Introduction

- “the initiative will modify the Directive or a proposal for a new Regulation repealing the Directive will be prepared, to notably encompass end-of-life and sustainability requirements. (… Q4 2020)” 2020 CWP
- Information from
  - Studies and consultation underpinning the assessment and evaluation of the Directive,
  - Studies and consultation carried out in the context of the ‘eco-design’ process,
  - Extensive consultation processes during and following up to the Strategic Action Plan on Batteries,
  - Two specific studies,
    - *Feasibility of measures addressing shortcomings in the current EU batteries framework system,*
    - *Study addressing particular topics on batteries (legal statuses, restrictions, etc).*

Proposed approaches and measures

- Taken from
  - EU institutions
  - Stakeholders' proposals
  - Technical and scientific publications
- Disclaimer

This document is part of a study which is being prepared for the European Commission. However, the information and views set out in this report are those of the authors and do not necessarily reflect the official opinion of the Commission. The Commission does not guarantee the accuracy of the data included in this initial presentation of results.

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Batteries Directive 2006/66/EC

Öko-Institut e.V.
Institut für angewandte Ökologie
Institute for Applied Ecology

Initial results of the study in support of the assessment of the Batteries Directive

Deposit Refund Systems (DRS)

Vienna, April 2020



DEPOSIT REFUND SYSTEM (DRS)

Measure 1

Assessment of possible measures establishing deposit and refund systems for batteries

DEPOSIT REFUND SYSTEM (DRS)

CONTENT / OVERVIEW

DEPOSIT REFUND SYSTEM (DRS)

PROBLEM DESCRIPTION

What is the current problem?

- A lot of waste portable batteries are not collected properly and end-up in residual waste, are lost through WEEE or are exported.
- Only about half of all MS (Member States) reach the 45% collection target.
- Overall, about 45% waste portable batteries are collected in the EU.

Low separate collection of portable batteries (losses: residual waste, batteries integrated in WEEE , exports)

Article 8 of the Batteries Directive (2006/66/EC) → MS shall ensure that appropriate collection schemes are in place for waste portable batteries and accumulators. One already existing measure for the take back of batteries is the EPR (Extended producer responsibility) schemes.

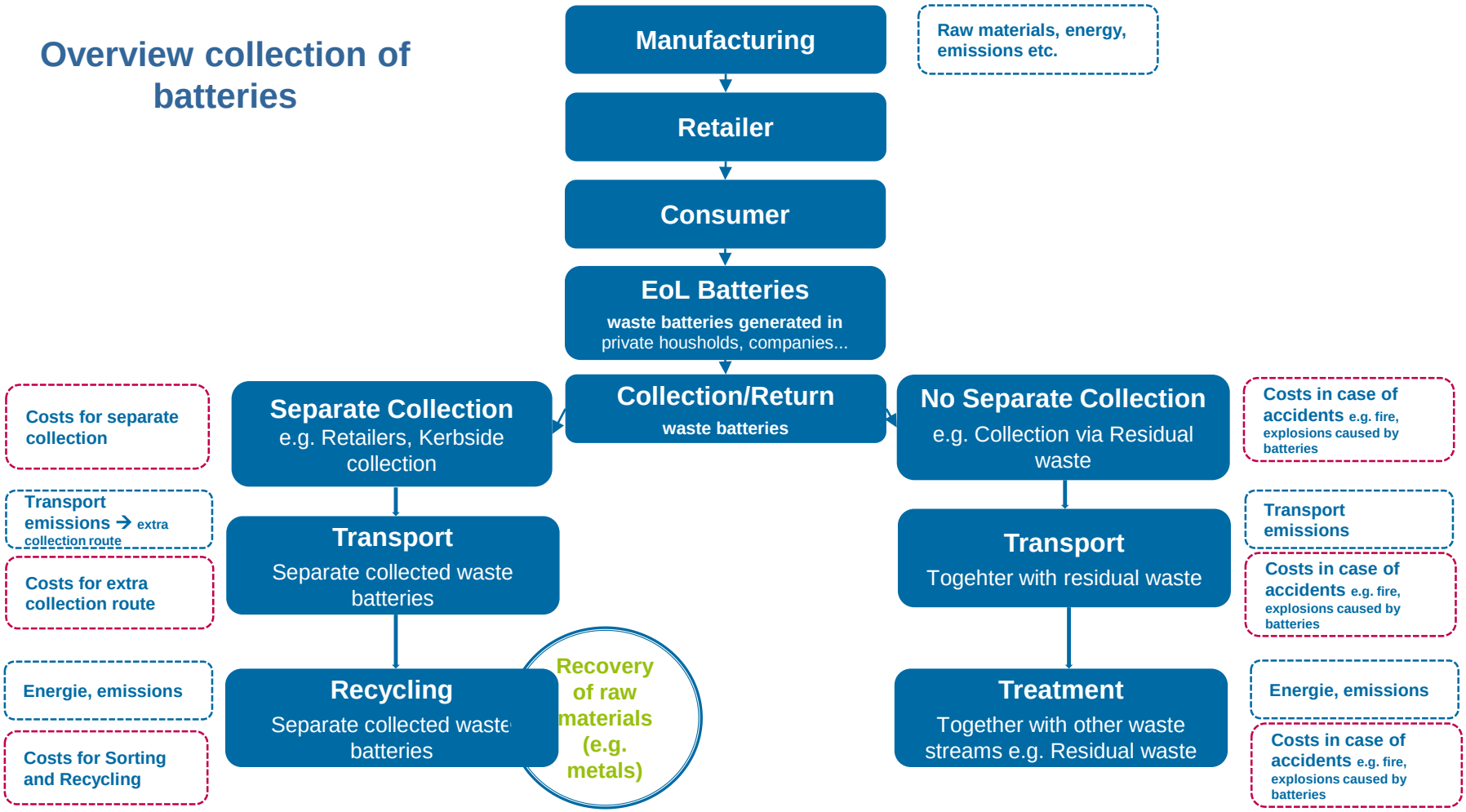
The high level of batteries lost is worrying since it increases the risk of pollution by hazardous components of waste batteries.

The purpose of this measure encompasses the assessment of deposit and refund systems (DRS) as measures for closing the gaps in the collection of different types of batteries.

DEPOSIT REFUND SYSTEM (DRS)

PROBLEM DESCRIPTION

Overview collection of batteries



DEPOSIT REFUND SYSTEM (DRS)

CONTENT / OVERVIEW

DEPOSIT REFUND SYSTEM (DRS)

LEGISLATION

From a legislative perspective, is the implementation of a DRS possible?

A provision in the EU Batteries Directive requiring MS to set up a deposit system may raise concerns about compliance with the principle of subsidiarity.

To compare the level of obligations of such a measure with other EU law, as a starting point, EU waste legislation recognises the following references to deposit systems:

- Article 4(3) WFD in conjunction with Annex IVa: Suggested use of deposit refund schemes and other measures to encourage efficient collection of used products and materials.
- Article 9(1)(a) SUP Directive: Member States may inter alia establish deposit refund schemes.
- Article 5(1)(a) Packaging Directive: Measures may include, inter alia the use of deposit-return schemes.
- Obviously, these all are examples where the Member States are free to introduce a deposit system also to decide on comparable approaches in line with pursuing the aim set by EU legislation.

DEPOSIT REFUND SYSTEM (DRS)

LEGISLATION

- Yet, there are examples of EU legislation which contain clear obligations concerning specific systems to be implemented by Member States.
  - Article 5(2) WEEE Directive determines that for WEEE from private households, Member States shall ensure that systems are set up allowing final holders and distributors to return such waste at least free of charge.
  - Member States shall ensure that when supplying a new product, distributors are responsible for ensuring that products can be returned at least free of charge

From legal point of view, currently it should be possible to introduce a deposit system for batteries in MS.

DEPOSIT REFUND SYSTEM (DRS)

CONTENT / OVERVIEW

DEPOSIT REFUND SYSTEM (DRS)

OPTIONS

Which options were considered?

Four options are considered and assessed.

- Baseline (current situation)
- Option 1 (non-binding legal provisions)
- Option 2 (obligatory DRS implementation in MS)
- Option 3 (alternative scenario with obligatory DRS + kerbside collection)

A kerbside collection without DRS as a separate scenario was not considered.

DEPOSIT REFUND SYSTEM (DRS)

OPTIONS - Baseline

The baseline reflecting the **current situation with no binding regulations** regarding the establishment of DRS systems is prescribed in the regulation. Article 8 of the Batteries Directive (2006/66/EC) → MS shall ensure that appropriate collection schemes are in place for waste portable batteries and accumulators. One already existing measure for the take back of batteries is the EPR (Extended producer responsibility) schemes.

cons

- Low collection rate
- Failure to achieve the objectives/targets of the Regulation
- An increasing problem is fires in treatment plants, due to Li-ion batteries that were not previously collected separately. Operators of recycling plants have problems with insurance companies to recover the cost of their damage.
- Loss of secondary raw materials

pros

+ No change in the collection
+ No costs for the implementation and operation of a DRS for batteries

DEPOSIT REFUND SYSTEM (DRS)

OPTIONS – Option 1

Option 1 includes the **introduction of possible new regulatory framework**. This contains non-binding legal provisions defined at the EU level to harmonize fully or partially the characteristics and the functioning of DRS, while leaving the decision on if and how to implement such a system to the MS. This option shall create a level playing field giving MS the flexibility to take into account national circumstances in terms of established schemes for batteries. More regulations concerning e.g. clearing house, deposit tourism, direct imports of private persons from non-EU countries, labelling etc. are necessary. Assumption: 30 % of MS will implement it.

cons

- Cost for the establishment and operation for DRS
- Deposit tourism → if some MS don't implement DRS, illicit cross-border shipments may occur
- Imports directly by final consumers or by EU traders from third countries (mainly China) without a deposit system. Processing would only be possible through the organs of customs clearance, see measure online sells.
- If the selling price is artificially increased by adding a deposit to the purchase price, this automatically increases the cost for the consumer. This has the effect that the consumer looks for alternative purchase opportunities in the EU and outside EU.

pros

+ Higher collection rates → higher amounts recycled (recovery of raw materials)
+ National circumstances in different MS can be considered
+ Negative effects of improper collection are reduced

DEPOSIT REFUND SYSTEM (DRS)

OPTIONS – Option 2

Option 2 **"A new regulatory framework for batteries in the EU"** is requiring Member States to establish DRSs and establishing legal provisions defined at EU level to harmonise fully the characteristics and the functioning of these systems. Assumption: **100 % of MS will implement** it. The law requires all MS to introduce a deposit for certain types of batteries. More detailed regulations concerning e.g. clearing house, deposit tourism, direct imports of private persons from non-EU countries, labelling etc. are necessary.

cons

- Different starting points/ circumstances in the MS –> implementation of fully harmonized DRS could be more difficult for some MS due to their current situation
- Different MS have different purchase power. The implementation of a DRS with a fix, common deposit throughout the MS might lead to distortions on the market (e.g. the same deposit amount might be too low for richer MS or too high for less wealthy MS)
- Height of the deposit varies → "deposit tourism"
- Cost for the establishment and operation for DRS need to be covered
- Deposit for long lasting batteries e.g. Li-ion →capital for deposit is long bound
- It is necessary to implement an infrastructure for battery deposit, the management system (e.g. Clearinghouse) and labelling

DEPOSIT REFUND SYSTEM (DRS)

OPTIONS – Option 2

cons

- If the selling price of the final distributor is artificially increased by adding a deposit to the purchase price, this automatically has the effect that the final consumer looks for alternative purchase opportunities in the EU and outside EU.

pros

+ Increasing collection rate
+ One “clear” and uniform measure for all MS
+ Mandatory implementation of DRS leads to higher collection rates in all MS
+ Good comparability between specific performance of MS
+ in a harmonized DRS cross-border shipment between MS shouldn’t be a problem

DEPOSIT REFUND SYSTEM (DRS)

OPTIONS – Option 3

Option 3 consists of **Option 2 + kerbside collection :** As an alternative to DRS, collection of portable batteries directly from households is considered. Assumption: **100 % of MS will implement** it. Small waste batteries are collected directly from households by the local authority (e.g. municipalities). Small waste batteries are collected in a separate collection container/bin (acid resistant) in private households. The collection vehicles for the collection of the residual waste are additionally equipped with a collection device for the collection of batteries. This means that the residual waste and the separately collected batteries are collected together in a vehicle with separate compartments.

cons

- Due to the increased risk of fire and explosion caused by the collection of larger quantities of batteries, collection in closed garbage rooms of apartment buildings or larger building complexes is not suitable.
- Refuse collection vehicles must be converted for the additional collection of batteries from households in such a way that the collection containers are acid-resistant and even damaged Li-ion batteries cannot cause damage.
- Individual contracts between Municipalities an Producers/Importers of batteries → distortion of competition

pros

+ Increasing collection rate for small batteries
+ By separating of batteries from residual municipal waste stream, the environmental impacts will be reduced e.g. collection via residual waste and common treatment, the incinerator bottom ash being classified as hazardous waste due to the level of heavy metals within the ash.
+ Prevention of accidents (e.g. explosions, fires) in residual waste treatment plants and recycling plants

DEPOSIT REFUND SYSTEM (DRS)

CONTENT / OVERVIEW

DEPOSIT REFUND SYSTEM (DRS)

SELECTION OF BATTERIES

Which batteries are suitable for a deposit and a kerbside collection in combination with a deposit?

Batteries (portable batteries, E-bikes and e-scooters batteries) suitable for the various options were selected and examined in detail.

Standard replaceable batteries (primary and rechargeable): including AA/AAA batteries, the button cell batteries etc. (Li, NiMH, Pb-acid, alkaline, etc.)

- non rechargeable and rechargeable
- high amount placed on the market
- a part of primary batteries are not properly collected and finally wrongly disposed of, e.g. they end-up in residual waste, due to their small size and little economic value
- portable primary Li batteries may cause fire if damaged
- low collection rate

- The biggest barrier to successfully implement a DRS for these batteries is their relatively **low cost**, which makes it difficult to set a deposit amount which is high enough to make it attractive for the consumer to bring them back to the shop, but low enough not to over exceed the purchase costs of the battery.
- These batteries are of relatively **low economic value** also for waste processors.
- The **labelling** on small batteries could be a problem (e.g. QR code)
- Many different types and compositions require **sorting** according to the separate collection

DEPOSIT REFUND SYSTEM (DRS)

SELECTION OF BATTERIES

Li-ion portable batteries embedded in electronic equipment (mobile phone, toothbrush, vacuum cleaner, electro razor etc.):

- amount and applications are steadily increasing (nowadays, 90 % are Li-Ion batteries)
- a part of these batteries are **non-removable by consumers**
- low collection rates

- They embed resources (such as Co, Ni etc.), which cause significant **environmental impacts** during the extraction phase.
- Their dispersion in the environment or their hoarding in households after the useful life, and the risks of fire if poorly managed, make this type of batteries a priority item to be collected and properly treated and recycled.
- Batteries used in electrical appliances (e.g. smartphones) might not be able to be easily removed by consumers. It is questionable whether a deposit on batteries can be transferred to an electrical appliance. This would then have to be returned to the retailer and the deposit would then be received for the battery or the appliance.
- Under no circumstances should consumers remove embedded, deposit-paid batteries. This can lead to accidents.

DEPOSIT REFUND SYSTEM (DRS)

SELECTION OF BATTERIES

E-bikes (and e-scooters) batteries, power tools:

- the market for e-bikes is growing rapidly
- the battery of e-bikes can normally be replaced very easily by consumer
- the battery of power tools can be replaced very easily and can often be used for several devices of the same brand
- depending on the charging cycles long service life
- risk of fire / accident
- tend to store at home in drawers, garages etc.

- Deposit system for long lasting goods: Li-ion batteries, whose average useful life is about six years, are to be classified as durable goods. Experience with deposit systems for durable goods such as refrigerators has shown that deposits paid on them are often not collected even after many years of use, partly because of the long useful life of the goods and partly because of the loss of the deposit mark or the loss of knowledge about the deposit. The labelling should therefore be applied directly to the battery.
- Damaged batteries or batteries that are no longer efficient can be brought back to the retailer in the shop. The deposit will be refunded. The contacts of the battery will be taped by the seller and the returned batteries will be collected separately in appropriately equipped collection containers.

DEPOSIT REFUND SYSTEM (DRS)

SELECTION OF BATTERIES

Batteries have a special hazard potential. In particular Li and Li-ion batteries, due to their composition carry a high risk of burning (and release of poisonous gases) or exploding.

The risks for the various options are shown in the table below:

Option	Collection	Transport	Sorting / Recycling
Baseline	Retailer: common collection of all batteries in one box. Damaged batteries can cause fires. Collection together with Residual waste: if batteries are collected together in one bin with residual waste, damaged batteries or untaped contacts can cause accidents (fire, explosion)	Batteries, which are collected together with the residual waste, can start to burn in refuse collection vehicles and cause damage.	Batteries that are not collected separately and treated together with other waste streams can cause accidents and damage in treatment plants.
Option 1 and 2	Automated return machines take back certain batteries and tape the contacts of li-ion batteries. the machines are equipped to prevent accidents caused by damaged batteries. Return to Retailer: Retailers tape the contacts of the batteries and collect them in appropriate collection containers. this prevents accidents.	Separately collected batteries are collected, stored and transported in appropriate containers. This prevents accidents.	Properly separated collection of batteries prevents contamination of other waste streams and is treated separately in appropriate treatment facilities. This avoids accidents and damage.
Option 3 Kerbside	separate collection of batteries in special collection container from households. Damaged batteries or untaped contacts can lead to accidents in households or apartment buildings.	Collection vehicles are appropriately equipped for separate collection of batteries to prevent accidents.	See above

DEPOSIT REFUND SYSTEM (DRS)

SELECTION OF BATTERIES

Which batteries are suitable for DRS and/or Kerbside Collection?

Term for battery used in the simulation model*	Chem.		Kerbside collection	Deposit
Pedelec (e-bike, e scooter)	Li- Ion		Kerbside Collection: Due to weight, size and hazard potential (fire, explosion) **not** suitable for kerbside collection	**Suitable** for deposit; manual return to retailer (taping of contacts, collection in appropriate containers)--> separate collection; - Cost ($$$) (set up and operation DRS, Retailer (take back), transport, sorting, recycling) + Separate collection → increasing collection rate + Proper collection prevents accidents (fire, explosion) + Recovery of metals
Electronic equipment (mobile phones, notebook, toothbrushes, electric shavers…)			Kerbside Collection: Due to weight, size and hazard potential (fire, explosion) **not** suitable for kerbside collection	**Suitable** for deposit; manual return to retailer (taping of contacts, collection in appropriate containers)--> separate collection; - Cost ($$$) (set up and operation DRS, Retailer (take back), transport, sorting, recycling) + Separate collection → increasing collection rate + Proper collection prevents accidents (fire, explosion) + Recovery of metals
New Applications (cleaning robots, mowing robots, drone..)			Kerbside Collection: Due to weight, size and hazard potential (fire, explosion) **not** suitable for kerbside collection	**Suitable** for deposit; manual return to retailer (taping of contacts, collection in appropriate containers)--> separate collection; - Cost ($$$) (set up and operation DRS, Retailer (take back), transport, sorting, recycling) + Separate collection → increasing collection rate + Proper collection prevents accidents (fire, explosion) + Recovery of metals

*In the simulation model, the different types of batteries and batteries embedded in devices were combined into the terms Pedelec, Electronic equipment, New Applications, Power tool, Other Applications and Primary batteries

DEPOSIT REFUND SYSTEM (DRS)

SELECTION OF BATTERIES

Which batteries are suitable for DRS and/or Kerbside Collection?

	Chem.		Kerbside collection	Deposit
Power tool (cordless screwdriver	Li- Ion		Kerbside Collection: Due to weight, size and hazard potential (fire, explosion) **not** suitable for kerbside collection	**Suitable** for deposit; manual return to retailer (taping of contacts, collection in appropriate containers)--> separate collection; - Cost ($$$) (set up and operation DRS, Retailer (take back), transport, sorting, recycling) + Separate collection → increasing collection rate + Proper collection prevents accidents (fire, explosion) + Recovery of metals
Other Applications (secondary batteries-rechargeable)	NiCd, NiMH,		Kerbside Collection: Due to weight, size **suitable** for kerbside collection - Cost ($) conversion of the collection vehicles for the additional collection of batteries --> one-time costs + Separate collection → increasing collection rate + Recovery of metals + collected together in a route with another waste stream --> saving of additional transport costs and associated emissions	**Suitable** for deposit; manual or automatic (return machines) return to retailer (taping of contacts, collection in appropriate containers)--> separate collection; - Cost ($$$) (set up and operation DRS, Retailer (take back), transport, sorting, recycling) + Separate collection → increasing collection rate + Proper collection prevents accidents (fire, explosion) + Recovery of metals
Primary batteries (non-rechargeable)	Alkaline, button cells etc.		Kerbside Collection: Due to weight, size **suitable** for kerbside collection - Cost ($) conversion of the collection vehicles for the additional collection of batteries --> one-time costs + Separate collection → increasing collection rate + Recovery of metals + collected together in a route with another waste stream --> saving of additional transport costs and associated emissions	**Suitable** for deposit; manual return to retailer (taping of contacts, collection in appropriate containers)--> separate collection; - Cost ($$$) (set up and operation DRS, Retailer (take back), transport, sorting, recycling) + Separate collection → increasing collection rate + Proper collection prevents accidents (fire, explosion) + Recovery of metals

*In the simulation model, the different types of batteries and batteries embedded in devices were combined into the terms Pedelec, Electronic equipment, New Applications, Power tool, Other Applications and Primary batteries

DEPOSIT REFUND SYSTEM (DRS)

CONTENT / OVERVIEW

DEPOSIT REFUND SYSTEM (DRS)

ASSUMPTIONS

What assumptions for the implementation of the assessment were made for option 1, 2 and 3?

Main assumptions for option 1 and 2

Measure assumed to start in 2023, results of higher collection later due to lifetime of batteries. Some assumptions are taken to define the main features of the DRS.

- The costs of a one-way deposit system are broken down into **process costs,** directly related to the material flow (e.g. for taking back, transport and sorting) and **administrative costs** for administration, clearing and registration.
- As a rule, the financing of one-way deposit systems is based on material revenues, deposit slippage and producer fees.
- The following **parameters** should be taken into account **for the financing** of a deposit system for disposable items: Collection rate, deposit amount, average weight and type of batteries, batteries placed on the market, revenue from waste material per ton of sorted deposit goods.
- Registration fee for distributors (manufacturers, bottlers, importers etc.) This is a one-off registration fee to participate in the deposit system.
- An independent body, a so-called **clearing house**, must be set up for the management of DRS

DEPOSIT REFUND SYSTEM (DRS)

ASSUMPTIONS

Main assumptions for option 1 and 2

A DRS is established for all batteries and is defined as follows**:**

- For standard replaceable batteries (primary and rechargeable): including cylindrical batteries (AA/AAA), the button cell batteries etc. (Li, NiMH, Pb-acid, alkaline, etc.)
- For Li-ion portable batteries embedded in electronic equipment (mobile phone, toothbrush, vacuum cleaner, electro razor etc.)
- For Li-ion batteries including e-bikes (and e-scooters), power tools
- For batteries that cannot be removed by the end user, the amount of the deposit for batteries is applied, but the entire electrical appliance is taken back in the trade. This means that in practice the entire appliance is marked as being subject to a deposit. i.e. the device containing embedded batteries is subject to a deposit. Legal regulations would be contained in the WEEE Directive.
- A DRS for Li-ion portable batteries embedded in electronic equipment (mobile phone, toothbrush, vacuum cleaner, electro razor etc.) and Li-ion batteries from e-bikes (and scooters) and power tools is managed with the establishment of **return points** on retailers or waste management collection points. The return of the batteries is performed manually by the shop/ collection system operator. Special rooms and bins must be equipped for storing the batteries, especially against fire risks. The sustainability of the system (e.g. the tracking of batteries for which a deposit was paid can be ensured by demanding the original receipt (e.g. same system as for products warranties)

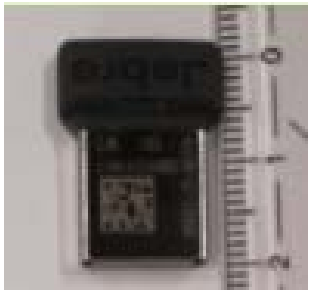
DEPOSIT REFUND SYSTEM (DRS)

ASSUMPTIONS

Main assumptions for option 1 and 2

- **Deposit amounts** are a good compromise between attractiveness for consumers (e.g. to bring the battery back), and the price of the product or appliance where the battery is embedded. These can be in the order of :
    1. 50 Euros for a e-bike battery (price for a new battery: 400 – 1000 Euro)
    2. 10-15 Euro for a notebook/smart phone battery (price for a new phone: 300-700 Euro)
    3. 20 Euros for power tools

- Batteries must be **labelled** in such a way that it is clearly and easily recognizable that they are subject to a deposit. E.g. bar code, colour code, structure codes, QR codes .
- The code should not be easily removable, clearly identifiable and forgery-proof.
- QR codes are very common and can be applied to very small areas.



DEPOSIT REFUND SYSTEM (DRS)

ASSUMPTIONS

Main assumptions for option 1 and 2

- For small portable batteries (primary and rechargeable batteries; type AA, AAA, button cell batteries) a DRS system can be implemented by means of reverse vending machines for the **automatic return** of batteries (similar to glass bottles return machines) due to their reduced size; or **manual** collection in shops.
  - In the case a distributor system is implemented:
    - No such examples exists at the moment for batteries. Automated systems would be installed in retailer shops. Regular collection and emptying of the machines must be conducted regularly. Labeling of the batteries for optical recognition or similar would be required.
  - Alternatively, collection should happen manually in the shops, e.g. the shop operator takes back the batteries and place them in a special container/bin.
  - A **deposit amount** for these batteries should be in the order of 30 - 50 cents for primary and rechargeable batteries (price per unit for new batteries: 1,5 – 3 Euro).
  - **Risk** of fire caused by Li and Li-ion batteries exist for both automated and manual take back system.

DEPOSIT REFUND SYSTEM (DRS)

ASSUMPTIONS

Main assumptions for Option 1 and 2

For the different batteries, it is assumed that the implementation for DRS **would lead to the following increase in the collection rates.**

Terms for battery used in the simulation	Chemistry	Example	Return Point in the scenario	Estimated increase in the collection rates %	Main assumptions behind the estimated increase in the collection rates
Pedelec	Li- Ion	e-bike, e scooter	Retailers (manual)	20	The deposit amount is a good incentive for consumers to bring the removable battery back
Electronic equipment		mobile phones, notebook		15	The deposit amount is a good incentive, but concerns with data privacy will be a deterrent for consumers to bring back batteries in appliances that cannot be removed by end users. If the battery can be easily removed, it can be returned without the device .
		toothbrushes, electric shaver			The deposit amount is a good incentive and high enough to be an incentive for consumer to bring the battery back, but some appliances containing batteries, that could not be removed by end users, might still be stored at home. If the battery can be easily removed, it can be returned without the device .
New Applications		Cleaning robots, mowing robots, drone,		15	The deposit amount is a good incentive and high enough to be an incentive for consumer to bring the battery back, but some appliances containing batteries, that could not be removed by end users, might still be stored at home. If the battery can be easily removed, it can be returned without the device .

DEPOSIT REFUND SYSTEM (DRS)

ASSUMPTIONS

Main assumptions for Option 1 and 2

For the different batteries, it is assumed that the implementation for DRS **would lead to the following increase in the collection rates.**

Term for battery used in the simulation	Chemistry	Example	Return Point in the scenario	Estimated increase in the collection rates %	Main assumptions behind the estimated increase in the collection rates
Power tool		Power tools like cordless screwdriver	Retailers (manual)	25	The deposit amount is a good incentive and high enough to be an incentive for consumer to bring the removable battery back.
Other Applications (secondary batteries-rechargeable)	NiCd, NiMH,	Cylindrical batteries	Retailers (automated machines ; or manual collection)	20	The deposit amount is a good incentive and high enough to be an incentive for consumer to bring the removable battery back.
Primary batteries (non-rechargeable)	Alkaline, button cells etc.	Button batteries, cylindrical batteries (AA, AAA)	Retailers (automated machines ; or manual collection)	20	The deposit which can be applied to these batteries cannot be too high; some consumers will not find it attractive to bring the batteries back.

DEPOSIT REFUND SYSTEM (DRS)

ASSUMPTIONS

Main assumptions for option 3

For the different batteries, a combination of DRS schemes and kerbside collection can be established :

- For batteries including e-bikes (and e-scooters), Electronic Equipment, Power Tools, New Applications a DRS is managed with the establishment of return points on retailers or waste management collection points, as in Option 1 & 2.
- For **small portable batteries** (primary batteries type AA, AAA, button batteries- rechargeable and non rechargeable batteries) a **kerbside collection** is implemented.

DEPOSIT REFUND SYSTEM (DRS)

ASSUMPTIONS

Main assumptions for Option 3

For the different batteries, it is assumed that the implementation for DRS **would lead to the following increase in the collection rates.**

Term for battery used in the simulation	Chemistry	Example	Return Point in the scenario	Estimated increase in the collection rates %	Main assumptions behind the estimated increase in the collection rates
Pedelec	Li- Ion	e-bike, e scooter	Retailers (manual)	20	As in Options 1 & 2
Electronic equipment		mobile phones, notebook		15	As in Options 1 & 2
		toothbrushes, electric shaver			As in Options 1 & 2
New Applications		Cleaning robots, mowing robots, drone,		15	As in Options 1 & 2

DEPOSIT REFUND SYSTEM (DRS)

ASSUMPTIONS

Main assumptions for Option 3

For the different batteries, it is assumed that the implementation for DRS **would lead to the following increase in the collection rates.**

Term for battery used in the simulation	Chemistry	Example	Return Point in the scenario	Estimated increase in the collection rates %	Main assumptions behind the estimated increase in the collection rates
Power tool	Li- Ion	Power tools like cordless screwdriver	Retailers (manual)	25	As in Options 1 & 2
Other Applications (secondary batteries-rechargeable)	NiCd, NiMH,	Cylindrical batteries	Kerbside collection	40	The proximity of collection points to the households will be an incentive for sorting the batteries, as it is common practices with other recyclables such as paper, metal, glas, etc.
Primary batteries (non-rechargeable)	Alkaline, button cells etc.	Button batteries, cylindrical batteries (AA, AAA)	Kerbside collection	40	The proximity of collection points to the households will be an incentive for sorting the batteries, as it is common practices with other recyclables such as paper, metal, glas, etc.

DEPOSIT REFUND SYSTEM (DRS)

CONTENT / OVERVIEW

DEPOSIT REFUND SYSTEM (DRS)

IMPACT ASSESSMENT

What are the main impacts of the different options?

General approaches

- Collection rates were assumed for selected batteries based on data from residual waste analyses, studies, calculations and comparisons with other existing deposit systems (e.g. vehicle batteries, beverage packaging).
- In the simulation model the following batteries and application types were distinguised: Primary Batteries, Power Tools, Electronic equipment (Laptops, cell phones etc.), New applications (vacuum cleaners, etc.) and Other applications.
- Measure assumed to start in 2023, results of higher collection later due to lifetime of batteries.
- Calculations in the model were carried out for the years 2022, 2023, 2024, 2026, 2028, 2030, 2032, 2034 and 2035 on the expected collection volumes with deposit system (option 2) and kerbside collection.
- The calculated quantities came from the model and are shown in tons. The costs were estimated based on literature research. For the Kerbside collection data from EPA* and for DRS data were taken from a new study by the Austrian Ministry of Environment**

*https://archive.epa.gov/wastes/conserve/tools/localgov/web/html/collection.html

**https://www.bmvit.gv.at/service/presse/kunststoffverpackungsmuell.html

DEPOSIT REFUND SYSTEM (DRS)

IMPACT ASSESSMENT

General approaches

For option 2 and 3 the impact are examined according to the following areas:

A. Quantity (in tonnes)

1. Addition amounts collected

- *in total*
- *per different batterie types*

2. Recovery of cobalt from Li-ion batteries (option 2 only)

3. Reduction of CO^2 (option 2 only)

B. Costs indication (($=low; $$= medium; $$$= high)

1. Set-up costs

2. Cost of operation

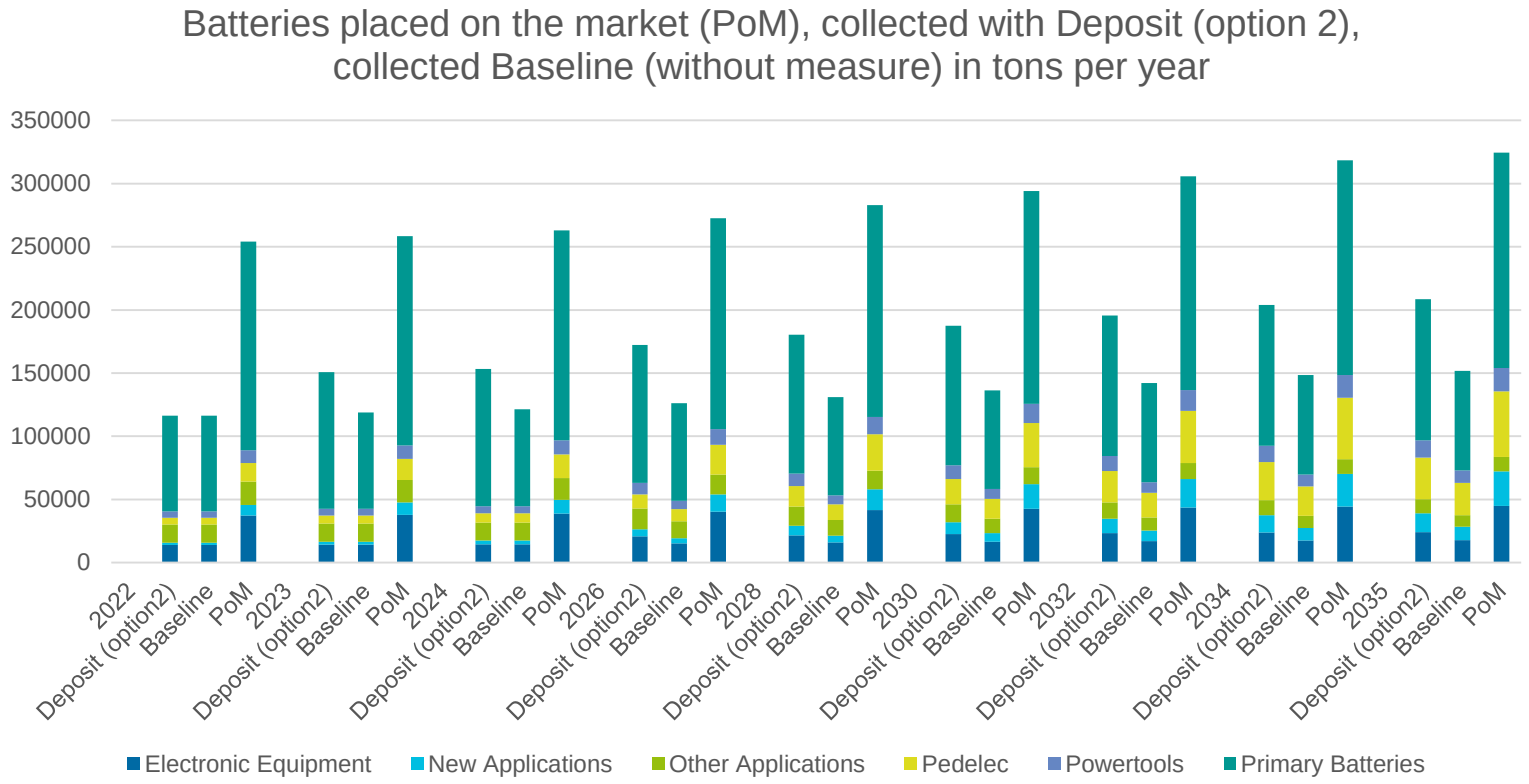
3. Additional cost

DEPOSIT REFUND SYSTEM (DRS)

IMPACT ASSESSMENT

A.1 Total collected batteries - Option 2

- By 2035: 50 000 t/a more collected batteries than in the baseline (mostly primary batteries)
- (For Option 1: 15 000 t/a more more collected batteries than in the baseline)

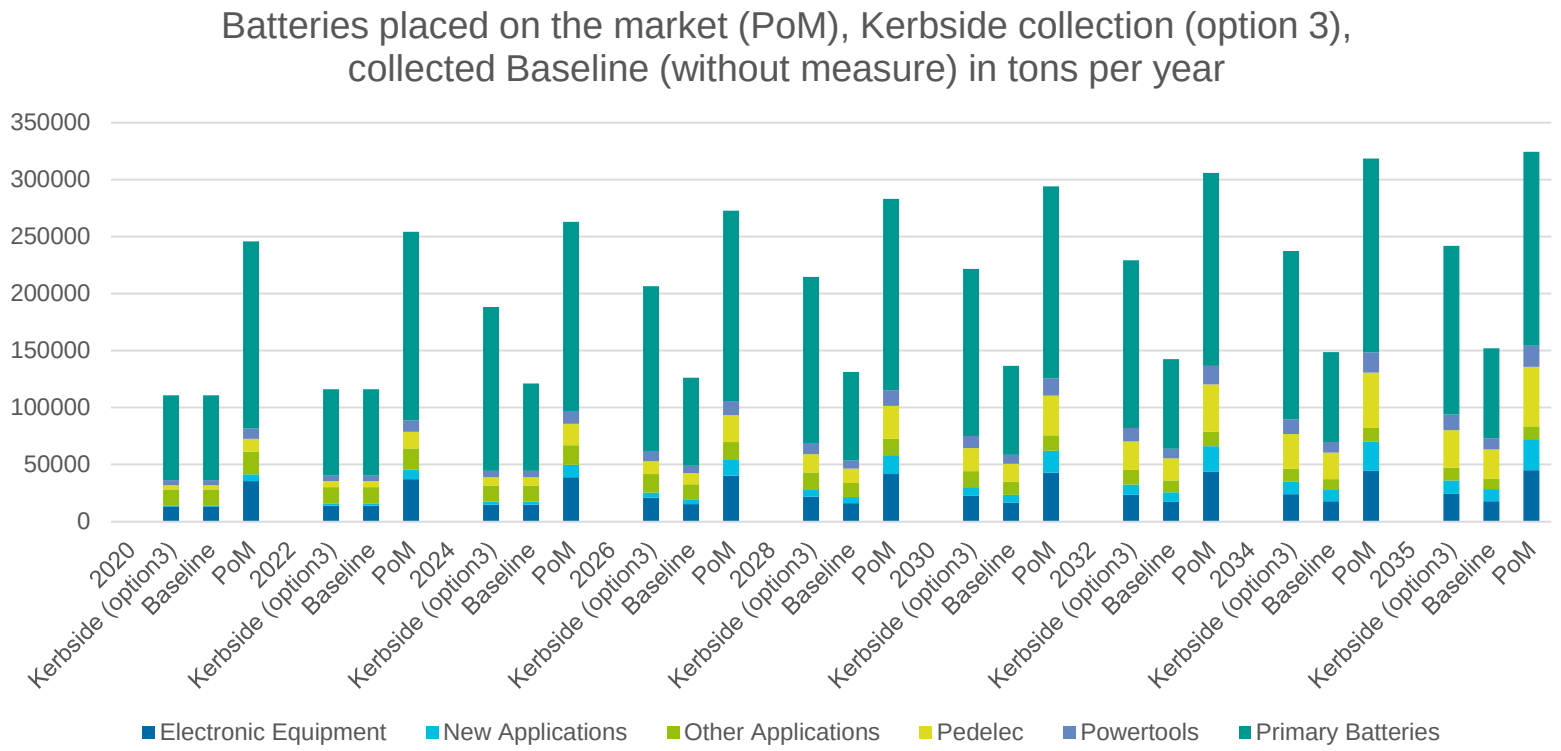


DEPOSIT REFUND SYSTEM (DRS)

IMPACT ASSESSMENT

A.1 Total collected batteries - Option 3

- By 2035: 100 000 t/a more collected batteries than in the baseline
- Especially in the field of primary batteries their is an hincreasing collection rate

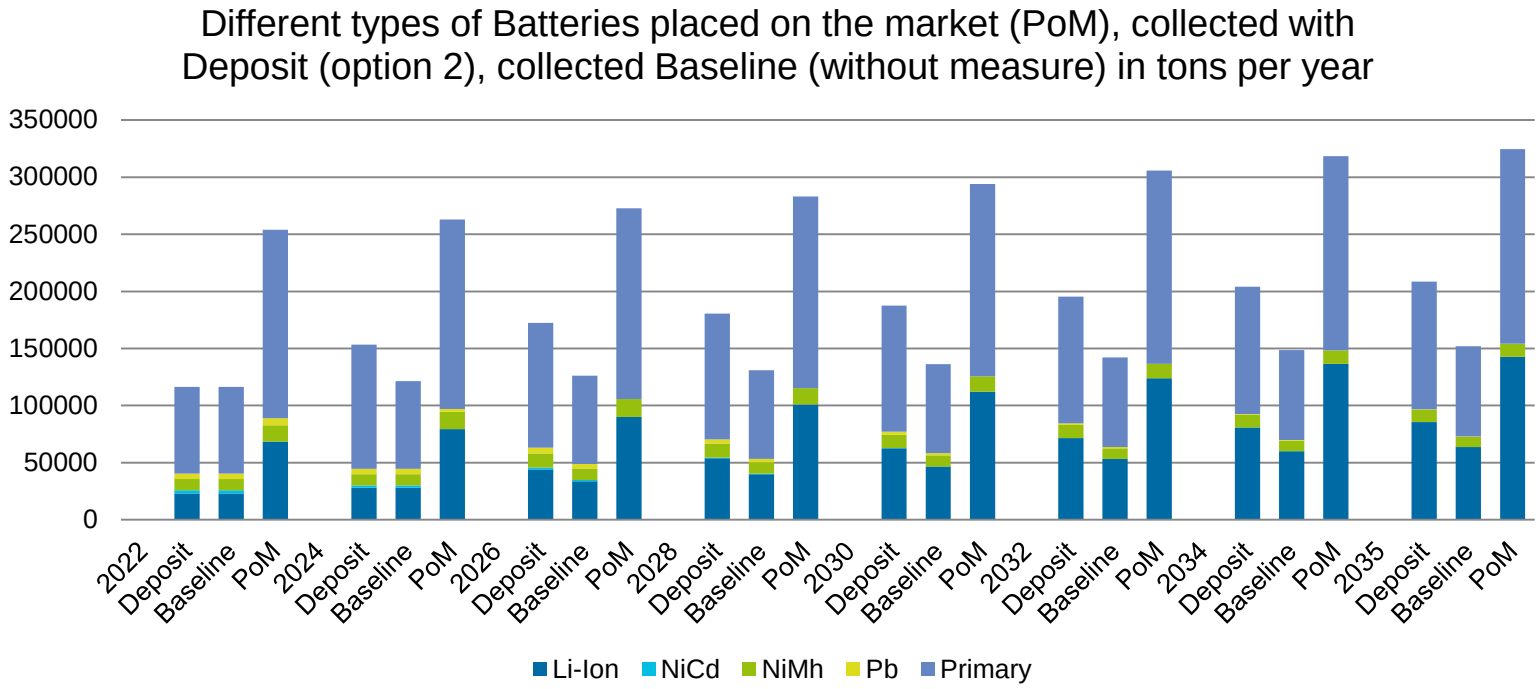


DEPOSIT REFUND SYSTEM (DRS)

IMPACT ASSESSMENT

A.1 Total collected batteries per type - Option 2

- The figure below shows the collection quantities for the different battery types
- Due to prohibition of NiCd it decreases in the collection
- Li -ion is continuously rising

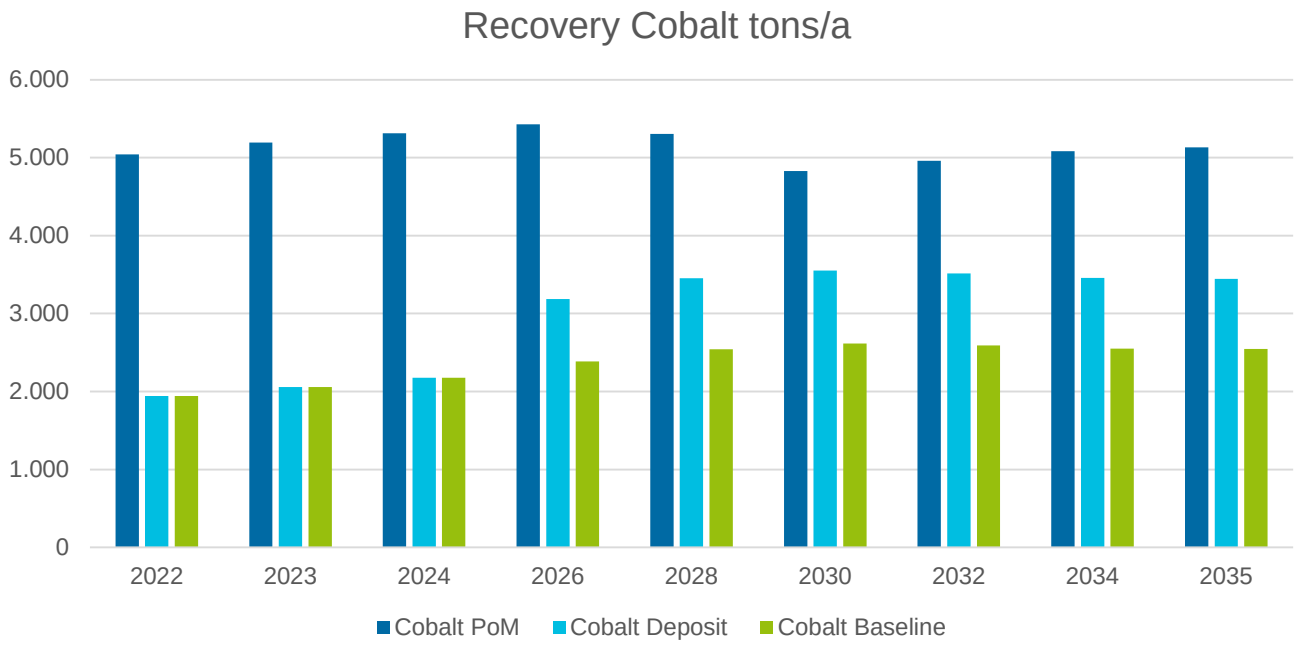


DEPOSIT REFUND SYSTEM (DRS)

IMPACT IMPACT ASSESSMENT

A.2 Recovery of cobalt from Li-ion batteries - Option 2

- Recovery of Co in Li-ion: average 880 t/a more compared to baseline (264 t/a for Option 1) (note: Co was chosen due to its high value on the market among all)

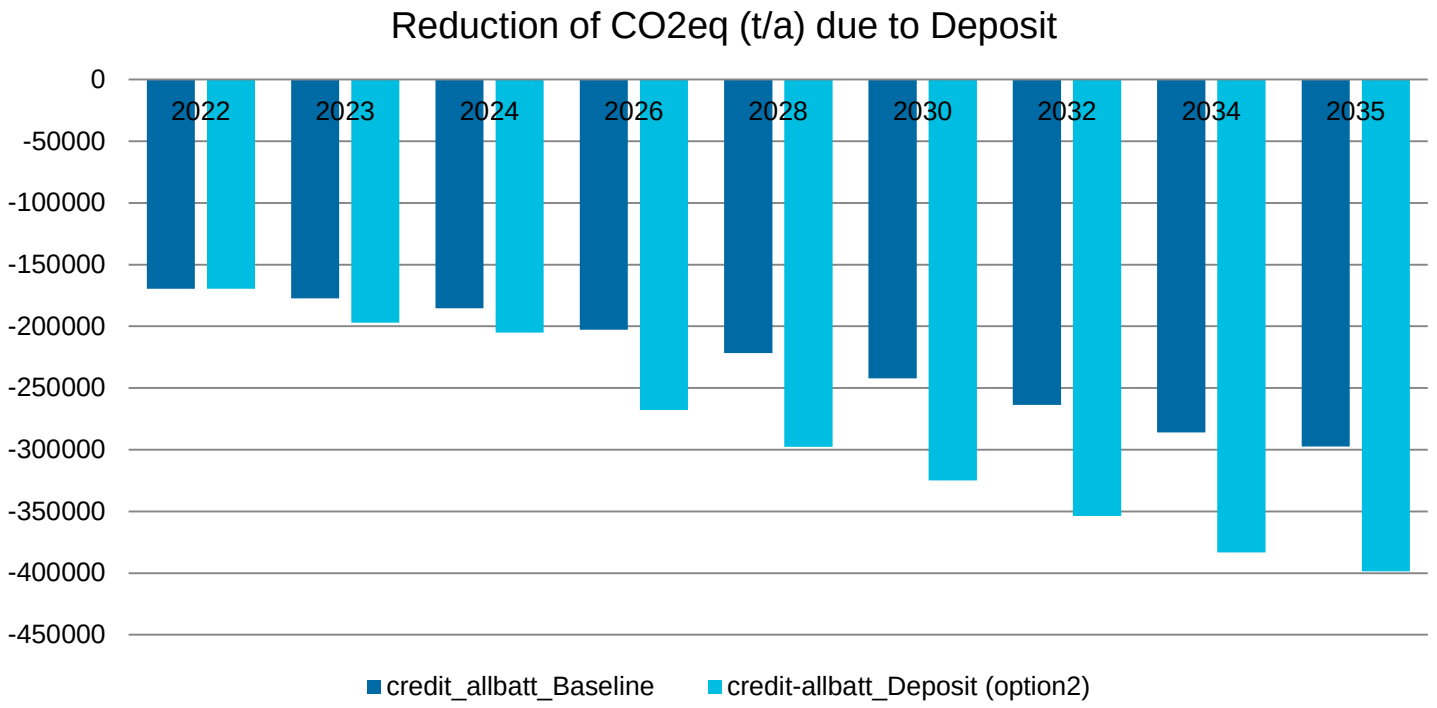


DEPOSIT REFUND SYSTEM (DRS)

IMPACT IMPACT ASSESSMENT

A.3 Reduction of CO^2 - Option 2

- Ca. 58 000 t/a CO2 savings until 2035 compared to baseline (4.5 Mio t CO2 cumulative) (for Option 1: 20 000 t/a)



DEPOSIT REFUND SYSTEM (DRS)

IMPACT ASSESSMENT

B.1 Set-up cost (*$=low; $$= medium; $$$= high)*

The major costs which will arise comprise:

- **Costs for the establishment of a DRS ($$$).** The Austrian Ministry of the Environment published a study on one-way deposits for beverage packaging in 2020. The study estimates the initial investment costs of setting up a deposit system at 156 million EUR. (Similar costs can be estimated in MS of the size of Austria). As no MS currently has a deposit on batteries, the construction and operational costs cannot be estimated. A very good cost estimate is available from a deposit study for disposable beverage packaging. It can be assumed that the cost of a deposit for batteries will not fall below the costs indicated.

DEPOSIT REFUND SYSTEM (DRS)

IMPACT ASSESSMENT

B.2 Cost of operation *($=low; $$= medium; $$$= high)*

The major costs which will arise comprise:

- **Costs for the administration of the DRS in shops and retailers (management costs)** ($$); The operating costs for the study cited above are calculated at 62 million EUR/year and the revenues (from selling recovered metals from this study, e.g. Co in Li-Ion) at EUR 58 million EUR/year. Hence the administration costs can be almost fully covered by the revenues of the system. Also, the revenues from the recovery of metals from the recycling depends strongly on the market situation (demand and offer) and varies accordingly. The costs for collection, transport, sorting and recycling must be offset against these.
  - **Costs for portable batteries**: costs for reverse vending machines. No such examples exist at the moment for batteries. The price for one machine would be from 30 000 Euro (Price for a bottle return machine approx. 40 000 EUR; for the operational costs, these are already included in the 62 million Euros) and the distributors will be cheaper if all MS would be obliged to implement this system. Costs for the automated machines will even be higher if there is no EU-wide market requirement.
  - For **e-bikes**, the system already partially exists (return points are established). Building a DRS for e-bikes´ batteries might therefore lead to less additional costs than for other types of batteries. Following the assumption that collection rates will be also increased through the monetary incentive for the consumers.
- Whether the recycling of Li-ion batteries is profitable from a cost point of view depends very much on the raw material prices, which are needed for the production of the batteries.

DEPOSIT REFUND SYSTEM (DRS)

IMPACT ASSESSMENT

B.3 Additional cost *($=low; $$= medium; $$$= high)*

- **Li-ion batteries and risk of fire**: hoarded waste Li-ion batteries present a risk of fire and may cause considerable damage → an increase of collection of Li-ion batteries might reduce the risk of damages (if awareness and better safety standards are established) or might simple shift risks and damage costs from private consumers to the shops were batteries are returned.
- The management of small batteries via a DRS will be challenging and especially to distinguish batteries covered by a DRS from other batteries (i.e. older batteries placed on the market before the DRS), if no l**abeling** for small batteries is introduced, then a sustainable management of the DRS will be very challenging.
- In Option 1: **tourism deposit** will penalize the MS which have implemented the DRS, and might cause financial losses and pose a risk to the functioning of the system, if no control mechanism is applied (i.e. label on all batteries placed on the market)

DEPOSIT REFUND SYSTEM (DRS)

IMPACT ASSESSMENT

Impacts of the options – initial results

Economic impacts Option 3 ($=low; $$= medium; $$$= high)

- For batteries included in the DRS system, costs will incur as described in Option 1&2 (excluded the costs for automated machines for small portable batteries, which are collected via a kerbside system in this scenario)
- For small portable small batteries, **collection costs** in kerbsides are related to the program's set out requirements and:
  - Increase with the number of separately segregated commodities. Single-stream is the least costly to collect, followed by two-stream, etc.
  - Increase with the frequency of collection. Collecting half as frequently (e.g., every other week instead of weekly) can reduce collection costs by approximately 25 percent, assuming traditional two-stream set outs.
  - Decrease as more materials are collected by the program. If few households participate in the program and the program does not collect many commodities, the per household cost soars, as it is costly to drive a recycling truck past household after household that has not set out recyclables.
  - The US EPA estimates that the costs for kerbside collection vary between 80 and 260 Euro/t (values converted from $)*.

*https://archive.epa.gov/wastes/conserve/tools/localgov/web/html/collection.html

DEPOSIT REFUND SYSTEM (DRS)

IMPACT ASSESSMENT

Impacts of the options – initial results

Economic impacts Option 3 ($=low; $$= medium; $$$= high)

- According to the assessment, the implementation of kerbside system would need an estimated capacity collection of 150 000 t/year by 2035.
- Depending on how the system is implemented, collection costs with kerbside system for portable small batteries could cost anywhere between 12.5 and 38 million Euro.

Social impacts Option 1, 2 and 3

Employment effects

- Option 2, 3: Total increase of collected batteries will need more human resources for batteries collection, sorting transport and recycling

DEPOSIT REFUND SYSTEM (DRS)

IMPACT ASSESSMENT

Comparison of options

The assessment of the Options is made by assigning (+) below each entry :
(-) = poor performance, (o) = average performance, (+) = good performance

Impact		Baseline	Option 1	Option 2	Option 3
Quan-tities (2035)	Increase of collection	n/a	15.000 t/y	50.000 t/y	100.000 t/y
	CO2 savings	n/a	20.000 t/y	58.400 t/y	63.500 t/y
	Assessment	**n/a**	**(-)**	**(o)**	**(+)**
Costs	Set-up Cost	n/a	($)	($$)	($$)
	Operational costs		($$$) tourisms deposit automated machines Labeling batteries	($$$) Reverse vending machines manual system Labeling portable batteries (	(($$) Kerbside system costs for portable batteries
	Assessment	**(+)**	**(-)**	**(o)**	**(o)**
Addional Costs	Fire risk	n/a	High	High	High + Kerbside
	Assessment	**(+)**	**(-)**	**(-)**	**(-)**
Revenue (2035)	Secondary material (Pb, Co, Ni, etc.)	n/a	116 Mio (Co)	358 Mio (Co)	336 Mio (Co)
	Assessment	**n/a**	**(-)**	**(o)**	**(o)**

DEPOSIT REFUND SYSTEM (DRS)

IMPACT ASSESSMENT

Summary Steakholder survey

In the course of the study, steakholders from various sectors were also interviewed on the subject of DRS for batteries. In particular, answers from the perspective of portable batteries were summarized.

cons

*"DRS doesn't make sense for **embedded batteries**. If there was a DRS we think it should be limited to batteries that are stand-alone batteries (non-rechargeable batteries, classical rechargeable, AA, AAA, …), but for embedded (e. g. Li-ion pouch batteries in Apple products) – no. The challenge of collecting batteries embedded in electronic devices needs to be answered holistically with the question of how to collect electronic devices. We have made great experiences with trade-in.*

*For **phone** is more difficult as the **lifetime** is longer and you may not know anymore where is the bill or where you bought it. Another point is with resale, the deposit is economically competing with the value you can get from **2nd hand market .***

*The **buying decision** of customers could be negatively influenced. The introduction of environmentally friendly tools (e.g. battery driven motors instead of combustion engines) could be slowed down.*

***The assumption above that "many batteries are not collected and end up in municipal waste" is not correct**. Several studies in different countries show that only a very limited amount of batteries are disposed of together with household waste.*

*As indicated by OECD, the objectives of DRS can also be **achieved through EPR Schemes:** "Typically, EPR schemes are much less prescriptive about how the waste management outcomes are to be achieved and place the responsibility on the participating firms to achieve the required outcome. This flexibility allows firms to select the most cost-effective ways of achieving the re-quired outcomes. In general, EPR will be more suitable than mandatory deposit-refund systems for managing wastes from products where refund arrangements would be costly or difficult to operate".*

DEPOSIT REFUND SYSTEM (DRS)

IMPACT ASSESSMENT

Summary Steakholder survey

cons

*"A **DRS is inadequate for the collection of batteries**.*

*Only 1/3 of the waste batteries are collected through the retail channel. Other collection points cannot be equipped for the handling of cash for the refunds. This could lead to a **substantial reduction of the density of the collection network**, hence a reduction of the collection.*

*Deposit schemes will give a **value to waste batteries**. This not only implies the risk of fraud, but also secured systems behind the counter. This will reduce the visibility of the takeback system.*
*Several studies indicate that even for portable primary (non rechargeable) batteries, the average lifespan exceeds four years. This **long lifespan leads to a very low rotation.***

*Typically, most **batteries cannot be reused** and not all batteries can be **removed by consumers** from the appliances they are used in.*

***Automation of the takeback of the waste batteries is not possible**, given the illimited number of sizes and types of batteries. Takeback of batteries with refund will always require an intervention of the staff of the collection point.*
*Besides the fact that the long lifespan makes a DRS less effective, **the results will only be visible after a very long period.***

*Since **convenience for the consumer is key for the collection**, we would definitely see a decrease of the collection because the number of collections points would seriously decrease (only 30% of the collection points are retail points with staff and the possibility to handle the refund).*

DEPOSIT REFUND SYSTEM (DRS)

IMPACT ASSESSMENT

Summary Steakholder survey

pros

“Any measure that could potentially be effective to increase recollection of batteries (in particular Lead-Acid, and BEV batteries given the market volumes) would be sensible.

If it helps to collect more batteries for recycling we are in favour of such a system.

The case is already made clearly in the introduction, current collection levels are too low, and DRS has shown itself to be an effective tool to stimulate collection rates. It is however on its own not sufficient but should be included with additional measures that would increase the ease of collection, I.e. through a pick-up service or easily accessible drop-off points. Taken together these measures are known to significantly increase return rates (up to 95% in the German Pfand-system for drink beverages).

Increased collection: there would be more incentives for households to turn batteries back. If the deposit is on the battery this will probably increase the rate of batteries collected separately. ”

Harmonisation

“Compliance costs for companies in the EU tend to fall drastically when specific rules are harmo-nised, in this case which type of batteries and the mechanisms. This will also reduce confusion for consumers.

As indicated, the minimum level of the deposit is key in its success, and should therefore also be harmonised.; A DRS system should be harmonized in all EU Member States. If you want a DRS apply it to all Member States.“

DEPOSIT REFUND SYSTEM (DRS)

CONTENT / OVERVIEW

DEPOSIT REFUND SYSTEM (DRS)

CONCLUSIONS

Initial conclusions

- ✓ Primary batteries and small rechargeable batteries currently represent the largest quantity placed on the market.
- ✓ With option 3, it can be foreseen that especially small portable batteries can be collected additionally. In e-bikes and new appliance (e.g. cleaning robots) segments , a significant increase in the volumes placed on the market is expected over the next few years.
- ✓ The use of Li-ion batteries is continuously increasing.
- ✓ The **establishment of a DRS has high costs** (comparably to the DSR on beverage bottles, e.g. Austria 156 million Euro). This would be true for all types of batteries, and for all Options.
- ✓ The **biggest environmental problem is due to the small batteries**, which get currently lost in residual waste (no separate collection). For these batteries, a high collection volume can in principle be achieved implementing a kerbside collection system. The implementation of a kerbside system **(Option 3) would not require additional costs such as** labeling costs, reverse vending machines; and deposit tourismus (the latter compared to Option 1), at least for portable batteries. Operation costs can be integrated in existing kerbside systems
- ✓ The implementation of a kerbside system **(Option 3) would not require additional costs such as** labeling costs, reverse vending machines and deposit tourismus (the latter compared to Option 1), at least for portable batteries. Operation costs can be integrated in existing kerbside systems. A one-off expense is the equipment of the collection vehicles

DEPOSIT REFUND SYSTEM (DRS)

CONCLUSIONS

Initial conclusions

- ✓ Option 2: If no return vending machines systems are applied and portable batteries are included in the manual DRS, then the costs will be smaller (if they can be integrated in the overall costs of DRS), Options 2 and 3 have then comparable costs.
- ✓ If Option 2 or 3 are implemented, the costs deriving from fires and explosions are reduced if the batteries are properly separately collected and stored (in comparison to the baseline).
- ✓ Option 1 should be the less preferred Option, due to the lower increased environmental benefits. Also in terms of implementability, tourismus deposit was identified as a major barrier to the functioning of the system.
- ✓ In the case a DRS has to be implemented, than it should be mandatory in all MS.