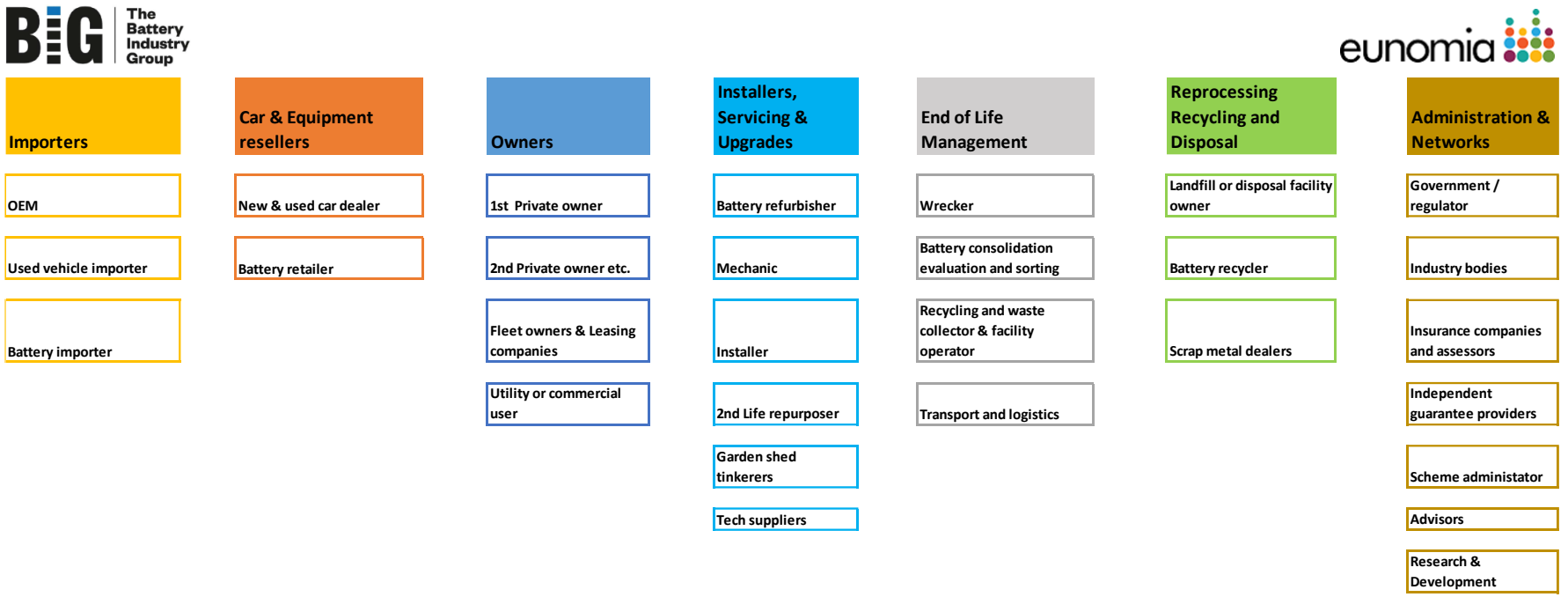


Figure 6: Value Chain Map: Battery Flows

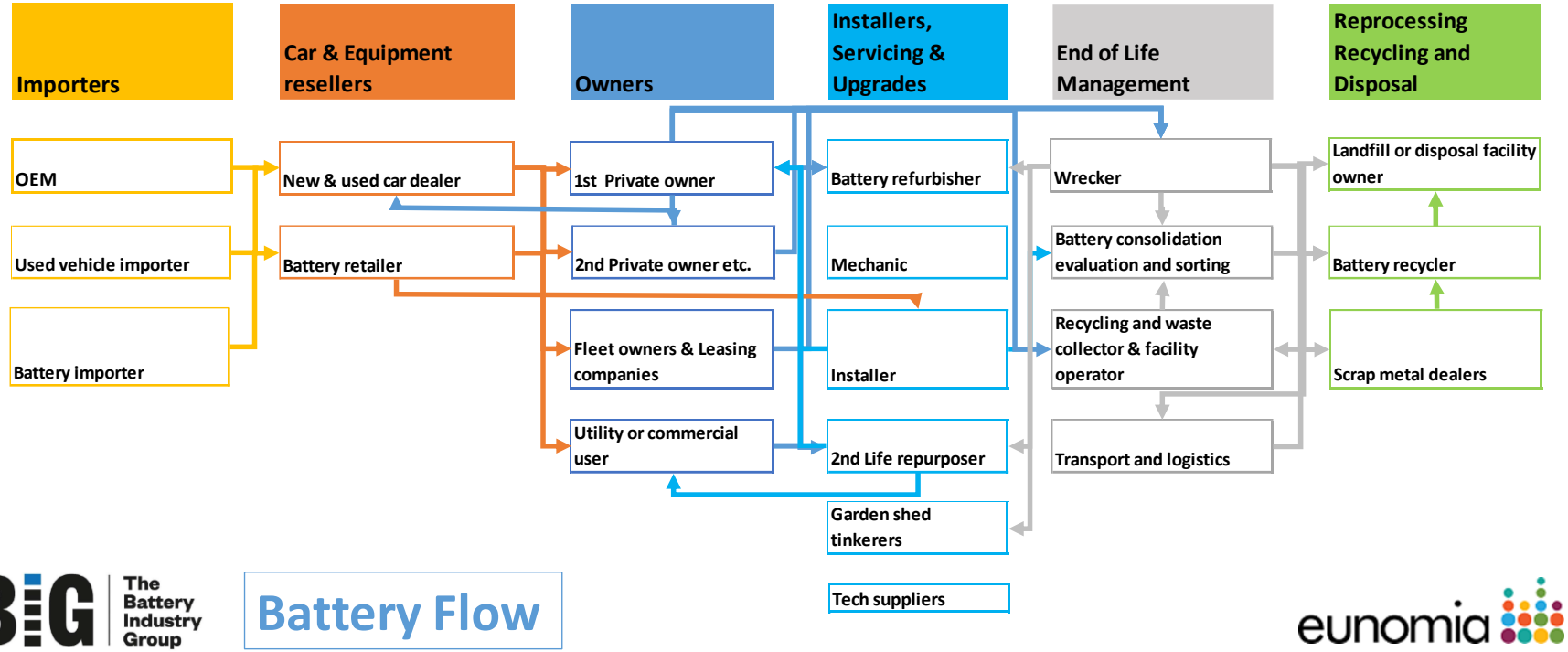


Figure 7: Value Chain Map: Money Flows

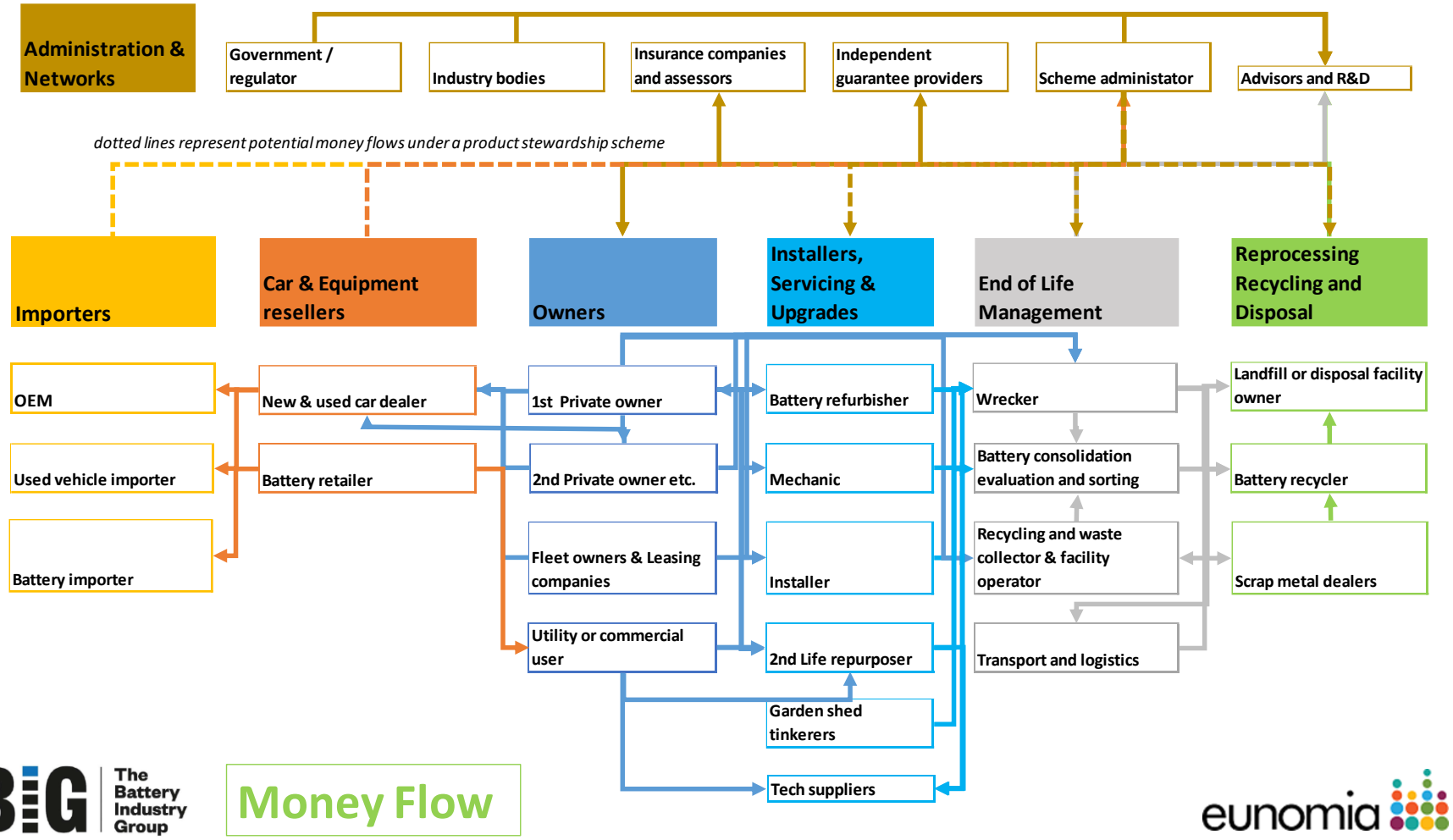
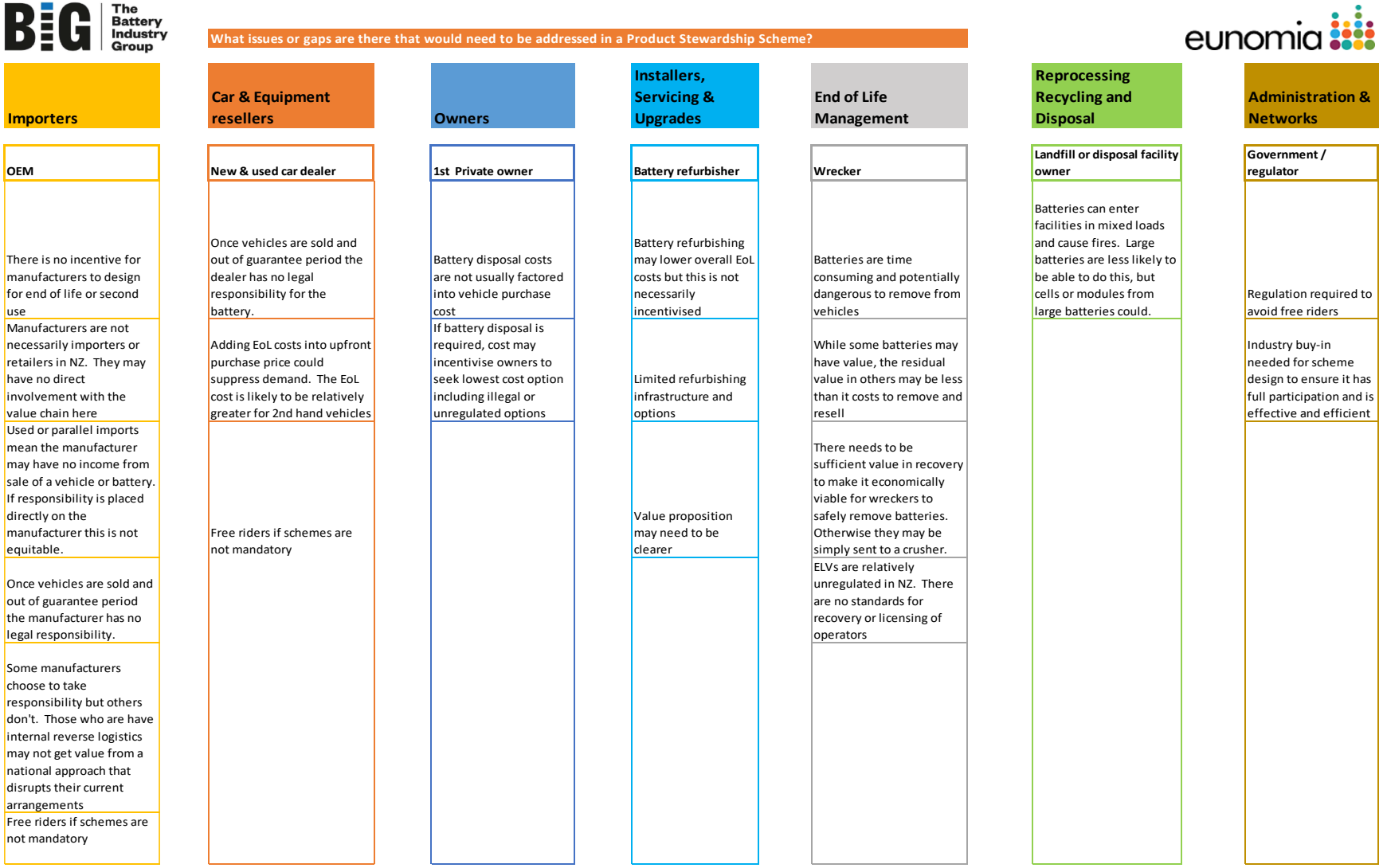


Figure 8: Value Chain Map: Gaps and Issues



Used vehicle importer	Battery retailer	2nd Private owner etc.	Mechanic	Battery consolidation evaluation and sorting	Battery recycler	Industry bodies
Once vehicles are sold and out of guarantee period the importer has no legal responsibility for end of life or end of use.	Once batteries are sold and out of guarantee period the dealer has no legal responsibility for the battery.	Battery disposal costs are not usually factored into vehicle purchase cost	Potentially a triage point for Evs and battery issues. May need to be upskilling and wider industry adoption of tech	Private businesses undertake these operations currently but at a small scale. There is no nationwide consistent system or network	Economics of recycling depend on commodity values and the ability to extract materials from batteries in a useful form	Industry bodies represent member interests but are not likely to be appropriate entities for EPR
Free riders if schemes are not mandatory	Adding EoL costs into upfront purchase price could suppress demand.	If battery disposal is required, cost may incentivise owners to seek lowest cost option including illegal or unregulated options		Markets for resusable and recyclable components are small and often informal	Gate fees still required to pay for processing	
	Free riders if schemes are not mandatory				Transport of batteries problematic due to safety risks. Pre-processing may be required for export.	
					No onshore battery recycling facilities (although some in pipeline).	
					The match between scale of onshore plants and demand is uncertain	

Battery importer	Fleet owners & Leasing companies	Installer	Recycling and waste collector & facility operator	Scrap metal dealers	Insurance companies and assessors
There is no incentive for manufacturers to design for end of life or second use	Depreciation of EV due to battery degradation may affect purchasing decisions	Ownership of batteries may need to be clarified.	Transfer stations are not necessarily set up to receive large quanities of batteries	Batteries show up in loads of material from e-waste to cars. It is problematic to deal with	Insurance companies need to accurately know the risks associated with batteries from wrecked vehciles and know whether write off or repair is appropriate and costs associated with each option
Manufacturers are not necessarily importers or retailers in NZ. They may have no direct involvement with the value chain here		2nd Life batteries may have different requirements fori installation or servicing?	There may be opportunities to utilise existing factilies as collection and (initial?) assessment centres	No value in batteries for dealers and costs in safely managing them	Fire risks from stationary storage
Used or parallel imports mean the manufacturer may have no income from sale of a battery. If responsibility is placed directly on the manufacturer this is not equitable.			Colletors have had issues with fires in collection vehicles	Market for EoL batteries is uneven.	
Once batteries are sold and out of guarantee period the manufacturer has no legal responsibility.			Guidance required for safe collection and handling of EoL batteries		
Some manufacturers choose to take responsibility but others don't					
Free riders if schemes are not mandatory					

Utility or commercial user
Battery disposal costs may not be factored into purchase cost

2nd Life repurposer
Supply of batteries needs to match demand for 2nd life batteries
Different batteries from differs suppliers, different specs, SOD etc.
Economics of 2nd life still evolving?

Transport and logistics
Transporting and storage of batteries is hazardous.
Lack of a consistent approach. Standards and guidance is likely to be important

Independent guarantee providers
Guarantee proviers need to accurately know whether write off or repair is appropriate and costs associated with each option

Garden shed tinkerers
Garden shed tinkerers provide demand for EoL batteries but this will only ever be small numbers
Some tech options or future businesses could emerge from this sector

Scheme administator
A legal entity would need to be established to oversee scheme
Need to evaluate options as to whether a PRO or individual businesses should be responsible for EoL batteries - or a combination

Tech suppliers
Battery passport and tracking batteries through the value chain requires industry wide uptake

Advisors & R&D
Pathways for research to be made available to potential users and commercialised and linking of specialist expertise to business will faciliate solutions

Figure 9: Value Chain Map: Change Points and Levers

Who will be incentised by which initiatives?

Importers	Car & Equipment resellers	Owners	Installers, Servicing & Upgrades	End of Life Management	Reprocessing Recycling and Disposal	Administration & Networks
OEM • Product content requirements, including recycled content and minimise hazardous materials • Incentivised changes to product design (e.g. product life) • Recycling targets and standards • Advance disposal fees give incentive to pass on cost • Deposit refund will give incentive pass on cost • Ownership stays with manufacturer/importer/retailer	**New & used car dealer** • Ownership stays with manufacturer/importer/retailer • Advance disposal fees give incentive to pass on cost • Deposit refund will give incentive pass on cost • Lease options would ensure custody is clear. E.g. Renault model in Europe is they sell the car but lease the battery.	**1st Private owner** • Deposit refund will give incentive to return • Advance disposal fee would avoid disincentives • Consumer information to ensure they know what to do • Collection networks to make disposal easy • Lease options would ensure custody is clear.	**Battery refurbisher** • Incentivise reuse, including remanufacture. • Consumer information will help make customers aware of options	**Wrecker** • Deposit refund will give incentive to return • Advance disposal fee would avoid disincentives • Consumer information to ensure they know what to do • Collection networks to make disposal easy	**Landfill or disposal facility owner** • Landfill Bans	**Government / regulator** • Recycling targets and standards. Incentivise implementation of Scheme

Used vehicle importer	Battery retailer	2nd Private owner etc.	Mechanic	Battery consolidation evaluation and sorting	Battery recycler	Industry bodies
• Recycling targets and standards • Ownership stays with manufacturer/importer/retailer • Advance disposal fees give incentive to pass on cost • Deposit refund will give incentive pass on cost	• Ownership stays with manufacturer/importer/retailer • Advance disposal fees give incentive to pass on cost • Deposit refund will give incentive pass on cost • Lease options would ensure custody is clear. E.g. Renault model in Europe is they sell the car but lease the battery.	• Deposit refund will give incentive to return • Advance disposal fee would avoid disincentives • Consumer information to ensure they know what to do • Collection networks to make disposal easy • Lease options would ensure custody is clear.	• Consumer information will help make customers aware of options • Database/market for new/refurb batteries to give options to customers	• Deposit refund will give incentive to return • Advance disposal fee would avoid disincentives	• Financing mechanisms • Collection networks to give ready access to suppluy of EoL batteries • Advance disposal fee to pay for costs of processing and make it economically viable	• Could establish Product Responsibility Organisations • Recycling targets and standards. Incentivise implementation of Scheme

Battery importer

- Recycling targets and standards
- Ownership stays with manufacturer/importer/retailer
- Advance disposal fees give incentive to pass on cost
- Deposit refund will give incentive pass on cost

Fleet owners & Leasing companies

- Deposit refund will give incentive to return
- Advance disposal fee would avoid disincentives
- Consumer information to ensure they know what to do
- Collection networks to make disposal easy
- Lease options would ensure custody is clear.

Installer

Recycling and waste collector & facility operator

- Deposit refund will give incentive to return
- Advance disposal fee would avoid disincentives
- Guidance
- Collection networks to make disposal easy

Scrap metal dealers

- Deposit refund will give incentive to return
- Advance disposal fee would avoid disincentives
- Guidance

Insurance companies and assessors

- Guidance

Utility or commercial user

- Deposit refund will give incentive to return
- Advance disposal fee would avoid disincentives
- Consumer information to ensure they know what to do
- Collection networks to make disposal easy
- Lease options would ensure custody is clear.

2nd Life repurposer

- Incentivise reuse, including remanufacture.

Garden shed tinkerers

Tech suppliers

- Formal scheme will create market for tech solutions: e.g. product tracking, recycling and refurbishment equipment supply, control systems for repurposed batteries

Transport and logistics

- Guidance

Independent guarantee providers

- Advance disposal fee would avoid disincentives

Scheme administator

- Recycling targets and standards
- Management and Governance requirements

Advisors and R&D

- Research funding
- Formal industry association will help create links and collaboration

6.0 Summary and Conclusions

Establishing the design objectives for the Circular Product Stewardship Scheme for Large Batteries will be vital, as this will guide the decisions around scheme design. The proposed design objectives are:

- Compatible with and facilitate a circular economy
- Comprehensive
- Economically efficient and fair
- Administratively simple to implement and run
- Aligned with statutory guidelines and regulations
- Future proof and flexible.

These design objectives will be consulted on and finalised through the stakeholder engagement process.

Research for this stage one report has highlighted a range of considerations that will need to be taken into account in the subsequent phases of the project. Chief among these is the fact that, while there are many examples of successful product stewardship schemes and, while the principles for such schemes are well established, there are no schemes for managing large batteries that can serve as a model for a New Zealand product stewardship scheme. It is clear that, because of their unique life cycle, large batteries pose a range of unique challenges in designing a product stewardship scheme. These include:

- The potential for second use applications
- The need for assessment and evaluation of batteries
- Hazards associated with handling, storage, and transport
- The time lag between when batteries are placed on the market and when they reach end of life is potentially up 20-30 years or more
- The importance of being able to track large batteries through their various ownership and use cycles
- Unlike household consumer items, there is less of a requirement for widely distributed collection systems and for public-facing communications.

Work on the New Zealand value chains highlighted the following:

- There are a wide range of organisations involved in the value chain that do not necessarily physically handle batteries, such as research organisations, government agencies, finance companies, insurance companies etc.
- Organisations may have a range of roles throughout the value chain
- The movement of batteries is generally simpler at the start and end of the value chains but more complex in the middle where multiple pathways become possible

- The money flows are generally from the middle of the value chain (the owners) outwards
- Overall, there is the potential for more cost than value associated with good management of batteries across the value chain
- Currently there is a lack of incentives to design batteries for optimal circular economy outcomes
- Placing appropriate incentives at the key points in the value chain will be a critical component in the design of a successful product stewardship scheme
- Ideally there will be the means to track batteries through their lifecycle in order to effectively measure performance of a product stewardship scheme.

The research canvassed a range of tools and approaches that could form a part of the design of the Circular Product Stewardship Scheme for Large Batteries. Subsequent phases of the project will explore the appropriateness of these for New Zealand.

APPENDICES

A.1.0 MfE Proposed Guidelines for Priority Product Stewardship Scheme Design

Design feature	Proposed Waste Minimisation Act 2008 (WMA) section 12 guidelines for priority product scheme accreditation
1.Intended objectives and outcomes	a) Specify the expected reduction in harm to the environment from the implementation of a scheme and/or the expected benefits from reduction, reuse, recycling, recovery or treatment of the product to which a scheme relates. b) Specify the expected quantifiable waste minimisation and management objectives for the product to which a scheme relates, and the plan to achieve significant, timely and continuous improvement. c) All schemes will be designed to incentivise product management higher up the waste hierarchy in priority order: waste prevention, reuse, recycling, recovery (materials and energy), treatment and disposal. d) For products containing hazardous materials: industry certification and compliance with other legislation for installation or use, maintenance, collection, transport, storage and disposal pathways. e) All schemes will be designed and financed to manage orphaned and legacy products,[53] as well as current products entering the market.
2. Fees, funding and cost effectiveness	a) The full net costs of collection and management of the priority product (reuse, recycling, processing, treatment or disposal) will be covered by producer and product fees associated with the scheme (eg, 'producer pays' or 'advance disposal fee').[54] b) The impact of more than one accredited scheme and opportunities for maintaining competition should be considered in terms of net cost effectiveness (including monetary and non-monetary costs and benefits). c) Specify plans to manage risk to sustainable scheme income, such as price volatility and leakage of materials into other markets. d) Specify how existing and emerging technologies will be used to help track and manage product or waste throughout the supply chain (eg, bar codes, radio frequency identification (RFID), and block chain).

[53] Legacy products include those sold into the market in earlier years that are now obsolete or banned (eg, agrichemicals containing POPs). Orphaned products include current or recent products for which a liable producer is no longer present (eg, e-waste marketed by companies no longer in business).

[54] The WMA defines producers to include people who: manufacture and sell a product in New Zealand under their own brand; are the owner or licence holder of a trademark under which a product is sold in New Zealand; import a product for sale in New Zealand; or manufacture or import a product for use in trade by them or their agent.

Design feature	Proposed Waste Minimisation Act 2008 (WMA) section 12 guidelines for priority product scheme accreditation
3. Governance	a) The scheme governance entity will be independent, non-profit and represent producers and wider stakeholders, including public interest. b) Governance should include wider stakeholders in two types of advisory groups: those including product producers and recipients of product management fees who have technical or supply chain knowledge, and other stakeholders who represent wider community and consumer interests. c) Structure and accountability of the scheme governance entity will be specified. Clear mechanisms will be implemented to fully control scheme operation, manage non-compliance and report on outcomes. d) The selection process for scheme directors will be transparent, and scheme governance provisions will follow best practice guidelines for New Zealand.[55] e) Given the size of New Zealand's population and market, the default expectation will be that either a single accredited scheme per priority product, or a clear platform for cooperation between schemes for efficient materials handling, will be part of the design.
4. Non-profit status	a) Given the prominence of expected net public good outcomes, the default expectation is that all priority product stewardship schemes will be operated by non-profit entities representing key stakeholders.
5. Competition	a) The scheme will clearly provide for transparent, non-discriminatory and competitive procurement processes for downstream services, such as collection, sorting, material recovery and disposal. b) The scheme will ensure that no collectors and recyclers (whether existing, new entrant or social enterprise) are unfairly excluded from participation. This includes making service packages of suitable scale (whether geographically, by material or other measure) to allow both large and small providers to compete fairly. c) Multiple accredited schemes will be considered if the net community and environmental benefit (including cost-effectiveness and non-monetary impacts) is likely to be improved. d) Provision will be made for regular independent audit of agreements among competitors. e) The design process for the scheme will have adhered to guidelines on collaborative activities between competitors as issued by the Commerce Commission, including, but not limited to, applying for collaborative activity clearance from that commission (eg, Commerce Commission, 2018a, 2018b, 2018c and 2019).
6. Stakeholder engagement and collaboration	a) The scheme will specify how wider stakeholders will be involved in decision-making by governance group (eg, use of stakeholder advisory groups). b) The scheme will have been designed with the active engagement of stakeholders currently involved in the product end of life (eg, collectors and recyclers).

[55] For example, the Institute of Directors of New Zealand *Code of Practice for Directors* (www.iod.org.nz/Portals/0/Publications/Founding%20Docs/Code%20of%20Practice.pdf).

Design feature	Proposed Waste Minimisation Act 2008 (WMA) section 12 guidelines for priority product scheme accreditation
	c) The scheme will specify how use of existing collection and processing infrastructure and networks will be maximised and new infrastructure and networks co-designed and integrated between product groups.
7. Compliance	a) The scheme will have a clear means of enforcing compliance of all participants and reporting liable non-participants to the government enforcement agency. b) The scheme will have strategies to reduce 'leakage' of higher value end-of-life products (eg, 'cherry picking' of e-waste components by informal collectors).
8. Targets	a) All schemes will be expected to set and report on targets that have the following characteristics: • significant, timely and continuous improvement • benchmarked against and aspiring to attain best practice recovery and recycling or treatment rates for the same product type in high-performing jurisdictions • a clear time bound and measurable path to move toward attaining best practice • targets for new product and market development to accommodate collected materials. b) Results against targets will be publicly reported at least annually. c) Material collection, recovery and disposal rates will be measured against one of the following: • actual trend data, if the scheme has pre-existed as a voluntary scheme • the average aggregate weight or count of products sold into the market in the previous three reported years • another specified method where market entry information does not yet exist. d) Plans will be specified for review, adjustment and reporting on performance targets preferably annually and no less than every three years, taking account of changes in the market, natural events and technology. e) A clear distinction will be made between funding arrangements and market capacity to manage both potential high volume legacy and orphaned product collections in earlier years and ongoing continuous improvement of collection rates. f) Performance targets will include measures for public awareness of scheme participant satisfaction and a record of response by the scheme to concerns raised. This will be made available to scheme auditors.
9. Timeframes	a) The timeframe within which an application for accreditation or reaccreditation of the priority product scheme is expected to be made after declaration of priority product is as follows: • priority product categories with existing accredited voluntary schemes (eg, refrigerants, agrichemicals, farm plastics, packaging): within one year from the date of priority product declaration • priority product categories with accreditation proposals that have been developed through a multi-stakeholder consultation process including, as a minimum, producers, local authorities, major users, existing collectors and recyclers (eg, tyres): within one year from the date of priority product declaration or the date of proposal completion, whichever comes later

Design feature	Proposed Waste Minimisation Act 2008 (WMA) section 12 guidelines for priority product scheme accreditation
	• other priority product categories: within three years from the date of priority product declaration. b) Within the accredited seven-year period, at least one full review will be undertaken of scheme costs and effectiveness. The results of reviews and proposed scheme amendments to improve cost effectiveness will be reported via the annual reporting process.
10. Market development	a) The scheme will have a research and development budget to develop new recycled products, encourage transition to circular product and recycled product materials design, and cooperate with other stakeholders to enhance onshore infrastructure.
11. Performance standards, training and certification	a) The scheme will have clear means for ensuring adequate training and certification of all people recovering and managing a product throughout its life cycle, to ensure best practice in prevention and reduction of harm to people and the environment. b) Any relevant standards for best practice will be referenced in training, supplier accreditation and monitoring (eg, AS/NZS 5377 for e-waste collection and processing). The scheme will participate in the development and revision of relevant standards. c) The scheme will have clear chain of custody arrangements for monitoring processing of materials and reduction of harm, both onshore and offshore, including annual reporting of findings.
12.Liability and insurance	a) The scheme will have clear chain of custody arrangements for monitoring receipt and processing of materials and reduction of harm, both onshore and offshore, including annual reporting of findings. b) The scheme will ensure that liability of parties is clear for each stage of product and materials handling, and adequate insurance for liability is in place at each stage of the process.
13. Design for environment	a) The scheme will contain financial or other incentives for diversion of collected products to highest and best resource use, weighted for applications higher up the 'waste hierarchy' (in priority order: reduction, reuse, recycling or composting, energy recovery, safe treatment and disposal). b) The fees paid by a producer to a collective scheme will, as far as possible, be linked to actual end-of-life treatment costs of their products, such as through variable or modulated fees. c) The scheme will facilitate good communication, feedback and incentives between designers, manufacturers, sales and marketing teams, distributors, retailers, consumers, collectors, recyclers and end disposal operators, to inform improved design of products and systems. d) The scheme will fund initiatives to improve circular resource use by reducing the 'end-of-life' components of the product(s) and improving design for reusability and recyclability of the priority product(s).

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14. Reporting and public accountability	a) The scheme will provide for clear, regular and open reporting and communication with stakeholders. b) Annual reports will be made public. These will include measurement of outcomes and achievement of targets, fees collected and disbursed, and net cash reserves held as contingency. c) Provision will be made for regular independent financial, compliance, enforcement and environmental audits of scheme performance. d) Scheme plans will address the following: data availability, especially when several PROs are in competition; materials' traceability; precise definition for data collection and reporting (eg, recycling rates and operational costs). e) The scheme will have mechanisms in place to protect competitive information relating to detailed operational costs (eg, 'black box' data collection by third party with aggregate reporting). f) Scheme performance measures will be harmonised between schemes as far as possible.
15. Public awareness	a) Branding and clear information on how and why the scheme operates will be easily available at point of distribution (intercompany) and purchase (consumer), point of waste product collection and online, and a link to the online information will be on the product or product packaging. b) The scheme will provide for transparent product stewardship fees at point of purchase. c) The scheme will ensure that consumer labelling standards for the product are complied with (eg, under the Hazardous Substances and New Organisms Act 1996 for hazardous substances). d) The scheme will regularly measure and report on public awareness and scheme participant satisfaction, and improvements made accordingly.
16. Monitoring, compliance and enforcement	a) The scheme will have a clear means of enforcing compliance of all participants and reporting liable non-participants to the government enforcement agency. b) The scheme will have strategies to reduce 'leakage' of higher value end-of-life products (eg, 'cherry picking' of e-waste components by informal collectors). c) The Government will enforce WMA regulations. d) Revocation of accreditation is possible under WMA section 18 if reasonable steps are not being taken to implement the scheme, and the scheme's objectives are not being met or are not likely to be met within the timeframes outlined in the scheme.
17. Accessible collection networks	a) The scheme will provide for an end-of-life product collection system that is reasonably accessible for all communities generating that waste product, whether metropolitan, provincial or rural. b) Collection will be free to the public (fully funded by the scheme) for all products covered by the scheme. c) Collection will be based on the product, not proof of purchase. d) Collections will, as far as possible, share infrastructure and public information with other collection schemes in the area.