



Environment Protection Authority

Regulatory impact statement – Product Lifecycle Responsibility Regulation 2025

Prepared by the NSW Environment Protection Authority
with the support of Marsden Jacob Associates

October 2025



A decorative vertical band on the left side of the page, featuring a series of overlapping Aboriginal patterns. These include a circular sun-like motif with radiating lines, a series of concentric circles, and a pattern of small dots arranged in a grid. The colors are various shades of blue and grey.

Acknowledgement of Country

The NSW Environment Protection Authority acknowledges the Traditional Custodians of the land on which we live and work, honours the ancestors and the Elders both past and present and extends that respect to all Aboriginal people.

We recognise Aboriginal peoples' spiritual and cultural connection and inherent right to protect the land, waters, skies and natural resources of NSW. This connection goes deep and has since the Dreaming.

We also acknowledge our Aboriginal and Torres Strait Islander employees who are an integral part of our diverse workforce and recognise the knowledge embedded forever in Aboriginal and Torres Strait Islander custodianship of Country and culture.

Aboriginal artwork by Worimi artist Gerard Black

Contents

Executive summary	5
1. Introduction.....	9
1.1 Objectives.....	9
1.2 Scope.....	10
1.3 Methodology	10
2. Policy environment.....	11
2.1 The role of batteries in net zero and decarbonisation.....	11
2.2 Product stewardship in Australia.....	11
2.3 International policy context.....	11
3. Battery market profile.....	13
3.1 Battery market segments.....	13
3.2 Current demand for batteries in NSW	14
3.3 Trends in NSW's battery market	15
3.4 Chemistry and quality of batteries.....	15
3.5 Implications for waste, recycling and manufacturing of lithium-ion batteries	16
4. Problem statement and objectives for government action.....	18
4.1 Problem statement.....	18
4.2 Contaminants.....	20
4.1 Human harm.....	20
4.2 Damage to infrastructure	22
4.3 Market failure and the case for government intervention	29
5. Consultation.....	31
5.1 To date.....	31
6. Options	32
6.1 Options for mandatory product stewardship	32
6.2 Complementary measures	33
7. Impact analysis	34
7.1 Cost-benefit analysis	34
7.2 The base case.....	34
7.3 Key findings.....	34
7.4 Summary of results	35
7.5 Sensitivity analysis.....	37

7.6	Key drivers of the results.....	38
7.7	Cost-benefit analysis approach.....	40
7.8	Overarching assumptions.....	41
7.9	Benefit assumptions.....	41
7.10	Cost assumptions	43
7.11	Material flows.....	45
7.12	Data limitations.....	54
7.13	Unquantified costs and benefits	54
	Overview of assessment	56
7.14	Summary.....	56
7.15	Implementation.....	57
7.16	Evaluation.....	58
	Appendix 1: International scheme comparison.....	59
	Appendix 2: Broader policy context.....	60
	Appendix 3: Cost-benefit analysis sensitivity analysis.....	66
	Appendix 4 - Better regulation principles	68

Executive summary

The market for batteries is expanding rapidly in NSW

NSW is witnessing dramatic growth in the number and volume of batteries available in the market. Batteries have become common in a range of applications, from small batteries in electronic devices to large stationary batteries underpinning renewable energy systems.

This growth is particularly strong with lithium-ion batteries, which have greater energy density than older battery technologies. Lithium-ion batteries are increasingly used in many small electronic devices, in e-micromobility devices like e-bikes, in vehicles, and in large battery storage.

The demand for batteries is projected to grow rapidly and will be critical to supporting the decarbonisation of the economy. Major trends influencing the growing demand for batteries include the

- increased adoption of electric vehicles and large, stationary battery storage devices
- increased application of batteries for use in small, electronic devices.

Batteries can pose significant fire risks

While batteries are generally safe when used properly, there are significant risks of fire in some circumstances, notably with lithium-ion batteries. The chemistry in them can enter a process called ‘thermal runaway’ when the battery is damaged, pierced or overheated. This results in fires that burn at hotter temperatures and are difficult to put out. They can cause significant damage and threaten lives, as evidenced by fatal e-bike battery fires in NSW over recent years.

Battery fires are also increasingly common when batteries are disposed of incorrectly. A battery in a waste or recycling vehicle or at a facility may be crushed or punctured, leading to fires that are difficult to put out. A battery is the suspected cause of a fire that destroyed Canberra’s only recycling facility on Boxing Day in 2022.

Fragmented avenues for the safe collection of batteries

The existing options to safely dispose of batteries are fragmented and can be difficult for the public to access. Small, removable batteries can be disposed of through the voluntary product stewardship scheme B-Cycle’s collection network, available in most supermarkets and hardware stores. But the collection rate of batteries through this network is below 20%, meaning that over 80% of these battery types are either landfilled or otherwise disposed of incorrectly.

B-Cycle is a Commonwealth accredited product stewardship scheme, where businesses that supply batteries voluntarily contribute financially to it. This money is used to offset the cost of collecting and processing batteries. Other types of batteries may be accepted through other product stewardship arrangements, such as the MobileMuster program for mobile phones and the National Television and Computer Recycling Scheme.

But with overall collection rates being low, and the growing risks of fires from incorrectly disposed of batteries, the existing voluntary arrangements aren’t enough.

This regulatory impact statement evaluates a proposed Regulation to implement mandatory product stewardship arrangements for batteries

In response to the growing risks from batteries, the NSW Government committed to putting mandatory product stewardship in place for certain categories of batteries. This commitment led to the passage of the *Product Lifecycle Responsibility Act 2025* (PLR Act), under which this proposed Regulation would be made.

Mandatory product stewardship arrangements define the responsibility for managing the health and environmental impacts of a product throughout its entire lifecycle. They are fundamental because they address the issue of ‘free riders’ that arise with voluntary product stewardship arrangements — that is, companies that choose not to participate in a voluntary scheme but benefit from the contributions of others.

The proposed Regulation intends to require brand owners of batteries supplied into NSW to join a product stewardship organisation. The NSW Environment Protection Authority (EPA), as the regulator, would be able to enter an agreement with a product stewardship organisation to guide its activities, and ensure appropriate oversight, transparency and accountability.

Under the proposed Regulation, a product stewardship organisation would need to prepare an action plan, which is a public-facing document outlining the actions the organisation commits to carry out to deliver the objectives of the proposed Regulation. The action plan would need to be submitted to and approved by the EPA.

The proposed Regulation is also designed to function if there were no agreement with a product stewardship organisation. In this case, responsibilities would fall directly on brand owners, who would need to individually prepare an action plan. While the EPA intends to form an agreement with one or more product stewardship organisations, the proposed Regulation is designed to be agile, present a series of options and scale up over time, if risks are not being adequately managed. The framework allows for brand owners to meet their own responsibilities in case a product stewardship organisation folds or otherwise can’t continue operating.

The proposed Regulation targets small, removable batteries and e-micromobility batteries

The scope of the proposed Regulation, and the batteries that are covered in this regulatory impact statement, include:

- standard size batteries used to power household items, including batteries of the following sizes - AAA, AA, C, D, 9-volt, and 6-volt lantern
- button and button cell batteries, and removable rechargeable batteries weighing 5 kg or less
- rechargeable batteries used to power e-micromobility devices
- portable power banks weighing 5 kg or less.

The proposed Regulation also states that if it is not practicable to remove a regulated battery from an e-micromobility device, the e-micromobility device is taken to be a regulated battery. This ensures that brand owners of e-bikes, e-scooters or similar with in-built batteries are also required to join a product stewardship organisation and contribute to their safe disposal at end-of-life.

The NSW Government has indicated that other types of batteries, such as consumer electronics with embedded batteries and electric vehicles, may be subject to future regulations under the PLR Act.

While these batteries are not within scope of the regulatory impact statement, they are noted as contributing factors to the growing use of batteries.

This regulatory impact statement assesses three options against a base case of no regulation

This statement has been developed to assess the expected impact of the proposed Regulation, as is required under section 5 of the *Subordinate Legislation Act 1989* (SLR Act).

The objectives of the proposed Regulation include to

- address the fire risks that can arise from batteries
- promote NSW's transition to a circular economy
- enable a nationally aligned approach to battery product stewardship.

As noted previously, the proposed Regulation allows for different product stewardship approaches. This includes the EPA entering into an agreement with a product stewardship organisation but also circumstances where there may not be one and brand owners must individually prepare action plans.

The assessment of options is intended to evaluate both the impact of the proposed Regulation against a do-nothing scenario, but also to evaluate the different ways in which the proposed Regulation could be put in place.

Base case – no regulation

The base case refers to the status quo or do-nothing scenario i.e., where the proposed Regulation is not made and existing, voluntary product stewardship arrangements continue. Under the base case, these arrangements are expected to see gradual improvement over time, but the significant risks and impacts of battery-related fires would persist.

Option 1: Scheme supported by an agreement between EPA and product stewardship organisation(s) (preferred)

Option 1 refers to the proposed Regulation where the EPA enters an agreement with one or more product stewardship organisations. This would likely be delivered by running a request for proposal-type process to invite submissions from prospective organisations which, if they meet certain conditions, could lead to negotiation of an agreement.

Under this option, the prospective product stewardship organisation(s) would need to prepare an action plan outlining how they intend to deliver on the objectives of the proposed Regulation. Battery brand owners supplying batteries into NSW would need to join a product stewardship organisation with which the EPA has an agreement. Not complying with an action plan is an offence.

Key activities of the product stewardship organisation(s) would need to relate to the matters listed in Schedule 1 of the proposed Regulation, including making sure there were sufficient collection points for batteries, maximising the recovery and recycling of batteries collected, and raising public awareness.

Option 2: Scheme implemented by brand owners

Option 2 refers to the proposed Regulation, but where the EPA does not have an agreement with a product stewardship organisation and instead, brand owners supplying batteries are directly responsible for meeting their responsibilities individually.

Under this option, battery brand owners supplying batteries into NSW would need to individually prepare an action plan to address the matters listed in Schedule 1 of the proposed Regulation.

Option 3: Scheme operated by Government

Option 3 refers to the proposed Regulation where the NSW Government establishes a product stewardship organisation and administers a scheme itself. Brand owners would need to participate. The scheme would involve Government setting up a collection system and determining fees payable by each brand owner.

This regulatory impact statement uses a cost-benefit analysis to assess the options

The cost-benefit analysis found that all options result in a net public benefit in comparison to the base case under the most likely scenario (see Table 1). As such, the analysis found that the proposed Regulation delivers a net public benefit compared to the status quo, regardless of the implementation approach selected.

The main benefit of each of the options assessed include the avoided costs of incorrectly disposed of batteries. These costs include the impacts of waste vehicle and facility fires, and the environmental harm from landfilling batteries.

Option 1, where the EPA forms an agreement with a prospective product stewardship organisation(s) is the preferred option as it has a higher net present value and benefit-cost ratio than Options 2 and 3, because it avoids many of the establishment costs, and it can be implemented more quickly.

Table 1: Cost-benefit analysis summary – 20-year analysis period, 5% discount rate

	Option 1	Option 2	Option 3
Net present value (\$m)	172.8	78.6	59.6
Benefit-cost ratio	1.43	1.21	1.15

Source: Marsden Jacob analysis, 2025

1. Introduction

The NSW Government has committed to putting mandatory product stewardship in place for certain categories of batteries. This commitment is intended to reduce the significant risk of harm to the NSW community and environment from the incorrect use and disposal of batteries, including the risk of serious fires.

There is significant growth in the global market for batteries, due to emerging battery technologies and their growing use in a wide variety of devices. Lithium-ion batteries have been a significant driver of this transformation.

A key priority of the NSW Government is to protect the community, firefighters, and waste and resource recovery workers from dangerous and preventable battery fires. Protection of the environment and promotion of the transition to a circular economy are also high priorities.

This regulatory impact statement evaluates the expected impacts of the proposed Regulation against the status quo, but also the various ways of implementing the proposed Regulation.

1.1 Objectives

The draft Regulation under the *Product Lifecycle Responsibility Act 2025* intends to establish a mandatory product stewardship scheme for certain types of batteries.

The Act allows regulations to require brand owners to take greater responsibility for the handling and disposal of relevant products. The objects are to:

- a. minimise the impact that products have on human health and the environment, throughout the lifecycle of the products
- b. ensure that persons who supply a product are responsible for minimising the potential harm of what is supplied
- c. support material circularity through design, production, use, re-use, collection, recycling, reprocessing and end-of-life management
- d. promote and support the principles of a circular economy.

The specific objectives of the proposed Regulation include to:

- address the fire risks that can arise from batteries
- promote NSW's transition to a circular economy
- enable a nationally aligned approach to battery product stewardship.

The economic, environmental and social opportunities presented by changing battery technology will be helped by achieving these objectives. This includes supporting the NSW Government's goals for decarbonisation.

1.2 Scope

The following regulated batteries are relevant to this regulatory impact statement:

- a. standard size used to power household items, including batteries of the following sizes:
 - i. AAA,
 - ii. AA,
 - iii. C,
 - iv. D,
 - v. 9 volts,
 - vi. 6-volt lantern,
- b. button and button cell batteries,
- c. removable rechargeable batteries weighing 5 kg or less,
- d. rechargeable batteries used to power e-micromobility devices,
- e. portable power banks weighing 5 kg or less.

The proposed Regulation explicitly notes the following batteries as being out of scope:

- a. lead acid batteries,
- b. mobile phone batteries,
- c. laptop or tablet computer batteries,
- d. back-up batteries incorporated in emergency lighting systems.

Other types of batteries not listed above are also out of scope for this Regulation.

The proposed Regulation also notes that if it is not practicable to remove a regulated battery from an e-micromobility device, the e-micromobility device is taken to be a regulated battery.

1.3 Methodology

The methodology adopted for this statement is consistent with the requirements of the *Product Lifecycle Responsibility Act 2025* (PLR Act), the *Subordinate Legislation Act 1989* (SLR Act) and the NSW Government Guide to Better Regulation. See also Appendix 4.

This statement is accompanied by the proposed Regulation.

2. Policy environment

2.1 The role of batteries in net zero and decarbonisation

Governments across Australia have recognised the potential benefits of batteries. For example, the Commonwealth Government's National Battery Strategy, released in May 2024, outlines how it will support our domestic battery industry, improve Australia's energy security, and ensure Australia's place in global battery supply chains.

In NSW, the NSW Government's Electric Vehicle Strategy has been designed to drive the uptake of electric vehicles with the aim of achieving 50% of new car sales by 2030-31.²

2.2 Product stewardship in Australia

The Commonwealth, states and territories have signalled product stewardship as a key tool to meet waste and circular economy commitments (see Appendix 2).

All state and territory governments now have specific product stewardship legislation to enable container deposit schemes. Further legislative and/or regulatory amendments would be needed to put product stewardship schemes in place for other products, including batteries.

Currently the main battery related product stewardship initiative in Australia is B-Cycle. It was launched in 2022 by the Battery Stewardship Council as a voluntary, industry-led scheme designed to coordinate collection and recycling of eligible batteries. The scheme aims to reduce the volume of loose consumer batteries sent to landfill while promoting safe recycling and material recovery. B-Cycle operates through a voluntary levy paid by battery importers, manufacturers, and retailers who have signed on as members.

Other battery collection pathways include:

- collections through designated local government transfer stations, community recycling centres and other collection points (such as libraries/council buildings) or through household hazardous waste or chemical collection programs
- the MobileMuster program, a voluntary accredited product stewardship scheme that collects mobile phone batteries.
- designated National Television and Computer Recycling Scheme collection points for laptop batteries
- mechanics and scrap metal dealers for vehicle lead-acid ignition batteries
- commercial collection for various industrial sized batteries, or original equipment manufacturers delivering batteries directly to recyclers.

2.3 International policy context

Most battery product stewardship schemes overseas are mandatory, but some countries have taken different approaches to product stewardship organisations, see Appendix 1.

About 400 product stewardship organisations operate globally across many product types, with the majority relating to small electronic and electrical equipment, batteries, packaging and tyres.

From 2025, targets affecting the sourcing, manufacturing, use and recycling of batteries are also being introduced. For example, the targets in the European Union are to:

- limit raw materials sourced from non-EU countries
- further reduce heavy metal content and ban other more harmful substances
- reduce the carbon footprint of battery production and recycling
- increase the recycled metal content in new batteries
- improve performance and durability and increase material recovery.

Digital battery passports accessible by QR code are also employed to provide wide-ranging information on battery characteristics including chemistry, source of raw materials, hazardous substances, appropriate fire extinguishing agents and collection points.

3. Battery market profile

This section provides an overview of the NSW battery market, with an emphasis on end-of-life batteries.

3.1 Battery market segments

There are many segments in the battery market. The following is from the EU Battery Regulation 2023/1542 (see Table 2). The batteries within the scope of this statement fall within the portable battery and e-micromobility device or light means of transport categories. This statement focuses on the potential for a mandatory stewardship scheme to deliver welfare gains to NSW for the in-scope batteries.

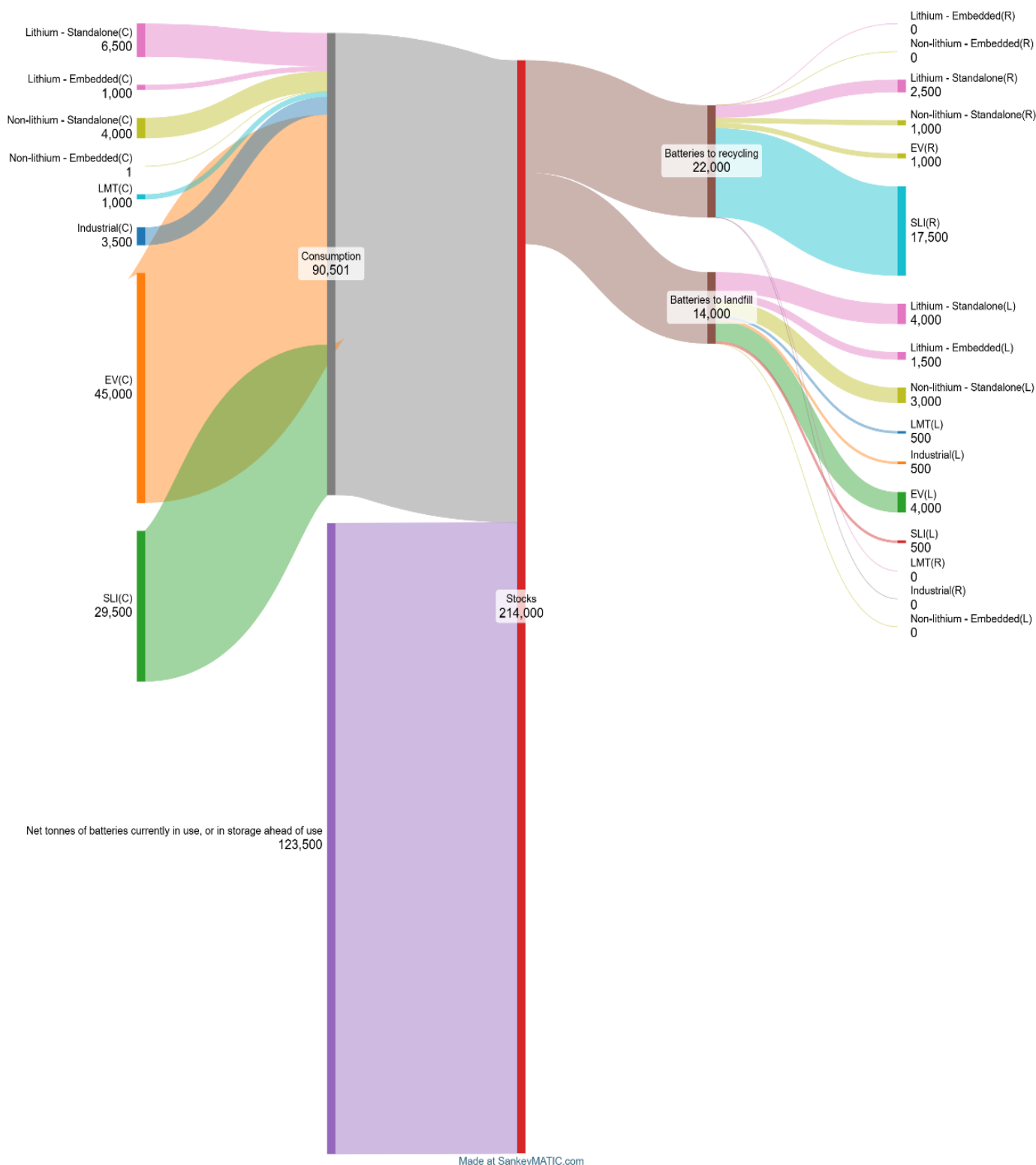
Table 2: EU battery definitions (Battery Regulation Article 3)

Category	Description	Weight
Portable battery	A primary or secondary portable battery specifically designed to be interoperable, within common formats: 3R12, button cell, D, C, AA, AAA, AAAA, A23 and PP3, not designed specifically for industrial use, starting, lighting or ignition or light means of transport.	less than 5 kg
Light means of transport battery (E-micromobility)	Specifically designed to provide electric power for traction for wheeled vehicles powered alone or in combination of motor and human power, including type-approved vehicles of category L (1) not an electric vehicle battery.	less than or equal to 25 kg
Starting, lighting and ignition battery	Specifically designed to supply electric power for starting, lighting or ignition also, auxiliary, or backup purposes in vehicles, other means of transport or machinery.	N/A
Industrial battery & stationary battery energy storage system	Specifically designed for industrial purposes or intended for industrial uses after repurposing, or any other battery with a weight greater than 5 kg that is not a light means of transport, electric vehicle or starting, lighting and ignition battery. A stationary battery energy storage system is an industrial battery with internal storage specifically designed to store and deliver energy from and into the grid to end users.	greater than 5 kg
Electric vehicle battery	Specifically designed to provide electric power for traction for hybrid or electric vehicles of Category L for hybrid and electric vehicles of M, N or O categories in the meaning of Regulation (EU) No. 2018.	greater than 25 kg

3.2 Current demand for batteries in NSW

In NSW it was estimated that in 2024-25, 214,000 tonnes of batteries were in circulation, and 36,000 tonnes were available for recycling or disposal (Figure 1).

Figure 1: NSW battery flows in tonnes, 2024-25



Source: Marsden Jacob analysis, 2025

3.3 Trends in NSW's battery market

Table 3 provides projections of annual demand for each battery type in NSW and estimates that there will be large growth in demand (greater than 300%) for electric vehicle, industrial and lithium-ion batteries embedded in devices. Demand for light means of transport batteries is also expected to grow, but more slowly than the other categories.

Demand for non-lithium-based standalone/easily removable batteries is expected to decline over time, as some devices (e.g., remote controls) that historically relied on loose batteries will gradually shift to using embedded batteries.

Table 3: Estimated demand for batteries in NSW by battery type and chemistry (millions), 2024-25 to 2044-45.

	2024- 25	2029- 30	2034- 35	2039- 40	2044- 45	2049- 50	% Change
Portable (non-lithium based) – standalone	148	145	142	139	136	131	-12%
Portable (non-lithium based) – embedded	0.10	0.11	0.11	0.12	0.12	0.13	+27%
Portable (lithium-based) – standalone	12	11	11	12	12	12	+8%
Portable (lithium-based) – embedded	8	12	17	22	28	34	+307%
Light means of transport (lithium-based)	0.44	0.48	0.51	0.54	0.56	0.59	+35%

Source: Marsden Jacob analysis, 2025

3.4 Chemistry and quality of batteries

There are a broad range of chemistries used in batteries including alkaline, lead acid, lithium ion, nickel cadmium, nickel metal hydride and silver oxide.

Table 4 provides a summary of estimated demand for battery by chemistry for 2024-25. Larger portable batteries (e.g., power tool batteries), light means of transports, industrial and electric vehicle batteries rely on lithium-ion.

Table 4: Estimated demand for batteries in NSW by battery chemistry (millions) in 2024-25

	2024-25 (NSW)
Portable (non-lithium based) – standalone	148
Portable (non-lithium based) – embedded	0.10
Portable (lithium-based) – standalone	12
Portable (lithium-based) – embedded	8
Light means of transport (lithium-based)	0.44

Source: Marsden Jacob analysis, 2025

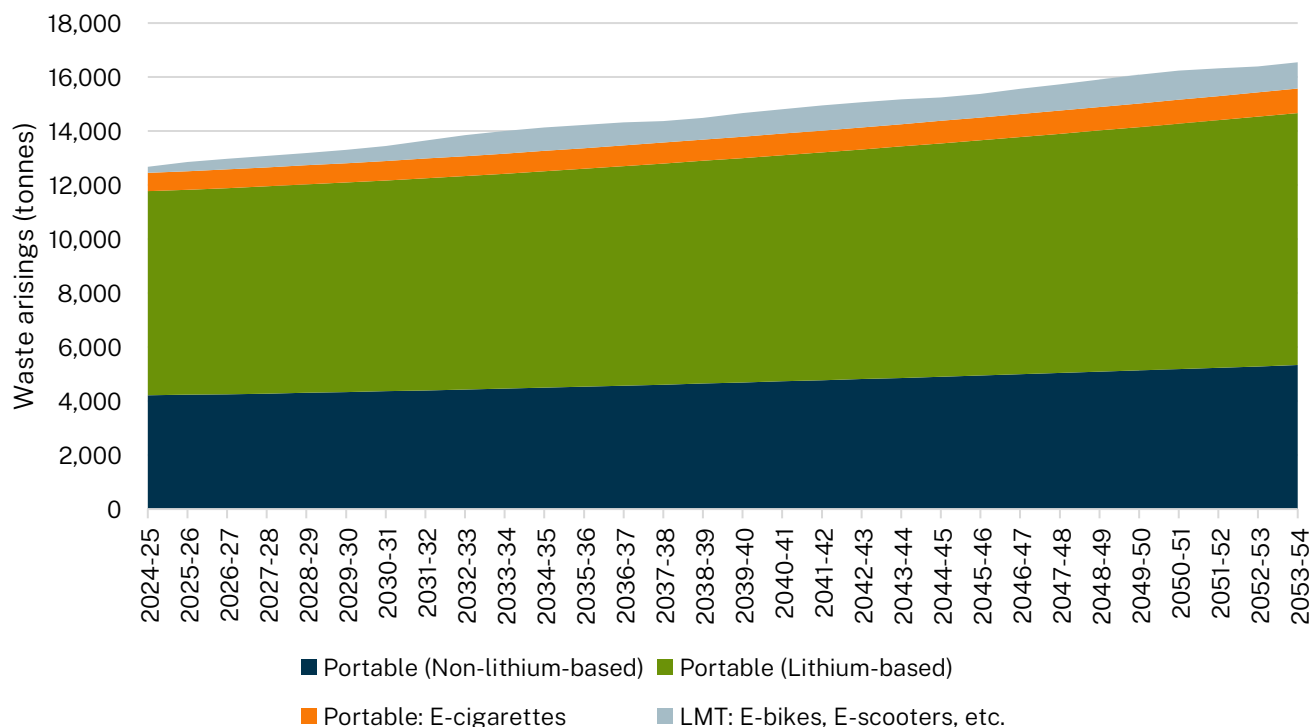
3.5 Implications for waste, recycling and manufacturing of lithium-ion batteries

The following factors are likely to impact the nature of the arrangements relevant to a product stewardship scheme for batteries in NSW.

3.5.1 Waste

The total volume of in-scope battery waste in NSW is expected to continue increasing over the next 25 years (see Figure 2 below).

Figure 2. Projected waste arising (tonnes) for NSW



Source: Marsden Jacob analysis, 2025

3.5.2 Recycling

Currently, there is no at-scale battery recycling in NSW, although companies are exploring opportunities.

However, the battery recycling sector has relatively high labour costs, high transport costs, relatively low feedstock volumes and the very limited output of a local battery manufacturing sector.

Lithium-ion chemistries are typically subject to mechanical and thermal treatment to produce a material called 'black mass'. This is then exported for use as a fuel source or further refinement to be used in battery manufacturing.

3.5.3 Manufacturing

Battery manufacturing in Australia (and thus NSW) is also in its infancy with mostly specialised manufacturers. The Commonwealth Government is investing in research and infrastructure as part

of the National Battery Strategy and announced in May 2024 over \$500 million of funding to support a local battery manufacturing industry.

In other parts of the world, battery recyclers typically co-locate with battery manufacturers, with up to 50% of batteries produced being deemed 'dead on arrival'. Their output becomes immediate feedstock for recyclers to recover materials for re-integration in the manufacturing process. This helps reduce the cost of recycling through exploiting economies of scale.

Without this feedstock, Australian battery recyclers are competing in a global materials market but with much lower throughput.

4. Problem statement and objectives for government action

4.1 Problem statement

The growth in demand for high energy batteries and the rapid innovation in the design of batteries represents enormous economic and environmental opportunities for NSW. Batteries are expected to become increasingly common and will underpin NSW's future electricity network and road vehicles.

However, the unsafe use and disposal of some batteries has created significant challenges for NSW. These include:

- The growing number of battery-related fires, and the consequent harm to human health, infrastructure and the environment.
- The impacts of growing numbers of batteries being landfilled, including the human health, infrastructure damage and environmental harm from battery-related contamination in landfill leachate.
- Market failures that compromise the management of batteries to enable a safe, circular economy.

Failing to address these challenges will lead to escalating harm and associated costs, with consequent risks to battery suppliers (from a loss of social licence), and compromise NSW's circular economy and decarbonisation goals.

4.1.1 Increasing incidence of fires

The number of lithium-ion battery fires reported by device is outlined in Table 5 below. In 2022-23, these totaled 285. It is estimated that there were 318 in 2024.¹

Those categories of devices with the highest incidence relate to:

- loose, removable batteries less than 5kg - estimated at 322 for 2022 and 2023 (essentially all categories other than those accounted for below). Although there are no more detailed breakdowns of the below categories, most are expected to be within scope of the regulation.
- batteries for e-micro mobility devices - the single most problematic category representing 90 of the 456 incidents in 2022 and 2023.

While outside the scope of this document, other notable categories relate to:

- energy storage, which represented 37 of the incidents in 2022 and 2023.

¹ NSW EPA, Spate of Lithium-ion fires and NSW Government Survey sparks community wake-up call on battery risks <https://www.epa.nsw.gov.au/news/epamedia/250210-spate-of-lithium-ion-fires-and-nsw-government-survey-sparks-community-wakeup-call-on-battery-risks> accessed 21 August 2025

- electric vehicle batteries, such as those in cars, trucks, motorcycles, and buses. These accounted for seven incidents involving hybrid and electric vehicles in 2022 and 2023.²

Table 5: Incidents by device involved

Material ignited first	2022	2023	Total
Electric bike, mobility scooter, ride-on toy	23	67	90
Charger (device), battery charger	19	27	46
Energy storage - battery, power supply, uninterruptible power supply	16	21	37
Hand tool, power tool (battery powered)	15	10	25
Mobile phone	10	13	23
Powerpack/portable charging device	8	10	18
E-cigarettes, vape pens	4	12	16
Laptop/Tablet	7	6	13
Lamps, lights, torches (battery powered)	5	7	12
Remote control toy/craft - cars, drones, robots, watercraft	4	7	11
Vacuum cleaners - handheld, robotic (battery powered)	4	5	9
Audio devices, speakers (battery powered)	3	5	8
Battery pack, battery system (hybrid vehicle, electric vehicle)	4	3	7
Rubbish, trash, waste, chimney waste, vent waste	2	4	6
Personal care device - toothbrush, shaver, epilator (battery powered)	–	4	4
Sensor/control device (battery powered)	2	1	3
Phone handset, two-way radio, microphone (battery powered)	1	2	3
Automated/robotic equipment (battery powered)	2	1	3
Camera, camcorder, photographic equipment (battery powered)	2	–	2
Gaming devices (battery powered)	1	–	1
Personal device - watch, tracker, medical aid	1	–	1
Other battery, unspecified	38	80	118
Total	171	285	456

Fire and Rescue NSW has reported that the share of total fires accounted for by lithium-ion batteries has increased from one in 100 in 2022, to one in 76 in 2023 and in the first six months of 2024 accounted for one in 40 fires.³ NSW Rural Fire Service has confirmed they are also facing challenges from lithium-ion battery fires.

² Fire and Rescue NSW, LITHIUM-ION BATTERY INCIDENTS 2022 - 2023 Version 1.4 – 21 March 2024

³ Fire and Rescue NSW, LITHIUM-ION BATTERY INCIDENTS 1 JANUARY TO 30 JUNE 2024.

The waste and recycling industry believes that there is significant under-reporting of fires. It estimates there are 10,000-12,000 battery fire incidents each year across the waste and resource recovery sector in Australia⁴.

Market engagement suggest that lithium-ion batteries will remain the technology of choice for devices that need high energy density (e.g. consumer electronics, e-mobility devices). Without intervention it is likely that the risk of battery-related fires will continue to grow.

With the increasing number of lithium-ion battery devices in homes and businesses, fires now can be expected to involve multiple lithium-ion batteries. These will require special handling to mitigate the risks of re-ignition or their entry into waste and recycling streams.

4.2 Contaminants

New battery chemistries continue to change and can permeate physiological barriers of living and plant organisms, causing harmful biological and environmental reactions (refer Table 6).⁵

Table 6: Contaminants in emerging batteries and their ecotoxicological effects

Contaminant	Ecotoxicological effects
Carbon-based nanomaterials	Alterations in microbial diversity in soil. Growth inhibition in cyanobacteria and green algae. Bioaccumulation in fish tissues and embryonic development alterations. Activation of local and systemic inflammatory responses.
Ionic liquids	Antimicrobial activity. Negative impact on plant growth and germination. Bioaccumulation in aquatic ecosystems. High toxicity towards algae.
Metal and metal oxide nanomaterials	Reduced photosynthetic rates and growth inhibition of plants. Modifications on microbial metabolism in soil. High oxidative stress and cell damage.

4.1 Human harm

4.1.1 Incidents

Fire and Rescue NSW has reported that people are four times more likely to be injured by a fire which originates from a lithium-ion battery in comparison to other fire types.⁶

⁴ NSW EPA, NSW leads the charge on mandatory battery safety, <https://www.epa.nsw.gov.au/News/Media-Releases/2024/EPAMedia241211-NSW-leads-the-charge-on-mandatory-battery-safety> accessed 21 August 2025

⁵ Kumah, E.A., Fopa, R.D., Harati, S. *et al.*, ‘Human and environmental impacts of nanoparticles: a scoping review of the current literature’ *BMC Public Health*, 2023.

⁶ Fire and Rescue NSW, Annual Report 2023-24.

Lithium-ion batteries present specific safety concerns as they are made from highly flammable materials. Short circuits, battery overcharging, puncturing of the battery case and flaws in manufacturing can cause a battery to ignite and explode.

The number and nature of lithium-ion battery-related fires in NSW over the period 2022 to June 2025 are listed in Table 7. From this we note that Fire and Rescue NSW reports a 67% increase in lithium-ion battery fires in 2023-24.⁷ There were two fatalities in 2024, underlining the threat that lithium-ion battery fires present to community safety.⁸

Table 7: Summary of lithium-ion battery-related fires in NSW, 2022 to June 2024.⁹

	2022	2023	Jan-Jun 2024	Jan-Jun 2025*
Lithium-ion battery incidents	171	285	217	158
Injuries	14	38	16	33
Evacuations	829	1320	677	1079

* Data collection is yet to be completed.

The risk of injury or death also affects members of the community and operational personnel involved in transporting, sorting and handling waste. In the last two years there have been four fatalities in NSW resulting from lithium-ion battery fires. Fire and Rescue NSW reports identify that the number of staff reporting exposure or injury from battery related fires increased from three in 2022 to 70 in 2024.

More recent updates (not evident below) have identified that the rate of fires continues to increase, with firefighters addressing more than one lithium fire per day early in 2025.¹⁰

4.1.2 Health consequences

When a lithium-ion battery combusts or simply gets ruptured it can release gases that are hazardous to human health. The nature of the contaminants and their effects are in Table 8. Thick smoke from the fire can also obscure visibility, making it difficult to escape.

The human health impacts of battery contaminants range from relatively minor health problems such as allergic reactions and hypersensitivity to serious health problems such as cancer, respiratory illness, reproductive problems and birth defects.

⁷ Fire and Rescue NSW, 2024. *Battery and Charging Safety*. Accessed 9 October 2024. <https://www.fire.nsw.gov.au/page.php?id=9389>

⁸ Fire and Rescue NSW, LITHIUM-ION BATTERY INCIDENTS 1 JANUARY TO 30 JUNE 2024, Fire and Rescue NSW, 2024b. *Lithium-Ion Battery Incidents 1 January to 30 June 2024*. Sydney, Australia. <https://www.fire.nsw.gov.au/gallery/resources/SARET/FRNSW%20LiB%20fire%20data%20Jan-Jun%202024.pdf>

⁹ Fire and Rescue NSW, 2024b. *Lithium-Ion Battery Incidents 1 January to 30 June 2024*. Sydney, Australia. <https://www.fire.nsw.gov.au/gallery/resources/SARET/FRNSW%20LiB%20fire%20data%20Jan-Jun%202024.pdf>

¹⁰ ABC News, 2025, <https://www.abc.net.au/news/2025-02-10/nsw-battery-fires-rise-nsw-stats-standards/104917372>

The risks depend on the contaminant and its concentration, the exposure pathway, the level of exposure, and the vulnerability of the exposed population.

Table 8: Contaminants in batteries and their ecotoxicological effects

Contaminant	Ecotoxicological effects
Cadmium	Intake by ingestion of contaminated food crops. Accumulation in the human body may cause kidney diseases. Carcinogenic effects.
Cobalt	Adverse effects on biomass and on physiological activity in crops.
Copper	Intake by ingestion of contaminated food crops. Liver damage and gastric related problems. Neurological complications.
Lead	Intake by ingestion of contaminated food crops. Negative effects on nervous systems, kidney and other organs. Cardiovascular diseases. Carcinogenic effects.
Lithium	Alterations in the development of invertebrates. Interference with nucleic acids synthesis. Accumulation in soil causes severe phytotoxicity.
Nickel	High oxidative stress in mammalian and terrestrial plant systems. Disruption of ion homeostasis.

4.2 Damage to infrastructure

Battery fires, and in particular lithium-ion battery-related fires which are chemical fires, are dangerous and can be difficult to contain due to the intense heat caused when the battery enters a state of ‘thermal runaway’. A thermal runaway event is triggered if the cells in a lithium-ion battery are allowed to reach elevated temperatures, typically 80°C and above.¹¹ Temperatures in large lithium-ion batteries can rise to as high as 900°C within minutes during thermal runaway,¹² producing jets of flame that can rise as high as two metres.¹³ The fires are difficult to put out and are

¹¹ Best, A, Cavanagh, K, Preston, C, Webb, A & Howell, S, 2023. *Lithium-ion battery safety: A report for the Australian Competition and Consumer Commission*, CSIRO. Canberra, Australia.

¹² Huang, P, Ke Li, PP, Chen, H, Wang, Q, Wen, J, Sun, J 2016. ‘Experimental and modelling analysis of thermal runaway propagation over the large format energy storage battery module with Li4Ti5O12 anode’, *Applied Energy*, v183. <https://doi.org/10.1016/j.apenergy.2016.08.160>

¹³ Russoa, P, Di Barib, C, Mazzaroc, M, De Rosac, A & Morriellod, I, 2018. ‘Effective fire extinguishing systems for lithium-ion battery’, *Chemical Engineering Transactions*, vol 67. https://iris.uniroma1.it/retrieve/e383531d-46de-15e8-e053-a505fe0a3de9/Russo_Effective-fire-extinguishing_2018.pdf

also known to spontaneously reignite.^{14,15} As a result, they can be particularly dangerous for property and infrastructure (and the environment).

Incidents by infrastructure and property type are in Table 9. The substantial increase in reported house fires is significant with 63 reported for the first six months of 2024 compared to 89 for all of 2023.

Table 9: Lithium-ion battery related incidents by type of infrastructure¹⁶

Infrastructure type	2022	2023	Total
Residential detached house	42	89	131
Residential attached dwelling	20	28	48
Multiple dwellings (onsite)	2	3	5
Multiple dwellings	12	16	28
Other residential	6	6	12
Office buildings	3	7	10
Commercial buildings	12	15	27
Vehicle storage	2		2
General storage	4	10	14
Factory, laboratories	4	3	7
Entertainment structures	5	5	10
Aged care related facilities	1	5	6
Garage	14	10	24
Non-structural buildings (roads, yards)	39	82	121
Total ¹⁷	171	285	456

4.2.1 Environmental harm

Battery-related fires present risks to the environment through the generation of combustion gases and contamination of firefighting runoff. The scale of potential harm depends on the proximity of any sensitive receptors¹⁸ and fuel sources present (e.g. plastics, metals, plants).

¹⁴ ACCC, 2023a. *Consumers urged to use and store lithium-ion batteries safely to prevent deadly fires*. Accessed 9 October 2024. <https://www.accc.gov.au/media-release/consumers-urged-to-use-and-store-lithium-ion-batteries-safely-to-prevent-deadly-fires>

¹⁵ ACCC, 2023b.

¹⁶ Fire and Rescue NSW, LITHIUM-ION BATTERY INCIDENTS 1 JANUARY TO 30 JUNE 2024.

¹⁷ Minor unaccounted for discrepancies between reported totals and sum of rows.

¹⁸ Receptors are attributes of biological systems, such as a cell or group of cells that detect specific stimuli and initiate the transmission of impulses via sensory nerves.

Water runoff

Water runoff from fires is known to contain contaminants that are hazardous for the environment and can be acutely lethal for aquatic life.¹⁹

Research indicates that runoff from extinguishing large lithium-ion battery-related fires can potentially be more toxic, due to fire extinguishing agents and from large-scale battery fire incidents with certain metals present (nickel, manganese, cobalt, lithium and aluminium)²⁰ and high concentrations of fluoride.²¹

Water used to address a battery fire has also been found to contain pollutants, higher than water runoff from fire extinguishment due to contaminants leaching out from the battery.^{22,23}

Waste and recycling

Battery-related fires in the waste and recycling sector are attributed to incorrect disposal of batteries in kerbside bins and generalised e-waste collections.

In the first half of 2024, Fire and Rescue NSW attended seven waste and recycling fires in which the cause was identified as discarded lithium-ion batteries in thermal runaway. The number of lithium-ion battery waste fires in 2022 and 2023 are in Table 10.

Table 10: Lithium-ion battery waste fire incidents requiring intervention by Fire and Rescue NSW.²⁴

	2022	2023
Li-ion battery fire in waste receptacle	2	3
Li-ion battery fire in waste truck	3	17
Li-ion battery fire in waste facility	4	2

Once a lithium-ion battery enters the waste management chain there is a high risk that the battery can be damaged, such as when waste is compacted in a waste truck, crushed in a rubbish

¹⁹ Noiton, D, Fowles, J & Davies, H, 2011. *The Ecotoxicity of Fire-Water Runoff, Part II: Analytical Results*, New Zealand Fire Service Commission Research Report Number 18.
https://www.researchgate.net/publication/272508692_Fire_Research_The_Ecotoxicity_of_Fire-Water_Runoff_Part_II_Analytical_Results_ESR#fullTextFileContent

²⁰ Bordes, A, Papin, A, Marlair, G, Claude, T, El-Masri, A, Durussel, T, Bertrand, JP, Truchot, B & Lecocq, A, 2024. 'Assessment of Run-Off Waters Resulting from Lithium-Ion Battery Fire-Fighting Operations', *Batteries*, 10:118.

²¹ Long, T, Blum, A, Bress, T & Cots, B, 2013. *Emergency Response to Incident Involving Electric Vehicle Battery Hazards*, National Fire Protection Association. <https://www.nfpa.org/education-and-research/research/fire-protection-research-foundation/projects-and-reports/emergency-response-to-incident-involving-electric-vehicle-battery-hazards>

²² Federal Roads Office, 2020. *Minimizing the risk of electric vehicle fires in underground transport infrastructures*, Research Project AGT2018/006, Swiss Confederation, Bern.

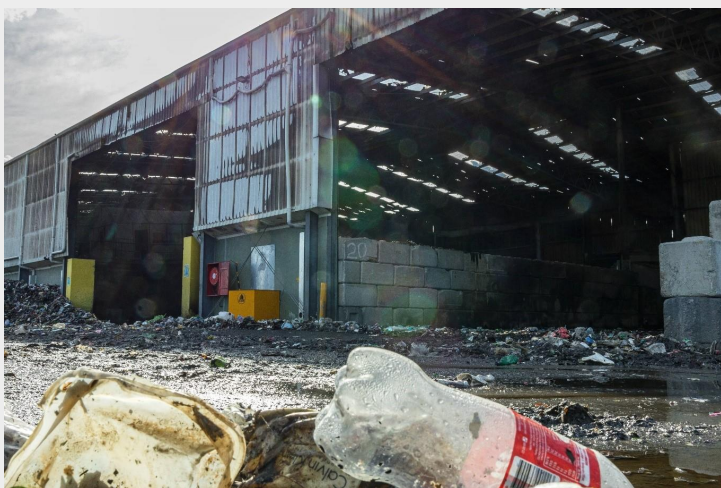
²³ van Veen, NW, Koppen, A & van Putten, EM, 2021. *Risks of smoke released when Li-ion batteries burn*, National Institute for Public Health and Environment, The Netherlands. <https://www.rivm.nl/bibliotheek/rapporten/2021-0019.pdf>

²⁴ Fire and Rescue NSW, 2024. *Lithium-Ion Battery Incidents 2022 – 2023*. Sydney, Australia.

compactor, dumped onto tipping floors, processed on conveyor belts or run through a shredder.²⁵ The following case studies highlight the risks.

Loss of the Hume Material Recovery Facility, Canberra, ACT.

On 26 December 2022 the Hume Material Recovery Facility experienced catastrophic damage because of a lithium-ion battery-related fire. Due to the loss of the facility, the ACT Government has been transporting waste for recycling to three facilities in western Sydney and one in Victoria. A new replacement facility is under development, funded via a joint investment of \$26 million from the ACT and Australian governments.



Aftermath of the battery-related fire that destroyed the Hume Materials Recovery Facility in Canberra on Boxing Day, 2022 (*Canberra Times*, 2022).

²⁵ Timpane, MR, Madden, B, Segundo, M, Patterson, A, & Dobroski, L, 2017. *South Bayside Waste Management Authority lithium-based battery assessment*. https://rethinkwaste.org/wp-content/uploads/legacy_media/7-a-attachment-d-lithium-based-battery-assessment-2017.original.pdf

E-waste stockpiling breaches and fire, Melbourne, VIC.

On 9 August 2020 Fire Rescue VIC responded to a structure fire at an e-waste facility in Campbellfield, Melbourne. The facility had stockpiled a significant number of batteries and general e-waste, more than the licensed limits on the quantity of e-waste that could be stored at the premises. The fire, caused by a discharge of static electricity, required over 70 firefighters to bring the blaze under control.

The fire resulted in pollution of the atmosphere and the water of Merlynston Creek and Foden Reserve. Charges were laid by the Victorian Environment Protection Authority, and remediation works continue at the site.



The remains of the MRI e-waste recycling facility (News.com.au, 2020).

Landfill

It is estimated that 7.7 tonnes of battery waste were sent to landfill in 2022-23.²⁶ This is a loss of valuable resources that could have been recovered and reused for the manufacture of new products.

Landfill leachate poses particular problems for the environment. It develops as water passes through dissolved solids (including batteries and other e-waste) and collects at the bottom of a landfill.²⁷ While modern landfills' impermeable layer and advanced treatment systems prevent leachate from escaping, typically some does leach out of landfills, and it can affect ground and surface water.²⁸

²⁶ NSW EPA, Draft NSW Waste and Circular Infrastructure Plan May 2025

²⁷ Victorian Department of Environment, Land, Water and Planning, *Managing E-Waste in Victoria*, 2017

²⁸ S. Paul, M. Choudhury, U. Deb, R. Pegu, S. Das, S. Bhattacharya, 'Assessing the ecological impacts of ageing on hazard potential of solid waste landfills: A green approach through vermitechology', *Journal of Cleaner Production*, Volume 236, 2019.

A 2017 Victorian Government report found that approximately seven per cent of all leachates generated within landfills in Victoria is lost to the environment through leakage.²⁹

The anticipated growth in portable battery consumption will only increase the likelihood that landfill leachate becomes more toxic unless a greater percentage of batteries are diverted from landfill.

4.2.2 Economic impact of battery-related fires

Damage

Battery-related fires have caused significant and costly damage to human health and infrastructure and particularly to waste and recycling infrastructure (facilities and trucks), and disruption to services.

Surrounding businesses have also incurred costs through the temporary closure of retail stores and offices due to air pollution and road closure.

Fire response

Fire responses incur costs through treatment of injured personnel and replacement of damaged equipment. The waste produced by fires can also be hazardous, with costly site cleanup after a fire.

The cost of training of fire and rescue staff to respond to and manage a range of threats and hazards is significant, especially relating to lithium-ion batteries as they involve:

- explosion risk in confined environments
- high fire intensity
- exposure to toxic gases and effluents
- protracted extinguishment and cooling
- handling, transport and disposal of damaged batteries.³⁰

Fire and Rescue NSW's Safety of Alternative and Renewable Energy Technologies has been established to produce valuable learning concerning:

- best practice fire brigade response to lithium-ion battery related fires
- end-of-life lithium-ion battery hazard management
- electric vehicle fires in structures
- fire propagation in battery energy storage systems.³¹

²⁹ Victorian Department of Environment, Land, Water and Planning, *Managing E-Waste in Victoria*, 2017

³⁰ Fire and Rescue NSW, 2022. *The Safety of Alternative and Renewable Energy Technologies Collaborative Research Program*. Accessed 14 October 2024. [https://www.afac.com.au/events/proceedings/06-10-21/article/417.-the-safety-of-alternative-and-renewable-energy-technologies-\(saret\)-collaborative-research-program](https://www.afac.com.au/events/proceedings/06-10-21/article/417.-the-safety-of-alternative-and-renewable-energy-technologies-(saret)-collaborative-research-program)

³¹ Fire and Rescue NSW, 2024. *Safety of Alternative and Renewable Energy Technologies (SARET) Research Program*. Accessed 14 October 2024. <https://www.fire.nsw.gov.au/page.php?id=9401>

The cost of continuous monitoring of the range of battery chemistries in circulation is also significant and involves the various contexts within which lithium-ion batteries are used, and assessments of the hazards to which personnel will be exposed, and to adjust firefighting procedures accordingly.

The nature of costs

Without intervention, costs in the following areas are also expected to increase as the frequency of battery related fires increases each year:

- a. **Service disruption:** Fires within a waste facility will force waste processing to stop until the fire is put out. Fires within garbage compactors need safe dumping of the load to be put out. These disruptions incur costs to waste service providers and may require recyclable waste to be disposed of at landfill.
- b. **Financial losses:** Battery-related fires in waste vehicles and at waste facilities can have significant costs, incurred through structural damage to material recovery facilities and damage to vehicles and equipment. Costs are also incurred through carrying out preventative measures, including installation of fire detection and suppression systems, buying battery-safe bins and fire system monitoring.^{32,33}
- c. **Escalating net costs of processing:** As battery manufacturers move from using relatively expensive chemistries (such as lithium-cobalt) to cheaper ones (such as metal oxide nanomaterials), there will be less financial incentive to reprocess. Also, some new technologies are proving to be more expensive to dismantle and process. Unless a form of intervention addresses these potential causes of market disruption, more batteries are likely to end up in landfill (even in jurisdictions with e-waste bans).
- d. **Escalating insurance costs:** Consultation with industry has established that businesses operating in the waste and recycling sector are finding it increasingly difficult to secure insurance coverage or face rising premiums or exclusions, due to the significant risks presented by battery fires. Material recovery facilities are now considered to be almost uninsurable, with some larger companies reportedly relying on self-insuring.

Transition to a circular economy

The adverse economic impacts of fires present a serious challenge to NSW's transition to a circular economy. Battery-related fire incidents in the waste and resource recovery sector can escalate quickly and in severe cases have resulted in the complete loss of a material recovery facility.

³² Pragmatic Research, 2024.

³³ USEPA, 2021.

4.3 Market failure and the case for government intervention

4.3.1 Market failure

The harms from battery-related fires and batteries sent to landfill (explored in the previous sections), most typically caused by low quality batteries and/or incorrect disposal of batteries, represent a ‘market failure’ known as a ‘negative externality’.

A ‘market failure’ is a situation where a market, in the absence of intervention, fails to allocate resources efficiently.³⁴

A ‘negative externality’ is when a market transaction causes an impact on a third party who is not involved in the transaction. Examples of negative externalities can include harm to the environment or public health. In the case of harms from waste batteries, the supplier of the batteries (who benefit from their sale) do not bear the cost or negative impact when those batteries are disposed of incorrectly.

Identifying a market failure is an important step in justifying that government intervention is required. The battery market is experiencing two crucial contributing market failures: information asymmetries and the presence of free riders.

4.3.2 Information asymmetry

Information asymmetry is when one party to a transaction does not have full access to information to inform their decision-making.

In the case of batteries, consumers often have limited access to information regarding performance, safety and disposal costs of battery products.³⁵ Because of this, there may be a lack of information to encourage consumers to take care when disposing of batteries. If this information were available to consumers, they may choose batteries that are safer and/or easier to safely dispose.

4.3.3 Free riders

Free riding happens when there is a lack of fair and reasonable distribution of financial obligations and rewards among the actors concerned.³⁶

In the battery market, this relates to battery suppliers that benefit from having their products collected and recycled through the existing voluntary stewardship scheme (B-Cycle), but that do not contribute to the associated costs of the scheme.³⁷

³⁴ NSW Department of Industry, 2017. Market failure guide: A guide to categorising market failures for government policy development and evaluation.

³⁵ MJA CBA report

³⁶ MJA report

³⁷ Battery Stewardship Council, [‘B-cycle 2.0 scheme review consultation paper’](#), Battery Stewardship Council, 2024, accessed on November 20, 2024.

B-Cycle has estimated that the scheme has lost potential revenue of an estimated \$7.05 million because of free riders.³⁸

The free rider problem exists in the battery market because there are currently few incentives for producers or retailers to contribute to the cost of disposal.³⁹ It is also difficult for B-Cycle to identify all battery suppliers in a complex market with many offshore participants. Government regulation can act as a tool to reduce the number of free riders in a market and increase scheme participation.

4.3.4 The case for government intervention

When market failure happens, it may be appropriate for the government to intervene to correct these failures. However, government intervention should only be considered when non-government means are unable to resolve the market failure in an equally effective manner and when the benefits of intervention outweigh the costs.

In the case of the batteries market, there is a clear role for government as the existing voluntary product stewardship approaches are not enough to overcome the market failures. Regulation can mandate participation and address free riders. In turn this will likely increase the funding available to:

- support community education to address the information asymmetries
- support the safe separation of batteries from general waste through expanded and consistent approaches to the safe collection, transport, storage and recycling of waste lithium-ion batteries.

Government can use product stewardship regulation as a tool to correct for negative externalities caused by batteries, to improve the safe management of batteries throughout their lifecycle and to reduce incidents of battery-related fires and batteries sent to landfill. Recovering valuable materials from these batteries will also increase the stream of materials available for recycling.

Existing voluntary and co-regulatory product stewardship arrangements include B-Cycle, MobileMuster, and the National Television and Computer Recycling Scheme. But many batteries fall outside the scope of these schemes. Many are disposed of in kerbside bins or in generalised e-waste collections.

Collection rates estimated at just 15.3% in 2023-24, with lithium batteries only accounting for 4.5% of total weight of collected batteries reaching end-of-life in 2021, is evidence of the limited effectiveness of the current voluntary industry led schemes such as B-Cycle.⁴⁰

³⁸Battery Stewardship Council, '[B-cycle 2.0 scheme review consultation paper](#)', Battery Stewardship Council, 2024, accessed on November 20, 2024.

³⁹ MJA Report

⁴⁰ Total Environment Centre https://www.tec.org.au/battery_recycling_crisis accessed 24 June 2025.

5. Consultation

5.1 To date

To support the analysis underpinning this regulatory impact statement, the EPA drew on the outcomes of stakeholder consultations and workshops.

Through 2025, the EPA has engaged closely with stakeholders, both during the development of the *Product Lifecycle Responsibility Act 2025* and the proposed Regulation.

The EPA has previously:

- held roundtables on battery product stewardship reform in October and November 2024, December 2023, February 2024 and August 2025
- brought together six peak bodies that represent businesses selling products with embedded or loose batteries
- brought together 17 peak bodies and business representatives from the waste and resource recovery sector
- brought together six peak bodies and business representatives from the battery recycling sector had extensive one-on-one meetings with key stakeholders across the battery supply chain
- engaged extensively with other Australian states and territories to discuss opportunities to put in place similar legislative frameworks to achieve a nationally aligned approach and reduce impact on the common market.

6. Options

6.1 Options for mandatory product stewardship

This regulatory impact statement assesses the expected impacts of the proposed Regulation against a base case or status quo scenario. As the proposed Regulation could be implemented in different ways, this statement is designed to both evaluate the proposed Regulation against the base case but also evaluate the different implementation approaches for the proposed Regulation.

They are assessed against a base case under which existing, voluntary product stewardship schemes for batteries continue to operate. These schemes are expected to see gradual improvement over time, but the significant risks and impacts of battery-related fires would persist. See section 7.2 below.

The key mandatory product stewardship scheme options and their characteristics are outlined below.

Product Stewardship

Product stewardship is a policy approach designed to manage the environmental impacts of products throughout their lifecycle. The primary responsibility for managing a product is on the producer, or the entity that manufactures, imports, or sells the product. A product stewardship policy typically compels producers to bear the financial and operational burdens of waste collection, recycling, and disposal.

Option 1: Scheme supported by an agreement between the EPA and a product stewardship organisation(s)

- Option 1 involves a scenario under the proposed Regulation where the EPA would enter an agreement with one or more product stewardship organisations, to administer and manage a mandatory product stewardship scheme.
- The organisation would complete an action plan that would need to be approved by the EPA.
- The organisation would need to manage and operate a scheme to fulfil the product stewardship requirements on behalf of brand owners.
- Battery brand owners supplying batteries into NSW must “join the scheme” by entering arrangements with a product stewardship organisation and paying it to manage and operate the scheme.
- A brand owner who has an agreement with a product stewardship organisation has complied with the requirements of the proposed Regulation.

Option 2: Scheme implemented by brand owners

- Option 2 involves a scenario under the proposed Regulation where there is no agreement between the EPA and a product stewardship organisation.
- Battery brand owners supplying batteries into NSW would need to individually meet product stewardship requirements set out in the proposed Regulation.
- Brand owners would also need to prepare and act according to an approved action plan.

Option 3: Scheme operated by Government

- Option 3 involves a scenario under the proposed Regulation where Government would establish a scheme and set up a product stewardship organisation to administer it.
- Under this option, Government would more directly administer the scheme - including setting up a collection system, determining fees payable by each brand owner and for reporting.
- Note that there would be no consumer deposit refund option, as it cannot be implemented under the *Product Lifecycle Responsibility Act 2025*.

6.2 Complementary measures

There are other potential regulatory interventions (e.g. disposal bans and design standards) and non-regulatory interventions (e.g. Government-funded education and behaviour change and targeted investment support, fire safety measures) that could complement mandated product stewardship reforms.

Some, such as trials for embedded battery collection at community recycling centres and device standards for e-micromobility devices are currently being trialed or implemented in NSW.

These measures are out of scope of this regulatory impact statement.

7. Impact analysis

7.1 Cost-benefit analysis

The assessment of options under the cost-benefit analysis framework adopted involves the consideration and assessment of options against a base case, according to NSW Government Guidelines (TPG-23-08)⁴¹.

7.2 The base case

Under the base case, the existing regulatory framework would remain unchanged. Existing relevant stewardship schemes, such as B-cycle, would remain in place and continue to operate.

The current conditions persist with a voluntary industry-led battery stewardship scheme being maintained. The base case assumes that no new initiatives will be implemented.

Not making any change to current arrangements (the base case), will leave the current shortcomings in collection and recycling and is least likely to address the concerns of the NSW Government in a timely and relevant manner. This suggests that the base case option is not acceptable irrespective of its low administrative cost.

7.3 Key findings

Options 1, 2 and 3 are economically positive

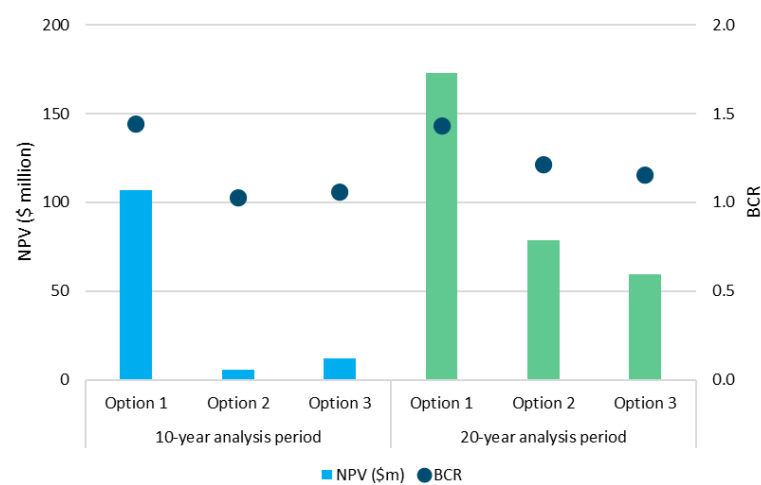
Options 1, 2 and 3 are expected to achieve positive net present value and benefit-cost ratio outcomes in comparison to the base case. As such, the proposed Regulation would have a net positive impact compared to the base case, regardless of which of the three implementation options were selected.

Cost and speed of implementation significantly influences the result

Option 1 is preferred over Options 2 and 3, in large part because it is less costly and faster to put in place, which is reflected in the higher net present value and benefit-cost ratio results over the 10-year and 20-year analysis periods.

⁴¹ NSW Government Guide to Cost Benefit Analysis, TPG 23-08, <https://www.nsw.gov.au/departments-and-agencies/nsw-treasury/documents-library/tpg23-08>

Figure 3: net present value and benefit-cost ratio, NSW, 10- and 20-year analysis period, 5% discount rate (MJA, 2024)



Source: Marsden Jacob analysis, 2025

Reprocessing costs exceed the value of recovered materials

In the economic analysis, reprocessing is net negative because processing costs exceed the value of recovered materials. However, financially, processing can break even or be profitable due to other income streams such as gate fees and scheme rebates (which are not considered in the economic analysis).

An assessment of the financial impacts of the model is set out in Appendix 3.

Avoided leachate contamination and waste industry fires are the most significant benefits

The benefits of avoiding further contamination of leachate in landfills and waste industry fires are in the order of hundreds of millions of dollars (net present value). While there are other benefits – such as the increased value of recovered materials – these values are in the order of tens of millions of dollars.

7.4 Summary of results

The following summary compares the NSW net present value, benefit-cost ratio and the main benefits and costs for the three options over 20 years with a five per cent discount rate. Based on this cost-benefit analysis, Option 1 is clearly the preferred option.

Option 1 has the highest net present value (\$172.8 million) and benefit-cost ratio (1.43) because it avoids the costs of establishing a new collection network and can be implemented relatively quickly.

In comparison to the base case, Option 1 results in the following key benefits and costs.

Table 11: Option 1, Key benefits and costs

Primary benefits	\$146.3 million in avoided costs of waste vehicle fires \$144.5 million in avoided costs of waste facility fires \$258.2 million in avoided costs of leachate damage
Primary costs	\$144.9 million in added costs of reprocessing \$114.6 million in added costs of collection and transport

Option 2 has a lower net present value (\$78.6 million) and benefit-cost ratio (1.21) than Option 1 because it needs administration with overlapping and unnecessary work, and collection and takes two extra years to implement.

In comparison to the base case, Option 2 results in the following main benefits and costs.

Table 12: Option 2, Key benefits and costs

Primary benefits	• \$112.7 million in avoided costs of waste vehicle fires • \$111.4 million in avoided costs of waste facility fires • \$203.8 million in avoided costs of leachate damage
Primary costs	• \$116.5 million in added costs of reprocessing • \$112.1 million in added costs of collection and transport.

Option 3 has the lowest net present value (\$59.6 million) and benefit-cost ratio (1.15) mainly due to the extra costs associated with:

- delay costs consistent with Option 2.
- extra monitoring and compliance cost for government.

In comparison to the base case, Option 3 results in the following main benefits and costs.

Table 13: Option 3, Key costs and benefits

Primary benefits	• \$112.7 million in avoided costs of waste vehicle fires • \$111.4 million in avoided costs of waste facility fires • \$203.8 million in avoided costs of leachate damage
Primary costs	• \$116.5 million in added costs of reprocessing • \$90.4 million in added costs of collection and transport

Table 14 details the results of the cost-benefit ratio for the three options under central assumptions and using the central discount rate of 5%.

Table 14: NSW scale cost-benefit analysis results – 20-year analysis period, 5% discount rate, central assumptions

Variable	Option 1	Option 2	Option 3
Net present value (\$m)	172.8	78.6	59.6
Benefit-cost ratio	1.43	1.21	1.15
Benefits	574.3	448.1	448.1
<i>Waste vehicle fires</i>			
Avoided costs to waste vehicle operators	124.1	95.6	95.6
Avoided cost of firefighting staff/resource costs	11.6	8.9	8.9
Avoided costs of health impacts	10.6	8.2	8.2
<i>Waste facility fires</i>			
Avoided costs to waste facility operators	110.7	85.3	85.3
Avoided cost of firefighting staff/resource costs	26.9	20.8	20.8
Avoided costs of health impacts	6.9	5.3	5.3
<i>Value of recovered material</i>			

Variable	Option 1	Option 2	Option 3
Extra value of recovered black mass (ex. reprocessors)	4.6	3.8	3.8
Extra value of recovered mixed metal (ex. reprocessors)	16.3	12.9	12.9
<i>Transport costs directly to landfill (via kerbside bins)</i>			
Avoided transport costs directly to landfill (via kerbside bins)	2.6	2.1	2.1
<i>Economic costs of landfill</i>			
Avoided landfill disposal costs	1.4	1.1	1.1
Avoided landfill externality costs (excl. leachate)	0.4	0.3	0.3
Avoided leachate damage cost – from batteries in landfills	258.2	203.8	203.8
Costs	401.5	369.5	388.5
<i>Battery reprocessing costs</i>			
Extra reprocessing costs	144.9	116.5	116.5
<i>Collection and transport costs to/from reprocessor (for collections associated with the stewardship scheme)</i>			
Extra collection and transport costs to reprocessor (for collections associated with the stewardship scheme)	114.1	111.7	90.1
Extra transport costs from reprocessor to landfill (i.e., material not recovered) (for collections associated with the stewardship scheme)	0.4	0.4	0.3
<i>Costs of maintaining collection point infrastructure</i>			
Extra costs associated with replacement of drums/drop-off receptacles	21.2	16.7	16.7
Extra costs associated with extra collection point sites	19.7	16.7	20.0
Costs associated with replacement of collection point sites	0.0	10.6	12.7
<i>Scheme participation costs (for households and businesses)</i>			
Extra scheme participation costs	53.0	41.8	41.8
<i>Costs to government</i>			
Extra government costs (development and implementation, ongoing costs (e.g., scheme oversight, compliance, reporting, enforcement)	16.3	23.5	58.7
Extra government costs (community education)	25.6	25.6	25.6
<i>Costs to suppliers (associated with the stewardship scheme)</i>			
Extra re-labelling/refund marking costs	0.60	0.74	0.74
Extra reporting costs	0.77	1.04	1.04
Extra costs associated with entering into supply arrangements	0.06	0.07	0.07
Extra costs associated with battery approvals	0.00	0.25	0.25
<i>Costs to scheme coordinator (associated with the stewardship scheme)</i>			
Extra scheme administration costs	5.0	3.8	3.8

Source: Marsden Jacob analysis, 2025

7.5 Sensitivity analysis

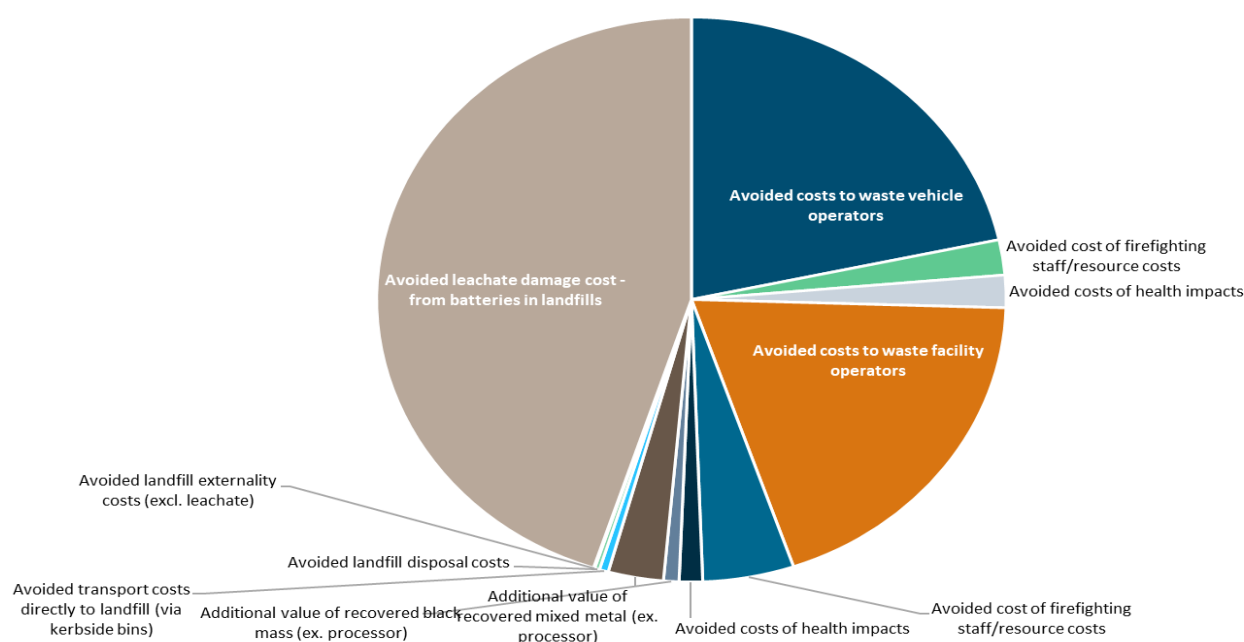
Reflecting the key drivers of the analysis, and analytical uncertainty, a sensitivity analysis has been done to assess the impact of changes to key assumptions.

Cost-benefit analyses are required to include sensitivity analyses that show the impact on the benefit-cost ratio and net present value of each option when assumptions or parameters are adjusted, to plausible alternative values, to reflect key risks and uncertainties.

A sensitivity analysis helps check how reliable the initiative is if things don't go exactly as planned. Sensitivity analysis provides information about how changes in different variables will affect the overall costs and benefits of the proposed Regulation. For example, one option might produce the highest net present value and benefit-cost ratio under the central set of assumptions, but poor results under other plausible assumptions, while another option produces satisfactory results under all sets of assumptions.

Results of the sensitivity analysis are set out in Appendix 3. The range of alternative assumptions tested does not alter the rankings of Options, 1, 2 or 3 although the net benefits can be negative under some circumstances.

Figure 4: Benefits, Option 1, 20-year analysis period, PV 5% discount rate



Source: Marsden Jacob analysis, 2025

7.6 Key drivers of the results

7.6.1 Cost and timeliness

Putting the initiatives in place early will help reduce fires and damage sooner by allowing quicker collection and reprocessing.

The preferred option (Option 1) performs better in the cost-benefit analysis because it uses the existing collection networks and achieves recovery rates sooner and cheaper than the other options. Sections 7.9 and 7.10 show the assumptions the analysis is based on.

7.6.2 Avoided leachate damage costs

The disposal of batteries to landfill results in the contamination of leachate with hazardous materials. Some leachate escapes even the best designed landfills and then affects surrounding groundwater and impacts fauna and flora.

All options are expected to avoid about 2,000 tonnes of batteries going to landfill each year by the late 2020s, rising to around 2,500 tonnes each year by the late 2040s.

The main difference between the options is that Option 1 is expected to avoid large volumes of batteries going to landfill from 2025-26 onward, while this benefit accrues from 2027-28 onward for Options 2 and 3 due to the slower implementation timeframe.

7.6.3 Avoided damage relating to waste vehicle fires

Data provided by various sources including FRNSW and Australian Council of Recycling (ACOR) highlight an increasing number of fires in waste vehicles caused by lithium batteries that have been improperly disposed of in kerbside bins. The options are expected to reduce the number of lithium batteries disposed of in kerbside bins compared to the base case, thus reducing the frequency of fires in waste vehicles.

For all options, annual avoidance of fires in waste vehicles is expected to be around 220 fires p.a. by the late 2020s, increasing to around 260 fires p.a. by the late 2040s.

The main difference between the options is that Option 1 is expected to avoid a substantial number of fires from 2025-26 onward, while this benefit accrues from 2027-28 onward for Options 2 and 3 due to the slower implementation timeframe.

7.6.4 Avoided damage relating to waste facility fires

Data provided by various sources including Fire and Rescue NSW and Australian Council of Recycling highlight an increasing number of fires in waste facilities caused by lithium batteries that have been incorrectly disposed of in kerbside bins. The options are expected to reduce the number of lithium batteries disposed of in kerbside bins compared to the base case, thus reducing the number of fires in waste facilities.

All options are expected to avoid about 150 fires in waste facilities every year by the late 2020s, rising to around 170 fires every year by the late 2040s.

The main difference between the options is that Option 1 is expected to avoid a lot of fires from 2025-26 onward, while this benefit accrues from 2027-28 onward for Options 2 and 3 due to the slower implementation timeframe.

7.6.5 Extra battery processing costs

Battery processing costs are large (\$5,500/tonne for lithium and lithium-ion batteries and \$1,500/tonne for non-lithium batteries).

For some battery chemistries, such as lithium-ion batteries that use Nickel–Manganese–Cobalt cathode, the value of recovered materials (black mass and metals) is almost enough to break even.

However, a trend towards lower value chemistries (e.g. Lithium Iron Phosphate) over time, is increasing the gap between the value of recovered materials and the cost of processing.

7.6.6 Extra collection and transport costs

Collection and transport costs are also large across all options.

Most of this cost is for collection and sorting (weighted average cost of around \$4,300/tonne), with transportation of aggregated batteries being relatively less costly.

7.6.7 Extra costs of developing and maintaining collection point technology and infrastructure

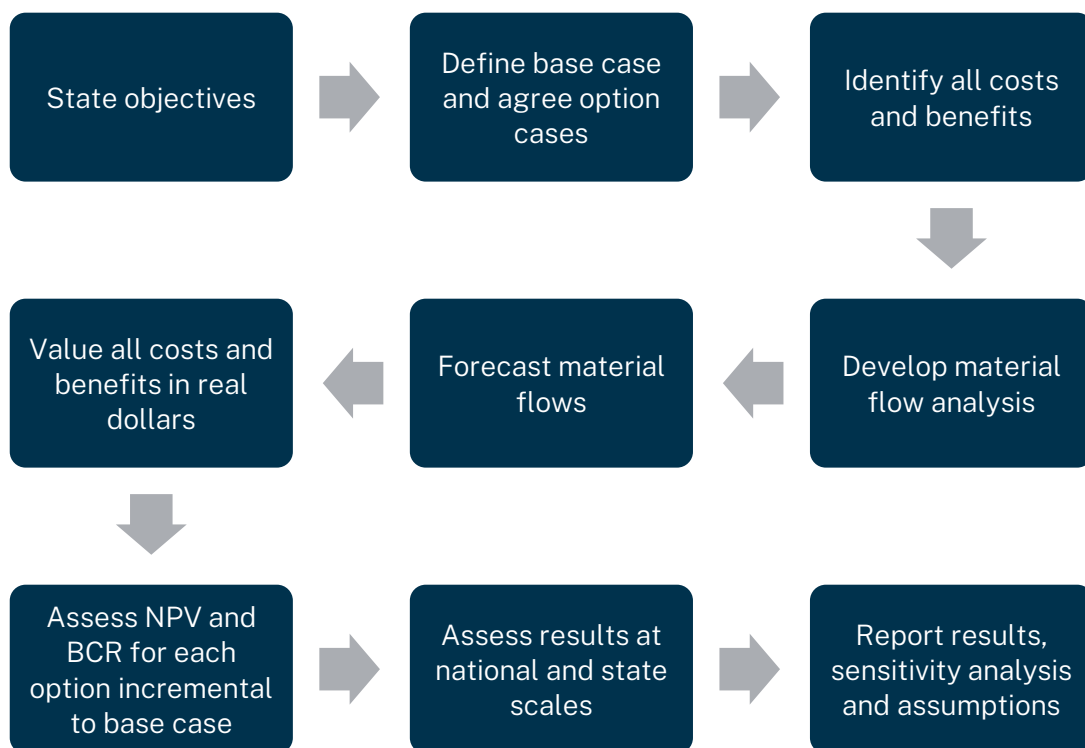
For all options, the Marsden Jacob Associates cost-benefit analysis has conservatively assumed that an extra 500 collection point sites will be needed to meet access requirements as defined in the options.

7.7 Cost-benefit analysis approach

The purpose of the cost-benefit analysis is to assess the costs and benefits of each of the options incrementally to the base case. Economic impacts (costs and benefits) are assessed in an economic model by grouping discounted annual estimates of each cost and benefit over the analysis timeframe.

The grouped costs and benefits are expressed using two key metrics: net present value ⁴² and benefit cost ratio ⁴³. The net present value measures the expected benefit (or cost) to society of implementing the policy in monetary terms. The option with the highest net present value is expected to deliver the highest scale of benefits to society, whereas the option with the highest benefit-cost ratio provides the highest benefit per unit of cost.

Figure 5: Key steps in developing the cost-benefit analysis



⁴² The net present value is the present value of benefits delivered by the option, less the present value of costs incurred.

⁴³ The benefit-cost ratio is the ratio of the present value of benefits to the present value of costs.

7.8 Overarching assumptions

The following overarching assumptions are applied to all options.

Table 15: Overarching assumptions applied for the CBA

Parameter	Assumption	
Real discount rate	5% (real) central 3%, 7% and 10% (sensitivities)	
First year of the analysis period	2026	FYE
Analysis period 1	10	years
Analysis period 2	20	years

7.9 Benefit assumptions

The cost-benefit analysis includes four key categories of benefits:

- i. Avoided costs from waste vehicle fires
- ii. Avoided cost from waste facility fires
- iii. There are understood to be around 10,000-12,000 waste industry (vehicles and facilities) fires in Australia, annually that are caused by batteries and with the increasing number of embedded lithium batteries in devices this is expected to increase.
- iv. Avoided cost: landfilling of hazardous materials
- v. Increased value: recovered materials

The cost-benefit analysis conservatively does not assume that the stewardship scheme will result in a lower rate of in use/in-home battery fires on the following basis:

- The regulatory impact statement's options do not include measures that affect design standards, and nor can a product stewardship scheme, aimed at lifting end-of-life collection rates through appropriate channels, be guaranteed to improve them. Design standards may be addressed through other policy and program initiatives by the Commonwealth or NSW Government.
- This RIS does not consider or mandate different consumer awareness funding scenarios in its options (that may in turn reduce in-life battery fires).
- Any consumer education funding that is available (after rebates and other scheme expenses have been paid) will prioritise improving consumers' awareness of the correct disposal pathways for batteries (and therefore prevent fires in waste contexts).
- Alternatively, communication campaigns aimed at reducing in-life battery fires will not necessarily be funded by a scheme whose primary aim is to improve end-of-life collection rates. It is therefore expected (and recommended) that in-life battery safety campaigns should be funded through more reliable funding sources – such as consolidated revenue.

Table 16: Benefit assumptions

Benefit type	Variable	Central value	Unit	Source
Avoided cost: Waste vehicle fires (Assumed breakdown is 95% minor fires, 5% major fires)	Minor repairs (minor fires)	20,000	\$/minor fire	Stakeholder consultation, Marsden Jacob Associates analysis of Fire and Rescue NSW data regarding callouts and costs, kerbside waste audit data (NSW, 2023) & Marsden Jacob Associates's material flow analysis
	Vehicle replacement (major fires)	400,000	\$/major fire	
	Site cleanup (all fires)	25,000	\$/fire (weighted average)	
	Firefighting costs (all fires)	3,750	\$/fire (weighted average)	
	Health impacts from fire exposure (all fires)	3,500	\$/fire (weighted average)	Using osteoporosis/arthritis as a proxy for health impacts from fluorine exposure Valued based on quality adjusted life year impacts (-15%)
Avoided cost: Waste facility fires (Assumed breakdown is 99.99% minor fires, 0.01% major fires)	Minor repairs (minor fires)	50,000	\$/minor fire	Stakeholder consultation, Marsden Jacob Associates analysis of Fire and Rescue NSW data regarding callouts and costs, kerbside waste audit data (NSW, 2023) & Marsden Jacob Associates's material flow analysis
	Facility replacement (major fires)	50,000,000	\$/major fire	
	Site cleanup (major fires)	50,000	\$/major fire	
	Firefighting costs (all fires)	13,500	\$/fire (weighted average)	
	Health impacts from fire exposure (all fires)	3,500	\$/fire (weighted average)	Using osteoporosis/ arthritis as a proxy for health impacts from fluorine exposure Valued based on quality adjusted life year impacts (-15%) WHO, Global Burden of Disease: Disability Weithers for Diseases and Conditions, https://www.who.int/data/global-health-estimates
Avoided cost: landfilling of hazardous materials	Environmental damage caused by leachate	9,400	\$/tonne of batteries disposed to landfill	Marsden Jacob Associates, 2016. cost-benefit analysis of options to reduce e-waste from landfill, report to Department of Environment, Land, Water and Planning, Victoria, final report, December 2016 & further analysis of and accompanying confidential data.
Increased value: recovered materials	Black mass: Alkaline batteries	-150	\$/tonne	Marsden Jacob Associates analysis of confidential data from stakeholder applications for EPA infrastructure grants and other confidential data provided by consulted stakeholders.
	Black mass: NMC batteries	12,000	\$/tonne	
	Black mass: Lithium-iron phosphate batteries	0	\$/tonne	
	Metals: Alkaline batteries	2,000	\$/tonne	
	Metals: Lithium Nickel Manganese	2,000	\$/tonne	

Benefit type	Variable	Central value	Unit	Source
	Cobalt oxide batteries			
	Metals: Lithium-iron phosphate batteries	1,500	\$/tonne	

7.10 Cost assumptions

The cost-benefit analysis assumes that there are several key categories of costs:

- Collection points: costs associated with establishing safe collection points for batteries, with a particular focus on portable batteries, light means of transport batteries. The analysis at this point does not consider the establishment of collection points for larger batteries such as battery energy storage systems and electric vehicles.
- Transport: costs associated with the safe transport of batteries, including both vessels and vehicles for carrying hazardous materials.
- Sorting: costs of identifying and categorising batteries at recycling facilities.
- Reprocessing and recycling infrastructure: the analysis assumes that the reprocessing is done in four locations around Australia. The output of the reprocessing is then exported because Australia does not currently have enough commercial scale battery production facilities. This is a conservative assumption because facilities may emerge (such as the proposed lithium-ion battery gigafactory led by Energy Renaissance⁴⁴).
- Scheme participation: costs to households and businesses of returning batteries to collection points (i.e., time).
- Government: staffing costs to NSW of developing, implementing, procuring, managing and regulating a scheme.
- Scheme coordinator/scheme administration costs.
- Suppliers: costs of re-labelling, entering supply arrangements and reporting and battery approvals.

Table 17: Cost assumptions

Cost type	Variable	Central value	Unit	Source
Collection points • For all options, it is assumed that an extra 500 collection point sites will be needed	New collection point site: Establishment cost (signage, fire safety, etc.)	15,000	\$/site (one-off)	Marsden Jacob Associates estimate based on stakeholder consultation
	New collection point site: annual cost (based on opportunity cost of space)	10,000	\$/site (ongoing, annual)	Marsden Jacob Associates estimate based on weighted average cost of retail, industrial and non-industrial space

⁴⁴ J Regan and S Vorrath, 'Australia's first battery gigafactory on track for December launch', Renew Economy, 2 September 2022, accessed on 21 November 2024.

Cost type	Variable	Central value	Unit	Source
For Options 2 and 3, it is also assumed that 50% of existing sites will be turned over during the transition to the new scheme and need to be replaced. This cost is assumed to be 20% higher for Option 3 compared to Option 2.	Replacement of drums/receptacles	800 (all options)	\$/tonne of batteries collected	Stakeholder consultation \$200/drum, useful life of 50 collections, average battery mass of 5kg per collection
	Infrastructure operating and maintenance costs Assumed to be 10% of the establishment/capital expenditure cost	6,000 (Option 3)	\$/collection point site/year	MJA estimate. This cost is higher than average for operating and maintenance costs (typically, 1-2% of capital expenditure), but this is due to the higher likelihood of repairs being required (e.g., due to minor fires).
Collection and transport For Option 2, it is assumed that the unit costs for collection and transport will incur a 5% cost premium but only for the first five years of the scheme, due to inefficiencies in logistics that will eventually be addressed.	Collection costs	3,400	\$/tonne of batteries collected (weighted average across all states and territories)	TfNSW guidelines accounts for vehicle type (van), road conditions, average speed, etc. An allowance (+100%) has been made for specialist training and equipment, hazardous cargo. Assumes 30 minutes spent on-site per collection.
	Transport costs	0.48	\$/km	TfNSW guidelines accounts for vehicle type, road conditions, average speed, etc. An allowance (+100%) has been made for specialist training and equipment, hazardous nature of cargo.
Sorting	Sorting costs	1,000	\$/tonne of batteries sorted	MJA analysis of confidential data provided by consulted stakeholders
Reprocessing and recycling infrastructure (assumed to be located in Melbourne, Sydney, Brisbane, and Perth)	Cost of establishing infrastructure and operating costs from reprocessing batteries (expressed as a levelised cost)	1,500 for non-lithium batteries 5,500 for lithium batteries	\$/tonne of batteries reprocessed (levelised cost)	MJA analysis of confidential data from stakeholder applications for NSW EPA infrastructure grants and other confidential data provided by consulted stakeholders
Scheme participation (households & businesses)	Time cost of returning batteries to collection points	2,000	\$/tonne of batteries dropped off	Time valued at \$15/hr, 10 min for collecting/grouping batteries and doing the physical drop-off (multi-purpose trip means travel time excluded), 50 × 25g batteries dropped off
Costs to NSW governments	Development and implementation costs (and procurement costs for Options 2 and 3) (costs	NSW: Option 1: \$4.0m Option 2: \$5.0m	\$ million (over the first three	Estimates provided by NSW governments, based on staffing requirements.

Cost type	Variable	Central value	Unit	Source
	reported are incremental to Base case costs)	Option 3: \$6.1m	years of the analysis period)	The cost of community education/marketing campaigns is based on the costs of similar campaigns undertaken by Bebat, then adjusted from Euros to Australian dollars and rescaled to account for Australia’s larger population and lower population density.
	Scheme oversight, compliance, reporting and enforcement (costs reported are incremental to Base case costs)	NSW: Option 1: \$1.2m Option 2: \$1.8m Option 3: \$2.4m	\$ million (ongoing/ annual for the remainder of the analysis period)	
	Community education campaigns – focused on awareness and behavioural change	NSW: All options: \$9.4m over the first three years All options: \$1.6m ongoing/annual cost for the remainder of the analysis period	\$ million (costs reported are incremental to Base case costs)	
Scheme coordinator/ scheme administration	Costs of coordinating and administering the scheme	Annual cost modelled as a non-linear function of the amount of batteries collected Based on the modelled options, the annual cost ranges from approx. \$1-2 million for NSW	\$ million (ongoing/ annual)	MJA estimate based on current B-cycle operating costs and costs for other similar schemes (e.g., NSW CDS)
Cost to suppliers	Entering supply arrangements with product stewardship organisation	600	\$/supplier	Adapted from previous MJA estimates for similar schemes (e.g., NSW container deposit scheme)
	Reporting	600	\$/supplier/year	
	Battery registration into the scheme	100	\$/battery type	
Fire mitigation infrastructure at waste facilities and in waste vehicles	No net cost impact because fire mitigation technologies are assumed to already be implemented under base case			

7.11 Material flows

Many of the benefits and costs are driven by assumptions regarding diversion of batteries from kerbside bins (under the base case) to correct disposal through designated drop-off/collection points.

A key assumption, discussed further, is that a mandated version of existing schemes (Option 1) will result in superior collection rates compared to the base case and will also get there faster, therefore

reaching the new, higher, stable collection rate within three years for Option 1, compared to within five years for the base case.

Alternatively, under Options 2 and 3, it has been assumed that there is a two-year delay due to considerations such as the time needed for design and implementation by scheme participants.

It is for the reasons described above that, on the graphs provided later in this section, there is a two-year period where Option 1 delivers benefits before Options 2 and 3 catch up. These reasons also explain the shifts in some of the curves for Option 1.

Collection rate assumptions

As discussed above, many of the benefits and costs are driven by assumptions regarding diversion of batteries from kerbside bins (under the base case) to appropriate disposal pathways (i.e., through designated drop-off/collection points). Different collection rates are assumed for different battery types, to reflect anticipated consumer behaviour. Embedded batteries and e-cigarettes/vapes are assumed to be out of scope for the stewardship scheme. However, collection of embedded batteries is currently being trialled in some community recycling centres.

Table 18: Collection rate assumptions

	Base case	Option 1	Option 2	Option 3
Collection rate at maturity for:				
Standalone/easily removable batteries	30%	45%	45%	45%
Embedded batteries (excl. e-cigarettes/vapes)	N/A	N/A	N/A	N/A
E-cigarettes/vapes	N/A	N/A	N/A	N/A
Light means of transport batteries (excl. embedded)	10%	45%	45%	45%
Collection rate improves from	2025-26	2025-26	2027-28	2027-28
Years to reach maturity	5	3	3	3
Maturity achieved by	2029-30	2027-28	2029-30	2029-30

Under the base case, B-Cycle is expected to achieve a 30% collection rate by 2029-30. This is an important assumption and has been set considerably above the current collection rate to avoid optimism bias.

Options 1, 2, and 3 are assumed to achieve the same collection outcomes at maturity (45%); however, a two-year delay is assumed for Options 2 and 3. This is a deliberately consistent assumption to ensure that the options are assessed on an equal performance basis. For further discussion on strengths and weaknesses of the options refer to Table 20.

For all options, improvements in collection rates are expected over a shorter period (three years) than for the base case (five years).

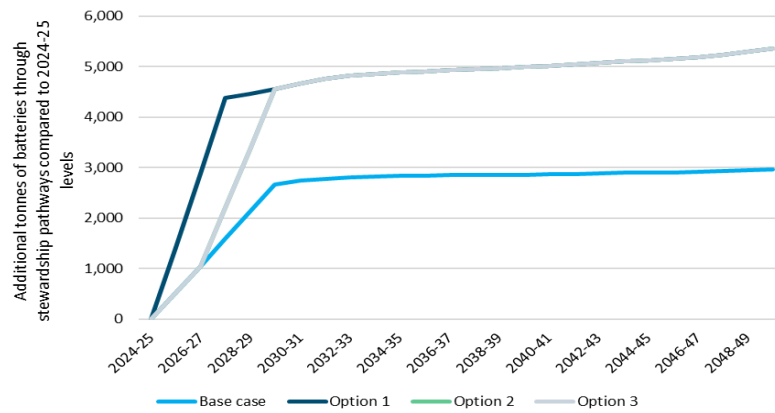
Diversion of batteries from kerbside bins to designated drop-off/collection points

Figure 6 illustrates the expected improvements in collection rates (in tonnes) for the base case and option cases compared to current levels.

Figure 7 provides the same projections as

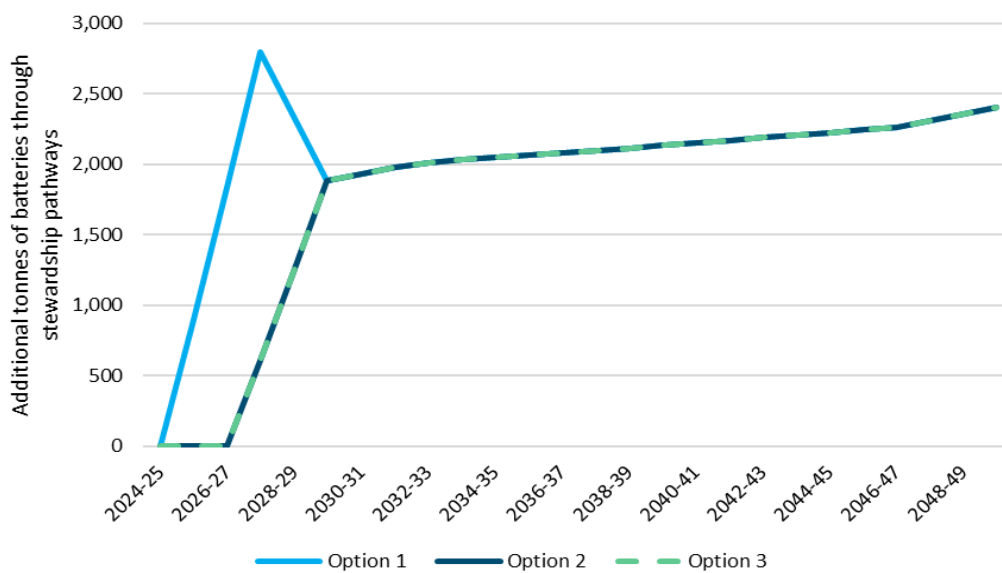
Figure 6 but shows each option's improvement relative to the base case. In Figure 7, the rapid increase then slight fall for Option 1 reflects the assumed faster improvement compared to the base case, after which the base case 'catches up'.

Figure 6: Additional tonnes of batteries through stewardship pathways compared to 2024-25 levels



Source: Marsden Jacob analysis, 2025

Figure 7: Extra tonnes of batteries collected under options, incrementally to the base case



Source: Marsden Jacob analysis, 2025

Batteries in kerbside bins and fires caused by lithium batteries

Waste industry fires are modelled to scale with the number of lithium batteries disposed in kerbside bins. This means improvements in the rate of correctly disposed of batteries (e.g., at designated drop-off/collection points) are expected to result in less waste industry fires compared to the base case.

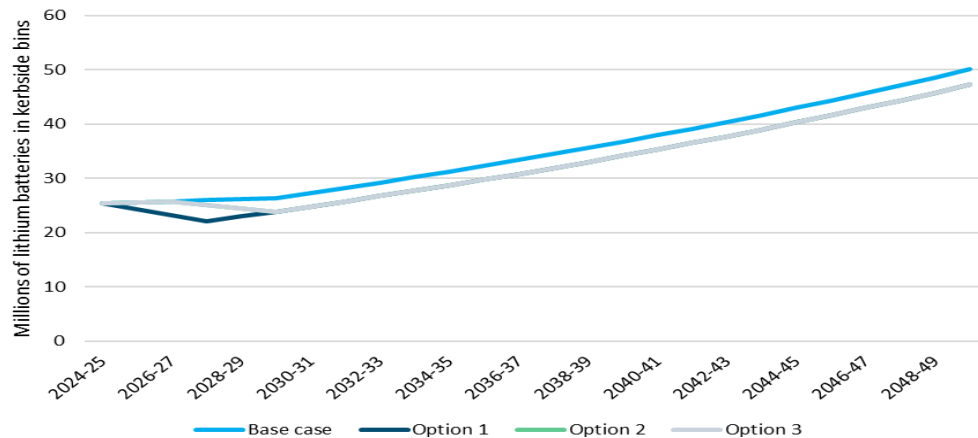
In the material flows analysis, it has been assumed that some devices (e.g., remote controls) that historically relied on loose batteries (e.g., AA) will gradually shift to using embedded batteries (thus, slowly phasing out loose batteries in these applications). The result is that use of embedded batteries (within devices) in the portable category is expected to grow faster than use of non-embedded batteries in the portable category, with use of non-embedded batteries possibly slowly declining over time.

Batteries in kerbside bins are contributing to fire risks

Reflecting feedback from Fire and Rescue NSW and waste industry stakeholders that lithium-ion batteries are the primary cause of fires in this sector, Figure 8 shows the modelled number of them in kerbside bins for the base case and option cases.

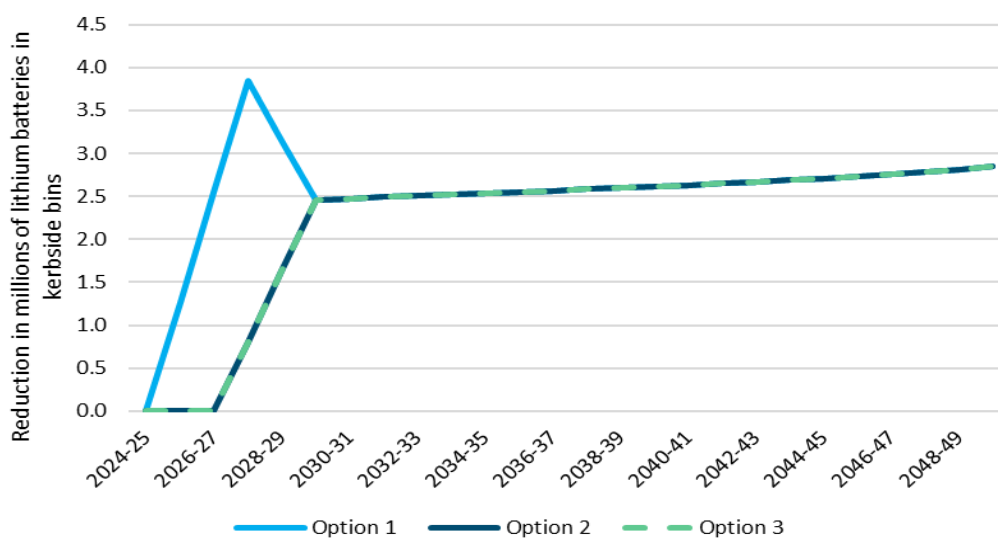
Figure 9 provides the same projections as Figure 8 but shows each option's improvement relative to the base case. In Figure 9, the rapid increase then slight fall for Option 1 reflects the assumed faster improvement compared to the base case, after which the base case 'catches up'.

Figure 8: Number of lithium-ion batteries in kerbside bins (millions)



Source: Marsden Jacob analysis, 2025

Figure 9: Reduction in lithium-ion batteries in kerbside bins (millions)



Source: Marsden Jacob analysis, 2025

Fires in waste vehicles

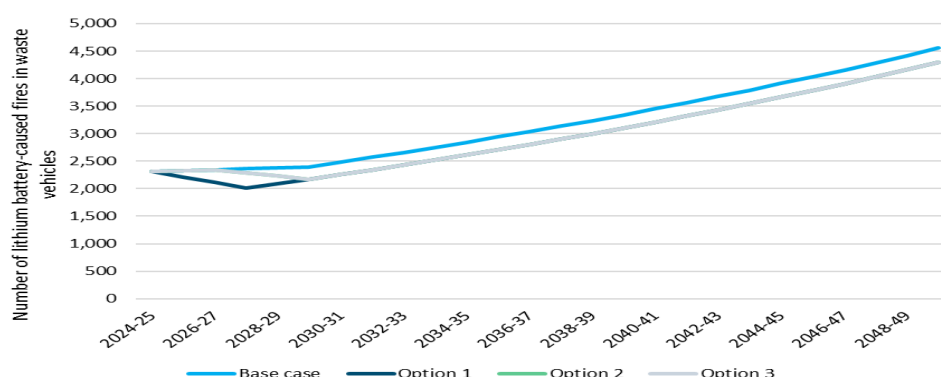
Waste vehicle fires are assumed in the modelling to scale with the number of lithium-ion batteries disposed of in kerbside bins. It's estimated there is one waste vehicle fire per 11,000 lithium-ion batteries in kerbside bins. (This is based on Fire and Rescue NSW and Australian Council of Recycling data and Marsden Jacob Associates' estimates of the number of lithium-ion batteries in kerbside bins.)

Diversion of lithium-ion batteries from kerbside bins to designated drop-off/collection points is expected to reduce the number of fires in waste vehicles compared to the base case.

Figure 10 presents the projected number of fires in waste vehicles caused by lithium-ion batteries, while Figure 11 provides the same projections, but is represented as improvements incrementally to the base case. The analysis does not assume that these fires are eliminated. This would only be possible if a complete collection outcome for all lithium-ion batteries.

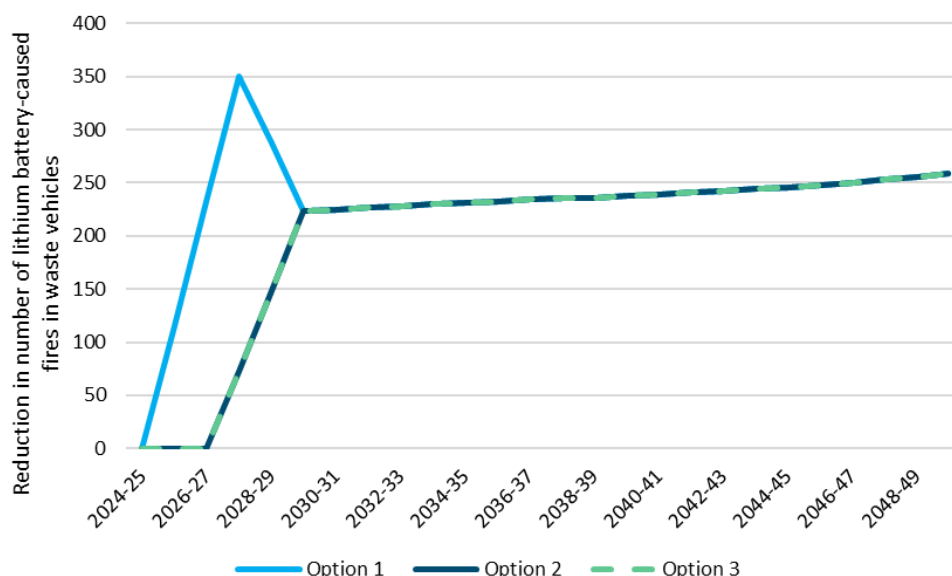
It may be that this cost-benefit analysis's assumptions and results are conservative, because some international schemes (such as Bebat in Belgium⁴⁵) are achieving greater than 60% collection rates. Ultimately, the rate at which levies are set heavily impacts on a scheme's collection rate as it determines how much can be spent on collection points, transport, rebates, consumer education and other expenses. As this regulatory impact statement does not consider different levy settings in the options, it has used conservative rather than optimistic diversion projections in the analysis to avoid the results being affected by optimism bias.

Figure 10: Number of lithium-ion battery-caused fires in waste vehicles



Source: Marsden Jacob analysis, 2025

Figure 11: Reduction in number of lithium-ion battery-caused fires in waste vehicles



⁴⁵ See [Bebat](#), accessed on 20 November 2024.

Fires in waste facilities

Fires in waste facilities, such as material recovery facilities are assumed in the modelling to scale with the number of lithium-ion batteries disposed of in kerbside bins.

The incidence of fires is estimated to be one waste facility fire per 16,000 lithium batteries in kerbside bins. (This is based on Fire and Rescue NSW, Australian Council of Recycling and Marsden Jacob Associates' estimates of the number of lithium-ion batteries in kerbside bins.)

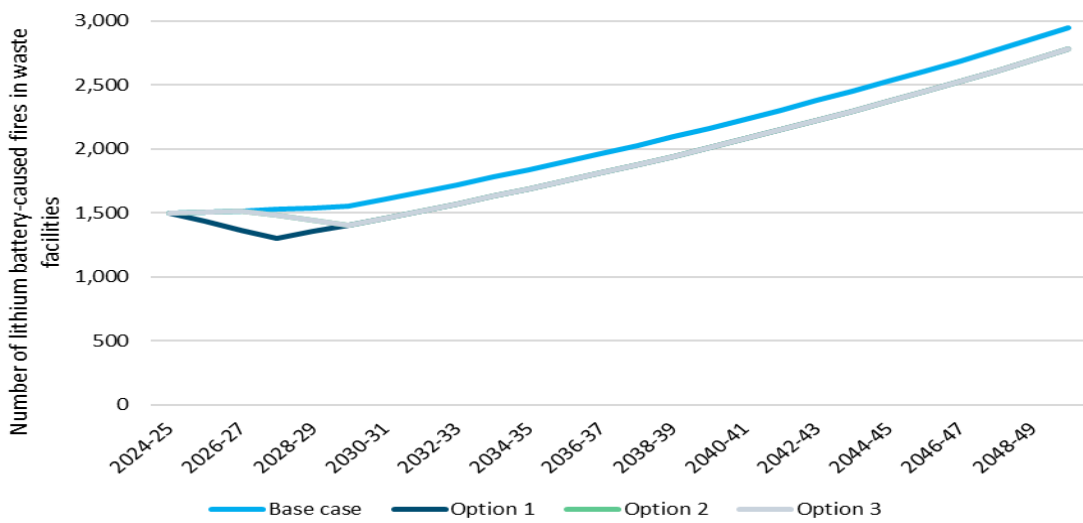
Only a very small proportion of these fires are anticipated to be major (such as the ACT material recovery facility fire that ended up destroying the facility). The majority are assumed to be minor fires that are readily contained but are still a risk to both human and physical resources. The major fire rate assumption is thus deliberately conservative.

Diversion of some of the lithium-ion batteries from kerbside bins to designated drop-off/collection points is expected to reduce the number of fires in waste facilities compared to the base case.

Figure 12 presents the projected number of fires in waste facilities caused by lithium-ion batteries, while

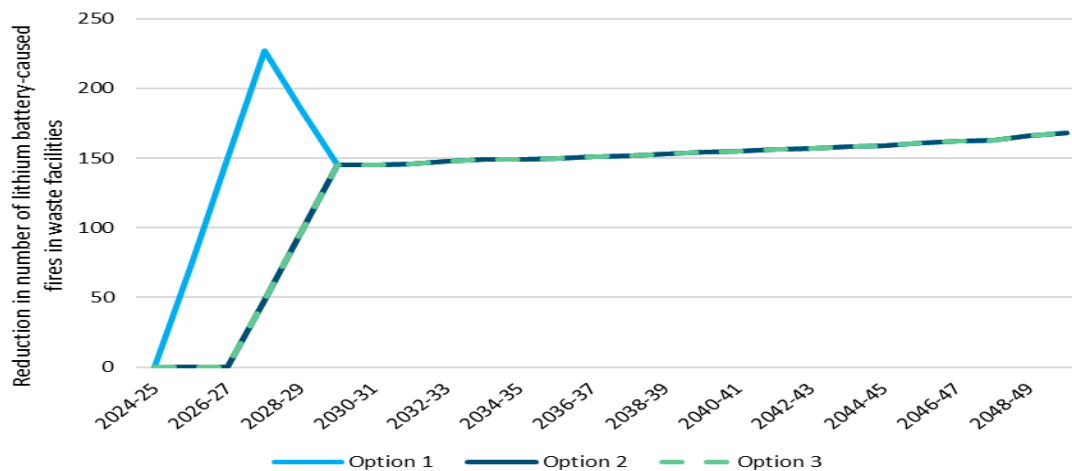
Figure 13 provides the same projections, but is represented as improvements incrementally to the base case.

Figure 12: Number of lithium battery-caused fires in waste facilities



Source: Marsden Jacob analysis, 2025

Figure 13: Reduction in number of lithium battery-caused fires in waste facilities



Source: Marsden Jacob analysis, 2025

7.12 Data limitations

The Australian Council of Recycling estimated there are between 10,000 and 12,000 battery-related fires a year across waste and recycling streams in Australia. This was based on a survey it carried out in 2024.⁴⁶ In contrast, Fire and Rescue NSW reported that it had been called out to just seven lithium-ion battery fires at recycling and waste facilities (including receptacles, trucks and facilities) in the first half of 2024.

In explaining the large discrepancy in data, stakeholders have reported that waste industry operators are likely to be extinguishing fires themselves and not reporting the incidents to authorities, most likely to keep insurance premiums down and avoid penalties.

It is acknowledged that the lack of a robust data collection has made it difficult to accurately quantify the extent of battery fires in waste contexts. For the purposes of this regulatory impact statement, the cost-benefit analysis has based its calculations on Australian Council of Recycling's survey.

7.13 Unquantified costs and benefits

There are several unquantified costs and benefits that could be included in this analysis. However, including them is not expected to materially impact the results and conclusions.

These unquantified costs and benefits include:

- i. fewer deaths and injuries to both responders to fires (Fire and Rescue NSW and NSW Rural Fire Service) and other victims. These benefits have been excluded due to a lack of data. Instead, we have modelled health impacts in terms of exposure to battery-related fires and potential exposure to harmful gases (e.g., fluorine)

⁴⁶ACOR, [Workshop report: Development of ACOR 3-year strategy Research results](#), June 2024.

- ii. battery production scale benefits: it is possible that a gigafactory industry could develop because of the initiative or that per unit costs at existing facilities fall as collection rates increase
- iii. other environmental impacts: various gases are produced by battery-related fires. It may be that they contribute to other air quality issues that have adverse health consequences
- iv. increased consumer surplus from better battery design and performance, including battery replaceability and longevity. Potential benefits include the avoided costs of battery disposal due to improvements in battery performance, ease and safety of disassembly, and increased recovery of recyclable materials
- v. avoided costs of less efficient methods of recovering the unfunded portion of battery disposal costs: for example, budget subsidies funded from taxes
- vi. the net carbon emissions of each option (given that opaque end markets for recovered materials, and materials sent offshore, mean that strong assumptions about reduced extraction of virgin materials cannot be made).
- vii. the extra fire and fugitive emission risks at recycling facilities presented by potential stockpiling as collection rates increase.

Overview of assessment

7.14 Summary

Table 19 has a summary overview of the outcomes of the assessment of options for a mandatory product stewardship scheme against key attributes. Strengths and weaknesses are identified in Table 20.

Option 1 was preferred given:

- The relative strength of the net present value and benefit-cost ratio providing a high benefit per unit of cost.
- The relatively quick implementation in line with an urgent need to mitigate battery related fire risks and environmental harm.
- The **flexibility** to address a broad and dynamic scope of batteries.

Table 19: Assessment of options against key criteria

	Option 1	Option 2	Option 3	Assessment summary
Net present value (benefit-cost ratio)	\$172.7m (1.43)	\$78.6m (1.27)	\$59.6 (1.15)	All options have a positive net present value, but Option 1 is strong because it has the lowest cost and starts to deliver benefit soonest.
Speed of implementation	Relatively fast	Relatively slower	Relatively slower	Option 1 is fastest to implement; Option 2 and 3 longer due to legislative complexity and need to procure and establish a new scheme administrator
Flexibility	More	Less	Least	Option 1 allows industry to leverage existing scheme infrastructure to develop bespoke approaches for specific battery types; Option 2 and 3 would replace existing schemes

Table 20: Overview of strengths and weaknesses of each option.

Option	Strengths	Weaknesses
Option 1: Scheme supported by an agreement between EPA and a product stewardship organisation	• Can use existing collection networks to have a product stewardship organisation mobilise quickly. • Drive recovery rates faster. • Complete oversight for Government over the process, product stewardship organisation and scheme operation. • Consistent messaging and education for consumers. • Consistent branding of collection network to improve awareness and drive higher recovery rates. • Simple levers to set targets for the product stewardship organisation.	• Reliant on a product stewardship organisation fulfilling criteria including demonstrated capabilities • Leaves less room for innovation from individual brand owners. • Must negotiate an agreement with a product stewardship organisation.

Option	Strengths	Weaknesses
	- Regulatory tools to ensure compliance with requirements. - Collective responsibility creates economies of scale. - Transparency for brand owners of stewardship organisations actions through regulatory oversight and reporting. - Action plan can be used to adjust outcomes over time.	
Option 2: Scheme implemented by brand owners	- Allows brand owners to come up with new ways of managing product stewardship requirements. - Brand owner is more directly involved in managing and retrieving the product they supply into market.	- Multiple relationships with brand owners and compliance that must be managed by Government. - Higher costs to government due to increased compliance and enforcement requirements - Difficulty policing number of brand owners. - Patchwork and inconsistent network of collection that may confuse consumers. - Risk of inconsistent branding and messaging across the collection network. - Reduced awareness. - Some brand owners don't have existing bricks and mortar presence to manage collection.
Option 3: Scheme operated by Government	- Consistent messaging and education for consumers. - Consistent branding of collection network to improve awareness and drive higher recovery rates. - Regulatory tools to ensure compliance with requirements. - Collective responsibility creates economies of scale. - Even greater transparency over the system.	- May not be able to use existing collection networks or expertise. - Not government's core business. - Assumed to be slower to set up and establish than Option 1. - Requires significant government investment and development of relationships with collectors and recyclers.

7.15 Implementation

The nature of the requirements of the NSW Government and arrangements between EPA and the product stewardship organisation will determine the issues most relevant to and timing of the implementation of the adopted option.

These arrangements can be expected to relate to:

- the obligations and requirements on product stewardship organisations including a requirement for an action plan (to be submitted to the Regulator under *Product Lifecycle Responsibility Act 2025*).
- arrangements for recycling and reuse of regulated batteries, including the types of battery that may be recycled and reused.
- how consumers can access collection points for regulated batteries.
- the safe management of batteries that are not regulated batteries.

- reporting and recording of activities of the product stewardship organisation and brand owners of:
 - the number of batteries supplied
 - the total weight of the batteries supplied
 - how consumers are informed about safe disposal and recycling of regulated batteries
 - achievements against the action plan.

These and other key issues are defined in in Schedule 3 of the draft Regulation.

7.16 Evaluation

The evaluation framework as it relates to the responsibilities of the product stewardship organisation and brand owners will need to be established as part of the arrangements between the EPA and the product stewardship organisation. The requirements of NSW Treasury Evaluation Guidelines are also likely to be relevant.⁴⁷

⁴⁷ See <https://www.nsw.gov.au/nsw-government/public-sector/financial-information-for-public-entities/centre-for-economic-evidence/nsw-government-investment-framework/evaluation-guidelines>.

Appendix 1: International scheme comparison

	Mandatory, voluntary, or co-regulated?	Regulation of materials?	Mandatory take-back scheme?	Mandatory labelling?	How is it funded?	Mandatory reporting?
Germany	Mandatory	✓	✓	✓	Manufacturers finance take-back	✓
Belgium	Mandatory	✓	✓	✓	Fee at point of sale and fee paid by manufacturers	✓
United Kingdom	Mandatory	✓	✓	✓	Manufacturers finance take-back	✓
California	Mandatory	x	✓	✓	Manufacturers finance take-back	✓
Switzerland	Mandatory	✓	✓	✓	Sale price includes advance disposal fee, and a fee is paid by manufacturers	✓
Washington State	Mandatory	x	✓	✓	Manufacturers finance take-back	✓
Slovakia	Mandatory	✓	✓	✓	Manufacturers finance take-back	✓
Sweden	Mandatory	✓	✓	✓	Manufacturers finance take-back	✓
Luxemburg	Depends on type of battery	✓	✓	✓	Manufacturers finance take-back	✓
Denmark	Mandatory	x	✓	✓	Importers and manufacturers finance take-back	✓
China	Mandatory	✓	✓	Unclear	Manufacturers finance take-back	Voluntary

Appendix 2: Broader policy context

Commonwealth

Waste and circular economy policy

The [National Waste Policy](#) 2018 sets out five key principles for waste management to guide Australia's transition to a circular economy. These include:

- i. avoid waste;
- ii. improve resource recovery;
- iii. increase the use of recycled material and build demand and markets for recycled products;
- iv. better manage material flows to benefit human health, the environment and the economy
- v. improve information to support innovation, guide investment and enable informed consumer decisions.⁴⁸

The [National Waste Policy Action Plan 2019](#) includes a series of actions under seven targets to implement the National Waste Policy. These targets and actions guide Australia's investment and national efforts and include:

- i. banning the export of waste plastic, paper, glass and tyres, starting in the second half of 2020;
- ii. reducing the total waste generated in Australia by 10% per person by 2030;
- iii. achieving an 80% average recovery rate from all waste streams following the waste hierarchy by 2030;
- iv. significantly increasing the use of recycled content by governments and industry;
- v. phasing out problematic and unnecessary plastics by 2025;
- vi. halving the amount of organic waste sent to landfill by 2030; and
- vii. making comprehensive, economy-wide and timely data publicly available to support better consumer, investment and policy decisions.⁴⁹

Work is underway to strengthen the National Waste Policy Action Plan towards the 2030 targets. This acknowledges that more is needed to prevent waste, including better product design and more efficient processes.

The Commonwealth is also developing a [National Circular Economy Framework](#) to consider the broader lifecycle of materials, products and services informed by the work of the Circular Economy

⁴⁸DCCEEW, 'National Waste Policy: Less waste, more resources, Australian Government', 2018, accessed on 20 November 2024.

⁴⁹ DCCEEW, 'National Waste Policy Action Plan - DCCEEW', Australian Government, 2022, accessed on 20 November 2024.

Advisory Group.⁵⁰ The framework will direct and drive a faster transition to a circular economy and ensure efficient use of key resources and materials in Australia.

The framework's overarching goal is to double Australia's circularity rate by 2030. This is supported by three targets that cover shrinking the material footprint by 25%, lifting resource productivity by 20%, and safely recovering 80% of resources (aligning with the NWPAP 2019). Achieving these targets will require action in four priority areas: (re)manufacturing, food and agriculture, the built environment, and in the resources and critical minerals sectors.

Product stewardship policy

The Commonwealth has primary responsibility for nationally implemented product stewardship policy and administers schemes through the *Recycling and Waste Reduction Act 2020* (RAWR Act). The RAWR Act requires the Minister for Environment to publish an annual [product stewardship priority list](#) that sets out products and materials requiring urgent product stewardship action. It also allows the Minister to make legislative rules to require certain product stewardship actions to be taken and to accredit voluntary schemes.

While some product stewardship schemes are administered by states and territories (such as the container deposit schemes) most are administered by the Commonwealth.

The National Product Stewardship Investment Fund

In 2020, the first round of the [National Product Stewardship Investment Fund](#) provided 24 grant recipients with up to \$1M to establish PSSs. For example, The Battery Stewardship Council received a grant of \$1M in 2021 to establish B-Cycle.⁵¹

Existing stewardship schemes for e-waste

B-Cycle (voluntary)

B-Cycle – the existing battery product stewardship scheme and base case in this regulatory impact statement - was formed by the Battery Stewardship Council in 2022 to provide free battery recycling to consumers across Australia.

The National Television and Computer Recycling Scheme (co-regulatory)

In 2011, the Australian Government implemented a co-regulatory product stewardship scheme for televisions and computers, the National Television and Computer Recycling Scheme. In its life it has recycled more than 500,000 tonnes of e-waste. This scheme covers desktop computers, laptops, monitors, televisions and peripheral devices such as keyboards.

⁵⁰Circular Economy Ministerial Advisory Group, 'Circular Economy Ministerial Advisory Group Interim report', April 2024, accessed on 20 November 2024.

⁵¹ Perchards and MS2, prepared for DCCEW, 'Product stewardship in North America and Europe – Final Report', 2009, accessed on 20 November 2024.

It requires importers and producers of televisions and computer products to join a co-regulatory arrangement approved by the government. This includes the payment of membership fees which are used to fund free e-waste drop-off services to households and small businesses, as well as cover recycling costs for products covered by the scheme.⁵²

MobileMuster (voluntary)

MobileMuster was established in 1998 by the Australian Mobile Telecommunications Association to collect and recycle mobile phones. MobileMuster has maintained government accreditation since 2014. The program has been responsible for collecting and recycling nearly 1,500 tonnes of mobile phones and accessories. In July 2022, MobileMuster expanded collection and recycling to also include network connectivity products (for example modems and routers), and smart home and wearables devices, many of which include embedded batteries.⁵³

Proposed stewardship schemes for e-waste

In June 2023, the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) released a discussion paper, [Wired for Change](#) in which it foreshadowed the introduction of a regulated product stewardship scheme for:

- small electronic and electrical equipment
- small scale photovoltaic (PV) systems.

In it, the Department envisaged that it would cover:

- most of the electronic items in homes and small businesses, weighing up to 20 kg, including those in the National Television and Computer Recycling Scheme
- any embedded (but not loose) batteries.

The PV product stewardship scheme would comprise:

- solar panels, inverters, attached cabling and racking; and
- potentially household energy storage batteries.⁵⁴

In June 2024, the Australian Government said it would prioritise the development of the solar panel product stewardship scheme; however, it did not say when work on a small electronic and electrical equipment product stewardship scheme would begin.

The National Battery Strategy

By 2035, the National Battery Strategy aims to:

- make Australia a globally competitive producer of batteries and battery materials

⁵²DCCEEW, [‘National Television and Computer Recycling Scheme’](#), Australian Government, 14 June 2024, accessed on 20 November 2024.

⁵³DCCEEW, [‘Mobile Muster’](#), Australian Government, 3 October 2021, accessed on 20 November 2024.

⁵⁴ DCCEEW, [‘Wired for change: Regulation for small electrical products and solar photovoltaic systems - DCCEEW’](#), Australian Government, June 2023, accessed on 20 November 2024.

- provide secure and resilient battery supply chains
- deliver affordable and secure energy for Australians
- boost productivity
- create wealth and opportunity while being part of the global energy transition.⁵⁵

Any regulated product stewardship approach should consider alignment with the National Battery Strategy.

Funding for battery recycling research and commercialisation

The Commonwealth continues to fund battery recycling research through programs at CSIRO and Australian Research Council grants to universities, including to support the training centre for battery recycling at the University of Adelaide and Deakin University's Institute for Frontier Materials (IFM).⁵⁶

Also, the \$20.3 million 'Building Future Battery Capabilities' program will map battery value chains and support the development of nationally consistent guidelines and standards.⁵⁷

Commercialisation funding will be made available through the 'Future Made in Australia Innovation Fund' which will provide \$22.7 billion over ten years to priority industries which include battery reprocessing technologies.⁵⁸

Controlling the international movement of e-waste

Australia has ratified the *1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal* (Basel Convention). The Basel Convention is designed to reduce the movement of waste between nations, and specifically to prevent the transfer of hazardous waste from developed to less developed countries. It encourages countries to keep waste within their boundaries and as close as possible to its source of generation.

From 2025, parties to the Basel Convention have agreed to control the international movement of all e-waste (whether hazardous or not). Consequently, any proposed shipments will need to be approved by the affected import, transit and export countries. This policy change will require Basel Convention member-states to manage a far higher proportion of their e-waste domestically.⁵⁹

⁵⁵ DISR, 'National Battery Strategy | Department of Industry Science and Resources', Australian Government, 23 May 2024 accessed on 20 November 2024.

⁵⁶ University of Adelaide, 'Transformative Battery Recycling Centre awarded funding | Newsroom | University of Adelaide', 1 August 2023, accessed on 20 November 2024.

⁵⁷ Australian Trade and Investment Commission (13 June 2024) *National Battery Strategy to build Australia's battery manufacturing industry*. Retrieved on National Battery Strategy to build Australia's battery manufacturing industry | Austrade International.

⁵⁸ Budget 2024-25, 'Investing in a Future Made in Australia', July 2024 and accessed on 20 November 2024.

⁵⁹ Basel Convention, 'Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal', 2022, accessed on 20 November 2024.

State and territory waste and circular economy policies

As well as contributing to the development of the Commonwealth waste and circular economy policies, states and territories have made significant circular economy policy commitments (see Table 21).

Table 21: State and territory waste and circular economy policy objectives

Policies	
ACT	<u>The ACT Circular Economy Strategy and Action Plan 2023-2030</u> <u>Objectives</u> 1. Grow extended producer responsibility 2. Grow markets for recovered materials and goods and circular business models. 3. Create high-value jobs and attract innovative new enterprises.
NSW	<u>The NSW Government Circular Economy Policy</u> <u>Waste and Sustainable Materials Strategy 2041</u> <u>Objectives</u> 1. Sustainable management of all resources 2. Value resource productivity 3. Design out waste and pollution 4. Maintain the value of products and materials 5. Innovate new solutions for resource efficiency 6. Create new circular economy jobs
NT	<u>The Northern Territory Circular Economy Strategy 2022-2027</u> <u>Priorities</u> 1. Modernise the regulatory framework to protect the environment and create the right regulatory settings for growing the circular economy industry. 2. Start transitioning the Territory to a circular economy. 3. Establish the circular economy industry as a contributor to the Territory's \$40 billion by 2030 vision.
QLD	<u>The Queensland Waste Management and Resource Recovery Strategy</u> <u>Priorities</u> 1. Build economic opportunity. 2. Reduce the impact of waste on the environment. 3. Transition to the principles of a circular economy to help retain the value of material in the economy for as long as possible.
SA	<u>The South Australian Waste Strategy 2020-2025</u> <u>Purpose</u> 1. Avoid waste 2. Improve resource recovery 3. Increase use of recycled material and build demand and markets for recycled products. 4. Better manage material flows to benefit human health and wellbeing, the environment and the economy. 5. Improve information to support innovation, guide investment and enable informed consumer decisions.
TAS	<u>The Tasmanian Waste and Resource Recovery Strategy 2023-2026</u> <u>Purpose</u> 1. Support strong circular economy to reduce waste and greenhouse gas emissions and improve the amenity, liveability, and sustainability of Tasmania. 2. Divert products and materials from landfill and recognise the inherent value of products and materials. To invest in circular economy programs to increase the recovery and reuse of products and materials and respond to emerging issues.

WA	<u>West Australia Waste Avoidance and Resource Recovery Strategy 2030</u> <u>Objectives</u> 1. Generate less waste 2. Recover more values 3. Protect the environment.
VIC	<u>The Victorian Circular Economy Policy (Recycling Victoria - a new economy)</u> <u>Goals</u> 1. Design to last, repair and recycle. 2. Use products to create more value 3. Recycle more resources. 4. Reduce harm from waste and pollution.

Appendix 3: Cost-benefit analysis sensitivity analysis

Discount rates

Cost-benefit analysis results for a range of real discount rates. For all options, the net present value is positive, and the ranking of options is unchanged.

Table 22: Cost-benefit analysis results for different real discount rates: NSW scale, 20-year analysis period (MJA, 2024)

Metric	Option	3% real discount rate	5% real discount rate	7% real discount rate	10% real discount rate
Net present value (\$m)	Option 1	214.0	172.8	144.3	115.1
	Option 2	109.9	78.6	57.6	37.0
	Option 3	88.2	59.6	40.8	22.7
Benefit-cost ratio	Option 1	1.45	1.43	1.42	1.41
	Option 2	1.25	1.21	1.19	1.15
	Option 3	1.19	1.15	1.12	1.09

Avoided waste related fires

Cost-benefit analysis results for a range of modelled reductions in waste industry fires. For the 50% lower assumption, the net present value for Options 2 and 3 is negative. For the 20% lower assumption, the net present value for Option 3 is negative. For all options, the ranking of options is unchanged.

Table 23: Cost-benefit analysis results for different levels of reduction in waste related fires: NSW scale, 20-year analysis period, 5% real discount rate (MJA, 2024)

Metric	Option	20% higher reduction than central assumption	Central assumption	20% lower reduction than central assumption	50% lower reduction than central assumption
Net present value (\$m)	Option 1	230.7	172.8	114.5	27.3
	Option 2	123.3	78.6	33.7	-33.6
	Option 3	104.3	59.6	14.8	-52.5
Benefit-cost ratio	Option 1	1.57	1.43	1.29	1.07
	Option 2	1.33	1.21	1.09	0.91
	Option 3	1.27	1.15	1.04	0.86

Avoided leachate

Cost-benefit analysis shows results for a range of modelled reductions in leachate damage costs. For the low assumption, the net present value for Options 2 and 3 is negative. For all options, the ranking of options is unchanged.

Table 24: Cost-benefit analysis results for different levels of reduction in leachate damage costs: NSW scale, 20-year analysis period, 5% real discount rate (MJA, 2024)

Metric	Option	High assumption	Central assumption	Low assumption
	Option 1	327.7	172.8	17.9

Net present value (\$m)	Option 2	200.8	78.6	-43.7
	Option 3	181.9	59.6	-62.7
Benefit-cost ratio	Option 1	1.82	1.43	1.04
	Option 2	1.54	1.21	0.88
	Option 3	1.47	1.15	0.84

Collection and transport costs

Cost-benefit analysis results for a range of modelled unit costs for collection and transport of batteries through the stewardship scheme. For all options, the net present value is positive (apart from Option 3 when the reduction in fire frequency is 50% lower than for the central case), and the ranking of options is unchanged.

Table 25: Cost-benefit analysis results for different unit costs of collection and transport: NSW scale, 20-year analysis period, 5% real discount rate (MJA, 2024)

Metric	Option	20% lower cost than central assumption	Central assumption	20% higher cost than central assumption	50% higher cost than central assumption
Net present value (\$m)	Option 1	190.3	172.8	155.3	129.0
	Option 2	95.7	78.6	61.4	35.7
	Option 3	73.4	59.6	45.8	25.0
Benefit-cost ratio	Option 1	1.50	1.43	1.37	1.29
	Option 2	1.27	1.21	1.16	1.09
	Option 3	1.20	1.15	1.11	1.06

Recyclate value

Cost-benefit analysis results for a range of assumed recyclate values for batteries recycled through the stewardship scheme. For all options, the net present value is positive, and the ranking of options is unchanged.

Table 26: Cost-benefit analysis results for different assumed values of recovered material from batteries: NSW scale, 20-year analysis period, 5% real discount rate (MJA, 2024)

Metric	Option	20% higher value than central assumption	Central assumption	20% lower value than central assumption	50% lower value than central assumption
Net present value (\$m)	Option 1	177.2	172.8	168.4	161.9
	Option 2	82.1	78.6	75.1	69.9
	Option 3	63.1	59.6	56.1	50.9
Benefit-cost ratio	Option 1	1.44	1.43	1.42	1.40
	Option 2	1.22	1.21	1.20	1.19
	Option 3	1.16	1.15	1.14	1.13

Appendix 4 - Better regulation principles

The methodology used in this regulatory impact statement is consistent with the requirements of the *Product Lifecycle Responsibility Act 2025*, the *Subordinate Legislation Act 1989* and the NSW Government Guide to Better Regulation.

The requirements and principles of the above are outlined below and cross-referenced to the relevant section of this regulatory impact statement (unless otherwise referenced).

Table 27: Product Lifecycle Responsibility Act 2025

Requirement	Assessment (in this regulatory impact statement)
1. Requirements as these relate to reporting arrangements and action plans and evaluation.	See section 8.2 and draft Regulation

Table 28: Subordinate legislation Act 1989

Requirement	Assessment (in this regulatory impact statement)
1. Wherever costs and benefits are referred to in these guidelines, economic and social costs and benefits are to be considered and given due consideration.	See sections 4, 7 and 8
2. (a) Objectives sought to be achieved and reasons for them must be clearly stated.	See sections 1.1 and 4.
(b) objectives must be checked to be reasonable, appropriate accord with enabling Act	See section 1.1.
(c) Alternative options, including not proceeding must be considered	See section 6 and 7.
(d) Costs and benefits of each option to be compared with those of statutory rule	See draft Regulation.
(e) If statutory rule is to impinge on another authority's area of responsibility consultation required to reconcile differences, overlapping and duplication	Not relevant
3. Administrative decisions to be based on adequate information and consultation concerning the need for and consequences of the proposed action	See sections 4 (need) and 7 (consequences)
4. Benefits to outweigh anticipated costs	See section 7.
5. Alternative option with greatest net benefit should be chosen	See sections 7 and 8 and draft Regulation.
6. Statutory rule must be expressed plainly and unambiguously and consistent with enabling legislation	See draft Regulation.

Table 29: Better regulation principles, from the NSW Government Guide to Better Regulation

Principle	Assessment (in this regulatory impact statement)
Principle 1: The need for government action should be established. Government action should only occur where it is in the public interest, that is, where the benefits outweigh the costs.	See section 4 Problem statement and objectives for government action
Principle 2: The objective of government action should be clear.	See sections 1.1 and 4.
Principle 3: The impact of government action should be properly understood, by considering the costs and benefits (using all available data) of a range of options, including non-regulatory options.	See sections 7 and 8.
Principle 4: Government action should be effective and proportional.	See section 8.
Principle 5: Consultation with business, and the community, should inform regulatory development.	See section 5.
Principle 6: The simplification, repeal, reform, modernisation or consolidation of existing regulation should be considered.	See section 6.
Principle 7: Regulation should be periodically reviewed, and if necessary reformed, to ensure its continued efficiency and effectiveness.	See section 8.3.



Published by NSW Environment
Protection Authority

Visit:

6 Parramatta Square
10 Darcy Street
Parramatta NSW 2150

Mail:

Locked Bag 5022,
Parramatta NSW 2124

Phone:

+61 2 9995 5000 (switchboard)

TTY users:

Phone 133 677, then ask for 131 555

Speak and listen users:

Phone 1300 555 727, then ask for 131 555

Email:

info@epa.nsw.gov.au

Website:

epa.nsw.gov.au

Report pollution and
environmental incidents

Environment Line:

131 555 (NSW only) or

info@epa.nsw.gov.au

ISBN 978 1 923328 38 9

EPA 2025P4631

October 2025

© 2025 State of NSW and the NSW Environment Protection
Authority

With the exception of photographs, the State of NSW and
the NSW Environment Protection Authority (EPA) are
pleased to allow this material to be reproduced in whole or
in part for educational and non-commercial use, provided
the meaning is unchanged and its source, publisher and
authorship are acknowledged. Specific permission is
required for the reproduction of photographs.

All content in this publication is owned by the EPA and is
protected by Crown Copyright, unless credited otherwise. It
is licensed under the Creative Commons Attribution 4.0
International (CC BY 4.0), subject to the exemptions
contained in the licence. The legal code for the licence is
available at Creative Commons.

The EPA asserts the right to be attributed as author of the
original material in the following manner: © State of New
South Wales and the NSW Environment Protection
Authority 2025.